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TADLA RESOURCES MANAGEMENT

NO. 608-0213

PROJECT PAPER

USAID/Morocco
July 30, 1992

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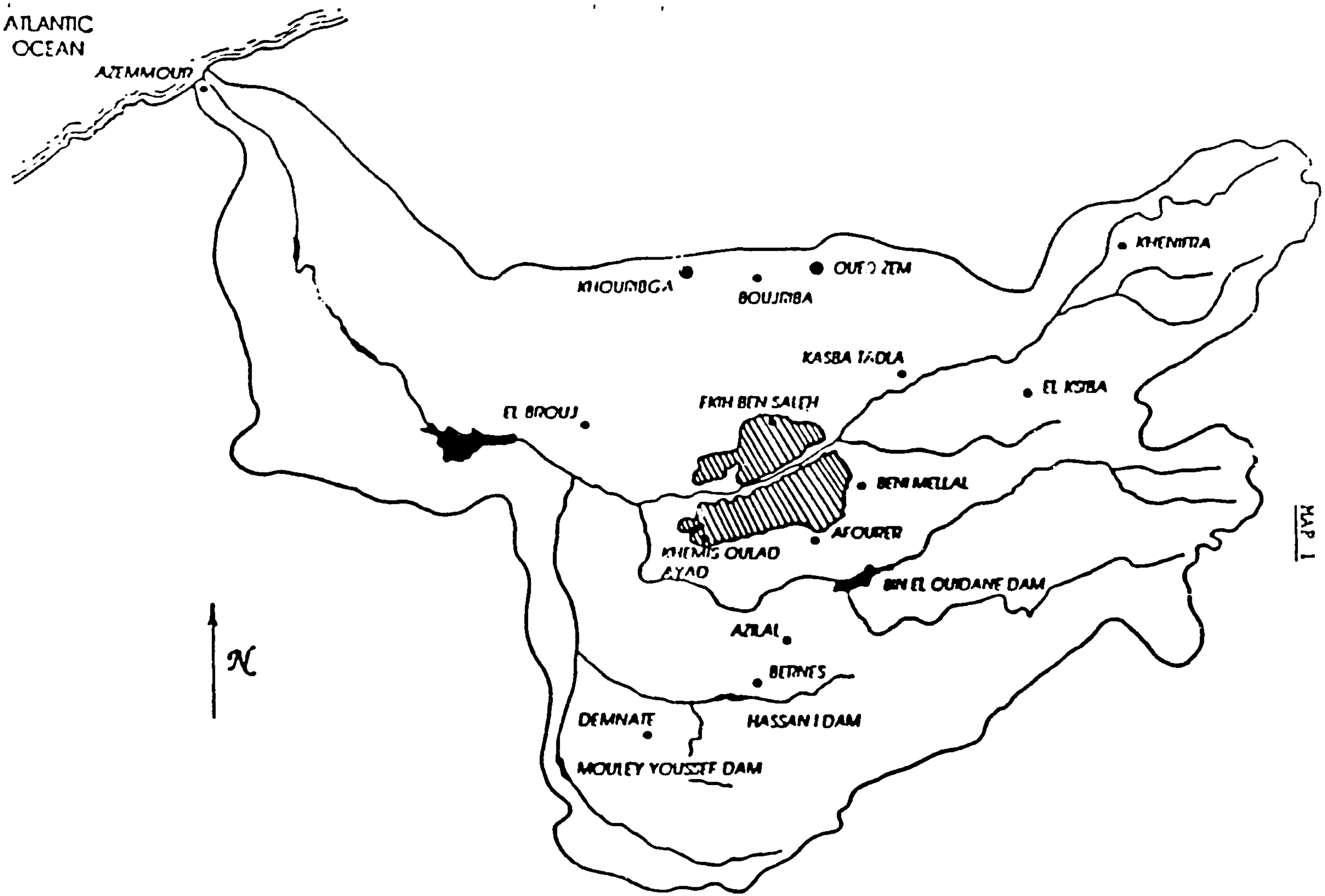

LOCATION OF THE TADLA PERIMETER WITHIN THE OUM ER RBIA BASIN

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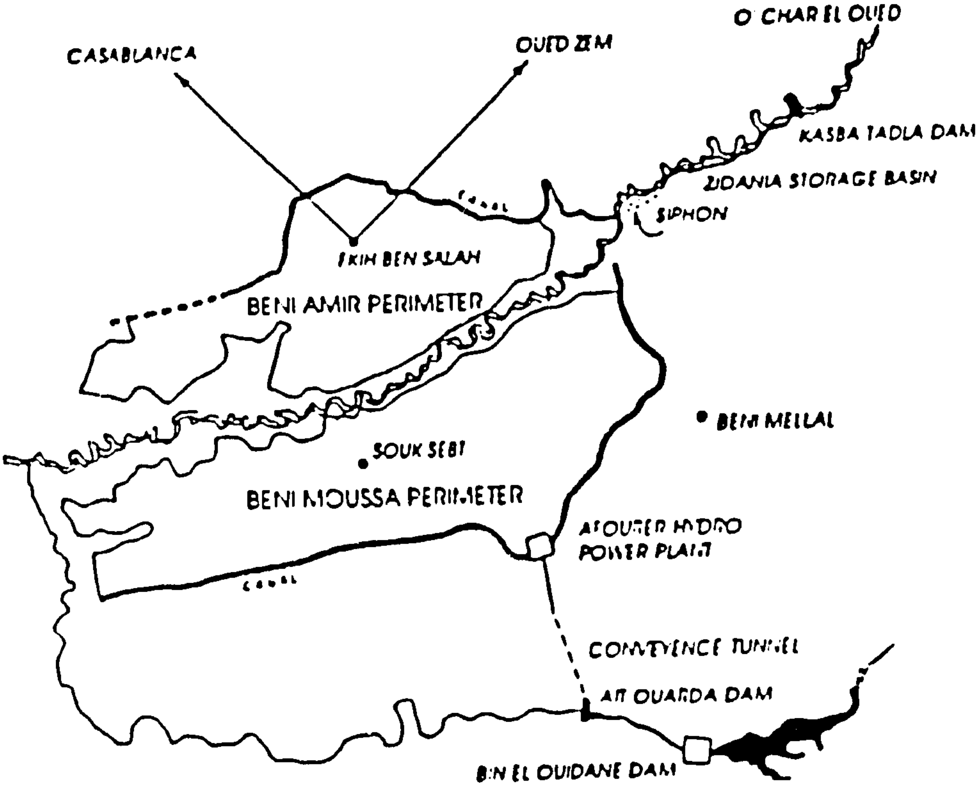


SCHEMATIC OF THE TADLA PERIMETER AND ASSOCIATED HYDRAULIC WORKS

LIST OF ACRONYMS

ABT	Association des Betteraviers du Tadla/Tadla Sugar Beet Producers Association
ACT	Association des Cotonniers du Tadla/Tadla Cotton Producers Association
ADB	African Development Bank
AET	Association des Eleveurs du Tadla/Livestock Producers Association of Tadla
AH	Administration de l'Hydraulique/Hydraulic Administration
A.I.D.	Agency for International Development—used to denote A.I.D. headquarters in Washington, D.C., as distinguished from field mission (denoted as USAID)
ANE	Former Asia/Near East Bureau of A.I.D.
ANR	USAID's Office of Agriculture and Natural Resources
ASAL II	Second Agricultural Sector Adjustment Loan (executed between the Government of Morocco and the World Bank in 1987, for the period 1987 to 1992)
ASAP	Association Syndicale des Agriculteurs Prévilegiés/Agricultural Associations (for Irrigation)
ASIL	Agricultural Sector Investment Loan of the World Bank
ASPAM	Association des Producteurs des Agrumes du Maroc/Morocco Citrus Producers Association
BCD	Bureau des Cultures Diverses/Bureau for Other Crops of the ORMVAT/SPA
BE	Bureau d'Exploitation/Bureau for Management of the ORMVAT/SGRID
BEI	European Investment Bank
BGA	Bureau de Gestion et d'Approvisionnement/Bureau for Management and Input Supply (in the ORMVAT/SPA)
BTI	Bureau des Techniques d'Irrigation et de Drainage/Technical Bureau for Irrigation and Drainage (in the ORMVAT/SGRID)

BV	Bureau de Vulgarisation/Bureau for Extension (in the ORMVAT/SVOP)
CA	Conseil d'Administration/Administrative Council (of the ORMVAT)
CAP	Common Agricultural Policy of the European Community
CGIAR	Consultative Group on International Agricultural Research
CIP	Commodity Import Program
CMV	Centre de Mise en Valeur/Development Center
CNCA	Caisse Nationale de Crédit Agricole/National Agricultural Credit Bank
COMAPRA	Compagnie Marocaine de la Commercialisation des Produits Agricoles/Moroccan Agricultural Production and Marketing Company
CRCA	Caisse Regionale de Crédit Agricole/Regional Agricultural Credit Bank
CS	Cellule de Suivi/Monitoring Unit
CT	Comité Technique/Technical Committee (of the ORMVAT)
DER	Direction de l'Equipement Rural/Direction for Agricultural Equipment (of the ORMVAT) within the MARA
DPA	Direction Provinciale de l'Agriculture/Provincial Agricultural Office
DRH	Direction Regionale Hydraulique/Regional Hydraulics Direction of the Ministry of Public Works
ESF	Economic Support Funds
FADA	Arab Fund of Abu Dhabi
FADES	Arab Fund for Economic and Social Development
FAO	Food and Agriculture Organization
FY	U.S. Government Fiscal Year
GDP	Gross Domestic Product
GIS	Geographic Information System
GOM	Government of Morocco
IA	Irrigation Association

IAV	Institut Agronomique et Veterinaire Hassan II/Hassan II Institute of Agriculture and Veterinary Medicine
IBRD	International Bank for Reconstruction and Development (World Bank)
IC	Institutional Contractor
IEE	Initial Environmental Examination
IIMI	International Irrigation Management Institute
IMF	International Monetary Fund/Fonds Monétaire International
INRA	Institut National de la Recherche Agronomique/National Institute of Agricultural Research
IQC	Indefinite Quantity Contract
ISCAE	Institut Superieur de Commerce et d'Administration des Enterprises/ Graduate Institute of Commerce and Business Administration
ISPAN	Irrigation Support Project for Asia and the Near East
LSDAS	Limited Supervisory Data Acquisition System
LSI	Large-Scale Irrigation Scheme/perimètres de grande hydraulique
LTTA	Long-Term Technical Assistance
MAP	Morocco Agribusiness Promotion Project (of USAID)
MARA	Ministère de l'Agriculture et de la Réforme Agraire/Ministry of Agriculture and Agrarian Reform
NGO	Non-Governmental Organization
O&M	Operation and Maintenance/opération et entretien
ODA	Overseas Development Administration of the United Kingdom
OMVA	Office de Mise en Valeur Agricole/National Agricultural Development Office
ONE	Office National d'Electricité/National Electricity Office
ONEP	Office National de l'Eau Potable/National

	Office for Potable Water
OP	Observatoire Permanent/Permanent Agro-Economic Monitoring and Evaluation Unit (of the ORMVAT)
OPEC	Organization of Petroleum Exporting Countries
ORMVA	Office Regional de Mise en Valeur Agricole/Regional Agricultural Development Office
ORMVAD	Office Regional de Mise en Valeur Agricole de Doukkala/Doukkala Regional Agricultural Development Office
ORMVAH	Office Regional de Mise en Valeur Agricole du Haouz/Haouz Regional Agricultural Development Office
ORMVAT	Office Regional de Mise en Valeur Agricole du Tadla/Tadla Regional Agricultural Development Office
PACD	Project Activity Completion Date
PAGI 1 & 2	Projet d'Amélioration de la Grande Irrigation/Large-Scale Irrigation Improvement Project (designated as PAGI 1 and PAGI 2 for the First and Second World Bank-funded Projects)
PID	Project Identification Document
PIO/T	Project Implementation Order/(for) Technical Services
PP	Project Paper
PRC	A.I.D. Near East Bureau's Project Review Committee
PSDAGI	Projet de Soutien au Développement Agricole de la Grande Irrigation/Agricultural Development Support Project for Large-Scale Irrigation Perimeters (of the World Bank)
RAM	Random Access Memory
RFP	Request for Proposals (contractor solicitation document)
RIG	Regional Inspector General's Office
RT	Référentiels Techniques/Crop Technical Reference Sheet
SAL	Structural Adjustment Loan
SE	Service de l'Elevage/Livestock Service (of the

	ORMVAT)
SEAE	Service des Etudes Agro-Economiques/Service for Agro-Economic Studies (of the ORMVAT)
SEHA	Service des Expérimentations de l'Hydraulique Agricole/Service for Research on Agricultural Irrigation Systems (of the ORMVAT and of MARA)
SGRID	Service de Gestion du Réseau d'Irrigation et de Drainage/Service for Management of the Irrigation Network and Drainage (of the ORMVAT)
SH	Service d'Hygiène/Health Service of Beni Mellal Province
SIG	Système d'Information pour la Gestion/Management Information System
SODEA	Société de Développement Agricole/Agricultural Development Group
SOGETA	Société de Gestion des Terres Agricoles/Agricultural Land Management Group
SONACOS	Société Nationale de Commercialisation des Semences/National Seed Company
SPA	Service de la Production Agricole/Agricultural Production Service (of the ORMVAT)
SPP	Service de la Planification et de la Programmation/Service for Planning and Programs (of the ORMVAT)
STTA	Short-Term Technical Assistance
SUBM	Sucrerie de Béni Mellal/Beni Mellal Sugar Mill
SUNAT	Sucrerie Nationale du Tadla/Tadla National Sugar Mill
SUTA	Sucrerie du Tadla/Tadla Sugar Refinery
SVOP	Service de la Vulgarisation et de l'Organisation Professionnelle/Service for Agricultural Extension and Professional Organization (of the ORMVAT)
TRM	Tadla Resources Management Project
USAID	United States Agency for International Development Mission in Rabat, Morocco (see also A.I.D.)
USGS	United States Geological Survey

PROJECT AUTHORIZATION

Name of Country: Kingdom of Morocco

Name of Project: Tadla Resources Management

Number of Project: 608-0213

1. Pursuant to Section 103 of the Foreign Assistance Act, as amended, I hereby authorize the Tadla Resources Management Project for Morocco (the "Cooperating Country") involving planned obligations of not to exceed eighteen million seven hundred and fifty thousand United States Dollars ($18,750,000) in grant funds over a seven 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 finance foreign exchange and local currency costs of the project. The planned life of project is seven years from the date of initial obligation.

2. The project consists of technical assistance, training, commodities, research and demonstration, and institutional and private sector strengthening aimed at increasing the efficiency, economic yield and environmental sustainability of irrigation resources management in the Tadla large scale irrigation perimeter of Morocco.

3. The Project Agreement which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms, covenants, and major conditions together with other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Project shall have their source and origin in the United States, except as A.I.D. may otherwise agree in writing. Procurement from local sources will be authorized to the extent permitted by the Agency's "Buy America Initiative" guidance cable dated December 5, 1990 (90 State 410442), as may be subsequently amended. Except for ocean shipping, the suppliers of commodities or services financed by grant funds shall have the United States as their place of nationality, except as A.I.D. may otherwise agree in writing.

Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States.

b. Other

No funding will be provided under the Project for any testing or breeding, feasibility studies, variety improvement or introduction, consultancy, publication, conference, or training in connection with the growth or production in a foreign country of an agricultural commodity for export which would compete with a similar commodity grown or produced in the United States if such activities will have a significant impact on the export of agricultural commodities of the United States.

Dennis M. Chandler
Mission Director
7/30/92

Drafting Officers:RScott:PDPE/ELoken:ANR:7/25/92

Clearances:

PROG:	FAmundson		ADO:	JSchamper	
PDPE:	RBurns		RCO:	MReynolds	MR
OFM:	RDeschambault		PHR:	JHolfeld	
RLA:	BBarrington	(draft)			

PROJECT PAPER
MOROCCO (608-0213)
TADLA RESOURCES MANAGEMENT (TRM)

PROJECT SUMMARY AND RECOMMENDATIONS

A. Grantee: The Government of the Kingdom of Morocco (GOM).

B. Implementing Agency: The Ministry of Agriculture and Agrarian Reform.

C. Amount: The Project is authorized for $18,750,000 in grant funds of which $8,801,432 will be obligated in FY 92. The remaining amount will be obligated in FYs 1994 and 1995. The LOP is seven years from the date of signing of the Project Agreement.

D. Project Costs: The total A.I.D. contribution is estimated to be $18,750,000 over the life of project. The GOM will contribute $4,500,000 and the private sector $1,750,000 in appropriate project costs over the LOP.

E. Project Goal and Purpose:

Goal: To promote the long-term competitiveness and environmental sustainability of Moroccan irrigated agriculture.

Purpose: To increase the efficiency. economic yield and environmental sustainability of irrigation resources management and use in the Tadla irrigation perimeter of Morocco.

F. Summary Project Description:

Since the inauguration of a comprehensive economic structural adjustment loan program in 1983, Morocco's overall economic performance has been good, with real growth in gross domestic product (GDP) averaging 4.6 percent per annum. While economic growth during the latter half of the 80's and into the 1990's has been satisfactory, the average rate of GDP increase masks wide fluctuations stemming largely from variability in precipitation with mixed consequences for agricultural production which contributes substantially to the economy - from 15 to 20 percent of the GDP.

If the Moroccan economy is to sustain its positive growth, all key sectors have a common need for reliable supplies of high quality water. Without this vital economic resource, the growing urban workforce cannot be maintained, many industrial enterprises cannot function efficiently, energy from hydropower cannot contribute to reducing Morocco's reliance on imported oil, and most importantly, domestic agricultural production cannot be stabilized to provide critical wage goods for domestic economic growth and for exploitation of export opportunities.

The GOM, therefore, has continually given the development of water resources its highest priority. Infrastructure has been developed throughout the country with the capacity to capture up to two-thirds of usable surface water. In several irrigation areas, including the Tadla perimeter, the ability to capture surface water has been exploited to the maximum extent possible. The next logical step is to maximize the efficient use of this water and minimize its waste in order to be able to respond to the inevitable increasing demands. As irrigated agriculture accounts for nearly 90 percent of total water consumption in Morocco, this sector is the most important and strategic place to start. In addition, the inefficient use of water and soil resources, and agrochemicals, has led to environmental problems such as salinization and waterlogging in irrigated areas which have potentially serious negative economic consequences for long-term agricultural production objectives.

The TRM Project will provide for an increased, yet sustainable, economic performance of some of Morocco's most valuable agricultural resources and infrastructure. In this way, it will contribute directly to the Mission's overall program goal of broad-based and sustainable economic growth, particularly by increasing the long-term competitiveness of Moroccan agriculture and agribusiness through the increased productivity and efficiency in the use of critical resources. The project will also contribute directly towards the promotion of the Mission's three cross-cutting strategic concerns of environment, women in development and democratic pluralism.

The project will promote a resource-efficient approach to improved irrigation management in Morocco, through an integrated program of policy analysis, technology transfer, research and demonstration, and institutional and private sector strengthening in the Tadla perimeter - the largest existing irrigation system in Morocco. The project will be implemented through four major components designed to improve system-level, on-farm and environmental management of perimeter operations, and to promote increased private regional participation in perimeter resources allocation, management and use. In addition, the project will provide for a modest cooperative research and demonstration program with the International Irrigation Management Institute (IIMI) based in Colombo, Sri Lanka, if current IIMI plans for program development in Morocco are realized.

A crucial element of the project will be the engagement of the local private sector, including local agricultural associations and cooperatives and small and medium enterprises in the decision-making process that controls resource allocation, management, and use in the perimeter. Private sector actors will be encouraged to play a more prominent role in the provision of commercial supplies and services for successful farming in the area. Mechanisms will be promoted which will allow local interests to present their ideas and needs for improved perimeter management which will result in more demand-driven, cost-effective, and efficient resource use patterns. All of this will accompany the mandated disengagement of the ORMVAT from the "directive" mode to one that is facilitative and responsive to the needs of the local farmers as they respond to the freer play of market forces under a liberalized management regime.

The project will be implemented under the auspices of the GOM's Ministry of Agriculture and Agrarian Reform (MARA), with the active participation of the Tadla private sector. Together, these project counterparts will contribute 25 percent of total project costs for technical support, office facilities and operations, travel and training, and equipment, materials and supplies. The project will be implemented in close coordination with two major new national World Bank projects promoting improved irrigation performance in Morocco, totalling $340 million.

The primary project beneficiaries will be the farm families and agricultural entrepreneurs resident within Tadla. These people will benefit from the provision of more cost-effective, reliable and better quality water supplies, both for irrigated agriculture and for domestic and industrial consumption. Improved irrigation water deliveries will, in combination with improved farming practices, result in increased agricultural production, incomes and employment in the perimeter. Increased production of higher-value crops and increased farmer revenues will, in turn, provide greater opportunities for private agribusiness growth, with additional employment, income and value-added benefits. As Tadla agribusiness becomes stronger and begins to account for an increasing share of the regional economy, it will be better positioned to assume an enhanced role in the management of perimeter affairs.

Second-order project beneficiaries will include water and energy consumers situated downstream of Tadla within the Oum Er Rbia River basin. These people will benefit from additional and/or cheaper supplies of water and electricity made possible through pollution reduction and efficiency gains realized in Tadla. Ultimately, the greater Moroccan society will benefit from the improved, sustainable performance of significant national investments in economic infrastructure, and the enhanced conservation of the nation's most valuable water and soil resources.

In summary, the project will concentrate on ensuring the most efficient, economically viable, and environmentally sustainable uses of irrigation resources in the Tadla perimeter. Lessons learned and technologies that are successful will be disseminated and used as models for other large-scale irrigation perimeters throughout the country. During this process, the local private sector and farmers resident in the perimeter will be brought into the decision-making framework while the ORMVAT disengages from complete control of perimeter affairs.

The project will be implemented through a direct A.I.D. contract. The Institutional Contractor responsible for the project will be located in Fkih Ben Salah in the project area. The USAID's Agriculture and Natural Resources Office in Rabat will manage project implementation.

G. **A.I.D./W Project Review Committee Design Guidance:**

The Bureau Project Review Committee (PRC) met on June 27, 1991 to review the Project Identification Document (PID). At that meeting, the PID was approved with the following design guidance (see Annex B):

1. Alternate Water Uses: The PRC requested the Mission to ensure that water saved through project interventions in Tadla is put to the most cost-effective use. According to the current Oum Er Rbia River basin master plan, water saved through pollution reductions and efficiency gains in Tadla could be used for additional/other irrigated agriculture, in either Tadla or the Haouz or Doukkala perimeters, additional hydropower generation, and for additional industrial and potable supplies in downstream basin areas, such as Marrakech and the Casablanca-Rabat coastal corridor. The choice among these different potential uses will vary, of course, according to the specific set of circumstances prevailing in the basin and region at any given time. The project will continually assess this question with concerned GOM counterparts to ensure that this water is put to the most cost-effective use. This topic will also be addressed as an important aspect of the project's two external evaluations.

2. Sustainability: The PRC raised the question of sustainability; in particular, it questioned whether the project had given sufficient thought to the ability of local NGO's to achieve financial sustainability after the PACD, and whether the ORMVAT has the capability to assume management responsibility for the newly installed management and monitoring systems after the PACD. The PP design team devoted careful attention to this subject during the course of their deliberations. The team results indicate that the ORMVAT is technically, administratively and financially capable and appropriate to assume these additional management and monitoring responsibilities beyond the PACD (see relevant PP Annexes). The question of NGO sustainability is more problematical. The project will address this concern through careful analysis of prospective NGO participants, on a case-by-case basis, prior to selection for project assistance. Only those organizations judged to possess the best prospects for long-term financial and administrative viability will be selected to participate in project activities. This screening process will maximize the chances that project-assisted NGOs will remain effective and viable following the cessation of project activities.

3. Donor Coordination: A major portion of Chapter One is devoted to explaining how the project will coordinate closely with other regional and national donor activities aimed at improved irrigation management in Morocco. Planned project cooperation with ongoing IIMI activities in Tadla is described in detail throughout the PP. Prospective areas of project coordination with ongoing and planned, national irrigation improvement projects sponsored by the World Bank has also been the subject of careful consideration and detailed discussion with concerned Bank staff. The project has incorporated structured yearly national workshops that will include representatives from other ORMVAs and national GOM agencies, plus World Bank and concerned other donor representatives. These national outreach workshops are specifically designed to provide a forum for disseminating lessons learned from the project and sharing ideas for maximum impact, leverage and cost-effectiveness in the delivery of donor assistance in this sector of economic development in Morocco. In addition, the Project Monitoring and Evaluation Unit will also publish periodic project progress and

evaluation reports for wide dissemination both in Morocco and among concerned bilateral and multi-lateral donors.

4. Project Replication: Using information from project monitoring and evaluation activities, and from the national and regional seminars and workshops, the project will periodically provide information to other ORMVA's and interested parties on the successes and failures of the project activities in Tadla, with the specific intent of encouraging other perimeters in Morocco to adopt appropriate successful strategies and to discard those that do not work. This information dissemination and feedback process will be facilitated by maintaining close project coordination with IIMI and World Bank activities in Morocco as discussed above, and with central MARA decision-makers in Rabat. In addition, the final project evaluation has been specifically scheduled for the end of the sixth year of project implementation to allow sufficient time for the effective dissemination of results and feedback prior to project close-out. Aside from its importance in achieving goal-level impacts, this project outreach program has been designed specifically to address ministerial-level concerns raised by MARA regarding the effective application of appropriate project results in the other large-scale irrigation perimeters of Morocco.

5. Environment: The PRC expressed the need for further assessment of the potential environmental effects of planned project activities. This additional environmental review was completed during the final project design consultancy (see Technical Analysis). The results of this review have been duly incorporated into the PP, largely as the project's significant, third, sustainable environmental management component. If implemented as recommended herein, the project fully addresses all of the environmental concerns raised by the PRC. Accordingly, there is no need for any further environmental review of this project at this time.

6. Crop Mix and Market Price: The PRC recommended that the project conduct certain analyses designed to further promote the shift in production to higher-value crops in perimeter areas. These analyses have been provided for in the PP. Ultimately, all of the planned project activities will contribute to facilitating the shift to higher-value crops in Tadla by providing farmers with increased information, flexibility and choice with respect to system water deliveries and on-farm irrigation techniques and practices for new crops and cropping systems. The project will also seek to facilitate the planned privatization of existing agro-industries in Tadla, such as the sugar factory and two refineries and the major cotton processor, in coordination with other USAID program assistance activities. Such privatization should also assist in freeing the Tadla economy and allowing perimeter operations to proceed on a more market-oriented basis.

7. Performance Indicators, Project Monitoring and Evaluation: The PRC concerns regarding project monitoring and evaluation requirements are all clearly addressed in Chapter Five. The project provides for a special Monitoring and Evaluation Unit to assure that these important project needs are fully met.

8. Participant Training: The Mission will take appropriate steps to ensure that the Institutional Contractor for the project will use Historically Black Colleges and Universities to the extent possible in fulfilling project participant training requirements (see Chapter Four).

9. Host-Country Contribution: The GOM, operating through MARA and the ORMVAT, and the Tadla private sector will jointly contribute 25 percent of total project costs - both for the project as a whole and for the IIMI Cooperative Program. These contributions will include public and private sector counterpart personnel and logistical support costs, in-country and overseas training support costs, various equipment and supplies procurement and operations and maintenance costs, project office facilities support costs, and other normally accepted services

(see Chapter Three and Annex F).

10. Lessons Learned: The PRC advised that A.I.D.'s experience in similar projects be factored into the design of the TRM Project. This concern has been addressed through a requested CDIE search for relevant A.I.D. information regarding lessons learned on the planned project topic, and through the use of and consultation with the multi-regional ISPAN Project during the course of project design. The results of these information-gathering activities have been duly incorporated into the final project design.

H. **Recommendations:**

USAID/Morocco has reviewed the Tadla Resources Management (TRM) Project and finds the project to be technically, economically, financially, administratively, socially and environmentally sound. Therefore, the Project is recommended for FY 1992 authorization and obligation of funds.

I

PROJECT RATIONALE

1. Host Country Context

The Government of Morocco (GOM) is pursuing an economic growth strategy that stresses a balanced approach to national development among sectors, with critical activities occurring in light industry, agriculture, mining and tourism. It has progressively established a more open foreign trade regime wherein domestic resource allocations are increasingly governed by world market forces and prices. Through this process, the economy has moved away from its prior orientation on import substitution, pervasive protectionism of inefficient domestic industries and agriculture, and heavy and direct state involvement in economic management at all levels. There is a new realization that development of a balanced, export-driven economy will require a more active and equal partnership between the public and private sectors, with public disengagement from commercial activities and much more emphasis on private investment and management in all areas of economic development.

Since the inauguration of a comprehensive economic structural adjustment loan (SAL) program in 1983, Morocco's overall economic performance has been good, with real growth in gross domestic product (GDP) averaging 4.6 percent per annum. However, while economic growth during the latter half of the 1980s and into the 1990s has been satisfactory, the average rate of GDP increase masks wide fluctuations stemming largely from variability in precipitation with mixed consequences for agricultural production.

If the Moroccan economy is to sustain this positive growth, all key sectors have a common need for reliable supplies of high quality water. Without this resource, the growing work force in urban areas cannot be sustained, many industrial enterprises cannot function efficiently, energy from hydropower cannot contribute to reducing Morocco's dependence on imported oil and, most importantly, domestic agricultural and agro-industrial production cannot be relied upon to provide critical wage goods for domestic economic growth and for exploitation of export opportunities.

A major emphasis of Moroccan development planning remains, therefore, on maximizing the capture of the country's surface water resources and providing for their optimal use in irrigated agriculture, potable water supply, industrialization and energy generation. Enormous capital resources have been invested in the infrastructure needed to control surface water flows in Morocco. Infrastructure to capture and utilize about two-thirds — or 10 billion cubic meters -- of surface water potential is in place, and at least four major capital projects are in advanced stages of planning and/or implementation to capture much of the remaining 6 billion cubic meters by the end of the century. Moreover, recently approved plans call for additional water development investments amounting to some $6 billion over the next 30 years to complete this program.

As Morocco begins to approach the end of the infrastructural development phase of its national water development plan, emphasis is beginning to shift to the more sophisticated and difficult task of ensuring a socially optimal and technically efficient allocation of existing water resources among competing consumer groups. This water resources allocation issue is a major focus of the 30-year sectoral development program mentioned above. This task is increasingly complex given Morocco's relatively high population growth rate (2.4 percent per annum), the rate of migration from rural to urban areas (6 to 8 percent per annum), and the great temporal and spatial variability in annual rainfall between regions.

The major risk now is that water that has been captured at such great cost will not be used efficiently and that Morocco, therefore, will not be able to optimize the returns to its economy from all of the investments made to date. Moroccan sub-surface water resources are limited and generally more expensive to exploit. Similarly, desalinization of seawater has not yet proven to be a cost-effective supply alternative. Thus, conservation and optimal use of existing surface water resources is a *sine qua non* for the country's successful economic development in the 1990s and beyond.

At the subsectoral level, irrigated agriculture has a high priority in Morocco. Irrigated agriculture is viewed as an important means by which Morocco will be able to meet the needs of its growing population and to expand exports of commodities and processed agricultural products to earn foreign exchange and contribute to redressing imbalances in the country's external trade account.

For these reasons, more economical development and management of the country's irrigation potential are critical components of Morocco's continued economic growth. This shift towards more efficient irrigation management was recently endorsed at the January 1992 meeting of the High Water Council - the GOM's supreme policy-making body regarding water resources development and use. The following two points underscore the fundamental economic importance of improved irrigation management in Morocco:

- Water use for irrigation accounts for 88 percent of total surface water use in Morocco (as opposed to 8 percent for potable water supplies and 4 percent for industrial uses). Therefore, if significant gains in water resources conservation are to be effected in the medium-term, attention must initially be focused on irrigation as the largest and, probably, the most wasteful consumer of water.

- Since the irrigated perimeters of Morocco produce essentially all of the high-value export crops, interventions here will also make an important contribution towards the long-term competitiveness of Moroccan agribusiness -- a key future area of agricultural sector growth and development.

The Tadla Resources Management (TRM) Project will work in the second largest river basin in Morocco — the Oum Er Rbia. Specifically, the project will target the upper basin area which includes the *Office Regional de Mise en Valeur Agricole du Tadla* (ORMVAT) irrigation scheme on the Tadla plain, one of nine large-scale irrigation schemes (LSIs) in the country. The planned project interventions will increase the quantity and quality of water available for the production of a range of high-value agro-industrial products for export and domestic markets in three of the LSIs — the Tadla, and less directly, the Haouz (ORMVAH) and Doukkala (ORMVAD) perimeters.

The project will also have significant impact on the availability of potable and industrial water supplies for two of the largest urban and most important commercial centers of Morocco situated farther downstream within the Oum Er Rbia river basin - the Casablanca/Rabat coastal strip and the Marrakech area - both of which are projected to experience serious water supply constraints over the coming decade.

2. Relationship to USAID Country Strategy

The project's goal of promoting more efficient, economic and environmentally sustainable management and use of Morocco's irrigation resources is fully consistent with and supportive of all salient development policies, strategies and objectives of both A.I.D. and USAID/Morocco.

At the Agency level, the project directly supports the new A.I.D. Mission Statement calling for programs which promote "responsible environmental policies and prudent management of natural resources". More specifically, it seeks to assist Morocco "to conserve and protect its environment and manage its exploited resources for sustainable yields" through economic and environmental policies and improved technologies, in agreement with the A.I.D. Policy Paper on Environment and Natural Resources (April 1988) and the new Agency Environmental Initiative and Strategy.

At the country level, the project will contribute directly towards the achievement of the Mission's overall program goal of broad-based and sustainable economic growth, particularly by increasing the long-term competitiveness of Moroccan agriculture and agribusiness through increased productivity and efficiency in the use of critical limited resources. As discussed above, reliable and high-quality water supplies are vital if semi-arid Morocco is to continue to grow economically and prosper in an increasingly competitive international marketplace. Similarly, the effective performance of the country's agricultural sector remains paramount if Morocco is to continue to meet its increasing domestic food and employment needs and expand exports. The juncture of these two critical economic concerns lies in the nation's irrigation infrastructure, which is responsible for some 90% of Morocco's total water consumption and virtually all of its agricultural and agribusiness exports.

The project will promote more efficient, economic and environmentally sustainable management and use of irrigation resources in the Tadla LSI perimeter of Morocco. Its successful implementation will result, therefore, in increased productivity and resource use efficiency within this irrigation perimeter and, through a concerted information dissemination and outreach program, throughout Morocco's extensive national LSI network. Consequently, the project will promote increased competitiveness and sustainability of Morocco's agricultural and agribusiness infrastructure for the nation's continued economic prosperity and growth.

In addition, the project will contribute significantly towards the promotion of the Mission's three identified cross-cutting strategic concerns: the environment, women in development and democratic pluralism. For the environment, the project provides for substantive assistance and resources, principally within its Environmental Management component, aimed at alleviating current major environmental problems within perimeter areas, e.g., waterlogging, salinization, agro-chemical management and use, and agro-industrial pollution.

The project's On-Farm Management and Private Sector Strengthening activities will seek a better understanding of women's roles in perimeter activities in order to develop specific interventions aimed at promoting a broader female role in both farm-level and system-level decision-making and enhanced women's participation in and share of the benefits of perimeter economic activities.

Finally, the project will contribute directly to Mission democratic pluralism objectives through its Private Sector Strengthening component, designed to promote enhanced private sector participation in perimeter management as the state disengages from those aspects of irrigation affairs better left to private, competitive market forces.

3. Relationship to Other Donor Activities

As a result of the high priority that the GOM places on the development and management of water resources in Morocco, a number of donor agencies and international and regional development fund programs are supporting various interventions in water control, transfer and/or use for irrigation, and potable and industrial water supply, throughout the country. While these activities are important to the general development and management of water resources in Morocco, most are of less direct relevance to the USAID project because they have little or no effect on development in the Tadla perimeter.

The only major donor currently conducting significant program activities affecting Tadla perimeter operations is the **World Bank**. At the sectoral level, the most important World Bank activities are the ongoing programs under the Second Agricultural Sector Adjustment Loan (ASAL II), and the future Agricultural Sector Investment Loan (ASIL), designed to reform and modernize Morocco's agricultural sector. This program operates within the comprehensive SAL mentioned above. The ASAL II, and its predecessor program (ASAL I), have set the essential policy framework within which all activities in the present project will be undertaken, i.e., liberalization of input, output and factor markets, state disengagement from commercial activities, privatization of public and parastatal enterprises, orientation toward a more export-driven economy, and more effective mechanisms for dialogue among the partners in the economy. The USAID project has been designed to be fully compatible with and supportive of all of these major economic policy orientations.

Within the irrigation subsector, the most important GOM/World Bank activities affecting the USAID project are the two projects designed to improve irrigation in Morocco's nine LSIs: the *Projets d'Amélioration de la Grande Irrigation*, denoted as PAGI 1 and PAGI 2, and the parallel project for support of agricultural development in the large-scale perimeters, *Projet de Soutien au Développement Agricole de la Grande Irrigation* (PSDAGI).

PAGI 1, funded at $39 million, was initiated in 1987 as a comprehensive five-year national effort to improve operating efficiency, management and financial performance in the nine large-scale irrigation perimeters. It has been quite successful in addressing its principal objectives. For example, irrigation water fee schedules have been increased significantly to better reflect the real financial cost of water in each perimeter. Receipts in several ORMVAs now cover all or most of the operations and maintenance costs, and in some cases, such as Tadla and Doukkala, they are also contributing to capital costs.

Similarly, the ORMVAs in each of the nine perimeters have been strongly encouraged to disengage from all commercial enterprises and to restructure themselves as public service organizations with primary responsibilities for water system management and agricultural extension activities. A process has been initiated to give farmers a much greater role in decision-making about desired crop and livestock enterprises, allocation of farm-level resources, and maintenance and management of tertiary and quaternary canal systems within the perimeters.

Presently, PAGI 1 is in its final stages of implementation. As a result of favorable project evaluations, the GOM and the World Bank have decided to proceed with a much larger PAGI 2 follow-on project, as well as the parallel PSDAGI to support agricultural research and extension. PAGI 2 design is now well advanced, with a tentative funding level of $300 million. Design of the PSDAGI, with funding projected at approximately $40 million, has only just begun. Both projects are scheduled for final approvals in late 1992 and loan signature in 1993, with first implementation activities to start in late 1993 or early 1994. If these schedules are adhered to, PAGI 2 and PSDAGI implementation activities would start within one year after the start-up of the USAID project.

The principal objectives of PAGI 2 are:

- To improve the financial and economic viability of the existing national irrigation infrastructure; and

- To improve administrative and financial management of the ORMVAs as well as MARA's central irrigation management directorate in Rabat.

These objectives are to be achieved through a significant nation-wide program, tailored to each ORMVA's needs, of technical assistance and training, system infrastructure construction and rehabilitation works, various equipment and vehicles, and miscellaneous supplemental activities, e.g., maintenance improvements, flooding reserve fund, studies and demonstrations, identified as important for improving irrigation management in Morocco.

While these general activity areas for PAGI 2 were defined in 1991, there is still considerable uncertainty at present as to which activities will actually benefit the Tadla ORMVA and at what levels of magnitude.

The primary PSDAGI objectives set out in the preliminary design documents are as follows:

- To improve irrigated crop production, both in terms of yields and rates of cropping intensities, in line with market prices and demand;

- To promote the restructuring of the development services offered by the ORMVAs in line with the findings of the *Systéme d'Information Pour la Gestion* (SIG) study financed by the World Bank;

- To encourage the development of professional organizations and their participation in development; and

- To encourage greater participation by Moroccan universities in irrigation development activities.

Based on the above descriptions, close and effective coordination between these two national projects and the USAID project in Tadla will be imperative. Consultations with the cognizant World Bank managers designing these projects suggest the following most promising areas for inter-project collaboration:

- Tadla perimeter system efficiency improvements, whereby PAGI 2 system "hardware" investments will be used to the greatest extent possible to enhance USAID project system "software" investments aimed at improving overall system efficiency, flexibility, responsiveness, etc., e.g., correcting system operational deficiencies identified through USAID-financed system modelling and monitoring efforts which require additional investments in system operating hardware;

- Information management, principally through ensuring compatibility of the proposed computer hardware and software to be purchased under the respective projects, i.e., financial and management information systems for PAGI 2, and system hydrologic and hydraulic, agro-meteorological, agricultural, socio-economic and environmental quality modelling and monitoring systems for the USAID project;

- Policy enhancement, through Special Studies designed to assess the actual, on-the-ground efficacy and appropriateness of new and/or revised irrigation policies in the Tadla LSI perimeter, e.g., the role of Irrigation Associations in perimeter management, the promotion of the process of disengagement of the state from involvement in commercial perimeter affairs, etc. The results of these studies will be fed into the established World Bank/GOM policy dialogue on these subjects continuing under the SAL, ASAL/ASIL and PAGI 2 projects; and

- Dissemination of useful and relevant USAID project results throughout Morocco's extensive national irrigation network, via PAGI 2's national scope of operations.

Additional areas of inter-project collaboration will be identified as the design for these two World Bank projects proceeds. It is clear that continued close coordination of these activities in Tadla will be required to ensure the best effective use of limited donor resources.

In addition to the above-cited World Bank projects, there are two research projects currently active in the Tadla perimeter. The first of these activities is jointly sponsored by the **International Irrigation Management Institute (IIMI)**, the *Service des Expérimentations de* *l'Hydraulique Agricole* (SEHA) in the *Direction de l'Equipement Rural* (DER) of MARA, and ORMVAT. The other activity is a collaborative study sponsored by Wye College and the *Institut Agronomique et Veterinaire Hassan II* (IAV).

The IIMI/GOM initiative is largely an on-farm research and demonstration program aimed at improving on-farm water use efficiency for selected Tadla crops. Accordingly, this activity is highly complementary to the improved water management objectives of the USAID project's On-Farm Management component. As a result, following promising preliminary field experiments and extensive discussions with IIMI home office and field staff, it has been decided to incorporate the subsequent implementation of the IIMI program into the USAID project. Details of this planned inter-donor collaboration are provided in subsequent sections of this document.

Wye College initiated a three-year academic exchange program agreement with IAV in July 1990. This agreement is funded at £226,000 by the British Overseas Development Administration (ODA). The agreement is centered around four principal research themes:

- Micro-economic analyses of the impacts of changes in Moroccan agricultural policies at the farm-level in the ORMVA perimeters;

- Determination of what kind of software packages are most appropriate for management information systems in the ORMVAs;

- Research on the use of expert systems in dealing with problems of irrigation and drainage; and

- Development of training modules on the information gathered under the above three research themes for presentation at two workshops to be held during the program.

This joint study program is now proceeding according to schedule, with completion planned in mid-1993. USAID project staff will closely monitor the results of this effort to ensure the timely and successful integration of Tadla-relevant results into the greater USAID project effort.

II

PROJECT DESCRIPTION

1. Perceived Problem

The project will address the **existing productivity and institutional gaps in the regional economy** of the Tadla irrigation perimeter. The productivity gap is defined as the difference between sustainable resource use within the agricultural production potentials of the Tadla perimeter, and the existing levels of resource use as expressed in actual crop and livestock production in the perimeter.

The institutional gap is defined as the transitional void created as the ORMVAT redefines its operational mandate and continues to disengage from those public sector activities deemed commercial in nature, and the time needed for the private sector to develop the capacity to assume new roles and responsibilities within the Tadla economy.

The project will take place within the upper Oum Er Rbia River basin of Morocco (see Map 1). Known as the "Mississippi of Morocco", the Oum Er Rbia River is the second largest river basin in Morocco, delivering on average some 25 percent of the country's total available surface water supplies. It is also the most developed basin in Morocco, with 4,775 million cubic meters or almost half of the nation's total available reservoir capacity within seven major dam systems, 370 megawatts or some 60 percent of the country's total installed hydropower production capacity, and 200,000+ hectares (ha.) of irrigated agriculture - 20% of total capacity and about 40% of the large-scale irrigation capacity. In addition, this system provides municipal, industrial and domestic water supplies for millions of downstream consumers, including a major portion of the requirements for the Casablanca-Rabat and Marrakech commercial and administrative centers of Morocco.

As a result of these tremendous investments in hydraulic infrastructure, this river basin is now developed almost to capacity. Nevertheless, with continuing growth of the population and the regional economy, demand for water will continue to increase, especially in the economically important area of industrial supplies. Current government estimates project a deficit of more than 800 million cubic meters of water per year in this basin by the year 2020, and there is little prospect of supply augmentation through transfers from other river basins. In fact, current plans call for additional water transfers from the Oum Er Rbia River basin to neighboring, less water-rich river basins. Therefore, this additional future demand can only be met through increased use efficiency and conservation of this vital economic resource.

The project will take place within the Tadla irrigation perimeter, one of two LSI perimeters within the Oum Er Rbia River basin. The Tadla perimeter is situated 200 kilometers southeast of Casablanca along the Oum Er Rbia River immediately downstream of Beni Mellal (see Map 1). The Tadla climate is arid to semi-arid, with a mean annual rainfall of 350 millimeters. Soils in the area possess adequate depth and suitable texture for irrigated agriculture.

The Tadla perimeter covers a total area of 320,000 ha., about 300,000 ha. of which are devoted to agricultural production. Ninety-seven thousand hectares of this area are irrigated under the large-scale irrigation scheme, 5,000 ha. are irrigated in small and medium-scale schemes, and 12,000 ha. are cultivated using pumped groundwater. Of the remaining area, 137,500 ha. are cropped under rainfed conditions, 17,000 ha. are classified as forests, and 28,000 ha. are used as grazing lands. With over 110,000 ha. of land under some form of irrigation, the Tadla system is the largest existing irrigation perimeter in Morocco, accounting for some 11% of the total existing capacity and 8% of the country's total irrigation potential.

The Tadla perimeter is divided into two hydraulically separate subperimeters by the Oum Er Rbia River (see Map 2). The Beni Amir subperimeter is located on the right bank of the river and contains about 27,000 hectares irrigated from the Oum Er Rbia River via the Kasba Tadla diversion dam. The reservoir associated with this dam has an operating storage of about 120,000 cubic meters capacity and provides water to the irrigated subperimeter through a canal along the left bank of the river connected to a small regulating reservoir of 100,000 cubic meters capacity at Kasba Zidania. The water discharges from this latter reservoir either through a small hydro-electric plant or into a siphon under the Oum Er Rbia River and into the main Beni Amir irrigation canal.

The Beni Moussa subperimeter is located on the left bank of the Oum Er Rbia River and covers about 70,000 hectares of land irrigated with water from the Bin El Ouidane Dam on the Oued (river) El Abid in Azilal Province. This dam has a total storage capacity of 1.5 billion cubic meters, with a regulated storage of 1.1 billion cubic meters. Of this total, 720 million cubic meters are allocated to the Beni Moussa subperimeter and 235 million cubic meters will be allotted to the lower Tessaout perimeter in the Haouz ORMVA upon the completion of the T2 transit canal in the next few years. This additional allocation will impose new constraints on the water supply to the Beni Moussa subperimeter from the Bin El Ouidane Dam.

Water for the Beni Moussa irrigation subperimeter is supplied from a compensating dam at Ait Ouarda, located immediately downstream of the Bin El Ouidane Dam. It then passes through a tunnel 10.5 kilometers long to a second hydro-electric plant at Afourer. Water from the hydro-electric plant at Afourer discharges directly into the two main canals — "GM" and "D" — of the subperimeter. The upper reaches of both main canals serve as in-line storage reservoirs with a total capacity of 300,000 cubic meters, allowing evening peak hydro-electric generation needs to be met while supplying the relatively constant irrigation system demands.

The principal hydraulic infrastructure for the two large-scale subperimeters, in addition to those mentioned above, includes 200 kilometers of main canals, 360 kilometers of primary and secondary canals, and 1,800 kilometers of tertiary canals, in addition to many more kilometers of unlined field ditches, or quaternary canals. Drainage is provided by a network of surface drains totaling 1,700 kilometers.

Approximately 28,000 farms are contained within the Tadla perimeter. Farm size varies considerably, with farms of less than 5 hectares constituting 82 percent of the total number, but only 41 percent of the total area; and the 2 percent of the farms which are greater than 20 hectares in size comprise 27 percent of the total area. The ability of water distribution managers to respond to farmers' requests is stressed by the sheer number of farmers and is compounded by the diversity of farm sizes and types.

The primary crops produced in the Tadla perimeter are cotton, sugar beets, forage crops, vegetables, olives, citrus, and hard and soft wheats, accounting for 90%, 33%, 15%, 12%, 11%, 10%, and 4% of total national production, respectively. Additional Tadla agricultural crops include paprika peppers, cut flowers, and minor areas of maize and soybeans.

Livestock production is also important in Tadla. Annual milk production, from some 110,000 head of dairy cattle, amounts to 70,000 metric tons. In addition, there are about 500,000 head of sheep and goats within the perimeter area. In the 1985-86 growing season, this regional economy accounted for over $375 million in total agricultural production.

It is not difficult to imagine the tremendous national investment represented in this perimeter and its associated upstream hydraulic and hydro-power works. Despite the impressive production figures cited above, at present, this system is not realizing its full economic potential. Recent estimates place the overall perimeter water use efficiency at about 50 percent, as a result of system design and operating deficiencies (6% direct loss), low canal delivery efficiencies (80%) and low field application efficiencies (40-60%), and canal leakages and other related structural defects throughout the system (14% direct loss). Thus, aside from certain structural defects, the fundamental reasons for the evident lack of performance of this perimeter are inflexible system design and operational characteristics, and inefficient water application and use at the farm-level.

Partially as a result of these inefficient water management practices, the system is also experiencing increasing environmental problems. Salinization, waterlogging and high nitrate levels are cause for increasing concern, especially in groundwater use areas where they are beginning to affect crop production and yields. To address these growing problems, Tadla managers require increased information on the system's hydrology and on the nature and extent of emerging troublesome land and soil management conditions as they occur. Only in this manner will they be able to effect the necessary remedial measures before these problems assume unmanageable proportions.

Under the original irrigation system design, farmers were to plant four or five major crops, e.g., sugar beets, cotton, alfalfa, soft and hard wheat, and vegetables, in strictly prescribed crop rotation patterns with rigidly defined planting and harvesting dates. Under such conditions, the system functioned as well as could be expected. However, with the country's new irrigation policies, farmers are now increasingly able to choose for themselves which crops they wish to grow and in what rotations. Thus, future cropping patterns will be determined by farmers in response to competitive market forces, rather than by government dicta and the constraints imposed by a rigid and inflexible system of perimeter management. As these more market-oriented production practices take hold, farmers are finding that they cannot obtain reliable water deliveries when and where they need them, resulting in inefficient on-farm water management practices. This problem is aggravated by farmers' lack of knowledge regarding optimal cultivation practices for these new, more competitive crops and cropping systems.

In order to be able to respond to these changing farmer demands, Tadla system managers must be able to react in a much more timely and flexible manner. Increased system flexibility requires that system managers possess a better knowledge of the true capability of the Tadla hydraulic system and optimal water requirements for these new crops and cropping systems. For their part, farmers require better information regarding system capabilities and constraints and on improved cultivation practices for these more marketable crop varieties, if they are to be able to fulfill their enhanced role in increasing the economic productivity and yield of the system and in realizing its true economic potential.

A greater reliance on open market forces in Tadla will require a strengthened and more vital private agribusiness sector to assume an expanded role in leading the perimeter through the transition to a more commercial, market-driven economy. Such leadership can only come through innovative, private organizational approaches to Tadla resources management, as the system attempts to overcome the great inertia imposed by many years of strict government control.

2. Project Goal

The goal of the project is to promote the long-term competitiveness and environmental sustainability of Moroccan irrigated agriculture.

Achievement of these goal-level objectives will require that Tadla-specific, purpose-level results are replicated to the extent applicable throughout Morocco's irrigation system network. This replication will be promoted through a planned program of periodically disseminating relevant project findings and results to the managers of the other irrigation perimeters in Morocco and to concerned national irrigation management officials in Rabat. Continued close project coordination with the World Bank's national PAGI 2 project will also help to ensure that sufficient resources are available for the timely replication of promising USAID project results in other irrigation perimeters throughout Morocco.

3. Project Purpose

The project **purpose** is to increase the efficiency, economic yield and environmental sustainability of irrigation resources management and use in the Tadla irrigation perimeter of Morocco.

This purpose will be achieved through an integrated program of technology transfer, research and demonstration, institutional and private sector strengthening, and policy analysis designed to:

- **Improve Tadla Irrigation Resources Conservation and Production Practices**

  This objective will be achieved through the provision of technical assistance, training, pilot demonstration programs, research, and equipment and supplies designed to examine existing irrigation resources allocation, management and use practices, and transfer improved technologies to yield optimal resource use efficiencies, cropping productivity and economic yield in Tadla perimeter irrigation operations.

- **Enhance the Environmental Sustainability of Resource Management and Use within the Tadla Perimeter**

  This objective will be achieved through the provision of technical assistance, training and equipment and supplies designed to examine key environmental issues associated with improved water and soil resources management within the Tadla perimeter area, and develop improved technologies, practices and procedures for addressing those issues in a sound and appropriate manner.

- **Increase Private Sector Participation in Tadla Resources Allocation, Management and Use**

  This objective will be achieved through the provision of technical assistance, training and small-scale institutional strengthening activities to promote increased participation of private regional interests in decisions regarding resource allocation, management and use within the Tadla perimeter area.

- **Improve Morocco's Irrigation Resources Management Policy Framework**

This objective will be achieved through the completion of policy analyses and socio-economic studies on such topics as water pricing policy and cost recovery, land tenure and resource user rights, the respective roles of the public and the private sectors in resource management and use, and mechanisms for mobilization of non-governmental participation in resource allocation, management and use decisions. Results of this work will be used to supplement the ongoing policy dialogue on these and other subjects, principally between the World Bank and the GOM.

4. Project Inputs and Outputs

The project will be implemented through **four principal components**, plus a modest, complementary cooperative research and demonstration grant to IIMI. Each of these components is described in the following section, together with their respective inputs and planned outputs.

a. Improved Irrigation System Management

This project component is designed to overcome the limitations of the existing physical irrigation system and associated operating procedures for providing appropriate irrigation water deliveries to farmers, i.e., greater efficiency, flexibility, reliability and timeliness of system-level water deliveries. Overall, this component comprises four main activities: system-level diagnostics, water supply analysis, water demand analysis and improved irrigation system management. Implementation of this project component will be the responsibility of a long-term, expatriate Irrigation Engineer.

The first step towards improving system-level management within the Tadla perimeter is completion of an initial system-wide diagnostic study. This study will provide a better understanding of what is actually happening at all levels in the irrigation system and will identify operational problems and constraints critical for the proper design and implementation of the other system management improvement activities described below. A second mid-term diagnostic study will also be undertaken after four years of project implementation to assess the direction and degree of change in system management in response to farmers' needs, and to allow for mid-course corrections in this project component. Completion of these two studies will require short-term technical assistance, including the full participation of ORMVAT staff and Tadla farmer representatives.

The second major activity to be completed under this project component will be a detailed analysis of water supply flows into the system, via both the Oum Er Rbia river and the Bin El Ouidane dam. This analysis will provide a reliable estimate of system water supplies upon which to base future system (and dam and hydropower plant) operating procedures and production plans. This task will entail performing a detailed statistical analysis of available historical river and dam hydrologic data, and associated dam and hydropower plant operational data. Completion of this task will require short-term technical assistance to conduct the initial analysis, a computer and appropriate software to store and analyze the data, and the training of ORMVAT staff to use the final hydrologic analysis system and to properly interpret and utilize system results.

The third activity under this component will be to develop a more reliable definition of water demand in the Tadla irrigation system. This activity will entail the completion of two associated tasks.

The first task will entail the development of a comprehensive Geographic Information System (GIS) to provide readily accessible information on the perimeter to improve system-level planning and management of irrigation and other regional agricultural activities. Important initial GIS parameters will include: perimeter geography and topography, the irrigation system layout, cropping patterns, soil types, land holdings, salinity contours and water table elevations. Other information of potential planning and evaluation interest, such as perimeter socio-economic data and demographic patterns, will be added to the GIS as time and resources permit. Development of an operational GIS will require short-term technical assistance to design the system, guide system installation and provide start-up training to selected ORMVAT and project staff, long-term overseas training in GIS applications for irrigation system planning and management purposes, and an integrated GIS, including a computer with two work stations and associated software and peripherals.

The second task to be completed under this water demand analysis activity is the installation of an agro-meteorological monitoring network within the perimeter for real-time monitoring and reporting of critical micro-climatic data for hydrological information and agricultural planning and production purposes. This task will entail the installation of automated meteorologic stations in each of Tadla's three distinct climatic zones, i.e., Beni Amir, Beni Moussa West and Beni Moussa East. Completion of this task will require short-term technical assistance for final system design, installation and training in system operations, and system equipment, including a computer and associated software, system sensors and data loggers, and radio data transmission and receiving equipment. Important additional water demand data will be provided through the project's On-Farm Management component described below.

The fourth activity to be completed under this component is improved irrigation system management. This activity will entail the completion of four associated tasks.

The first of these tasks will be the establishment of a supervisory data acquisition system for improved monitoring of system-level operations and to provide input into the system hydraulic model (see below). Establishment of this system will entail the installation of appropriate water flow monitoring devices at selected points throughout the system. In addition to flow rates in principal system canals, this system will monitor unused return flows at critical system points to better relate system flows to water actually used in the perimeter. A more detailed description of this planned hydraulic monitoring system is provided in Part 1 of the Technical Analysis. Completion of this activity task will require short-term technical assistance for final system design, installation and staff training, equipment and materials for system installation, short-term overseas training to study and learn from similar systems existing in the U.S., and a computer with associated software and radio data transmission and receiving equipment.

The second task included under this activity will be the development of a computerized hydraulic model of the primary elements of each of the two Tadla subperimeters. This model, fed with real-time data from the supervisory data acquisition system described above, will serve as the principal planning and management tool for improving system-level operational efficiency, responsiveness and flexibility. Model development will require short-term technical assistance and training to install the model and to train ORMVAT system managers in its operation and use, and two dedicated computers - one for each subperimeter - with associated software and peripherals.

The third task under this component activity is the development of mobile monitoring units for each of the two Tadla subperimeters to provide improved information on water distribution at the primary, secondary and tertiary levels of the irrigation system. These units will routinely monitor performance at the lower levels of the system to better determine overall system operational efficiencies and to identify and correct any problems observed in the hydraulic system, e.g., turnout gate settings, physical deficiencies, etc. Completion of this task will require short-term technical assistance and training to establish the two units and associated operating procedures, various portable water flow measuring devices, and vehicles.

The fourth and final activity task, which relies on the successful completion of the other component activities described above, is the development of an improved water distribution and management system in the Tadla irrigation perimeter for more efficient, timely, responsive and flexible future system operations. This task will entail the computerization of water ordering and delivery procedures to free Tadla "ditch riders", or *aiguadiers*, from excessive paperwork, allowing them to devote additional time towards the effective implementation of water delivery schedules and to discuss problems with farmers. Completion of this task will require short-term technical assistance and training to develop the computerized system and to train ORMVAT staff in its operating procedures, and three computers - one for each perimeter subdivision - with associated software and peripherals.

The long-term Irrigation Engineer will be responsible for coordinating the implementation of all of the short-term technical assistance, training and commodity inputs for this project component, as well as for ensuring that all of the improved system-level information generated under this component is properly integrated and used in the improved perimeter irrigation planning and management process for the benefit of system farmers. S/he will require two vehicles for this purpose, i.e., one at project start-up, and one replacement vehicle during year four of project implementation.

A summary of the inputs and outputs of this project component follows:

(1) Irrigation System Management Component Inputs

- Long-term Technical Assistance
  - Irrigation Engineer (5.5 py)
- Short-term Technical Assistance (57 pm)
  - System Diagnostic Studies

- Surface Water Hydrology/Hydraulics
- GIS Design, Installation and Training
- Agro-Meteorology
- System Data Acquisition/Management
- System Operations Modelling/Monitoring

- Training (shared cost)

  - Long-term Overseas (48 pm)
  - Short-term Overseas (14 pm)

- Equipment and Supplies (see Annex K)

  - Computers and peripherals (7)
  - Computer software (misc.)
  - Geographic Information System (1)
  - System Data Acquisition and Monitoring Equipment and Materials (misc.)
  - Vehicles (4)

(2) Irrigation System Management Component Outputs

- More efficient, reliable, flexible and timely delivery of irrigation water, through:

  - A better understanding of the capabilities and limitations of the hydraulic systems in the perimeter;
  - More flexible system operating capabilities and procedures that are responsive to farmer's needs and evolving cropping systems;
  - Improved water delivery efficiencies, i.e., total water savings of up to 68.4 million cubic meters per year from increased canal delivery efficiencies;
  - Near real-time measurement of crop water requirements and climatic variability within the perimeter;
  - A microcomputer network, linking databases in system supply and demand, and operations and management; and
  - Improved timeliness and appropriateness of system water management decisions, with an associated improvement in the ORMVAT's ability to respond to farmers' irrigation needs in a flexible and timely manner.

- Increased availability of critical management information to farmers, processors, and other public and private agricultural interests in the region, through:

- Current weather data made available to farmers, processors, and other private sector actors for improved decision-making for all agricultural operations; and
- An improved understanding by farmers of the capabilities and limitations of the water delivery system and how they affect farmers' enterprise management decisions.

■ Improved information available for irrigation planning purposes, resulting in increased system productivity from improved decision-making, through:

- An up-to-date hydrologic database with the expertise necessary to analyze water supply scenarios for application to the irrigation planning process; and
- Improved definition and understanding of actual cropping and land-use patterns in the perimeter, and of how these patterns are evolving over time.

b. Improved On-Farm Management

This project component is designed to improve farm-level management of Tadla perimeter resources. This objective will be accomplished through three major component activities, including farm-level diagnostics, on-farm pilot demonstration activities and an information dissemination program. Implementation of this component will be the responsibility of a long-term, expatriate Agricultural Economist. This project component is closely related to the planned IIMI on-farm research and demonstration program described below.

The first step towards improving on-farm management of irrigation resources in Tadla will be the completion of an intensive farm-level diagnostic study. This study will serve to identify farm-level constraints to improved resources management, e.g., water, land, labor, capital, and managerial and technical expertise, and will assist in the design of relevant pilot demonstration activities to show Tadla farmers the best methods to alleviate those constraints. The study will be designed and implemented to ensure that the role of women in the regional agricultural economy is also properly addressed. The study will also include sufficient scope to collect accurate baseline information on other important socio-economic characteristics of the Tadla population.

Detailed farm-level information is indispensable for enabling irrigation system managers to better meet changing farmer demands for water supplies. It will also enable farmers to gain a better appreciation of irrigation system constraints in order to better adapt their technologies and practices for effective on-farm resource allocation, management and use.

The initial task in completing this diagnostic study will be the development of an accurate inventory and typology of farm enterprises in the Tadla perimeter. This inventory will be used to select a representative sample of 200-300 Tadla farms for detailed study. The initial intensive diagnostic study will be completed over at least two full cropping cycles, i.e., winter and summer crop rotations over two successive years. This diagnostic procedure will then be institutionalized within the ORMVAT through the completion of annual study updates conducted jointly by ORMVAT and project staff to establish a permanent regional capacity to collect and analyze information on farm households and their operations in the perimeter over time. The results of this work also will be incorporated into the Tadla GIS for improved, integrated perimeter planning and management. Completion of this activity will require short-term technical assistance for study design, implementation and analysis, and staff training.

The second activity under this component - on-farm pilot demonstration activities - is designed to promote new and improved technologies for on-farm resources management and use. Demonstration activities will be selected based on the results of at least the first full year of the diagnostic study described above. An illustrative list of possible demonstration activities includes: on-farm water management; conjunctive use of surface water and groundwater; agronomic field trials of new, high-value crops and cropping systems; selected, improved pest management techniques; soil management practices; on-farm drainage alternatives; and water recycling and re-use. These demonstration activities will be conducted with the full participation of regional private sector input suppliers to maximize opportunities for strengthening and upgrading local private capabilities for meeting identified farmers' needs for the provision of new equipment, technologies, materials and supplies. Completion of this activity will require short-term technical assistance for demonstration activity design, monitoring and evaluation, study tours to obtain first-hand knowledge of similar promising techniques in other Moroccan and/or third country situations, and demonstration equipment, materials and supplies.

The third, and final, activity under this component is an effective information dissemination and outreach program to ensure that project results are effectively conveyed to as wide an audience as possible and put to effective use in improving overall perimeter performance and realizing project objectives. Information generated and recommendations advanced from this component, as well as the other project components described above and below, will be discussed and debated at a series of annual regional workshops. Participation in these workshops will be open to all interested parties, including ORMVAT personnel, representatives of farmer groups, cooperatives, and professional organizations, and the private sector. Representatives from other ORMVAs with similar problems and opportunities will also be invited to participate in these workshops in order to maximize cross-fertilization of ideas and dissemination of results.

The project will also work closely with extension agents, professional organizations and other interested parties at the regional and national levels to develop and disseminate technical information summaries, both orally and in written form, with detailed recommendations as appropriate. Field days will be organized for farmers and other groups to visit pilot demonstration sites and discuss with project staff and participating farmers how new technologies could be adopted and put to effective use. Finally, the project will also assist in establishing a regional capability for radio broadcasting of project results and other relevant national and international agricultural information throughout the Tadla perimeter area. Completion of this activity will require short-term technical assistance to organize and assist in implementing the project outreach program, workshop and local travel costs, and radio station equipment, materials and supplies.

The long-term Agricultural Economist will be responsible for coordinating the implementation of all short-term technical assistance, training and commodity inputs required for this component, and for ensuring that all of the farm-level information generated is used effectively for the benefit of Tadla farmers and other regional private sector interests. S/he will require two vehicles for this purpose, i.e., one at project start-up, and one replacement vehicle.

A summary of the inputs and outputs of this project component follows:

(1) On-Farm Management Component Inputs

- Long-term Technical Assistance
  - Agricultural Economist (4.5 py)
- Short-term Technical Assistance (42 pm)
  - On-Farm Diagnostic Studies
  - Pilot Demonstration Activities
  - Information Dissemination/Outreach
- Training (shared cost)
  - Regional Workshops (5)
  - Study Tours (16 pm)
- Equipment and Supplies (see Annex K)
  - Demonstration Equipment, Materials and Supplies (misc. - shared cost)
  - Radio System Support (misc. - shared cost)
  - Vehicles (2)

(2) On-Farm Management Component Outputs

- Improved definition and understanding of the socio-economic characteristics of the Tadla farming community - including womens' roles in the regional economy - and of actual cropping, land-use and tenure patterns, and how they are evolving over time;

- Improved understanding by farmers of the capabilities and limitations of the Tadla water delivery system and how these relate to and affect their farm management and resource allocation decisions;

- Improved understanding by the ORMVAT of farmers' decision-making processes and an enhanced ORMVAT capability to be more responsive to its clients' requirements;

- A set of tested, improved technologies and practices for dissemination to Tadla farmers to alleviate constraints on resource use efficiencies and economic performance at the farm level; and

- Improved water delivery efficiencies to farms and improved water application/use efficiencies at the farm level, i.e., a total water savings of up to 42 million cubic meters per year from improved field application efficiencies within 15 years.

c. **Sustainable Environmental Management**

This component will address major environmental problems within the Tadla perimeter, such as waterlogging, salinization, and water and soil degradation, resulting largely from inappropriate water and soil management practices, excessive and/or inappropriate agrochemical management and use, and agro-industrial pollution. These objectives will be realized through the completion of four major activities, including improved groundwater and drainage management, improved soil and water quality management, improved agrochemical management and use, and agro-industrial pollution prevention -- all designed to enhance the environmental sustainability of Tadla perimeter operations.

Due to the cross-cutting nature of this project component, its successful implementation will require the joint oversight of the Irrigation Engineer (water and drainage aspects), Agricultural Economist (soil and agrochemical aspects) and the long-term, expatriate Private Sector Coordinator (private agrochemical and agro-industrial aspects). (The more fundamental tasks and input requirements for the Private Sector Coordinator are described below in the Private Sector Strengthening component.) The Irrigation Engineer will retain primary responsibility for ensuring that this component's activities are completed in a timely and effective manner.

The first activity is designed to improve groundwater and drainage management within perimeter areas. The first and most important step towards achieving this objective will be the establishment of a comprehensive groundwater and drainage monitoring network within the perimeter. This monitoring network will provide real-time information on the nature, causes and extent of such environmental concerns as waterlogging and salinization in perimeter areas, allowing for the design and implementation of appropriate and timely remedial measures. This network will consist of some 100 new groundwater monitoring stations and 20 new gauging stations for drainage monitoring within the perimeter to supplement the inadequate existing monitoring network. The network will also provide for sufficient equipment to conduct special studies of identified problem sites.

Information generated through this improved monitoring network will be used to complete a comprehensive, computerized model of the groundwater resources in Tadla. Upon completion, this groundwater model will be integrated with the surface water hydraulic model being developed under the first project component, as well as the Tadla GIS, for improved, integrated management of all Tadla water resources. The results of this activity will also be used to design appropriate on-farm pilot demonstration activities, discussed above under the second project component, on such topics as management of water table fluctuations, conjunctive use of surface and groundwater resources, and appropriate drainage system alternatives.

Completion of this activity will require short-term technical assistance to complete the final monitoring network designs and the groundwater model, to provide design and implementation oversight for the on-farm demonstration activities, and to train ORMVAT staff in network and model operations and analysis. Other component inputs will include short-term overseas study tours to demonstrate similar groundwater and drainage monitoring/management systems in the U.S. and other countries, monitoring equipment and supplies, laboratory analysis services, on-farm demonstration equipment and materials, and a computer with associated software and peripherals.

The second activity included under this component is <u>improved soil and water quality management</u>. The initial task here will be the establishment of soil and water quality monitoring systems throughout the perimeter. The soil monitoring network will consist of three sub-samples taken at each of 20 sites three times per year for such parameters as pH, salinity, total nitrates, mineral nitrates and cation exchange capacity. The water quality network will consist of 100 sites, each of which will also be sampled three times per year for such parameters as pH, dry residues, nitrates, nitrites, salinity and the prescence of up to five selected toxic chemicals (see agrochemical activity below).

The information generated from this monitoring network will be integrated into the Tadla GIS. This information will also be used for developing effective and timely remedial interventions through the on-farm pilot demonstration activities described above and through the agrochemical management and agro-industrial pollution prevention activities described below.

This activity will require short-term technical assistance to finalize the monitoring network design and to train staff in its operation, water and soil monitoring equipment and supplies, laboratory sample analysis services, on-farm demonstration equipment and materials, and a computer with associated software and peripherals.

The third activity under this component is designed to improve the management and use of perimeter agrochemicals. As little information is available at present regarding current agrochemical management practices in the perimeter, the first task here will be to complete a comprehensive inventory of current agrochemical suppliers, and storage and disposal sites throughout the perimeter, as well as an assessment of existing agrochemical use practices, e.g., application dosages and rates, mixing and application procedures, handling precautions, and means of disposal. Much of this information will be collected as a part of the on-farm diagnostic activity described above under the second project component.

Information generated from these studies will be used to develop an agrochemical monitoring system for perimeter areas, which will include the capability for incorporation of new suppliers and storage and disposal sites as they are identified. This system will be closely integrated with the soil and water quality monitoring program described above in order to provide more detailed information regarding potential toxic hazards or impacts at critical sites. Once established, this system will be integrated into the Tadla GIS to further assist system managers in identifying potential problems and effecting timely remedial action.

Agrochemical assessment results will also be used to develop a targeted farmer training and education program designed to improve on-farm management and use of agrochemicals, including appropriate safety precautions. This information will also feed into the on-farm demonstration activities described above for use in the design of appropriate pilot interventions aimed at reducing the use of uneccessary and/or potentially hazardous agrochemicals, such as integrated pest management techniques.

Completion of this component activity will require short-term technical assistance to complete the inventory/assessment and to design and oversee implementation of the monitoring system, the training and education program, and the on-farm demonstration activities, and to provide on-site training of regional staff and farmers' representatives. This activity will also require agrochemical sampling equipment and supplies and laboratory services, on-farm demonstration equipment and materials, and a computer with associated software and peripherals.

The fourth and final environmental management activity is agro-industrial pollution prevention. This activity will work with regional agro-industries, selected in coordination with the environmental quality monitoring program described above, to identify cost-effective opportunities for minimizing waste generation and reducing pollution through improved management and operations of agro-processing plants and equipment. This program will be implemented through the completion of environmental audits at selected regional plants. These audits will be designed to assess existing plant operations and to recommend appropriate pollution prevention measures, such as improving operational efficiencies, minimizing waste generation, and employing appropriate waste recycling alternatives and general good plant housekeeping procedures. Special attention will be devoted to those facilities capable of effecting significant reductions in water use and/or water pollution in perimeter areas, in agreement with the project's water conservation objectives. Priority will also be accorded to export-oriented firms and those firms currently on the GOM's list for privatization, in support of other important USAID program objectives.

Completion of this activity will require short-term technical assistance to perform the audits and assist interested firms in implementing agreed upon audit recommendations, and facility-upgrading equipment and materials.

Two vehicles, i.e., one at project start-up and one replacement vehicle, will also be required for this project component.

A summary of the planned project inputs and outputs for this project component follows:

(1) Environmental Management Component Inputs

- Long-term Technical Assistance (no additional cost)
  - Irrigation Engineer

- Agricultural Economist
- Private Sector Coordinator (included in Section d. below)

■ Short-term Technical Assistance (50 pm)

- Groundwater Hydrology/Management/Use
- Agricultural Engineering
- Agro-Chemical/Environmental
- Soil Management
- Irrigation Drainage/Water Re-Use

■ Water/Soil Quality Analysis Services (150,000+ samples)

■ Training (shared cost)

- ST Overseas (10 pm)

■ Equipment and Supplies (see Annex K)

- Computers and peripherals (2)
- Computer software (misc.)
- Groundwater/Drainage Monitoring Equipment and Materials (misc.)
- Water/Soil Quality Monitoring Equipment and Materials (misc.)
- On-Farm Demonstration Equipment and Materials (misc. - shared cost)
- Facility Upgrading Equipment and Materials (misc. - private sector cost)
- Vehicles (2)

(2) Environmental Management Component Outputs

■ A better understanding of water balance and drainage system efficiencies in the Tadla perimeter;

■ A functional Tadla groundwater model, integrated with the surface water management model, for improved, integrated management of all perimeter water resources;

■ Improved management of groundwater resources and soil decomposition resulting from salinity problems in perimeter areas;

- A better understanding of water and soil quality issues related to agrochemical use in perimeter areas;

- An information exchange network to enhance awareness of critical water and soil pollution levels in Tadla;

- Improved agrochemical storage, handling, use and disposal practices in Tadla; and

- Improved management of water and soil quality problems in the perimeter, through demonstration of improved on-farm and agro-industrial practices and technologies.

d. Private Sector Strengthening

This component is designed to increase private sector participation in the Tadla regional economy. For project purposes, the private sector is broadly defined to include farmers, cooperatives, associations and other professional groups, and private agribusiness firms and publicly-owned firms slated for privatization. This objective will be achieved through the completion of four component activities, including a comprehensive Tadla agribusiness assessment, a private sector institutional strengthening program, a private sector promotion program, and a program designed to enhance private sector participation in Tadla resources allocation, management and use. Implementation of this component will be the responsibility of a long-term, expatriate Private Sector Coordinator, with primary experience in farm-level irrigation production technologies and associated business practices.

The first activity under this component will be the completion of a comprehensive, gender-sensitive assessment of Tadla agribusiness interests. This assessment will provide a better understanding of existing private regional agribusiness commodity linkages, or *filieres*, in Tadla, including their respective capabilities, needs and constraints. Based on the results of this assessment, promising and interested private regional agribusiness interests, such as multi-service cooperatives and firms, will be selected for more detailed diagnostic study of their respective strengths and weaknesses in such areas as overall business management, strategic planning, financial planning and management, assets and liabilities, cash flow, member/client base, effectiveness at meeting member/client needs for services and support, and potential for future growth and expansion.

The results of these detailed diagnostics will serve as the basis for the design of second component activity - the private sector institutional strengthening program. Under this program, participating firms, cooperatives and associations will receive technical assistance and training specifically designed to upgrade their identified areas of weakness and strengthen their roles as reliable private input and service suppliers within the Tadla economy. In addition, selected associations and cooperatives will receive limited business management equipment support on a cost-shared basis. Implementation of this program will rely, to the greatest extent possible, on Moroccan business management and training expertise, in agreement and coordinated with the objectives and procedures developed under USAID's Training for Development, Agribusiness Promotion and New Enterprise Development Projects.

Completion of these first two component activities will require short-term technical assistance to conduct the private sector assessment and diagnostic studies and design and implement the strengthening programs, short-term overseas study tours and internships to obtain first-hand experience regarding the proper management of similar private agricultural service organizations in the U.S. and other countries, extensive short-term in-country training coursework, workshops and seminars, and business management and training equipment and supplies.

The third activity of this component is the private sector promotion program. This activity is designed to promote the public-to-private sector transfer of responsibility for the provision of commercial agricultural services in Tadla through the identification of and assistance to promising areas of new or expanded private agribusiness opportunities as the public sector disengages from this sphere of the regional economy. Most of these business opportunities will be identified through the agribusiness assessment described above and through the on-farm diagnostic to be completed under the second component. Similarly, the assistance here will be provided primarily through the active encouragement of local private participation in the project's irrigation system improvement, on-farm demonstration, and environmental monitoring and analysis activities.

It is anticipated that many new or expanded opportunities for the provision of private commercial services and supplies will be identified as new techniques and technologies are developed, tested and disseminated under the project. Program participants will also benefit from the assistance to be provided under the private sector strengthening program described above and, where applicable, from the assistance available through other USAID private sector promotion projects. Maximum attention will be devoted to facilitating joint U.S./Moroccan ventures for the provision of promising new irrigation resources management technologies, in agreement and collaboration with other appropriate USAID projects and program objectives. Special attention will also be devoted to women-owned businesses, and to enterprises where women figure prominently in business operations, such as dairy cooperatives and agribusiness processing plants.

The fourth and final private sector strengthening activity is designed to enhance private regional participation in Tadla resources allocation, management and use in order to further facilitate the ORMVAT disengagement process, and to provide for increased information flow between farmers and private sector interests and system managers. These objectives will be accomplished through the analysis of existing mechanisms for public-private sector dialogue in Tadla, and through assistance in implementing improved mechanisms for facilitating a more effective and mutually rewarding information exchange.

This in-country work will be enhanced through joint public-private sector study tours to similar communities in the U.S. to obtain firsthand insights into effective public-private sector relationships in agricultural resources allocation, management and use. Provision will also be made for similar joint U.S. groups to travel to Morocco, in the interest of fostering a more lasting, "twinning"-type relationship between Tadla and a similar agricultural community in the U.S.

Completion of this activity will require short-term technical assistance to complete the analytical studies and assist in implementing agreed-upon recommendations, and short-term overseas travel expenses.

The Private Sector Coordinator will have primary responsibility for the effective coordination and implementation of all of the short-term technical assistance, training and commodity support required for this component. S/he will require two vehicles for this purpose, i.e., one at project start-up, and one replacement vehicle.

A summary of planned inputs and outputs for this project component follows:

(1) Private Sector Strengthening Component Inputs

- Long-term Technical Assistance

  - Private Sector Coordinator (4 py)

- Short-term Technical Assistance (35 pm)

  - Cooperative Management
  - Professional Association Management
  - Irrigation Association Management
  - Private Sector Input & Service Supply
  - Regional Agribusiness Support

- Training (shared cost)

  - Short-term Overseas (study tours, courses, internships - 22 pm)
  - Short-term In-country (coursework, workshops, seminars - misc.)

- Equipment and Supplies (see Annex K)

  - Business Equipment and Supplies (misc. - shared cost)
  - Training Equipment and Supplies (misc.)
  - Vehicles (2)

(2) Private Sector Strengthening Component Outputs

- A better definition of the role of the regional private sector in the Tadla economy, including the manner and scope of their involvement, and their capabilities, needs and constraints;

- A better understanding of operative agricultural commodity chains, or *filieres*, at all stages of irrigated agriculture in Tadla;

- Strengthened private regional capacity in Tadla to manage agricultural business/service activities and to assume an increased role in the regional economy;

- A more smooth and rapid public-private sector transfer of commercial activities in Tadla through the identification and promotion of new and expanded opportunities for private sector provision of agricultural-related supplies and services; and

- Enhanced private regional participation in Tadla resources allocation, management and use decision-making - including women - through more effective public-private sector dialogue and increased information flow, and demonstration of improved principles and procedures for such interaction.

e. IIMI Cooperative Agreement

In addition to the four major components described above, the project will also support a modest, complementary on-farm research and demonstration program in Tadla currently being implemented with the cooperative assistance of the International Irrigation Management Institute (IIMI), based in Colombo, Sri Lanka.

IIMI is an autonomous, non-profit international research and training institute associated with the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is sponsored by the Food and Agricultural Organization (FAO) of the United Nations, the World Bank, and the United Nations Development Program (UNDP), and comprises more than 45 donor countries, international and regional organizations and private foundations. IIMI's mission is to strengthen national efforts to improve and sustain the performance of irrigation systems in developing countries.

The primary objectives of the IIMI program in Tadla are to develop more complete information on the water requirements of selected, representative perimeter crops and, based on the results of this research, to <u>develop and disseminate improved techniques and practices for more efficient, economic and environmentally sustainable on-farm water use in Tadla</u>. These objectives will be achieved through a series of pilot research and demonstration trials on selected farmer plots in Tadla, with an associated information dissemination and outreach program for promoting the adoption of promising program results.

Overall responsibility for the implementation of this program will rest with Morocco's Resident IIMI Representative, based in Rabat, acting in coordination with senior SEHA and ORMVAT staff. Day-to-day program management will be the responsibility of a full-time, on-site Field Coordinator and a Field Assistant, provided from the ORMVAT's staff. These managers will be assisted by short-term technical assistance to aid in program design, implementation and analysis, and to assist in the effective dissemination and the final evaluation of program results. Additional planned program inputs include short-term overseas training and study tours for participating ORMVAT staff, research fellowships for Moroccan and foreign university students, in-country workshops to periodically assess program progress and disseminate program results, and office staff, equipment and supplies, vehicles, and miscellaneous publications, and research/demonstration equipment and materials.

Although the IIMI program is designed as a "stand-alone" activity within the greater A.I.D. project effort, the great similarity between planned IIMI activities and the project's own On-Farm Management component indicates the need for close inter-activity coordination at the field-level to ensure an effective utilization of limited resources. This coordination will be ensured through the requirement that IIMI program activities in Tadla will be implemented under the overall supervision of the project Institutional Contractor, through such mechanisms as joint annual workplanning, and progress and evaluation reporting.

It must be noted here that project support will only be provided for this IIMI program in the event that IIMI decides to maintain an assistance program in Morocco. A decision on this subject is expected in September 1992. It is largely anticipated that this decision will be positive. However, in the event that this decision is negative, A.I.D. will either seek an alternative organization to undertake this on-farm research and demonstration program, or re-program the project funds allotted to this program into the project's related On-Farm Management component.

A summary of the planned inputs and outputs for this program are as follows:

(1) IIMI Cooperative Program Inputs

- Long-term Technical Assistance
  - IIMI Resident Representative (Irrigation Specialist - part-time, i.e., 9 pm over 3 years; 25% of Representative's time)
- Short-term Technical Assistance (7 pm)
  - Irrigation Research
  - Information Dissemination
  - On-Farm Water Management
  - Evaluation/Audit

- Training (shared cost)
  - Research Fellowships (6)
  - Short-term Overseas Courses/Study Tours (6 pm)
  - In-country Workshops (3)
- Equipment and Supplies
  - On-Farm Research/Demonstration Equipment and Materials (misc. - GOM/private sector cost)
  - Computers and peripherals (2)
  - Vehicles (2 - IIMI cost)
  - Mopeds (10 - IIMI cost)
  - Vehicle Operations and Maintenance (misc.)
- Office Operations (misc.)
  - Secretarial Support (3 pm)
  - Office Operations and Supplies (misc.)
  - Printing and Publications (misc.)

(2) IIMI Cooperative Program Outputs

- A better understanding of the on-farm water requirements of selected representative crops within the Tadla perimeter, under a variety of different growing conditions;
- An improved capability to predict crop water requirements for different growing conditions within Tadla;
- More efficient, effective, and locally appropriate practices and techniques for on-farm water management and use in Tadla;
- Enhanced mechanisms for the dissemination of promising on-farm water management practices and technologies to Tadla farmers; and
- Reduced water-related environmental problems, e.g., waterlogging, salinization, etc., in Tadla through improved on-farm water management practices.

f. Project Administration, Monitoring, Evaluation and Outreach

All of the project components and activities described above, with the exception of the IIMI Program, will be administered and coordinated by the long-term, expatriate contractor Chief-of-Party (C-O-P) - a Senior Irrigation

Management Specialist. S/he will be assisted in these tasks by a full office staff, based in Fkih Ben Salah, consisting of Moroccans employed in the following long-term capacities: an Administrative Assistant; an Accountant; a Secretary; a Secretary/Translator; a Chauffeur; and a Chauffeur/Expeditor. The office will be fully equipped throughout the project's life with all required office facilities, equipment and supplies, computers and associated software and peripherals, and vehicles and operations support and services. Short-term technical assistance will be required to perform periodic audits of project financial accounts.

In addition to his/her administrative responsibilities, the C-O-P will also be required, in coordination with the other long-term advisors included above, to fulfill important project technical requirements, including: project planning, monitoring and evaluation; project data management, analysis and integration, including design, installation and operations of the Tadla GIS; project national and international information outreach programs; and project policy analyses and special studies. S/he will be assisted in these tasks by a long-term Moroccan Monitoring and Evaluation Specialist.

Project planning, monitoring and evaluation will be conducted both internally, throughout the life of the project, and through two external evaluations. Project planning, monitoring and evaluation needs will be met through the establishment of a Project Monitoring and Evaluation Unit, consisting of the IC's Monitoring and Evaluation Specialist and selected ORMVAT staff. This unit will be responsible for assuring that all project planning, monitoring and evaluation requirements are properly fulfilled and for the effective management, analysis and integration of the tremendous amount of data that will be generated under the various activities described above. Details regarding this unit's mandate and operations are provided in Chapter 5.

Unit establishment and operations will require computers and peripherals, office equipment, materials and supplies, and annual project planning and monitoring/evaluation workshops. Unit information management functions will be facilitated through the Tadla GIS described above. The two external project evaluations will require short-term technical assistance services.

In order for the project to achieve its national, goal-level irrigation resources management improvement objectives, a concerted effort will be made to disseminate information and results obtained from project activities in Tadla to the other ORMVAs throughout Morocco. This information outreach program will be implemented through a series of annual, national workshops, sponsored under the project, bringing together a wide group of public and private sector interests with a stake in improved irrigation management in Morocco. It should also be realized that this information-sharing process will be a "two-way street", affording Tadla project participants valuable information and insights regarding problems and solutions occuring in other irrigated regions of the country. For the maximum efficency and effect, these workshops will be closely coordinated with the World Bank's national irrigation improvement activities described in Chapter 1.

Project international outreach efforts will be accomplished largely through association with the IIMI Cooperative Program, association with various A.I.D. centrally-funded, world-wide resources management projects through special studies and evaluations, and through widespread dissemination of project evaluation reports. The final project evaluation has specifically been scheduled for the end of the sixth year of project implementation to allow sufficient time for final report dissemination and feedback prior to the project's closeout.

Finally, the project's policy enhancement objectives will be achieved through the completion of analyses and special studies selected throughout the life of the project. The purpose of this activity is to provide timely, Tadla-specific information on selected policy-level considerations affecting improved irrigation resources management in Morocco. This information will feed into the established policy dialogue on this subject between the World Bank and the GOM. Topics selected for project review will flow directly from the "hands-on" experience of the Tadla agricultural community for maximum interest, support and impact. Topic selection will be facilitated, in particular, through the on-farm diagnostic and the private sector assessment activities described above.

A summary of the planned inputs and outputs for this aspect of the project follows:

(1) Project Administration, Monitoring, Evaluation and Outreach Inputs

- Long-term Technical Assistance

- ☐ Chief-of-Party (Senior Irrigation Management Specialist - 5.75 py)
- ☐ Office Support Staff (5.5 py each)
  - Administrative Assistant
  - Accountant
  - Secretary
  - Secretary/Translator
  - Chauffeur
  - Chauffeur/Expeditor
- ☐ Monitoring/Evaluation Specialist (5 py)

■ Short-term Technical Assistance

- ☐ Special Studies and Analyses (30 pm)
- ☐ Evaluations (20 pm)
- ☐ Audits (10 pm)

■ Training (shared cost)

- ☐ Project Start-Up Workshop (1)
- ☐ Project Planning, Monitoring and Evaluation Workshops (9)
- ☐ National Information Dissemination/Sharing Workshops (5)
- ☐ Counterpart English Language Training (60 py)

■ Equipment and Supplies (see Annex K)

- ☐ Office Space and Operations (misc. - GOM cost)
- ☐ Office Equipment and Supplies (misc.)
- ☐ Project Support Services (translation, reproduction, printing, etc. - misc.)
- ☐ Vehicles (2)
- ☐ Vehicle Operations and Maintenance (26 vehicle-years)

(2) Project Administration, Monitoring, Evaluation and Outreach Outputs

■ An established and sustainable capability to monitor, manage, integrate and use the tremendous quantity of Tadla-specific information generated under the project;

■ An effective, national-level irrigation management information outreach and sharing program; and

■ Timely and effective Tadla-specific inputs into the ongoing dialogue regarding irrigation policy analysis and reform in Morocco.

III

COST ESTIMATE AND FINANCIAL PLAN

1. Introduction

The total cost of the project is estimated at $25 million. The project will be supported by contributions from A.I.D., the participating GOM agencies and the Tadla private sector. Table 3.1 below presents a summary of total project costs by major input category and contributor. Additional information on the planned contributions to the project is provided in the Financial Analysis (Annex F). Details of each of these respective contributions are described in the following sections, together with project financial and audit plans.

Table 3.1

TRM Project Budget Summary
($000s)

Item/Source	A.I.D.	GOM	Other	Totals
Technical Assistance	7,140	2,400	300	9,840
Training	1,335	190	270	1,795
Commodities	2,060	780	820	3,660
Indirect Costs	7,465	880	360	8,705
IIMI Cooperative Agreement	750	250	-	1,000
TOTAL COSTS	**18,750**	**4,500**	**1,750**	**25,000**

2. Cost Estimates

a. A.I.D. Contribution

A.I.D. will provide a total of $18.75 million of grant funds for the project, or 75% of total project costs. These funds will be provided for technical assistance, training, equipment and supplies, and indirect costs to support implementation of the project components described above. Tables 3.2, 3.3 and 3.4 present A.I.D. project cost and expenditure summaries by fiscal year, component,

Table 3.2 : A.I.D. TRM Project Input Costs

Annual Expenditures

Inputs	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	TOTAL
1. Long-term Tech Assistance	577,000	846,000	846,000	846,000	703,500	387,000	4,205,500
2. Short-term Tech Assistance	474,240	688,360	673,360	419,360	409,360	269,360	2,934,040
3. Training	107,500	308,500	322,500	246,500	226,500	121,500	1,333,000
4. Equipment & Supplies	491,000	572,000	318,500	347,000	187,000	147,000	2,062,500
5. IIMI Coop Agreement	225,000	225,000	225,000	75,000			750,000
Sub-total:	1,874,740	2,639,860	2,385,360	1,933,860	1,526,360	924,860	11,285,040
6. Overhead (inst. Contractor)							
-LTTA	323,120	473,760	473,760	473,760	393,960	216,720	2,355,080
-STTA	218,150	316,646	309,746	192,906	188,306	123,906	1,349,658
-Other Costs	209,475	308,175	224,350	207,725	144,725	93,975	1,188,425
7. Fee: (Inst. Contractor)	131,979	193,189	172,829	148,709	122,109	73,989	842,803
8. Contingency	82,487	120,743	108,018	92,943	76,318	28,840	509,349
9. Inflation	0	120,743	221,437	293,003	328,940	255,522	1,219,645
TOTAL:	2,839,952	4,173,115	3,895,499	3,342,905	2,780,718	1,717,811	18,750,000

NOTE: 100% Overhead on Tech Assistance (wages & fringe benefits only)

35% Overhead on Other Costs

8% Fee for Institutional Contractor

5% Contingency

5% Compounded Inflation

TABLE 3.3 : A.I.D. TRM Project Annual Expenditure by Component

Component / Inputs	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	TOTAL
1. IRRIGATION SYSTEM MGMT							
A. Long-term TA	142,500	190,000	190,000	190,000	190,000	142,500	1,045,000
B. Short-term TA	185,000	225,000	30,000	110,000	0	0	600,000
C. Training	26,000	112,000	106,000	20,000	20,000	0	284,000
D. Equipment & Supplies	175,000	300,000	96,100	25,000	0	0	596,100
Sub-total:	528,500	827,000	472,100	345,000	210,000	142,500	2,525,100
2. ON-FARM MANAGEMENT							
A. Long-term TA	142,500	190,000	190,000	190,000	142,500	0	855,000
B. Short-term TA	30,000	120,000	120,000	60,000	60,000	30,000	420,000
C. Training	0	30,000	40,000	50,000	50,000	40,000	210,000
D. Equipment & Supplies	25,000	60,000	60,000	85,000	60,000	60,000	350,000
Sub-total:	197,500	400,000	410,000	385,000	312,500	130,000	1,835,000
3. ENVIRONEMTAL MGMT.							
A. Long-term TA	0	0	0	0	0	0	0
B. Short-term TA	124,240	208,360	188,360	114,360	114,360	64,360	814,040
C. Training	20,000	20,000	20,000	20,000	20,000	0	100,000
D. Equipment & Supplies	55,000	50,000	25,400	25,000	0	0	155,400
Sub-total:	199,240	278,360	233,760	159,360	134,360	64,360	1,069,440
4. PRIV SECTOR STRENGTHENING							
A. Long-term TA	95,000	190,000	190,000	190,000	95,000	0	760,000
B. Short-term TA	60,000	60,000	60,000	60,000	60,000	50,000	350,000
C. Training	50,000	115,000	125,000	125,000	105,000	60,000	580,000
D. Equipment & Supplies	30,000	22,000	22,000	47,000	12,000	12,000	145,000
Sub-total:	235,000	387,000	397,000	422,000	272,000	122,000	1,835,000
5. PROJECT ADMINSTRATION							
A. Long-term TA	197,000	276,000	276,000	276,000	276,000	244,500	1,545,500
B. Short-term TA	75,000	75,000	225,000	75,000	175,000	125,000	750,000
C. Training	11,500	31,500	31,500	31,500	31,500	21,500	159,000
D. Equipment & Supplies	206,000	140,000	115,000	165,000	115,000	75,000	816,000
Sub-total:	489,500	522,500	647,500	547,500	597,500	466,000	3,270,500
6. IIMI COOPERATIVE AGRMT	225,000	225,000	225,000	75,000			750,000
GRAND TOTAL	1,874,740	2,639,860	2,385,360	1,933,860	1,526,360	924,860	11,285,040

Table 3.4: A.I.D. TRM Project Input/Output Costs

With Contingency & Inflation Fully Distributed

INPUTS	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	TOTAL	% of Total
1. Tech Assistance	1,729,172	2,600,950	2,656,117	2,295,975	2,079,626	1,251,302	12,613,141	67%
– Long-Term	975,130	1,472,040	1,516,455	1,563,091	1,340,524	753,669	7,620,908	41%
– Short-Term	754,042	1,128,910	1,139,662	732,884	739,102	497,633	4,992,233	27%
2. Training	159,100	472,005	510,356	403,675	384,032	211,102	2,140,270	11%
3. Equipment & Supplies	726,680	875,160	504,026	568,256	317,060	255,407	3,246,589	17%
4. IIMI Coop Agreement	225,000	225,000	225,000	75,000			750,000	4%
TOTAL:	2,839,952	4,173,115	3,895,499	3,342,905	2,780,718	1,717,811	18,750,000	100%

OUTPUTS	INPUTS: Long-term Tech Assit	Short-term Tech Assit	Training	Equipment & Supplies	TOTAL
DIRECT					
1. Irrigation Management	1,045,000	600,000	284,000	596,100	2,525,100
2. On-farm Management	855,000	420,000	210,000	350,000	1,835,000
3. Environmental Mgmt.	0	814,040	100,000	155,400	1,069,440
4. Priv Sector Stregt'n	760,000	350,000	580,000	145,000	1,835,000
5. Proj Administration	1,545,500	750,000	159,000	816,000	3,270,500
6. IIMI Coop Agreement					750,000
Sub-Total:	4,205,500	2,934,040	1,333,000	2,062,500	11,285,040
INDIRECT					
Overhead	2,355,080	1,349,658	466,550	721,875	4,893,163
Fee	336,440	234,723	106,640	165,000	842,803
Contingency & Inflation	723,888	473,811	234,080	297,214	1,728,994
Sub-Total:	3,415,408	2,058,193	807,270	1,184,089	7,464,960
TOTAL:	7,620,908	4,992,233	2,140,270	3,246,589	18,750,000

input/output category and type of input, i.e., direct and indirect costs. Table 3.5 provides a summary listing of the assumptions and background information used in estimating the A.I.D. cost contributions to this project. A more detailed explanation of project cost estimates follows:

(1) Technical Assistance

A.I.D. will finance all project technical assistance costs, estimated at $7,139,540 or 38% of total A.I.D. project costs, including $4,205,500 for long-term technical assistance (LTTA) and $2,934,040 for short-term technical assistance (STTA). The bases for these cost estimates are as follows:

(a) Long-term Technical Assistance: Project long-term technical assistance includes both expatriate advisors and resident-hire staff. Long-term expatriate advisor costs have been estimated at $190,000 per person-year (py). This figure includes both base contractor salary and benefits, and support costs, e.g., shipping, housing, international travel and associated dependent travel and education costs. Long-term resident-hire staff costs include only contractor salary and benefits. Resident-hire salary costs, listed in Table 3.5, are based on current prevailing rates for these services in Morocco.

(b) Short-term Technical Assistance: Short-term expatriate technical assistance, estimated at $15,000 per person-month (pm), includes base contractor salary and benefits, and international and in-country travel and subsistence costs. Short-term Moroccan technical assistance, estimated at $6,500/pm, includes base contractor salary and benefits, and in-country travel and subsistence costs. Where the planned STTA services can be either expatriate or Moroccan, i.e., 208 pm total, an estimate of $10,000/pm has been used, as an average of the above estimated expatriate and Moroccan STTA costs.

(c) Laboratory Analysis Services: The project will require extensive laboratory services to assist in the analysis of the many water and environmental quality samples to be taken under the third component's monitoring programs. The costs for these services are estimated at $2/sample, in accordance with established Moroccan rates.

(2) Training

Project training requirements will be met with contributions from A.I.D., the GOM and the private sector.

Table 3.5: A.I.D. TRM Project Cost Estimates

Line Item	Unit Cost	No. of Units
TECHNICAL ASSISTANCE		
– Long Term TA (US)	$190,000 /year	19.75 py
– Local Office Staff:		
Admin Assistant	$10,000 /year	5.5 py
Accountant	$10,000 /year	5.5 py
Secretary	$7,000 /year	5.5 py
Secretary/Translator	$8,000 /year	5.5 py
Chauffeur	$6,000 /year	5.5 py
Chauffeur/Expeditor	$5,000 /year	5.5 py
Monitoring/Eval Specialist	$40,000 /year	5.0 py
– Short–term TA (US)	$15,000 /pm	36 pm
– Short–term TA (US or M)	$10,000 /pm	198 pm
– Short–term TA (M)	$6,500 /pm	10 pm
– Lab Analysis Services	$2 /sample	157,020 samples
TRAINING		
– ST–Overseas Training	$10,000 /pm	62 pm
– Private Sector In–ctry Training	$100 /person	3,600 indiv's
– In–country Workshops	$10,000 /event	20 workshops
– Long–term Training	$3,000 /pm	48 pm
– Language Training	$150 /person/year	60 py
COMMODITIES		
– Component 1: Irrig. Sys. Mgmt	$496,100 Total	
– Component 2: On–Farm Mgmt		
Demo Equipment, Mat., Supplies	$250,000 Total	
Radio Broadcast Support	$50,000 Total	
– Component 3: Envtl Mgmt	$105,400 Total	
– Component 4: Priv Sector Strgth		
Business Equip & Supplies	$70,000 Total	
Training Equipment	$25,000 Total	
– Project Admin. et. al.		
Office Equip & Supplies	$150,000 Total	
Office Supplies/Comm	$400,000 Total	
– Vehicles	$25,000 /vehicle	12 vehicles
Operation/Mt. Costs	$6,000 /vehicle/year	26 vehicle years
– Project Support Services	$60,000 Total	
IIMI COOPERATIVE AGREEMENT	$750,000 Total (extra–budget basis)	

Contractor Overhead Rates:	100% of TA wages and benefits
	35% of Other Costs
Contractor Fee	8%
Contingency	5% /year
Inflation	5% compounded annually

A.I.D. project training costs - estimated at $1,333,000 or 7% of total A.I.D. project costs - are for tuition, course and conference fees and associated subsistence expenses, and insurance (where applicable). These costs have been estimated as follows:

(a) Long-term Overseas: Long-term overseas training has been estimated at $3,000/pm, or $36,000/py. This figure includes all costs associated with this training, such as tuition, books, subsistence expenses, insurance, and other necessary items. International travel costs for all overseas participant trainees are included as a part of the GOM contribution to the project (see below), in agreement with Mission-wide training policy.

(b) Short-term Overseas: All short-term overseas courses, seminars, conferences, study tours and internships have been estimated at $10,000/pm. This figure includes all overseas course fees, subsistence costs and insurance fees associated with this training, similar to the long-term training described above. GOM overseas participants' international travel costs will be funded by the GOM. Private sector international participants will be responsible for both international travel costs and domestic travel costs overseas, i.e., all required airfares and international travel per diem costs to study sites. For project purposes, members of private, non-governmental organizations in Tadla participating in overseas training activities will be treated as GOM participants, i.e., responsible for international travel costs only.

(c) In-Country Workshops: All in-country workshops have been estimated at an average cost of $10,000 each. A.I.D. workshop costs will be for workshop facilities (where required), materials and participant subsistence expenses (where applicable). Subsistence expenses for GOM participants will be limited to the difference between the actual negotiated per person cost and the established GOM subsistence rate at the time and place of a given workshop.

(d) Other In-Country Training: Other in-country training will consist of business management training conducted as a part of the project's private sector strengthening program. This training will consist of the attendance of selected private sector representatives at short-term courses available both through existing private business management schools in Morocco and through Tadla-specific courses designed and implemented on-site with the assistance of project private sector staff. The estimated A.I.D. cost of this training is $150/participant (average). A.I.D. will cover the total costs of course participants who are members of private, non-governmental organizations in Tadla. Participants from private sector firms will be required to cover half the costs of formal, off-site, in-country business management courses, in addition to associated subsistence expenses.

(e) Counterpart Language Training: English language training will be provided for up to 10 key project counterparts throughout the life of the project. The costs for this training have been estimated at $150/person-year, based on current "normal" program rates at the American Language Center in Morocco. All language training participants will be responsible for all travel and subsistence expenses associated with this training.

(3) Equipment and Supplies

The project will fund the procurement of a variety of different equipment, materials and supplies. A.I.D. equipment and supply costs -estimated at $2,062,500 or 11% of total A.I.D. project costs - will be for: computers, and associated peripherals and software, including the Tadla GIS; irrigation system and environmental quality monitoring equipment, materials and supplies; on-farm demonstration equipment, materials and supplies; radio broadcast support for project-related agricultural information; training equipment, materials and supplies; office equipment, materials, supplies and operations costs; and vehicles, and vehicle operations and maintenance costs. Where possible, Annex K provides a detailed description and cost estimate of these project commodity requirements. Cost estimates for those items not included in the Annex are as follows:

(a) Demonstration Equipment, Materials and Supplies: These commodities are required to complete the various on-farm pilot demonstration activities included in the second project component. They will consist of a variety of different types of farm and water management equipment, materials and supplies. The exact requirements for this line item will not be known until these activities are designed during the course of project implementation. The costs of these items will be shared with the GOM, and participating farmers and private sector input and service suppliers. A.I.D. costs for this category of commodities will be reserved primarily for the procurement of new or improved, U.S. irrigation, water and land management equipment and technologies. The estimated A.I.D. cost for this category of commodities is $250,000.

(b) Radio Station Support: The project will provide technical assistance, training and limited materials and supplies in support of establishing a regional capability for radio broadcasting of project-related and other relevant agricultural information. The estimated cost of the A.I.D.-financed commodity support for this radio station, i.e., broadcast materials and supplies, is $50,000 over the life of the project. All equipment and facilities for this radio station will be provided by the GOM.

(c) Vehicle Operations and Maintenance: Twelve, all-terrain, 4X4, diesel vehicles will be procured under the project. Operations and maintenance costs for these vehicles are estimated at $6,000/vehicle-year.

(d) Business Management Equipment and Supplies: This item allows tor the procurement of various, limited business management equipment for associations and cooperatives participating in the project's private sector strengthening program. Such equipment would include computers and associated peripherals and business management software, calculators, typewriters, etc. This equipment will be financed on a 50/50 cost-sharing basis, with the total A.I.D. contribution estimated at $70,000.

(e) Training Supplies: The project will procure a variety of training equipment for development and implementation of on-site workshops and training courses, also primarily in support of the private sector strengthening program. The costs for meeting ongoing supply requirements for this training equipment, such as video/audio cassettes, film/film processing, flip-chart paper, and other training materials, are estimated at $2,000/year.

(f) Office Operations Support: The project will maintain a full office at Fkih Ben Salah throughout its life, including office staff, equipment and logistical support. The cost of supporting the operations of this office is estimated at $75,000/year, exclusive of office space and utilities costs which will be covered by the GOM.

(4) Overhead

Contractor overhead has been estimated at 100% of wages and benefits for all long- and short-term technical assistance services, and 35% of the costs of other contractor services. These additional A.I.D. costs - estimated at $4,893,163 - are included in the indirect costs category.

(5) Contractor Fees

The Institutional Contractor (IC) will be responsible for the provision of all A.I.D.-financed technical assistance, training and commodities under the project, with certain limited exceptions noted elsewhere. The IC's fee for these services has been estimated at 8% of the total costs of these IC-managed items, or $842,803.

(6) Contingency and Inflation

Project contingency has been estimated at 5% of all A.I.D. project costs for each year of implementation, or $509,349. Inflation has also been included at a 5% annually compounded rate, amounting to $1,219,640.

(7) IIMI Cooperative Agreement

The IIMI Cooperative Agreement has been designed as a separate, "stand-alone" program funded under the auspices of the project. Total program costs are estimated at $1,000,000, including $750,000 of A.I.D. funds (4% of total A.I.D. project costs) and $250,000 of non-A.I.D. funds. This total program amount includes all costs associated with this program, including all indirect costs.

The Agreement will include contributions from A.I.D., the GOM and the Tadla farming community, and IIMI. A.I.D. program costs will be for LTTA (shared cost), STTA, overseas and in-country training and fellowships, office operations and equipment, materials and supplies, and logistical support. GOM program contributions will be for staff salaries, international travel costs for program overseas participant trainees, on-farm research/demonstration equipment and materials, office facilities and utilities (excluding communications costs), and staff support costs. Tadla farmer contributions to the program will include "in-kind" contributions of labor and on-farm materials and supplies. IIMI will furnish the program vehicles and mopeds. The information and assumptions used in estimating program technical assistance, training and commodity costs are similar to those described above for the main A.I.D. project, modified as appropriate to conform with established IIMI policies.

b. GOM Contribution

The primary GOM contribution to the project will be the in-kind costs associated with the provision of technical and administrative personnel, and associated office space and logistical support for project operations. The GOM will also continue salary payments for government employees while they participate in training activities sponsored under the project. These in-kind staff support costs are estimated at $400,000/year equivalent, or $2,400,000 over the life of the project.

The GOM will be responsible for all airline tickets and other international travel costs for Moroccan officials participating in overseas training under the project, at an estimated cost of $2,500 equivalent per participant. The GOM will also contribute to the costs of project workshops ($5,000 equivalent each). The total estimated cost for this training support is $190,000 over the life of the project.

In addition, the GOM will be responsible for a portion of the costs of the on-farm demonstration equipment, materials and supplies ($250,000 equivalent), all of the equipment for the Tadla radio station ($125,000 equivalent), the IC's office space and utilities (excluding communications costs) in Fkih Ben Salah ($15,000/year equivalent), and for a gradually increasing portion of the operations and maintenance costs of project-finarced equipment ($315,000 equivalent).

GOM contingency has been provided for also at a 5% annual rate. GOM inflation is estimated at a 10% annually compounded rate. The total estimated costs for these indirect cost items is $880,000 equivalent over the life of the project.

The total GOM contribution to the project, therefore, is estimated at $4,500,000 equivalent, or 18% of total project costs.

c. Private Sector Contribution

Private sector firms and individuals benefiting directly from project interventions, training, and/or technical assistance will also contribute to project costs.

This private sector contribution is anticipated to include payments for: airline tickets and other international and overseas domestic travel costs for private sector training participants ($80,000 equivalent); half of the costs of participation in Moroccan business management training courses ($190,000 equivalent); promotional equipment, materials and supplies in support of the project's on-farm demonstration and environmental quality monitoring programs ($250,000 equivalent); half of the costs of business management equipment and supplies provided under the private sector strengthening program ($70,000 equivalent);

facility upgrading equipment and materials under the agro-industrial pollution prevention program ($500,000 equivalent); and miscellaneous salaries and logistical support for private sector personnel working with project specialists on collaborative project activities ($50,000/year equivalent or $300,000 total).

Private sector contingency and inflation - estimated at $360,000 equivalent over the life of the project - are calculated according to the same rates as for the GOM project contributions described above.

The total private sector contribution to the project is estimated at $1,750,000 million equivalent or 7% of total project costs.

3. Financial Plan

Most project activities will be implemented through a direct A.I.D. institutional contract. USAID-managed funds for special studies, evaluations and audits will be implemented through project buy-ins to centrally-managed A.I.D. projects and Indefinite Quantity Contracts (IQCs) and/or through purchase orders, where warranted by the size and source of the procurement. Disbursement of A.I.D. project funds will be through both direct payment and reimbursement. Table 3.6 summarizes the expected project implementation and financing methods for the disbursement of A.I.D. funds.

4. Project Audit Requirements

The project includes funds for the completion of two external audits throughout its life, i.e., one audit for each three years of project implementation. These audits will be comprehensive financial audits of all project operations and accounts. They will be conducted by a reputable Moroccan financial management firm under the supervision of the A.I.D. Regional Inspector General's (RIG) Office based in Dakar, Senegal. These audits will comply with current U.S. government financial audit requirements.

A.I.D. also reserves the right to conduct additional external performance or financial audits of project operations throughout the its duration as it deems appropriate.

Table 3.6

Expected Implementation and Financing Methods for A.I.D. Funds

Type of Expense	Implementation Method	Financing Method
Technical Assistance	A.I.D. Direct Contract	Direct Reimbursement
Training	A.I.D. Direct Contract	Direct Reimbursement
Equipment and Supplies	A.I.D. Direct Contract <u>or</u> Letters of Commitment/Purchase Orders	Direct Reimbursement/ Payment
Special Studies, Evaluations, Audits and Project Support Services	A.I.D. Direct Contract <u>or</u> Buy-Ins/IQCs/Purchase Orders	Direct Reimbursement/ Payment
IIMI Cooperative Program	A.I.D. Cooperative Agreement	Direct Reimbursement/ Payment

IV

IMPLEMENTATION PLAN

1. Implementation Approach

The life of the project will be seven years from the date of the signing of the Project Agreement with the Ministry of Agriculture and Agrarian Reform (MARA) - the parent GOM counterpart agency for the ORMVAT and the project. As the Project Agreement will not be signed until the final quarter of fiscal year 1992, the effective project length will be reduced by one year, i.e., to six years duration.

Most project activities will be implemented by an Institutional Contractor (IC). The nature of the project and the level of local technical assistance required indicate that some type of consortium of U.S. and Moroccan firms, universities and/or agricultural cooperative organizations recognized for their irrigation management expertise would be most suitable for this purpose.

The IC will be responsible for the provision of most of the A.I.D.-financed project inputs, with the few exceptions noted below. These IC-managed inputs include: long- and short-term technical assistance, including both Moroccan and expatriate personnel; all in-country and overseas training, workshops and study tours; and most of the equipment and commodities required for successful project execution.

A.I.D.-funded inputs to be provided outside the institutional contract include certain early implementation actions required for timely project start-up, the IIMI Cooperative Program, a portion of the Special Studies funds, and project Evaluation and Audit requirements. Implementation of these latter activities will be the responsibility of USAID project management as described more fully below.

Key long-term project technical personnel will include the contractor Chief-of-Party, an Irrigation Engineer, an Agricultural Economist, a Private Sector Coordinator, and a resident-hire Monitoring/Evaluation Specialist. These resident project advisors will be complemented by short-term personnel — both Moroccan and expatriate — as needed to implement the project in a timely and effective manner.

The project will be based in Fkih Ben Salah to facilitate the necessary interactions with ORMVAT staff and other project participants resident in the Tadla perimeter. The project will maintain its own office throughout its duration. The IC will be responsible for the timely provision of all required office administrative and logistical support, with the exceptions of project office space and utilities which will be provided by the GOM, and certain early USAID procurements required to facilitate the timely start-up of project implementation.

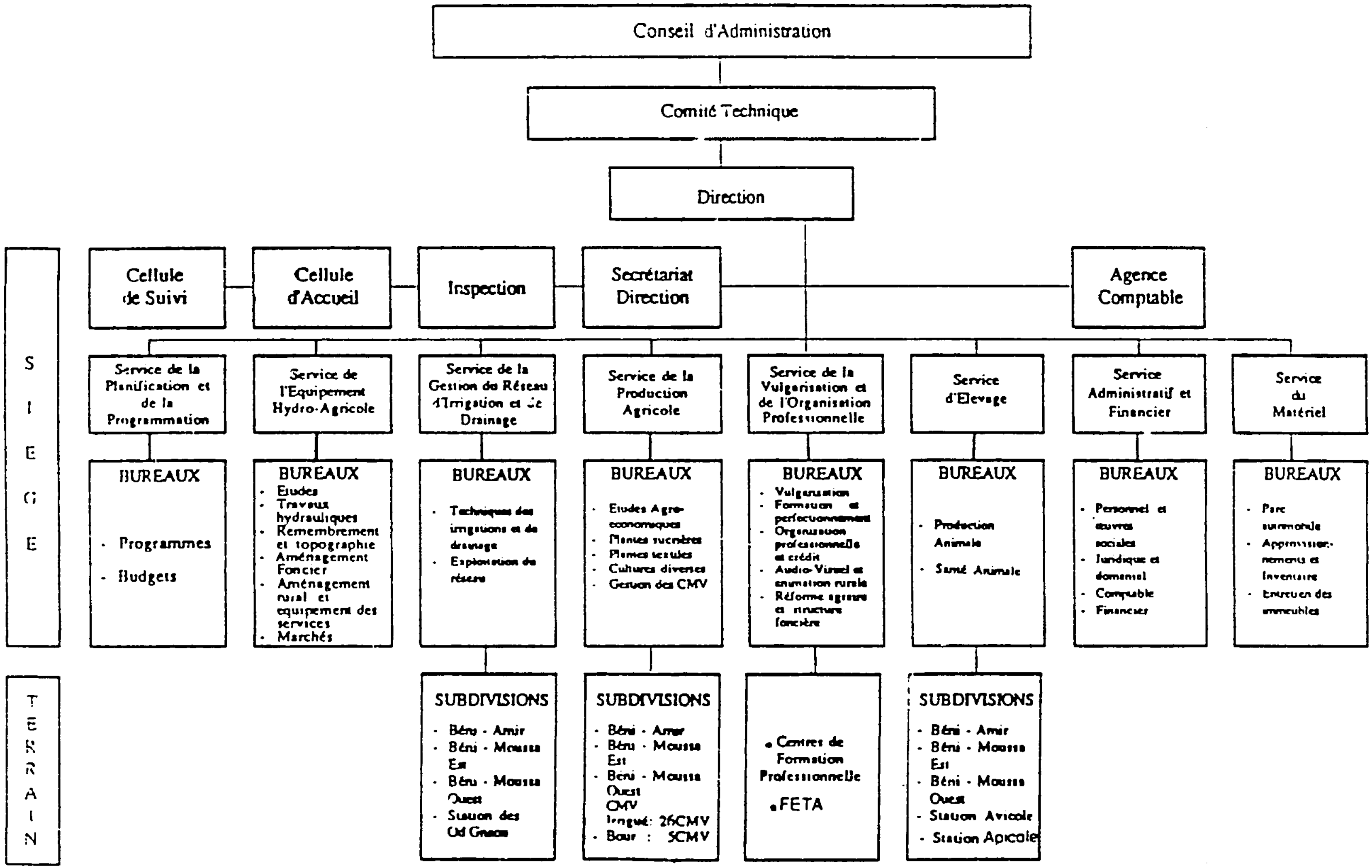
2. Counterpart Relationships

The key GOM counterpart agency for this project will be the ORMVAT, which is one of the oldest and best established regional irrigation authorities in Morocco. It has a solid reputation for sound perimeter management and a positive orientation towards implementation of the country's new irrigation policies.

The project has been designed to develop and institutionalize critical new capacities and activities within the ORMVAT. The project is committed to sustainability - the continuing capacity of the ORMVAT to manage effectively its new responsibilities after termination of USAID support, and to adapt to the changing needs in the irrigation subsector. Implementation will be geared toward strengthening ORMVAT capacities through full staff involvement in project activities within the existing structure, albeit within a diminished sphere of operations. Therefore, there will be no need for creating any new institutions under the project. Figure 4.1 provides an illustrative presentation of the current ORMVAT organization.

The project will require the substantive participation of private entrepreneurs and farmers, agribusiness firms, professional associations, cooperatives, chambers of commerce and agriculture, and other non-governmental organizations. A variety of mechanisms have been designed to ensure that these important project implementation agents are fully prepared to assume their critical roles both in the project and in the Tadla economy. In this interest, close liaison will need to be maintained with the ORMVAT *Comité Technique* (CT) and with the its *Conseil d'Administration* (CA) - the key organizational mechanisms for ORMVAT interaction with the Tadla agricultural community.

ORGANIGRAMME DE L'ORMVAT



In collaboration with the ORMVAT's *Service de la Planification et de la Programmation* (SPP), the IC will produce annual workplans, quarterly progress reports and financial accounting reports. The annual workplans will be submitted to USAID for review and approval prior to implementation. The approved annual workplans will also be made available to MARA's DER in Rabat for donor coordination purposes, and to the Office of the Governor for the province of Beni Mellal, and the Provincial Technical and Administrative Councils, and the Provincial Development Council to foster greater community support for project activities.

Counterpart relationships, while not formalized, will be functionally as follows:

Project Resident Staff	Functional Counterpart
Chief-of-Party	Director of ORMVAT
Irrigation Engineer	Head of SGRID (see below)
Agricultural Economist	Head of SPA (see p. 55)
Monitoring/Evaluation Specialist	Head of SPP

The Private Sector Specialist's primary ORMVAT counterpart will be the Head of the *Service de la Vulgarisation et de l'Organisation Professionelle* (SVOP); however, this advisor's principal project counterparts will consist of the variety of different private, non-governmental interests resident within Tadla.

3. Implementation Strategy

a. Improved Irrigation System Management

This first project component will be implemented under the supervision of the Irrigation Engineer. This resident advisor will work closely with the ORMVAT's *Service de la Gestion du Réseau d'Irrigation et de Drainage* (SGRID) and its subdivisions as described below. The Irrigation Engineer will be responsible for assisting in the establishment of the different SGRID sub-units described below, developing effective linkages between these sub-units and integrating them into a single perimeter management system. Implementation of this component will proceed according to a phased approach, with two years devoted to establishing the working units, two years for finalizing linkages between these units, and two years for operating and troubleshooting the improved management system.

(1) System Management Improvement Units

(a) Water Resources Management Unit: The IC project staff will assist the ORMVAT in the establishment of a Water Resources Management Unit within the *Bureau d'Exploitation* (BE) of SGRID that will be responsible for surface water hydrology, groundwater hydrology and water quality. This component's activities will focus on the surface water responsibilities of this unit, in particular, on establishing an adequate database for reliable predictions of surface water supply to the Tadla irrigation system. The groundwater hydrology and water quality responsibilities of this unit are included under the third project component, Sustainable Environmental Management, described below.

Surface water hydrology activities will require cooperation between the ORMVAT, the Haouz ORMVA, and the regional offices of the Ministry of Public Works' *Direction Régional d'Hydraulique* (DRH) and the *Office National d'Electricité* (ONE) of the Ministry of Energy and Mines. The primary task of this unit will be to develop and maintain a database of flows in the Oum Er Rbia River at the Kasba Tadla diversion dam and into Bin El Ouidane Dam for hydrographic analysis. As the regional DRH has normal responsibilities for collecting this data, a working agreement will need to be established with this office for the regular importation of this data into the ORMVAT database.

Statistical analysis of the flow data on the Oum Er Rbia River will yield the required hydrograph of water available for diversion into the Beni Amir main canal for use in the seasonal planning and water delivery scheduling process for this subperimeter. Statistical analysis of inflows into the Bin El Ouidane Dam will serve as a basis for a review of the operating rules for both the dam and power plant at Afourer for the same purpose for the Beni Moussa subperimeter. This latter review will also need to take into account the additional constraints imposed through planned new water supply commitments to canal T2 as part of the "corrected manifest of Bin El Ouidane" agreed to by the ORMVAT, ORMVAH and ONE.

The ORMVAT will provide the necessary staff for the Water Resources Unit, consisting of a surface water hydrology specialist, a groundwater specialist, and various technicians. This unit will be assisted by short-term project technical assistance as required.

(b) Geographic Information System Unit: This unit will also be established within SGRID's BE to provide improved, integrated and easily accessible information on the Tadla perimeter. The initial focus of the GIS will be on perimeter water demand information which will directly aid in implementing the seasonal irrigation planning and water delivery processes. Eventually, the GIS will become the central unit serving the majority of the ORMVAT's external information needs and will be integrated into the *Système d'Information Pour la Gestion* (SIG) master plan for the ORMVAT, in coordination with the ORMVAT's *Cellule de Suivi* (CS) and the SPP.

The GIS Unit will be staffed by two engineers, either *Ingénieurs du Travaux Rurale* or *Ingénieurs du Travaux Topographiques*. These engineers will be the project's two long-term participant trainees. During their absence in the U.S, this unit will be established with the assistance of IC project staff; in particular, the Monitoring/Evaluation Specialist working under the supervision of the C-O-P. Upon their return to Morocco during the third year of project implementation, these two trainees will assume responsibility for continuing unit operations. Short-term technical assistance will be required for the design, installation and start-up operations of the GIS, and for initial on-site staff training in system operations.

(c) Agro-Meteorological Monitoring Unit: This unit will be established within SGRID's *Bureau des Techniques des Irrigations et de Drainage* (BTI). It will be responsible for operating the three automated weather stations to be supplied by the project, maintaining a weather database and publishing a weekly weather bulletin, which will be made available to farmers, extension agents, aiguadiers, agro-industrial processors, and other public and private sector interests throughout Tadla. Supplying this information on a timely, regular basis will greatly improve water demand estimates and, hence, decision-making for all agricultural operations in the perimeter. If deemed appropriate, this unit could also eventually provide direct irrigation scheduling services for farmers. The Agro-Meteorological Unit will be staffed by one engineer and one technician. Unit establishment and operations will be assisted by project short-term technical assistance as required.

(d) System Supervision and Control Units: Two System Supervision and Control Units will be established in the perimeter - one in the office of the *Subdivisionnaire* of the Beni Amir subperimeter at Fkih Ben Salah, and the other in the office of the Subdivisionnaire of the Beni Moussa subperimeter at Afourer. Each unit will be composed of a Remote System Monitoring Team and a Mobile Monitoring Team. These two teams are required to provide a better understanding of the working hydraulics of the canal system through hydraulic modeling, canal calibration and real-time system monitoring.

Each Remote System Monitoring Team will be responsible for monitoring real-time water flows and for developing and operating a hydraulic model of their respective irrigation subperimeters. Modeling will be used to provide system status reports and, in conjunction with real-time flow measurements and scheduled gate settings, to keep a current database of the hydraulic characteristics of the irrigation distribution system. This database will be used by the Subdivisionnaires in planning and scheduling water distributions. Each team will consist of an engineer specializing in hydraulic systems and two technicians to operate the model and the real-time measurement system.

The Mobile Monitoring Teams will be responsible for field measurement and verification of canal system operational parameters for each subperimeter. These teams will work in close cooperation with their respective Remote System Monitoring Teams described above. Each Mobile Monitoring Team will consist of an engineer specializing in hydraulic measurement, and three technicians with skills in surveying, hydraulic measurement techniques, and electronic data management. These units will be assisted by short-term technical assistance under the project as required.

(2) Improved Irrigation System Management

Once established, the different information gathering and processing units described above will be integrated into a coordinated surface water resources management system for Tadla. The project Irrigation Engineer will work with the head of the BE and the heads of each of the three perimeter subdivisions to formulate an operational policy, prepare annual and seasonal operating plans, prepare procedures for water delivery schedule preparation and formulate an iterative process to improve system operational procedures based on actual system measurements and field monitoring.

Formulation of a detailed operational policy and general operating criteria for ORMVAT SGRID system operators and irrigation associations will require interaction with all relevant actors in the water distribution process.

Identification of and interaction with these actors will be accomplished in the course of the two system-level diagnostic analyses. These studies will be used to define the precise roles of the new working units in water policy decision-making. Preparation of the annual and seasonal operating plans will involve estimation of expected water supplies by the Water Resources Unit, and estimation of water demands for projected cropping patterns by the GIS and Agro-Meteorological Units.

Preparation of a specific set of procedures to operate perimeter headworks and water conveyance systems to provide efficient water deliveries to farmers will involve the System Supervision and Control Units, the Agro-Meteorological Unit, and the GIS Unit working in close coordination. Definition of these procedures will require an understanding of actual hydraulic conditions in the system, water demand patterns and near real-time weather data. Iterative improvements in these procedures over time will require definition of monitoring procedures to verify outputs from the System Supervision and Control Units described above. Figures 4.2 and 4.3 illustrate how these iterative system planning and operations feedback processes will function.

b. Improved On-Farm Management

The Agricultural Economist will be responsible for the implementation of this project component. Component activities will be centered in the ORMVAT's *Service de la Production Agricole* (SPA), which under the PAGI 2/SIG ORMVAT restructuring plan will soon be converted into the *Service des Etudes Agro-Economiques* (SEAE). As a result of the joint public/private sector nature of the various activities to be conducted under this component, a small working committee will be formed to oversee implementation of its various activities, including staff from the *Service de l'Expérimentation de l'Hydraulique Agricole* (SEHA), the SGRID, and the SVOP, and farmers and private sector representatives relevant to each activity undertaken. Component implementation will also be closely coordinated with IIMI program activities described below.

Starting in Project Year 1, a detailed workplan for component activities will be drawn up by this working committee for presentation at an annual workshop. Participants at the workshop will include members of the working committee - farmer representatives who have been selected by their peers at the *Centre de Mise en Valeur* (CMV) level; private entrepreneurs with commercial

Figure 4.2

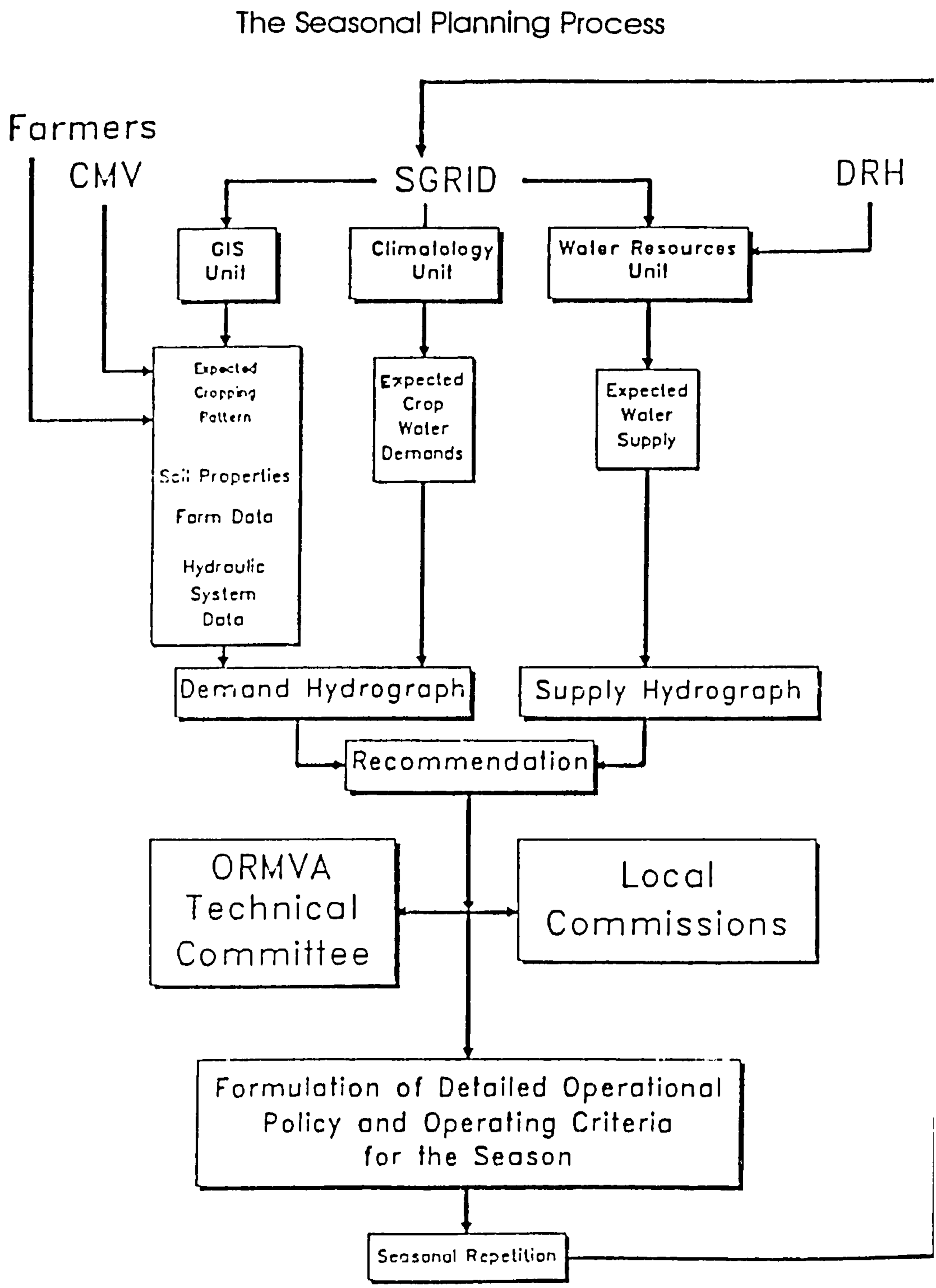
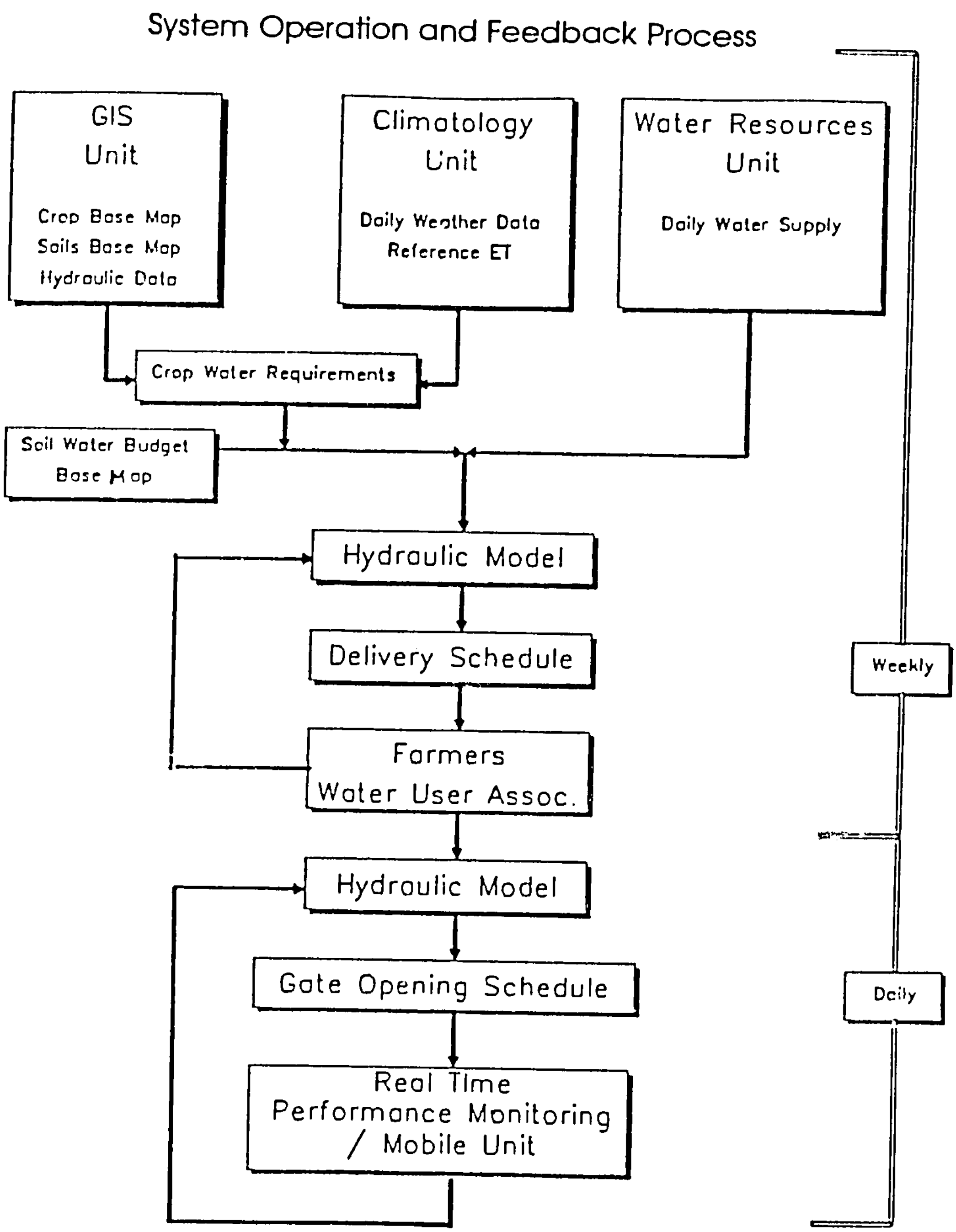

The Seasonal Planning Process
Farmers
CMV
SGRID
DRH
GIS Unit
Climatology Unit
Water Resources Unit
Expected Cropping Pattern
Soil Properties
Farm Data
Hydraulic System Data
Expected Crop Water Demands
Expected Water Supply
Demand Hydrograph
Supply Hydrograph
Recommendation
ORMVA Technical Committee
Local Commissions
Formulation of Detailed Operational Policy and Operating Criteria for the Season
Seasonal Repetition

Figure 4.3


System Operation and Feedback Process
GIS Unit
Crop Base Map
Soils Base Map
Hydraulic Data
Climatology Unit
Daily Weather Data
Reference ET
Water Resources Unit
Daily Water Supply
Crop Water Requirements
Soil Water Budget Base Map
Hydraulic Model
Delivery Schedule
Farmers Water User Assoc.
Hydraulic Model
Gate Opening Schedule
Real Time Performance Monitoring / Mobile Unit
Weekly
Daily

interests in the perimeter; and professional association and cooperative representatives - as well as representatives of other concerned institutions within the GOM, other ORMVAs, and the donor community.

Starting in Project Year 2, these annual workshops will include a presentation of component accomplishments vis-à-vis annual workplan objectives. Workshops in that year, and successive years, will provide a major forum for information flow and feedback on component results. The discussions and recommendations generated during each workshop will serve as a means of informing all participants of project activities and accomplishments, and will catalyze cooperation between project staff and community representatives for the following year's work.

(1) Farm-Level Diagnostic Study

Over the first two years of project implementation, the major activity to be completed under this component will be an intensive diagnostic study of farm management strategies and practices in Tadla. This study will be based on a representative sample of 200-300 Tadla farm households. The study will be designed and conducted by the resident Agricultural Economist, other short-term technical assistance specialists and personnel from the new SEAE. After the initial study has been completed, the staff of the SEAE's *Observatoire Permanent* (OP) will continue to collect farm-level information on a seasonal basis, and will be supported in this effort by technical assistance, equipment and training provided through the project. This diagnostic work will serve to guide project on-farm demonstration and dissemination activities starting in Project Year 2, with activity results feeding directly into the project Monitoring and Evaluation Unit, and the ORMVAT's CS and SPP.

(2) On-Farm Pilot Demonstration Activities

The intensive farm diagnostic study will provide on-farm baseline information on existing crop yields and resource use practices that will be used as benchmarks in establishing the potential and actual impacts of improved crop production packages and techniques on the various farm types in the Tadla perimeter. Information on average crop production for the entire perimeter is currently gathered by the SPA; changes in these figures will be used in developing indicators of project farm-level impacts.

The results of the diagnostic studies will also be used to design a set of on-farm pilot demonstration activities to develop, test and demonstrate improved resource management techniques and crop production practices under different farming conditions in Tadla. Possible topics of interest include: the conjunctive use of groundwater and gravity-fed water for irrigation; farm water application efficiencies and field efficiencies; farm-level use of fertilizers and pesticides; field preparation and soil management practices, such as level-field borders and checks; use of pressurized and other improved on-farm irrigation techniques; and alternative crops, cropping systems and improved crop production packages.

Water-related demonstration activities will be designed and implemented by the Irrigation Engineer working in coordination with SGRID's BTI and BE. Crop-related activities will be designed and implemented by the Agricultural Economist working in coordination with the SPA's *Bureau des Cultures Diverses* (BCD) and with SEHA's *Station Expérimental d'Hydraulique Agricole* at Ouled Ganou (in Tadla). Demonstration activities will commence during the second through the fourth year of project implementation, and will continue throughout the project's life. Wherever possible, demonstration activities will be conducted with the active participation of private regional agricultural input suppliers to facilitate the transfer of new or improved crop varieties and production technologies, and the development of a stronger and more responsive private agricultural support network in Tadla. The project will provide short-term technical assistance for the design and implementation of these demonstration activities as required.

(3) Information Dissemination and Outreach

In addition to the annual, regional workshops described above, a variety of activities will be used to disseminate promising on-farm demonstration results throughout the Tadla farming community. Working with the SVOP's *Bureau de Vulgarisation* and various private regional interests, appropriate IC project staff will organize demonstrations of improved technical packages in farmers' fields, farmer field days and group-specific training sessions. The last activity is seen as especially important for informing the private sector of potential new clients and business opportunities. However, all activities will focus on the economic value of the information and technical innovations being generated under this component, and will promote farmer adoption and adaptation of promising new or improved techniques and packages.

Information and recommendations for discrete innovations and/or technical packages will be summarized as crop technical reference sheets (*Référentiels Techniques*, or RTs) for specific farmer groups. These reference sheets, as well as occasional information bulletins, will be circulated to all concerned parties, including farmers, private sector firms, professional associations and cooperatives, in both French and Arabic. A mailing list will be established for this purpose. In addition, results of this project component will be widely disseminated throughout the perimeter through regular broadcasts of agricultural information via the radio station to be established at an appropriate regional site.

While the Agricultural Economist will have primary responsibility for the successful implementation of this project component, s/he will be assisted in this work by the Irrigation Engineer for water-related activities, and the Private Sector Specialist for the private sector outreach and information dissemination activities. These resident project staff will be assisted by short-term technical assistance throughout the project as required.

c. Sustainable Environmental Management

Due to the cross-cutting nature of this component, its successful implementation will require the joint oversight of the Irrigation Engineer (water and drainage aspects), Agricultural Economist (soil and agrochemical aspects) and the Private Sector Coordinator (private agrochemical and agro-industrial aspects). However, the Irrigation Engineer will retain primary responsibility for ensuring that this component's activities are completed in a timely and effective manner.

(1) Groundwater/Drainage and Water/Soil Quality Monitoring Systems

In order to place perimeter operations on an environmentally sustainable basis, timely and accurate information is required on the nature and extent of the various environmental problems occurring in perimeter areas. This information will be obtained through the establishment of comprehensive groundwater and drainage, and water and soil quality monitoring systems throughout the perimeter. Implementation of these monitoring systems will be the responsibility of the Water Resources Management Unit described above established within the

ORMVAT's SGRID. The groundwater monitoring system will need to be coordinated closely with the regional DRH, which already has a rudimentary groundwater monitoring program in certain perimeter areas.

The information generated by the groundwater and drainage monitoring systems will be used by the IC and SGRID to develop a computerized groundwater model for Tadla. This model will be adapted from similar, existing groundwater models available in the U.S. or through other international sources. The model will be developed, calibrated and verified by Project Year 4. It will then be integrated into the surface water system hydraulic model and the GIS discussed above for comprehensive perimeter water resources planning and management.

The water and soil monitoring system will also be established within SGRID's Water Resources Management Unit. Unit technicians will be responsible for system installation and sample collection. For the first several years of project implementation, sample analyses will be performed by external laboratory services on a standard fee basis. During this period, the IC will evaluate the most appropriate manner for institutionalizing these services in Tadla. Possible options include continuing to contract these services out to a suitable public or private sector laboratory, or supplementing the existing analytical capability within the ORMVAT to conduct these services in-house. This environmental quality monitoring system also will be designed for eventual integration into the Tadla GIS.

Information generated through all of these monitoring systems will be used for the design of appropriate project interventions to mitigate identified environmental problems throughout the last 4 years of project implementation. These interventions will be included as parts of the on-farm demonstration activities described above, and the agrochemical management and agro-industrial pollution prevention programs described below. Project staff will be assisted in this work by short-term technical assistance as required.

(2) Agrochemical Management and Use

This activity will be implemented with short-term technical expertise acting under the supervision of the Agricultural Economist. These project staff will be assisted in this work by the ORMVAT's SPA, and regional staff of MARA's

Direction de la Production Végétale, du Controle Technique et de la Répression des Fraudes (DPVCTRF).

Key information-gathering requirements here include investigating and documenting current agrochemical supply, storage and disposal sites, and associated use practices, in perimeter areas. Most of this information will be obtained through the on-farm diagnostic study and the environmental monitoring activities described above, and the Tadla agribusiness assessment described below.

Working with SPA and DPVCTRF staff, this information will then be used by the IC to develop a monitoring system to track the evolution of key agrochemical storage and disposal sites, and their resultant environmental impacts over time. The SPA will be responsible for maintaining this database and integrating this information into the GIS Unit in the BE.

The IC will also use this information to develop appropriate on-farm demonstration and agro-industrial pollution prevention activities for implementation under the respective project programs described above and below.

In addition, the IC will work with the ORMVAT's SVOP to develop and implement a program to educate Tadla farmers and agrochemical suppliers regarding appropriate agrochemicals for use in Tadla and the potential human and environmental hazards associated with these materials, and to train them in improved procedures for their proper management and effective use. For maximum impact, this latter activity will be coordinated with the ongoing programs of other regional entities concerned with public health and safety, such as the *Office National de l'Eau Potable* (ONEP), the *Service d'Hygiène* (SH) of Beni Mellal, and the DRH.

(3) Agro-Industrial Pollution Prevention

This activity will be implemented under the supervision of the Private Sector Coordinator. Based on the results of the regional agribusiness assessment and the environmental quality monitoring program described above, s/he will work with the management of regional enterprises and appropriate short-term advisors to conduct environmental audits of selected plants and operations, and assist in implementing agreed upon recommendations for pollution prevention measures. Enterprise owners will be responsible for all costs associated with the installation of facility upgrading equipment. Where appropriate, the project will explore the possibility of securing a portion of these funds from other USAID and GOM projects and programs.

d. Private Sector Strengthening

The Private Sector Coordinator will be responsible for supervising the implementation of this component. Component activities will involve working with private, non-governmental agricultural associations and cooperatives in Tadla as well as existing private agribusiness enterprises and interested entrepreneurs. For this reason, a major portion of this component's services will be provided through an appropriate U.S. non-governmental agricultural cooperative organization experienced in international development work. These agricultural cooperative services will also assist in implementing the farmer information dissemination and outreach program described above for the second project component, and the proposed twinning arrangement described below.

During Project Year 1, the Private Sector Coordinator will work with short-term advisors to complete the Tadla agribusiness assessment as well as more detailed diagnostic studies of selected regional associations, cooperatives and firms. The objective of these studies will be to develop an appropriate technical assistance and training program for subsequent project support and to establish a working relationship with private regional agricultural interests.

The results of these studies will be used to develop the private sector strengthening and promotion programs. These programs will be implemented by the Private Sector Coordinator with the assistance of short-term technical and training expertise. In-country training will include both the development of Tadla-specific courses and materials, and use of existing business management schools in Morocco. Maximum use will be made of Moroccan experts and training institutions in completing this work. This approach will facilitate development of culturally and linguistically appropriate training materials and will allow the U.S. expertise to concentrate on improving business management practices and services, and associated marketing strategies. Project assistance will also be available for the provision of limited business management equipment and supplies to selected organizations on a 50/50 cost-sharing basis. These in-country activities will be supplemented by overseas courses and study tours to obtain firsthand knowledge of successful agricultural cooperative, association and business management practices in the U.S. and other countries.

Irrigation associations merit special concern under the project, both because of their current rudimentary stage of development in Tadla and their proposed substantial new responsibilities for the proper operation and maintenance of the secondary levels of the irrigation system. The Irrigation Engineer, and appropriate ORMVAT staff, will work with the presidents and managers of these associations to assist them in assuming their expanded role in fulfilling system rehabilitation and maintenance requirements. Association managers will also benefit from the private sector strengthening program described above, with assistance targeted specifically at effective irrigation association organization and management.

These private sector promotion activities will also be assisted by a variety of other project and non-project mechanisms. First, the project will seek to involve the Tadla private sector as much as possible in the procurement of the required goods and services in the interest of promoting project sustainability, i.e., supporting ongoing equipment operations and maintenance requirements, and of facilitating the ORMVAT's disengagement from the provision of commercial agricultural services. There should be substantial opportunities for such procurements under many of the planned project activities.

Second, the on-farm diagnostic and demonstration program will identify and disseminate information on new market opportunities for the commercial supply of agricultural inputs, equipment and services. Similarly, the third project component will provide additional regional opportunities for the provision of private environmental quality monitoring and analysis equipment and services, as well as the direct agribusiness pollution prevention assistance described above.

Third, the Private Sector Coordinator will be responsible for identifying and coordinating promising opportunities for assistance from other appropriate USAID projects and programs. Potential sources of such private sector assistance include: the Training for Development Project, for business management training assistance; the Morocco Agribusiness Promotion Project, for technical assistance, training and limited commodity support for horticultural agribusiness interests; the New Enterprise Development Project, for emerging agricultural entrepreneurs; the Access to International Markets Project, for export-oriented firms and firms interested in establishing venture relationships with U.S. firms; the Energy Demand Management Project, for private energy management assistance services; and the Privatization Sector Assistance Program, for facilitating the privatization of selected regional agro-industries, e.g., the regional operations of the *Société Nationale de Commercialisation des Semences* (SONACOS) and the *Compagnie Marocaine de la Commercialisation des Produits Agricoles* (COMAPRA), the two sugar beet mills (SUBM and SUNAT), and the Tadla Sugar Refinery (SUTA).

The final component activity will assess and enhance existing institutional mechanisms for private regional participation in Tadla resources allocation, management and use. Using short-term technical assistance as required, the contractor C-O-P and the Private Sector Coordinator will work with regional decision-makers to develop and implement recommendations for a more effective information exchange between public and private sector agricultural interests in Tadla. Project design team findings suggest that these objectives will best be achieved by focusing on improving existing institutional mechanisms in Tadla for such public-private sector dialogue, such as the ORMVAT CT and CA, and the Provincial Technical, Administrative and Development Councils. This in-country assistance will be supplemented by joint public-private sector study tours to the U.S. and exchange visits by similar U.S. groups arranged by the IC's private sector specialists.

e. IIMI Cooperative Agreement

The IIMI Cooperative Program will be implemented as a separate, "stand-alone" activity under the auspices of the greater USAID project. It will be managed by the Resident IIMI Representative to Morocco in cooperation with central and regional staff of MARA's SEHA, and the ORMVAT. On-site program implementation will be the responsibility of the ORMVAT's full-time program Field Coordinator and Field Assistant based at SEHA's Ouled Ganou research station in Tadla, acting under the overall field supervision of the IC C-O-P. These key program staff will be assisted by intermittent technical advisors as required, including IIMI technical staff, external consultants, and SEHA and ORMVAT personnel.

The agreement will provide for an on-site office at Ouled Ganou for the program's entire three year duration, with appropriate office staff, equipment and operations support, and transport. All IIMI program procurements will be completed by the IIMI Resident Representative and the on-site program management staff in accordance with applicable IIMI policies and USAID regulations and procedures.

The program's key research and demonstration activities will be conducted both on farmers' fields and at the Ouled Ganou research station throughout the program's duration. These activities will be implemented by a team of ORMVAT staff working with farmer participants and station personnel, under the supervision of the program management staff described above. The ORMVAT and farmers participating in the program will be responsible for the provision of all required research and demonstration equipment and materials. The information generated from the research and demonstration program will be analyzed by central SEHA technical staff in Rabat, with the assistance of IIMI staff and other short-term advisory assistance as required. Program progress and results will be documented and disseminated through a series of annual in-country workshops, preparation of periodic program progress reports, and a final program evaluation and workshop. Program dissemination activities will also include a variety of activities designed to facilitate farmer adoption of promising new or improved farm-level technologies and cropping systems, similar to those described above in the On-Farm Management component of the USAID project.

The IIMI/SEHA/ORMVAT program managers will be responsible for organizing and implementing all of these in-country program activities. In addition, they will be responsible for arranging and monitoring all overseas fellowships, training and study tours to be conducted under the program.

Although this program is being handled as a discrete IIMI activity within the overall USAID project, its high degree of complementarity to important USAID project activities and objectives, especially with regards to the On-Farm Management component, indicates the need for close coordination between these two initiatives in Tadla. The contractor C-O-P and the other resident USAID project advisors will be responsible for working with IIMI program managers to ensure that effective on-site coordination is maintained between these two initiatives in order to take advantage of the substantial opportunities anticipated for inter-program collaboration and to avoid any duplication of effort. This field coordination will be ensured through joint IIMI/A.I.D. program workplanning, and progress and evaluation reporting to be completed under the overall supervision of the IC C-O-P.

f. Project Administration, Monitoring, Evaluation and Outreach

(1) Project Administration

The contractor C-O-P will be responsible for administering and coordinating all of the project components and activities described above, with the exception of the IIMI Cooperative Program, which will be administered by the Resident IIMI Representative to Morocco. The C-O-P will serve as the primary contractor representative in interactions with both USAID and the GOM. S/he will assemble, manage and coordinate the inputs of all of the various entities associated with the prime institutional contract and project sub-contracts or agreements. S/he will oversee day-to-day management of all project administrative and financial actions, and all project monitoring, reporting and audit requirements. S/he will ensure proper coordination between IIMI and other project activities in Tadla, through joint workplanning, and progress and evaluation reporting. S/he will have primary responsibility for ensuring that all A.I.D. project implementation regulations and procedures are properly adhered to throughout the life of the project.

The C-O-P will be assisted in these administrative tasks by a full office staff, consisting of the following long-term, full-time, resident-hire personnel: an Administrative Assistant; an Accountant; a Secretary; a Secretary/Translator; a Chauffeur; and a Chauffeur/Expeditor. The office will be fully equipped throughout the project's life with all required office facilities, equipment and supplies, computers and associated software and peripherals, vehicles, and operations support and services. The GOM will be responsible for the provision of the contractor's office space and utilities. Short-term technical assistance will also be required to perform periodic audits of project financial accounts.

(2) Project Monitoring and Evaluation

Project planning, monitoring and evaluation will be the responsibility of the C-O-P and the Monitoring/Evaluation Specialist, working in coordination with the other resident advisors and the staff of the ORMVAT's CS and SPP. Chapter 5 provides a detailed discussion of how these important project requirements will be met.

(3) Information Outreach Program

The information outreach program will consist largely of a series of annual national workshops sponsored by the project, bringing together a wide group of knowledgeable public and private sector managers to discuss selected topics concerning improved irrigation management in Morocco. The C-O-P will be responsible for implementing this program, working in close consultation with ORMVAT management and senior staff of MARA's DER in Rabat. For maximum effectiveness, it is anticipated that annual workshop venues will rotate throughout the major ORMVAs in Morocco. This program will also be closely coordinated with the World Bank's ongoing national irrigation improvement activities described above.

(4) Policy Enhancement Program

Implementation of this project program will entail the completion of selected policy analyses and special studies regarding improved irrigation management in Morocco. This program will be implemented through short-term technical advisors working under the direct supervision of the C-O-P. USAID will retain a portion of these special study funds for analysis of topics of its own choice, also using short-term technical services. Study topics will be selected and researched in close collaboration with concerned World Bank staff to avoid any duplication of effort and to ensure timely and appropriate follow-up with central GOM decision-makers.

4. Implementation Mechanisms

a. Technical Assistance

Most project technical assistance will be obtained through a fully competed direct A.I.D. Institutional Contract. As described above, this contract will provide for most of the long- and short-term project advisory assistance through a consortium of U.S. and Moroccan private firms, universities and/or non-governmental agricultural cooperative organizations. The Request for Proposals (RFP) for this contract will be issued following the signing of the Project Agreement, with contractor mobilization anticipated in the first half of 1993. Representatives of MARA will be expected to assist in contractor selection.

Due to their special nature, certain short-term project services will need to be contracted by alternative means as follows:

(1) Evaluation Services: The project will conduct formal, external mid-term and final evaluations. These short-term services will be obtained by Mission buy-ins to centrally-managed evaluation Indefinite Quantity Contracts (IQCs). Both evaluations will be developed, conducted and

implemented with the maximum participation of project contractors, counterparts and Tadla representatives. However, primary responsibility for their implementation will rest with USAID project management.

(2) Audit Services: The project provides for completion of two external audits throughout its life. These audits will be conducted by reputable private Moroccan financial management firms. These services will be obtained by USAID project management staff through an existing USAID financial services IQC under the supervision of RIG Office staff in Senegal.

(3) Laboratory Analysis Services: The groundwater and environmental quality programs will require substantial laboratory analysis services on a periodic basis throughout the project's duration. For the first several years of project implementation, these services will be obtained through an IC sub-contract to a reputable Moroccan analytical laboratory and paid on a per sample fee basis. During this period, the IC will examine alternative mechanisms to secure these services for both the remainder of the project's duration and beyond.

(4) Special Studies: Special studies will be conducted on an intermittent basis throughout the project's life. A portion of the funds for securing the necessary short-term services for these studies will be included as a part of the institutional contract described above. The balance of these studies will be designed and implemented by USAID project management through project Mission buy-ins to appropriate A.I.D. centrally-managed projects. A portion of these funds may also be used to secure short-term technical assistance services to meet specific project support requirements.

b. Training

All project training funds will be included in the institutional contract for implementation by the IC. The IC will be responsible for arranging, implementing and monitoring all project training activities, including both in-country workshops and course participation and overseas course participation and study tours. All project training will be conducted in accordance with applicable Agency and USAID training policies and procedures, with appropriate implementation and follow-up documentation. Overseas participants' visa requirements will be met with the assistance of the USAID's Training Office staff.

c. Equipment and Supplies

Funds for the procurement of most of the A.I.D.-financed project equipment and supplies will also be included in the institutional contract for implementation by the IC. All project commodities will be either of U.S. or Moroccan source and origin. Project office and computer equipment, and vehicles will be U.S. origin commodities procured through Moroccan suppliers, i.e., sources, in order to ensure that ongoing equipment maintenance and repair services can be met in a timely manner throughout the life of the project and beyond. All project commodity procurements will be for complete items, i.e., no mixing of A.I.D./GOM/private sector funds for any particular procurement, with the exception of the private sector business management equipment which will be procured on a 50/50 cost-shared basis with participating organizations. All project commodity procurements will be conducted in accordance with applicable Agency policies and procedures.

d. USAID Project Support Services

USAID project support services include certain services, such as translation, reproduction, printing, publication, etc., provided by the Mission in support of project implementation. A modest amount of project funds will be retained by the Mission for the provision of these services through appropriate procurement documentation, e.g., PIO/Ts, purchase orders, etc.

e. IIMI Cooperative Agreement

The IIMI Cooperative Program will be implemented through a direct A.I.D. Cooperative Agreement with IIMI headquarters in Colombo, Sri Lanka. The Agreement will provide for all required IIMI program costs, including indirect costs. Although not a part of the institutional contract, this program will be implemented in close coordination with and under the overall field supervision of the IC. Details regarding the implementation of this program are provided in Section 3.e. above.

5. Special Implementation Concerns

A.I.D. encourages the participation to the maximum extent possible of U.S. entities that are small business concerns, small disadvantaged business concerns, including women-owned concerns, historically black colleges and universities, colleges and universities whose student body is at least 40 percent Hispanic American, and private voluntary organizations controlled by socially and economically disadvantaged individuals, including women. It is anticipated that no less than 10 percent of the total value of project contracts will be subcontracted to such Gray Amendment entities. Subcontracting plans reflecting no less than 10 percent subcontracting with Gray Amendment entities will be required in contractor proposals submitted.

6. Implementation Schedule

a. Early Implementation Activities

In order to facilitate the timely start-up of project implementation, USAID will need to directly implement certain project actions prior to the arrival of the IC team. These actions include some or all of the following: (1) completion of an initial vehicle procurement; (2) completion of an initial computer procurement; (3) completion of USAID Project Support Services documentation; and (4) award of the IIMI Cooperative Agreement. In addition, USAID may also wish to complete buy-ins to appropriate centrally-funded projects, e.g., the Irrigation Support Project for Asia and the Near East (ISPAN), the Implementing Policy Change Project, etc., for short-term technical assistance for the USAID-managed Special Studies and project implementation assistance services.

Actions requiring early GOM attention include: (1) selection of the project's two, long-term participant trainees (GIS applications); and (2) location of suitable IC office space and housing in the Tadla area.

The USAID and GOM may jointly wish to initiate the counterpart English language training program as soon as possible in order to afford key project counterparts the opportunity to participate effectively in contractor selection and initial project start-up activities.

b. Implementation Schedule

Table 4.1 below illustrates the planned timing of the implementation of the project's major activities, by project component and implementation year quarter.

Table 4.1

Tadla Resources Management Project Implementation Schedule

Project Activities/Fiscal Year (FY)	FY 93 Quarters				FY 94 Quarters				FY 95 Quarters				FY 96 Quarters				FY 97 Quarters				FY 98 Quarters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Project Administration																								
Project Agreement Signed with GOM	x																							
Request for Proposals Released	x																							
Institutional Contract Awarded	x																							
Contractor Team Members Arrive		x																						
Project Office Established and Local Project Staff Hired		x	x																					
Commodity Procurement Initiated			x	x																				
Project Start-Up Workshop			x																					
Annual Planning Workshops						x				x				x				x						
Annual Evaluation Workshops								x				x				x				x				x
National Outreach Workshops							x				x				x				x				x	
Special Studies						x	x			x	x			x	x			x	x			x	x	
External Project Evaluations											x									x				
External Project Audits												x												x

Table 4.1 (Cont.)

<u>Long-term Staffing</u>																							
Chief-of-Party	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Irrigation Engineer	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Agricultural Economist	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x		x		
Private Sector Specialist	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x				
Monitoring/Evaluation Specialist		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Administrative Support Staff	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Improved Irrigation System Management																							
<u>Hydrology Unit</u>																							
Commodity Procurement		x	x																				
Equipment Installation and Training			x	x	x	x	x	x	x	x	x												
Unit Operations				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>GIS Unit</u>																							
Commodity Procurement		x	x																				
Equipment Installation and Training			x	x	x	x	x	x	x	x	x												
Unit Operations				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>Agro-Meteorological Unit</u>																							
Commodity Procurement		x	x																				
Equipment Installation and Training			x	x	x	x	x	x	x	x	x												
Unit Operations				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>Supervisory Data Acquisition System</u>																							
Preliminary Hydraulic Study and Development of Specifications		x	x																				
Commodity Procurement and Installation			x	x	x	x	x																
Construction of Control Sections				x	x	x	x	x	x														
On-Site Training				x	x	x	x	x	x	x	x												
System Operations and Feedback				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 4.1 (Cont.)

<u>Hydraulic Model Department</u>																								
Procurement of Modeling Software				x	x																			
Hands-On Training					x	x	x	x	x	x	x	x	x	x	x	x								
Model Calibration and Operations					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>Mobile Monitoring Team</u>																								
Commodity Procurement			x	x																				
On-Site Training				x	x	x	x	x	x	x														
Monitoring System Calibration				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Development of Operational Procedures and Feedback Mechanisms								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>Computerization of Water Delivery Schedules</u>																								
Commodity Procurement			x	x																				
Technical Training				x	x	x	x	x																
Water Delivery Scheduling					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
System Diagnostic Analyses				x	x	x	x											x	x	x	x			
Integrated Water Management					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Study Tours			x			x	x			x	x				x				x					
Improved On-Farm Management																								
Intensive Farm Management Survey				x	x	x	x	x	x	x	x	x	x											
Semi-Annual Crop Reports						x		x		x		x		x		x		x		x		x		x
Commodity Procurement and Installation					x				x				x				x				x			
Pilot Field Trials					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pilot Field Demonstrations											x	x	x	x	x	x	x	x	x	x	x	x	x	x
Information Dissemination/Outreach											x	x	x	x	x	x	x	x	x	x	x	x	x	x
Regional Workshops						x				x				x				x				x		
Study Tours							x			x	x			x	x			x	x			x	x	

Table 4.1 (Cont.)

Support for Agro-Economic Studies Service (SEAE)						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sustainable Environmental Management																								
<u>Water Balance and Drainage</u>																								
Procurement and Installation of Monitoring Equipment				x	x	x	x	x																
Data Collection and On-Site Training					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Groundwater Model Development					x	x	x	x	x	x	x	x												
Model Calibration/Verification													x	x	x	x	x	x	x	x	x	x	x	x
Water/Drainage Demonstration Activities													x	x	x	x	x	x	x	x	x	x	x	x
Model Integration and Operations															x	x	x	x	x	x	x	x	x	x
<u>Water and Soil Quality Monitoring</u>																								
Procurement and Installation of Monitoring Equipment				x	x	x	x	x																
Data Collection and On-Site Training					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Soil, Water and Agro-Pollutant Analyses					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Water and Soil Quality Demonstration Activities									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Water and Soil Quality Monitoring System Integration and Operations											x	x	x	x	x	x	x	x	x	x	x	x	x	x
<u>Agro-Pollution Prevention</u>																								
Inventory of Agrochemical Storage and Disposal Sites			x	x																				
Monitoring of Storage and Disposal Sites				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Analysis of Farmer and Agro-Industry Practices				x	x	x	x	x																
Pollution Prevention Demonstration Activities									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Environmental Audits						x	x			x	x			x	x			x	x			x	x	
Farmer Training and Information Dissemination									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Establishment of Pollution Information Network											x	x	x	x	x	x	x	x	x	x	x	x	x	x
Study Tours			x			x	x			x	x			x	x			x	x			x	x	

Table 4.1 (Cont.)

Private Sector Strengthening																								
Private Sector Assessment																								
Conduct Agribusiness Assessment			x	x	x	x																		
Complete Diagnostic Studies					x	x	x	x		x	x			x	x			x	x			x	x	
Private Sector Strengthening																								
Develop Training Program				x	x	x	x	x	x	x	x	x												
Conduct In-Country Training						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Implement Business/Service Improvement Activities							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Private Sector Promotion																								
Conduct Agro-Services Marketing and Feasibility Studies			x	x		x	x			x	x			x	x			x	x			x	x	
Implement Promotional Activities					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Public-Private Sector Dialogue																								
Analyze Institutional Mechanisms				x	x	x	x			x	x			x	x			x	x			x	x	
Implement Analysis Recommendations						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Study Tours			x			x	x			x	x			x	x			x	x			x	x	
IIMI Cooperative Agreement																								
IIMI Cooperative Program																								
Sign Cooperative Agreement	x																							
Implement On-Farm Research/Demonstration Activities			x	x	x	x	x	x	x	x	x	x	x	x										
Implement Farmer Information Dissemination Activities					x	x	x	x	x	x	x	x	x	x										
Overseas Study Tours, Training and Fellowships				x		x	x			x	x			x										

V

MONITORING AND EVALUATION PLAN

1. Introduction

The project monitoring and evaluation plan is presented in two sections. The first section concerns the monitoring of project implementation by USAID and the GOM. The second section addresses the investigation, measurement and reporting of project impacts.

2. Monitoring Plan

Day-to-day monitoring of ongoing project activities will be the responsibility of USAID. The USAID Project Officer within the Mission's Office of Agriculture and Natural Resources (ANR) will have primary responsibility for monitoring project implementation, tracking project progress against workplan targets and development objectives, and for effecting timely remedial measures as required. He will be assisted in these monitoring tasks by appropriate staff from USAID's Offices of Financial Management, for project financial accounting requirements, Human Resources and Training, for training activities, Program, for external evaluations, and the Regional Contracting Officer, for contractual matters. Important additional assistance will be provided by the project's Monitoring and Evaluation (M&E) Unit, comprised of key IC and counterpart staff (see below).

The key document for monitoring project implementation will be the Annual Project Implementation Workplan. Annual project workplans will be developed, in part, through annual planning workshops attended by key representatives of the IC, USAID, ORMVAT and the Tadla private sector. The C-O-P will be responsible for workplan preparation for review at these workshops prior to finalization and distribution to all concerned parties. S/he will be assisted in this task by the Monitoring and Evaluation Specialist and the rest of the M&E Unit staff.

Project monitoring will also be facilitated by bimonthly project management meetings to be held in Fkih Ben Salah. Participants in these management meetings will include the C-O-P, the senior representative of the Moroccan technical assistance contractor, the USAID Project Officer, and the

ORMVAT Director and key ORMVAT staff. Other project staff and representatives of participating agencies will attend these bimonthly meetings as needed.

The IC will also be responsible for submitting quarterly and annual project progress reports to USAID and the GOM. Annual progress reports will be reviewed at annual project evaluation workshops prior to finalization and distribution to all concerned parties. These annual project reviews will serve to provide timely feedback on project implementation progress towards achieving its stated objectives and impacts, and will assist in addressing any project issues identified in a timely manner. In addition to the above participants, these annual evaluation workshops will also be attended by representatives from the IC's home office and key subcontractors, and selected external consultants as required.

Proper fulfillment of these critical project monitoring functions will assure that activities are following the project design and the workplans. It will also ensure that planned project activities continue to be relevant to the problems facing the Tadla irrigation perimeter, and that the project's focus and activities are modified as appropriate to meet the exigencies of the evolving situation.

3. Evaluation Plan

a. Evaluation Objectives

The purposes of the project evaluation plan are to provide project management, the GOM and USAID with timely information regarding the economic, social and environmental impacts that the project is having on the Tadla area, and the potential for replication of activities in other areas. The project purpose - **to increase the efficiency, economic yield and environmental sustainability of irrigation resources management and use in the Tadla perimeter** - is the basic framework in which project evaluation activities will be designed. Accordingly, the evaluation plan is organized around the following fundamental themes:

- **Reactions in the ORMVAT Perimeter to Project Activities**

  - To provide a structured comparative analysis of planned project objectives and actual results/impacts obtained; and

- To identify and analyze factors that explain adoption of planned interventions or, conversely, account for resistance to adoption and divergences from planned outcomes.

- **Project Impacts in the ORMVAT Perimeter**

  - To identify, characterize, and, wherever possible, quantify the types of change and the transformations in the regional economy induced by project activities; and

  - To evaluate impacts of planned activities on anticipated and actual project beneficiaries in quantitative and qualitative terms.

Project evaluation activities will also look at the process of disengagement of the ORMVAT from commercial activities in order to develop a list of lessons learned that might be applicable to other perimeters in Morocco. These investigations will also study the restructuring of the ORMVAT's remaining functions to enable it to be more responsive to the needs of its clients. These analyses will examine closely the constraints to the progressive transfer of regional economic activities and functions from the ORMVAT to farmers, private sector firms, cooperatives and professional associations.

At the goal level, evaluation activities will be concerned with assessing the project's national-level impacts, largely through the replication of promising project activities and results demonstrated in Tadla throughout the other eight LSIs in Morocco.

b. Project Monitoring and Evaluation Unit

The project will generate a tremendous amount of new information regarding all aspects of the Tadla perimeter. Proper handling and management of this information will be essential both to project success and to measuring the project's impact on the Tadla target area. Accordingly, some important information management questions need to be addressed during project implementation, such as:

- How can adequate levels of confidence be guaranteed in the various baseline data to be collected?

- How can data collection be structured so that the process is sustainable after the PACD?

- How can efficient data entry and analysis be ensured?

- What will be the process for centralizing the information collected and making it accessible to both the GOM and USAID?

- What are the most important methods of assuring that such information is relevant and is utilized, not stored and forgotten?

To ensure that the project's monitoring and evaluation program provides current and accurate information, systematically and consistently, the project will have an internal Monitoring and Evaluation Unit that will be responsible for all monitoring and evaluation activities. The M&E Unit will be staffed by the IC Monitoring and Evaluation Specialist, acting under the direct oversight of the C-O-P, with supporting staff seconded from the ORMVAT's *Cellule de Suivi* (CS) which is charged with similar responsibilities for the ORMVAT.

The activities of this unit will be coordinated by a three-person technical committee consisting of the IC's C-O-P, the head of the ORMVAT SPP, and a suitable external Moroccan expert appointed by mutual consent of USAID and the ORMVAT. The professional staff of the M&E Unit will serve as the secretariat and implementing arm for the technical committee. As such, they will work as necessary with representatives of all ORMVAT services, ORMVAT staff at the CMVs, long- and short-term project staff, and representatives of the private sector, including farmer groups, professional associations and private firms.

The project Monitoring and Evaluation Unit will be responsible for data entry, analysis and distribution of information to the relevant project participants, including the ORMVAT Director and the service heads, the IC C-O-P, the USAID Project Officer, relevant directions of MARA, and representatives of the private sector. The unit will also develop organized archives of accumulated data and discrete analyses for subsequent reference and use. This information will include both existing studies, reports and theses, as well as the results of project diagnostic studies, assessments, reports and water and environmental quality monitoring data. It is important to note that this information base will be updated consistently over the life of the project through the various annual updates described above and, ultimately, integrated into the Tadla GIS.

The M&E Unit will also be responsible for the preparation of the Annual Project Evaluation Report discussed above. Finally, the unit will be responsible for preparing scopes of work and background materials for the two external project evaluations scheduled in Project Years 3 and 6, and for responding to interim requests for project-related information from the USAID Mission Evaluation Officer.

c. Evaluation Plan Implementation

Project funds have been provided for two external project evaluations, including a mid-term evaluation at the end of Project Year 3 and a final impact evaluation at the end of Project Year 6. The timing of the final evaluation will afford sufficient time prior to the end of the project to assess properly project accomplishments and to disseminate promising project results.

The various diagnostic studies and assessments to be completed for all project components will provide the bulk of the baseline data required for establishing realistic benchmarks to evaluate the project's progress in meeting its objectives. The M&E Unit will analyze this information and determine what additional information is needed to complete project evaluation requirements. Secondary source information will also be obtained as required from the ORMVAT and MARA, professional associations, chambers of agriculture and commerce, farmer groups, other GOM agencies, and other donors working in the perimeter. The unit will also be responsible for analyzing this information and determining further data needs in conjunction with the technical evaluation committee described above.

d. Objectively Verifiable Indicators

In order for objectively verifiable indicators of project progress and impact to be useful, they should be: reflective of the objectives of the project and its major components; quantifiable; and, necessary for the successful evaluation of the impact of project activities, either by project, USAID and ORMVAT staff, or by external evaluators. Recommended evaluation indicators for the project are listed below by project component. This is not an exhaustive list, but, rather, is intended as a framework for the development of further areas of project evaluation and investigation.

(1) Improved Irrigation Management

- Establishment and use of an integrated computer-based water management system within SGRID;
- Formulation and implementation of a detailed water delivery policy with operational criteria and procedures for each subperimeter;
- Increased flexibility of water deliveries as reflected by increased surface water use intensities;
- Increased operational efficiency of the system as evidenced by substantial reductions in return water flows; and
- Increased farmer involvement in the seasonal irrigation planning and water delivery processes.

(2) Improved On-Farm Management

- Use by farmers of improved irrigation strategies, leading to more efficient farm-level decision-making and increases in net farm incomes. For example, improved timeliness of wheat irrigation which would lead to yield increases of up to 50 percent;
- Use by farmers of improved water application methods leading to greater field use efficiencies. Such improved methods might include the adoption of pressurized systems for some summer horticultural crops, and replacement of the robta system with improved gravity systems for field crops;
- Modification of cropping patterns aimed at increased cultivation of higher value crops, and more intensive crop rotations. One indication of this will be an increase in the area devoted to summer horticultural crops;
- Greater efficiency in technical coefficients between crop output and units of fertilizers and other agrochemicals applied. An example would be increased grain, vegetable, or fruit yield per unit of N, P, or K used; and
- Efficient integration of groundwater resources into overall water use at the farm level.

(3) Sustainable Environmental Management

- Integration and use of water balance data and the groundwater model into the SGRID management process for conjunctive use of surface and groundwater resources;

- Better overall control of groundwater levels and decreased incidence of waterlogging;

- Integration of water and soil quality data into the groundwater model, and the use of this information in improved resources management in perimeter areas. An important indicator of success here would be reduced salinization, among other environmental quality indicators;

- Establishment of an information exchange network to improve awareness of pollution levels in the region, including development of mechanisms for joint action to mitigate the impacts of these pollutants on human and livestock populations;

- Decreases in the quantities of agrochemical residues such as nitrate/nitrite levels detected in the water table and the perimeter drainage system;

- Increased regional knowledge and capability regarding the wise management and use of agrochemicals, including implementation of improved agrochemical supply, storage and disposal procedures.

(4) Private Sector Strengthening

- Assumption by private/non-governmental businesses and agricultural interests of bookkeeping responsibilities;

- Development of investment plans for private/non-governmental businesses and agricultural interests that include clear goals for membership service and prioritization of commercial activities;

- Increased receipts from sales and services provided by private/non-governmental businesses and agricultural interests;

- Increases in the market shares for private agricultural input, service and processing businesses and interests;

- Development of new agricultural and agro-industrial enterprises, and increased business volume in higher value crops; and

- Improved public-private sector dialogue and information flow, leading to increased private regional participation in perimeter resources allocation, management and use decision-making.

(5) Additional Evaluation Concerns

- An assessment of whether water saved through project interventions in Tadla is being put to the most effective possible use;

- An assessment of the project's national-level outreach program, i.e., the extent to which project activities in Tadla are being replicated and/or are having an impact on the operations of other irrigation perimeters in Morocco;

- An assessment, with appropriate examples, of successful A.I.D. project collaboration with and impact on related other donor activities in Morocco, e.g., the World Bank, IIMI; and

- An assessment, with specific examples, of the project's impact on women in the Tadla target area.

VI

PROJECT ANALYSIS SUMMARIES

A. Technical Analysis

1. Element 1—System-Level Water Management Issues

The canal systems of the ORMVAT are vital links for conducting irrigation water to farmers in the perimeter. The physical infrastructure in Tadla was installed to operate under a set of specified crop rotations. Policy changes directed at liberalizing these fixed crop rotations require corresponding changes in the management of irrigation water distribution. This section summarizes the operational characteristics of the existing system; the demands imposed on the system by policy changes; and how project interventions will address new system demands and limitations.

a. Operational Characteristics of the Existing System

The physical characteristics of the ORMVAT perimeter were described in Chapter Two, with Maps 1 and 2 illustrating the geographical orientation of the perimeter.

The irrigation systems in the ORMVAT were originally designed to meet the peak crop water requirements of a fixed crop rotation. This pattern of crop rotation was specified to limit water losses in field application and to minimize the peak flows required from the system. Canals and turnout structures were sized to meet this minimal peak demand.

Control of the irrigation water distribution system is accomplished through the use of control structures upstream in the canal system. Operationally, this means that water released at the canal head is not held in reserve. If inflows and outflows are not balanced, irrigation water either passes through the system—flooding farms and/or drains—or is diverted only to upstream users.

In order to increase the operational efficiency of such a system and to ensure that water is distributed throughout the system, it is necessary to use a system of arranged water delivery in which a schedule of gate settings is determined in advance. This schedule would take into account the flow dynamics of the system and the ability of system operators to make the necessary adjustments in distributing water released into the canal head to meet system water demands. For the fixed cropping rotation, the water distribution policy had been set based on the system design. Likewise, schedules could easily be set based on the rotation of crops and standard system flow rates.

Implementation of the fixed rotation plan was rendered impossible when farmers deviated in any way from the prescribed pattern. Since farmers started modifying both irrigation techniques and the fixed rotations **to suit their perceived needs** almost as soon as they occupied their land, the ORMVAT soon discovered that it needed to schedule gate settings on the basis of a water ordering system. This system requires that the farmers request irrigation water the week before it is needed. Water ordering is implemented for each farmer in the group served by a tertiary canal, using Request Form MV-I. Water orders for the tertiary canal groups are aggregated by an aiguadier who is responsible on average for about 500 farmers.

During a period of extreme water shortages in 1982 and 1983, upper limits were placed on the quantities of water farmers could order, based on weekly ORMVAT estimates of crop water requirements for those crops specified in the fixed rotation(s). These upper limits are still being used as guidelines in weekly water ordering.

The schedule of gate settings is determined by each aiguadier from the information contained in Request Form MV-I and recorded on Request Form MV-II. Steady-state conditions are assumed in the system at all times and the aiguadiers are instructed to, if possible, maintain constant flow rates for the week in the primary or secondary canals under their supervision.

When changes need to be made in system flows on short notice, due to canal breaks or plugging, rainfall, or changes in farmer water demand, operational losses of water will occur and/or farmers will not receive needed water at the proper time. Losses can be minimized if water already released into the system can be utilized on short notice by users in another part of the system. Present scheduling techniques have only limited ability to respond to rapid changes. This inherent inflexibility in the present system results in significant flows of unused irrigation water to system drains, the distribution and billing of water to farmers who no longer need and will not use the water delivered, and/or delays in the deliveries of water to meet critical water demands elsewhere in the system.

b. Demands Imposed on the System by Policy Changes

The policy changes calling for the liberalization of the fixed rotation type of cropping pattern open up the possibility of an unlimited number of cropping patterns in the Tadla irrigation perimeter. Responding to these new cropping patterns in ways that promote wise use of limited water resources requires consideration of the following: irrigation water deliveries to fully meet all crop water demands may no longer be feasible in the perimeter; farmers will grow crops requiring more flexible water delivery schedules for higher productivity; demands for irrigation water will increase and will cause increased tensions in the water distribution system because breakdowns in the system will result in increased financial losses for farmers; and system managers will be expected to meet the water demands of farmers who will no longer be following fixed crop rotations.

Meeting these changes in a wise manner will require greater efficiency, flexibility, reliability, and timeliness in irrigation water deliveries than has been the case in the past. Efficient system operations will result in a maximum volume of water being made available to farmers. Flexibility in system operations will contribute to system efficiency and to productivity under alternative cropping patterns. Reliability in flow rates, volumes delivered, and times of delivery will contribute to on-farm efficiency and develop a sense of trust in the water delivery process that will promote farmer participation in efforts to increase system-wide productivity and efficiency. Timeliness refers to the way in which the system meets the actual water requirements of the crops for maximum productivity.

c. How Project Interventions Address System Demands and Limitations

In the context of the limitations of the physical system and present operating procedures, addressing demands for improvements in irrigation water delivery, i.e., greater efficiency, flexibility, reliability, and timeliness, must first take into consideration certain operational realities. For example, changes in one major element of the current ORMVAT operational policy are likely to require reformulation of the whole operational policy and the general operating rules system operators must use in determining detailed operational plans. Diagnostic analysis is the basic tool used for assessing existing procedures for and roles of system managers and participants where new systems are to be installed. It provides a sound basis for making policy changes.

Second, a well-run irrigation water delivery system is necessarily based upon the careful preparation of the annual and seasonal operating plans. Reliable estimates of system-wide water availability and the water requirements of anticipated cropping patterns are essential. Current databases for area hydrology, weather, cropping patterns, and soils are also needed in the planning process. Ultimately, farmers set cropping patterns; thus, their informed participation in the planning process is essential to defining feasible cropping patterns or water allocation processes.

Third, effective operation of a water delivery system with upstream controls requires a specific set of procedures to operate the head works and the water conveyance and delivery systems. This in turn requires an in-depth understanding of the actual hydraulic happenings in the system since all control events, barring accidents, are caused by system operators. Hydraulic modeling provides the most efficient way of determining system operational possibilities. The gate scheduling process is also a key element in refining operational procedures to make the system more flexible and efficient. Computerization of the process will increase flexibility and free the ORMVAT aiguadiers for the more important tasks of monitoring actual system operations and interacting with farmers about problems and needed changes in system operations.

Ultimately, reliability is not measured by good intentions but by actual delivery performance. Development of procedures to monitor actual water distribution in the system will indicate whether the system is performing according to the operational plan. It will also provide feedback for improving gate setting procedures and indicate where adjustments are needed in water delivery scheduling. Real-time measurements of the system at crucial points will allow for adjustments to reduce losses on a timely basis. Actual system status reports from the Mobile Monitoring Units to be created under the project will provide additional verification of the effectiveness of irrigation water distributions.

2. Element 2—Farm-level Issues

a. Water Use Strategies

As currently managed, the ORMVAT perimeter is best understood as an arid-region crop production scheme. Water resources for the perimeter include an average of 350 millimeters of free but unpredictable water in the form of rainfall; 630 millimeters of affordable but inadequate canal water; and large quantities of more expensive well water of widely divergent accessibility and quality. As previously mentioned, Project Element 1 is concerned with increasing the utility of the system-wide canal water delivery system. Complementing this activity at the farm level will be the most important objective of Element 2 - changing the effective cropping systems in the perimeter by increasing the use of pumped groundwater from farm wells to complement the water supplied from the gravity system.

The number of farm wells tapping the shallow perched groundwater table—premiere nappe—under the perimeter has doubled to 9,220 in the last decade. In most cases, these wells provide added flexibility and security for irrigated farming. In some cases, however, this shallow aquifer is an immediate threat to soils and crops and, in others, it may be a long-term threat. This problem is of direct concern to Elements 2 and 3.

The cost of using groundwater for irrigation is a function of the fixed and variable costs of pumping it from the farm well. At present, pumped groundwater is estimated to be about three times more expensive than water available from the gravity system, primarily because pumping systems used in the wells are often inefficient per liter of fuel used. The costs of using groundwater for irrigation could be reduced by using more efficient pumps. Element 2 field trials will concentrate on developing more efficient pumping systems. Moreover, pressurized irrigation systems using well water would certainly reduce irrigation costs by increasing the overall efficiency of the delivery and application system. The attractiveness of such systems for farmers, however, is diminished at present because GOM trade policies artificially raise system purchase costs. Element 2 will study this problem as well.

Finally, there is significant potential for improving field application efficiencies in gravity irrigation systems throughout the ORMVAT perimeter. The pervasiveness of traditional robta irrigation techniques, combined with lack of land leveling and poor field maintenance practices, have diminished the overall efficiency of the Tadla gravity irrigation system in the past. Element 2 will initiate a process of change toward more efficient on-farm use of canal water by testing improved water application and field tillage methods. In all cases, improved water application systems will be demonstrated on crops that are most likely to benefit from more efficient irrigation. This is as important for improved gravity irrigation as it is for pressurized irrigation systems.

b. Agricultural Chemical Strategies

There is a growing awareness in Morocco that adverse environmental impacts can result from irrigated agriculture. The uneconomic use of fertilizers in a manner detrimental to water quality is a common occurrence in Tadla. As a result, proper fertilizer use will be part of the crop production packages to be tested and demonstrated under Element 2.

On-farm practices for storage, use, and disposal of potent agricultural chemicals are virtually unknown, and the use of these chemicals is essentially uncontrolled. Element 2 will be concerned primarily with promoting more economic use of insecticides, pesticides, and fungicides at the farm level and will work with Element 3 on chemical safety and pollution issues as well.

c. Crop Production Strategies

The GOM has liberalized its policy on mandated cropping rotations in irrigated perimeters during the last four years. Crop production packages for alternative crops that provide increased net farm incomes or more flexibility in rotations or both will be developed under Element 2. Improved production packages for some traditional crops–e.g., hard and soft wheats and maize—which should be highly responsive to more intensive management, will also be developed.

Examples of water management interventions are improving the timeliness of supplementary irrigations on winter crops; improving gravity irrigation techniques for alfalfa; and improving water application efficiencies on summer horticultural crops by means of pressurized systems.

d. Impacts

The long periods of time often required to test and demonstrate improved production technologies are the most important problem to be overcome if innovations generated by Element 2 are going to have significant impacts during the life of the project. Several methods will be used to mitigate this constraint.

First, testing of innovations that essentially are new to the Tadla perimeter—or that appear particularly promising—will start in Project Year 1. Second, testing will be done on-farm. This will give farmers the opportunity to learn about and evaluate a given technology for themselves long before it is officially recommended or rejected. And, third, to the maximum extent possible, field testing of new technologies will be done in collaboration with agribusinesses having commercial interests in the Tadla perimeter. This will facilitate promotion of proven technologies at the same time that local private firms are gearing up to supply required services, inputs, and equipment for farmers.

3. Element 3—Environmental Issues

The activities in Element 3 have been selected to provide a more complete picture of the environmental changes that have accompanied the development of the Tadla irrigation subperimeters. Short-term technical assistance, training, equipment, and commodities will be provided to develop management tools to assess current conditions and allow for the long-term monitoring of key environmental indicators—i.e., groundwater fluctuations, waterlogging, soil decomposition, overall water quality, and agrochemical residues present in the perimeter. Integrating these data with the information collected in Project Elements 1 and 2 will enhance the soil and water management capabilities of ORMVAT decision makers, as well as allow for more economically efficient and environmentally sound on-farm management practices. A summary explanation of the rationale for each of the three Element 3 activities is presented below. An in-depth discussion of the key issues for Element 3 is to be found in Annex E, Part 3.

a. Groundwater Resources and Perimeter Drainage Systems

Following the initiation of irrigated farming in Beni Amir in 1938 and Beni Moussa in 1954, the subperimeter water tables began to rise rapidly—by as much as 2 to 3 meters per year at some sites. The pumping of groundwater from the more than 9,200 private wells constructed during and since the 1979-84 drought period has contributed to significant drawdowns—2 to 3 meters—of subperimeter water tables. Waterlogging and related problems, however, remain very critical at sites in both subperimeters where water tables are close to the soil surface. In Beni Amir, 36 percent of the irrigated area is potentially vulnerable to waterlogging and soil decomposition due to a water table that is at or less than 2 meters below the surface. In Beni Moussa, the problems affect about 30 percent of the land, mostly concentrated in Beni Moussa West. The dense network of monitoring sites to be installed under Element 3 and the database resulting from monitoring the network will give ORMVAT managers a more complete picture of the dynamics of the groundwater system across the subperimeters and provide the basis for more comprehensive strategies for integrated management of soil and water resources.

To offset the waterlogging problems in the subperimeters, the ORMVAT has constructed a surface drainage system with widely spaced (400 to 700 meters apart) open ditches. To supplement this system, 12 pumping stations were established along the East Median Canal in the Beni Moussa subperimeter to pump 30 million cubic meters of water annually. Around 1,700 kilometers of drainage ditches and outlets need to be rigorously and continuously maintained to make the system work effectively, but the ORMVAT is currently only able to handle about 200 kilometers a year. The lack of system maintenance and the wide spacing of the ditches and drainage canals are certainly factors affecting the efficient functioning of this drainage network. Rigorous assessment and continuous monitoring of this system under Element 3 will allow for better estimates of its real efficiency. With these data, alternative management strategies for the complex groundwater system will be studied to provide better control of the water table below critical depths in the Tadla subperimeters.

b. Soil Modification and Water Quality

The intensification and modernization of irrigated farming in Tadla has led to use of large amounts of fertilizers and other agrochemicals to increase agricultural production. Yet, at the same time, the low irrigation efficiency (approximately 50 percent) in the area has resulted in an increase in the leaching factors for salt, nitrates, and chemical pollutants through the relatively permeable soils.

Significant salt accumulations have occurred, however, where the water tables are shallow—i.e., aquifers of less than 1.5 meters—in Beni Amir and Beni Moussa West. Maximum concentrations have reached 2.5 to 3.0 grams per liter. This is the result of a combination of soil leaching-irrigation water with relatively high salt content from the Oum Er Rbia River—and evaporation from shallow water tables.

The rate of nitrate accumulation has also become a matter of great concern during the last three years. Measurements in observation wells indicate annual increases of about 5 milligrams per liter, which has resulted in a high concentration of 50 milligrams per liter—the upper tolerance level for drinking water—in many parts of the two subperimeters. Agro-industrial firms, including the three sugar factories, also contribute to nitrates and pollutants to the aquifer. Raw effluent from these sources is carried into the existing drainage system, which in turn flows directly into the Oum Er Rbia River.

Water quality in the perimeter is also affected by raw sewage flowing into the existing drainage system from the urban centers of Beni Mellal, Afourer, Dar Oulad Zidouh, Fkih Ben Salah, and Souk Sebt. Recent studies have indicated that pollution levels at some sites within the perimeter—e.g., along the Beni Amir canal and drain outlet G12 in Beni Moussa West—far exceed recognized national standards. However, these investigations have also shown that current pollution levels in the Oum Er Rbia River downstream from the Tadla perimeter do not pose a threat to public health, nor to socio-economic activities of users of the water from the Al Massira Dam. The construction of the storage dam at Dechra El Oued—upstream from Kasba Tadla—is liable to exacerbate the pollution problem when water quantities, which contribute to the natural flushing action of the Oum Er Rbia River, are significantly reduced. Increases in pollution levels and decreases in water quality, combined with water stagnation along the irrigation canals and drainage network, explain the presence of water-related diseases—e.g., schistosomiasis, cholera, and malaria—in the Beni Amir subperimeter.

Present monitoring programs for water quality and soil modification are not systematic and are only partially undertaken by local or regional technical services such as SGRID, DRH, SH in Beni Mellal, and the sugar factories. The comprehensive database to be developed under Element 3 will enable environmental managers to make better assessments of soil and water salinity, nitrate, and chemical pollutant problems in the perimeter. This tool will make possible integrated surface and groundwater management and help offset some of the negative environmental impacts brought on by irrigated farming activities within the perimeter.

c. Agrochemical Storage, Use, and Disposal

With the ORMVAT disengagement, commercial supply of agricultural inputs, including fertilizers and pesticides, is being shifted to the private sector. The potential for increasing pollution hazards and environmental risks from these agrochemicals will grow in this new economic environment if appropriate storage, handling, and disposal requirements for these substances are not mandated and enforced by the government.

At present, however, information is lacking on existing agrochemical storage facilities and disposal sites in Tadla. And there is no existing mechanism for monitoring on-farm handling practices for these materials. The potential environmental benefits from better controls on the dosages and mixing and application procedures for agrochemicals are great, and adoption of proper disposal regulations, coupled with efforts to increase public awareness of the hazards associated with these materials, would significantly reduce present pollution problems.

In addition to the ORMVAT, a number of other public institutions in the Beni Mellal province—i.e., DRH, SH, ONEP, and *Eaux et Forets*—have an active interest in issues of water quality and the impacts of pollution on human and animal health. Unfortunately, however, at present there appears to be very little effort expended in sharing information between these agencies or coordinating resources. A network for information exchanges between all interested environmental actors will be established under Element 3.

4. Element 4—Private Sector Resource Allocation, Management, and Use

The activities in Element 4 support disengagement of the ORMVAT and other parastatals from commercial activities. Elements 1, 2, and 3 will create commercial opportunities for private firms, cooperatives, and professional associations in supplying agricultural inputs and services. Element 4 will provide short-term technical assistance, training, and material support to strengthen private sector capacities. The rationale for component activities is given here in summary form. Annex E, Part 4 provides a fuller explanation.

a. Promotion of the Private Sector

In Morocco, the process of disengagement of public agencies from commercial activities and privatization of parastatal agro-industrial enterprises is managed by the government. The process is gradual, to avoid shocks to productive capacity and undesirable impacts on consumer prices and employment. The government generally seeks assurances from potential private investors that any privatized operation will continue to operate at the same or, ideally, an increased level of production or service in the future.

Element 4 of the project is designed to broaden the options for transfer of commercial enterprises from the state to the private sector and facilitate the creation of new enterprises in Tadla. It will build on the work of Elements 1, 2, and 3, which will identify input and service requirements, fund new environmental monitoring activities, and demonstrate market potentials in input supply and services and agro-industrial processing and commodity marketing.

Element 4 is designed to provide technical assistance to help private sector firms define their positions and evaluate market potential for expanding their operations and/or starting new enterprises. In this regard, there appear to be potentially large markets in Tadla for land leveling services, sales of pressurized irrigation systems, custom harvesting, and consulting on pesticide application, storage, and disposal. The national seed and fertilizer supply industries are scheduled to undergo major restructuring with the privatization of the major parastatals, and this should provide opportunities for expanded private distributor operations in Tadla. Element 4 resources will be made available to private sector firms in analyzing these new opportunities, preparing bankable proposals for business expansion, and improving current business operations.

Moroccan banks, chambers of agriculture and commerce, and individual investors have remarked on the relatively low level of new capital flows into Tadla for commodity packing and processing enterprises. This lack of new investment is attributed partly to the strength of competing centers for commodity packing and processing in Marrakech, Fes, Meknes, and Casablanca. It is also thought to be due to the high guarantee requirements imposed by banks for obtaining operating capital or opening lines of credit for agricultural enterprises and the fact that private capital tends to flow to the coastal cities and into non-agricultural investments in real estate or commerce.

In the Tadla area, the new capital inflows have tended to focus on center pivot irrigation development, for which the government has offered very attractive financial incentives, and into paprika pepper production and processing for the European and American markets. As exemplified in these cases, major new investments in production and processing of horticultural or other crops appear to require an external investor who is able to bring proven production and processing technologies and an existing marketing arrangement into the local partnership. Local firms can do much to attract external partners in that they are well organized and can present realistic assessments of local opportunities. To facilitate this process for medium-sized and smaller firms, Element 4 will provide technical assistance to develop analyses of markets, enterprise feasibility studies, and business plans outside of the horticultural sector. And resident project staff will direct firms with interests in horticultural enterprises to the USAID Morocco Agribusiness Promotion Project (MAP).

b. Assistance to Local Cooperatives and Professional Associations

Three activities will provide short-term technical assistance and training for selected cooperatives and professional associations to improve their management of costs and services, to develop their abilities to plan and undertake commercial operations, and to help them develop strategies for sustainability.

Multi-service cooperatives were selected as participants for several reasons. They have the best spatial coverage of the perimeter; they operate on a cooperative decree that gives them broad choice in their business activities; they have dairy enterprises, which provide regular cash flow throughout the year; and they have developed a diversified business base, including sales of consumer goods, supply of agricultural inputs, supply of fuel, and custom machinery services. These enterprises also augment year-round cash flows. They have accumulated capital reserves and are targeted for accelerated disengagement by the ORMVAT—i.e., movement out of or rental of CMV facilities used as collection, storage, and retail space; and transfer of cooperative director salaries and accounting costs from the ORMVAT to cooperative accounts. With proper management of their transition to independent, business-based operations, these cooperatives could invest in the input supply and custom service opportunities arising from project activities and the privatization and sale of the SONACOS, the two local sugar mills, and the sugar refinery. Development of cooperative management skills will enable these cooperatives to provide cost-shared management services to other cooperatives in Tadla.

Activities with the AET professional association were designed because of the large potential impact AET activities—dairy and livestock production, breed improvement, and so on—could have on the mix of agricultural enterprises in the perimeter and hence on the efficient use of water and soil resources. A successfully implemented activity centered on business training for membership services will serve as an example to other professional associations housed in the Beni Mellal professional association building of how to structure and operate member-oriented business services.

Irrigation associations are the newest local organizations in Tadla. They are being asked to assume both management and financial responsibilities in canal operations and maintenance. They are governed by a decree that greatly limits the possible range of their economic activities. And their "income" is limited to the 20 percent reimbursement of water charges they are to receive to cover the costs of their operations and maintenance work and provide a small profit. Three irrigation associations have been formed to date. They are expected to start their operations and maintenance work in 1992.

The design options regarding the irrigation associations were to devote a high level of resources to them early in the project or to provide a somewhat lower level of assistance until main system operations had been adjusted to provide farmers with a more reliable and responsive water distribution system, the latter of which is indispensable for the successful local management of water and maintenance of tertiary and quaternary canals and drains. Assisting the associations at a lower level, if chosen as an option, also would continue until it became clear exactly what resources would be available under PAGI 2 to support the associations and canal rehabilitation efforts in Tadla.

The design choice was taken to assist irrigation associations through management planning, training, and short-term technical assistance. This modest assistance will lay the groundwork for a more effective turnover of operations and maintenance responsibilities to the associations after Elements 1 and 2 have had the opportunity to address fundamental water allocation problems at the system and farm levels and PAGI 2 resources have begun to rehabilitate existing infrastructure.

B. Financial Analysis

1. Cost Estimates

The total cost of the project is estimated at $25 million. The project will be supported by contributions from A.I.D., the participating GOM agencies and the Tadla private sector. Table 3.1 repeated below presents a summary of total project costs by major input category and contributor.

Table 3.1

TRM Project Budget Summary
($000s)

Item/Source	A.I.D.	GOM	Other	Totals
Technical Assistance	7,140	2,400	300	9,840
Training	1,335	190	270	1,795
Commodities	2,060	780	820	3,660
Indirect Costs	7,465	880	360	8,705
IIMI Cooperative Agreement	750	250	-	1,000
TOTAL COSTS	**18,750**	**4,500**	**1,750**	**25,000**

Details of each of these respective contributions are described in Chapter 3. Additional information on the planned contributions to the project is provided in the complete Financial Analysis (Annex F).

2. Financial Plan

Most project activities will be implemented through a direct A.I.D. institutional contract. USAID-managed funds for special studies, evaluations and audits will be implemented through project buy-ins to centrally-managed A.I.D. projects and Indefinite Quantity Contracts (IQCs) and/or through purchase orders, where warranted by the size and source of the procurement. Disbursement of A.I.D. project funds will be through both direct payment and reimbursement. Table 3.6 (in Chapter 3) summarizes the expected project implementation and financing methods for the disbursement of A.I.D. funds.

3. Project Audit Requirements

The project includes funds for the completion of two external audits throughout its life, i.e., one audit for each three years of project implementation. These audits will be comprehensive financial audits of all project operations and accounts. They will be conducted by a reputable Moroccan financial management firm under the supervision of the A.I.D. Regional Inspector General's Office based in Dakar, Senegal. These audits will comply with current U.S. government financial audit requirements.

A.I.D. also reserves the right to conduct additional external audits throughout the project's duration as it deems appropriate.

4. Recurrent Costs and Flow of Funds

a. GOM

Recurrent cost obligations incurred by the GOM as a direct result of project activities are expected to be modest. These obligations will consist primarily of the additional staff and operations and maintenance costs resulting from the new system-level, on-farm and environmental quality monitoring systems developed under the project. These additional O&M costs are estimated to be approximately $750,000 per year in real terms.

Given that the ORMVAT is progressively divesting itself of the cost of many commercial activities at the same time that its gross revenues are increasing due to higher irrigation water fees and better collection procedures, it should be in an excellent position to assume these projected additional recurrent cost obligations by the end of the project. As mentioned above, ORMVAT is now collecting water revenues sufficient to cover all current O&M costs plus about 40% of system capital investment costs.

b. Private Sector

No significant additional recurrent cost obligations are anticipated for private sector firms or individuals as a result of their participation in the project.

c. A.I.D.

Once funds are obligated for the project, earmarking, commitments, and disbursements will proceed according to the expenditure schedule presented in Table 3.2 (Chapter 3). Flow of A.I.D. funds will be subject to standard A.I.D. rules and regulations.

C. Economic Analysis

This section presents a summary of the economic analysis for the project with respect to the net benefits from increased water efficiency savings in quantitative terms. Full quantitative and qualitative analyses of the potential supplementary benefits from improvements in factor and from the environmental component can be found in Annex G.

In the quantitative analysis, the value of the water savings was compared with the anticipated USAID grant investment in the project ($18.75 million) and with the total project cost stream—i.e., USAID, GOM ($4.5 million), and private sector contributions ($1.75 million) to the project over six years. This investment is projected to yield a total of $159.12 million in undiscounted benefits from water savings alone over 20 years from project initiation.

To add further reality to these figures, the assumption was made that the GOM would incur recurrent costs equivalent to $0.75 million per year after Project Year 6 to maintain the level of activities institutionalized by the project. The calculations were repeated taking these recurrent costs into account for Years 7 to 20 in the cost stream.

In the first case of USAID grant investment alone and without consideration of GOM recurrent costs, the present values of the net benefit stream discounted at 10, 20, 30, and 40 percent are, respectively, $48.0 million, $14.79 million, $4.09 million, and $0.1 million. The internal rate of return on the investment was computed at 40.4 percent.

In the second case of total project investment and without consideration of GOM recurrent costs, the present values of the net benefit stream discounted at 10, 20, 30, and 40 percent are, respectively, $43.61 million, $11.55 million, $1.59 million, and ($1.90) million. The internal rate of return on the investment was computed at 33.4 percent.

In the third case of total project investment and with consideration of GOM recurrent costs, the present values of the net benefit stream discounted at 10, 20, 30, and 40 percent are, respectively, $40.49 million, $10.39 million, $1.09 million, and ($2.15) million. The internal rate of return on the investment was computed at 32.4 percent.

The projected net benefits from water savings alone, therefore, provide a very substantial cushion for adding in a higher estimate of the recurrent costs to the ORMVAT that would be incurred in assuming project activities over a 20-year period. Since essentially all of the technical personnel required to implement project activities are already in place at the ORMVAT, recurrent expenditures for personnel will not be a very significant additional cost item. Expenditures will be needed over time, however, to replace and/or update system-level equipment and computer hardware and software, and to pay for the services of Moroccan consultants for short-term special assignments at the ORMVAT after the project is over.

It appears, therefore, that the water savings to be derived from Project Elements 1 and 2 are more than sufficient in themselves to justify approval and implementation of this project on economic grounds. This would be so even if there were to be no additional benefits forthcoming from Project Elements 2, 3, and 4—which certainly will not be the case, as explained further in Annex G.

In qualitative analyses, the potential for additional benefits derived from better allocation of the factors of production, shifting to higher value crops at the farm level, more private sector involvement in agribusiness at the regional level, and improved environmental management are discussed. More specifically, Elements 2 and 4 are expected to provide additional benefits flowing from the following:

- Cost savings from more efficient pumping and conjunctive use of groundwater;

- Increases in net farm incomes derived from a gradual shift away from uneconomic industrial and food crops—e.g., sugar beets, hard and soft wheats, and cotton—to higher value crops—e.g., forages, fruits, vegetables, and specialty crops—in the Tadla perimeter;

- Efficiency gains to the economy and cost savings to the government from increased private sector participation in agribusiness in the regional economy and privatization of inefficient public and parastatal businesses;

- Efficiency gains to the economy and financial savings to the government from the ORMVAT's disengagement from commercial activities and better management of its residual mandate; and

- Efficiency gains from use of infrastructure rehabilitated under PAGI 2 from the complementary activities undertaken in the project.

The economic benefits of the project's environmental component cannot be estimated in quantitative terms. It should be possible, however, to define categories of benefits and costs as the Element 3 interventions are initiated and refined. The activities associated with this component—improved groundwater quality and management and improved storage, use, and disposal of agrochemicals—will lead to benefits that are directly linked to sustaining environmental resources. Mitigating the adverse effects of current practices will lead to reductions in abatement, damage, compensation, and transaction costs related to environmental pollution. For the Tadla perimeter, these benefits will include the following:

- Improved human health and welfare—particularly in those areas where water-related sicknesses, diseases, and impacts of chemical toxins present in the soil and water are prevalent;

- Increases in productivity of ecological systems—e.g., increased yields in crop and livestock enterprises and fisheries;

- Decreases in corrosion and other materials damage, cleaning costs, and waste storage and disposal expenses associated with agricultural production and processing; and

- Reduced alteration of ecological systems with positive consequences for human welfare—e.g., species diversity, ecosystem stability, and recreational use.

D. Administrative Analysis

1. Introduction

The key GOM counterpart agency for this project will be the ORMVAT, which is one of the oldest and best established regional irrigation authorities in Morocco. It has a solid reputation for sound perimeter management and a positive orientation toward implementation of the country's new irrigation policies. In addition to the ORMVAT, a number of other GOM agencies will collaborate on specific project activities, particularly with respect to implementation of Elements 1 and 3. The project will also encourage participation from private entrepreneurs and agribusiness firms, professional associations, chambers of commerce and agriculture, and nongovernmental organizations, particularly in activities under Elements 2 and 4. Finally, selected cooperatives and irrigation associations will participate in project activities.

A variety of mechanisms for involving all of these agencies in project activities are described in the Project Implementation Plan (see Chapter Four). These mechanisms are designed to ensure that project participants are fully prepared to assume their roles in the pursuit of the project's objectives.

2. The ORMVAT

The ORMVAT was constituted as a civil agency, with legal autonomy to manage its own personnel, property, and legal and financial affairs. It reports administratively to MARA. In addition to the tutorial role played by MARA, the Ministry of Finance also plays a role with respect to the ORMVAT's budget from the GOM and in ensuring financial audits on a regular basis.

The mandate of the ORMVAT originally was to develop and manage an irrigated agricultural system in Tadla and to improve agricultural production. In this role, the ORMVAT had a double character as public utility and parastatal commercial enterprise. This original mandate has changed recently in response to modifications in GOM economic policies. In the future, the ORMVAT's role is to be centered on water management as a public utility and on agricultural extension. It has and will continue to withdraw from direct involvement in commercial activities, which will be taken over by the private sector.

Within the ORMVAT, the director is responsible to a *Conseil d'Administration* on which sit the Minister of Agriculture and Agrarian Reform, the Governor of Beni Mellal Province, the President of the Provincial Assembly, and the President of the local Chamber of Agriculture. This *conseil* has major responsibilities for planning and implementing the ORMVAT's program. It is assisted in these tasks by the ORMVAT *Comité Technique* which is chaired by the Governor of Beni Mellal Province and is composed of local representatives from all the concerned national ministry departments and local farmer representatives. It meets once a month—or whenever necessary—to examine the issues and problems the ORMVAT faces. Local technical committees are organized by the ORMVAT SPA to deal with specific crops—i.e., cotton and sugar beets. During each agricultural season, these committees assemble all interested parties and experts each week to discuss problems. Finally, a *Commission Locale de Mise en Valeur* is situated at each cercle. It is chaired by the super-caid, who is the committee's reporter. It meets whenever necessary to examine the issues and problems faced locally by the ORMVAT.

In the design team's opinion, all of the committees described above are potentially useful vehicles for furthering project objectives. Given the nature of their different membership and mandates, they can and will be used to foster discussions and constructive dialogue on many of the issues raised by the GOM's new policies toward the irrigation subsector and the increased role envisaged for the private sector. They can also facilitate coordination of project activities and dissemination of results to all interested parties.

At headquarters, the ORMVAT is divided into departments, or services, each with several bureaus or sections (see Figure 4.1, "The Organizational Chart for the ORMVAT"). At the field level, the ORMVAT has established three subdivisions to supervise the activities of the 31 CMVs operating within their territorial boundaries. They also coordinate the activities of the various ORMVAT services—i.e., SGRID, SPA, SE, and SVOP—in the field. The CMVs are the basic units through which crop and livestock development activities are integrated.

The project has been designed to institutionalize new capacities and activities within the ORMVAT. All the activities of the project are integral parts of the mandates of the services. The implementation of project activities will not require creation of new administrative units *per se* within the ORMVAT, but simply the rearrangement of existing personnel resources within services. However, processes and mechanisms to facilitate discussion and interaction among participants and partners will be created during the project implementation process.

The project is devoted to sustaining the activities started with project resources—i.e., the continuing capacity of the ORMVAT to manage effectively its enhanced responsibilities beyond USAID support—and to adapting to changing needs in the irrigation subsector. Therefore, the implementation of the project will be geared toward building staff capacity to ensure full involvement in project activities and fostering action-oriented mechanisms within the existing structure of the ORMVAT. Since it is these people who will make integrated activities work, attention will be directed toward creating not only a positive internal organizational culture, but positive staff attitudes toward coordination of activities and dialogue with farmer-clients and other partners.

3. Other GOM Agencies

Given the multiple activities of the project under its four elements, effective linkages and working relationships will need to be established with a number of key GOM agencies at the provincial and national levels. This section briefly outlines the nature of the activities envisaged with these agencies.

Under Element 1, the project will consolidate a Water Resources Unit within the BE of SGRID. This unit will be responsible for surface water hydrology, groundwater hydrology, and water quality within the perimeter. Surface hydrology activities will require agreements between the ORMVAT, the ORMVAH, the Ministry of Public Works, and the ONE. In order to develop and maintain a database of flows in the Oum Er Rbia River at Kasba Tadla diversion dam and the inflows into Bin El Ouidane Dam, an agreement will be established with the DRH of the Ministry of Public Works for the regular importation of such data into the ORMVAT database. The Oum Er Rbia River flow data is available in computer format from the *Administration de l'Hydraulique* (AH), a division of the DRH in Beni Mellal. Data for the Bin El Ouidane Dam flows will come from the DRH in Rabat. Statistical analysis of inflows into the Bin El Ouidane Dam will serve as a basis for a review of the operating rules for the dam and power plant at Afourer, taking into account the new constraints imposed by water supplies to canal T2 for ORMVAH as part of the "corrected manifest of Bin El Ouidane" between ORMVAT, ORMVAH, and ONE.

Activities under Element 3 will focus on the development and active use of a permanent monitoring system and database of groundwater fluctuations and water quality, and drainage system efficiency in the Tadla perimeter. In Project Years 1 and 2, the institutional contractor will work with the SGRID to establish the groundwater and drainage monitoring network. A minimum of 100 permanent sample points will be established to monitor water table fluctuations. SGRID personnel will ensure that these sample points are established in a manner that will complement the 56 points currently being monitored within the subperimeters by the DRH in Beni Mellal. It is of paramount importance that close collaboration and information sharing occur between the SGRID and the DRH.

Two other activities under Element 3 will focus on monitoring soil modification and water quality in the subperimeters. The first activity will establish permanent sampling points for collecting soil, water quality, and agrochemical residue data during Project Years 1 and 2. It is assumed that the analyses will be done to determine the presence of a minimum of five toxic substances selected and prioritized in conjunction with the ORMVAT SPA, agro-industries operating in the area, and the Ministry of Health's *Service d'Hygiène* (SH) in Beni Mellal.

The second activity will integrate these data into the real-time management process of the SGRID. Results from the soil and water quality monitoring will become part of the ORMVAT GIS. These data, when viewed with other overlays of real-time farming practices—e.g., current crop areas and their agrochemical demands—and surface and groundwater use, will enhance the decision-making capabilities of the SGRID managers.

It is extremely important that water quality and pollution information reach the local population. To help accomplish this, the project will work through the ORMVAT SVOP to develop an information network with the regional institutions concerned with these issues. The action-oriented groups most likely to be included are the DRH, in concert with ONEP and the extension agents of the SH in Beni Mellal.

4. Private Sector Firms, Professional Associations, and Other Support Agencies

a. Private Sector Firms

Element 2 will work within the context of a systematic program of consultation and reporting. Planning, implementation, evaluation, and dissemination of results for the activities in Element 2 will be centered in the SPA, which under the PAGI 2/*Système d'Information Pour la Gestion* (SIG) restructuring plan is soon to be converted into the *Service des Etudes Agro-Economiques* (SEAE). To facilitate work within the ORMVAT and with the private sector, a small working committee will be formed with the participation of ORMVAT staff from the *Service des Expérimentations de l'Hydraulique Agricole* (SEHA), the SGRID, the SVOP, and the private sector representatives relevant to each activity undertaken.

Starting in Project Year 1, a detailed work plan will be drawn up by the working committee and presented at a workshop. Participants at the workshop will include members of the Element 2 working committee; representatives who have been selected at the CMV level by farmers; private sector agribusiness people selected for their interests in the perimeter; professional association and cooperative representatives; and representatives of other concerned institutions within the GOM and the donor community.

Starting in Project Year 2, these annual workshops will include a presentation of Element 2 accomplishments to date vis-à-vis work plan objectives. These workshops will provide the major forum for a general flow of information and feedback. In addition to its information dissemination function, it is anticipated that the dialogue generated will serve as a vehicle to catalyze cooperation between the project and the participant representatives for the following year's work.

As work under Element 2 proceeds, results are generated, and recommendations are formulated, other forums will be used for dissemination. Working with the SVOP and private sector groups—e.g., input suppliers, cooperatives, and so on—these will include: demonstrations of improved technical packages in farmers' fields, farmer field days, and group-specific training sessions. This last activity is seen as especially important for informing the private sector of potential clients and business opportunities.

Information and recommendations with respect to discrete innovations and/or technical packages being proposed for specific farmer groups will be summarized as crop technical reference sheets (*Référentiels Techniques*, or RTs). These sheets, as well as any other occasional bulletins generated by Project Element 2, will be circulated to all concerned parties, including farmers, private sector firms, professional associations, and cooperatives, in French and Arabic. In addition to the means for disseminating the information outlined above, Element 2 will seek to participate in radio broadcasts of agricultural information if current plans for regional agricultural radio programming materialize.

All elements will procure goods and services from the private sector. Element 2 will identify market opportunities in input, equipment, and service supply. Element 3 will provide short-term technical assistance to work with farmers, cooperatives, professional associations, and private firms concerning the proper techniques to use and precautions to take in supply, storage, use, and disposal of agrochemicals. Both the project Chief-of-Party and the Private Sector Coordinator will work with the private sector as the ORMVAT disengages and the major input and service suppliers—e.g., SONACOS, the two sugar beet mills (SUBM and SUNAT), and the sugar refinery (SUTA)—are privatized during the next few years. With short-term assistance under Element 4, they will help identify and define options for these and other transitions, ranging from service contracts with private firms to cooperative or association takeover of supply and custom services, to expansion of existing company operations in Tadla and new start-up operations.

Increasing private sector investment in production and value-added agro-industry will be done via short-term consulting assistance to develop feasibility studies and business plans. Element 4 assistance will be oriented primarily toward those crops and related activities falling outside the horticultural sectors. Project staff will orient investors in horticultural crop services, production, and processing to the MAP.

b. Professional Associations

Morocco has a long history of professional associations. These organizations borrow from models created in Europe, where there are often close ties and a continuum of interest among the individual, company, regulatory agency, ministry, and research and educational participants. In Morocco, professional associations have benefitted from a public interest charter. This charter identifies the associations' public responsibilities to support programs in the national interest, while granting them a large measure of operating autonomy. While they are required to communicate and coordinate with public agencies, the associations' directors do not have to be civil servants, nor are their day-to-day operations or financial management subject to supervision by public agency staff, as is the case with most cooperatives.

Four professional associations represent producers in the Tadla: the *Association des Betteraviers du Tadla* (ABT), *Association des Eleveurs du Tadla* (AET), *Association des Maraichers du Tadla* (AMT), and the *Association des Producteurs de Coton du Tadla* (ACT). Some doubt exists about the representivity of these associations, despite the fact that they can mobilize significant resources, because the names of certain local personages appear frequently in the hierarchies of all four associations. With the support of local authorities, these people have accumulated both technical resources and political power. Farmers in general, however, remain passive because of a lack of information and the lack of association efforts to mobilize them.

The associations do not provide high quality technical expertise. All are burdened with unnecessarily high administrative costs and would do well to share a secretarial pool since they already share a building in

Beni Mellal. Associations often incur costs for unnecessary expenses due to poor managerial decision-making.

The essential role envisaged for professional associations vis-à-vis project activities is to disseminate information about technical packages and crop recommendations, to participate in and backstop project activities and research, as feasible, and to support the interests of their memberships during the period of ORMVAT disengagement.

The project will work primarily with the professional association that appears to have the greatest potential for affecting the efficiency of soil and water resources in and around the perimeter—AET. AET currently plays a role in organizing the importation and distribution of purebred cattle. In the future, it may also assume a role as manager of the dairy cattle artificial insemination program when the latter is transferred from the ORMVAT to the private sector.

c. Other Support Agencies

Under the anticipated implementation schedule, the project will start implementation well in advance of the World Bank PAGI 2 and PSDAGI. This means that the project will be generating important results and initiating pilot activities well before World Bank project activities come on line. The present planning in the MARA and at the ORMVAT is to use the USAID project information and results to target the PAGI 2 and PSDAGI activities more precisely, both in Tadla and, as relevant, in the other eight ORMVAs. For this reason, the USAID design team has worked in close collaboration with GOM representatives at both the ORMVA and MARA levels to ensure—to the maximum extent possible—that all elements of the USAID project are not only fully compatible with PAGI 2 and PSDAGI as designed to date, but that they will also contribute to the future planning and implementation of those activities after 1993.

Two research projects operate in the ORMVA Tadla perimeter at present. One is jointly sponsored by the International Irrigation Management Institute (IIMI), SEHA in the DER of MARA, and the ORMVAT. The other is a collaborative study sponsored by Wye College and the Institut Agronomique et Veterinaire Hassan II (IAV).

USAID design team members had several discussions with the IIMI country representative about this project and the means of coordinating activities in Tadla. As a result of the highly complementary nature of this activity with the A.I.D. project, it has been decided to incorporate this program into the A.I.D. project. Details of this inter-donor collaboration are provided throughout the PP text.

The Morocco project director for the Wye College study was the co-team leader of this project design team, and his presence on the team ensured that anticipated project activities would be compatible with—and not duplicative of—Wye College activities.

5. Cooperatives and Irrigation Associations

a. Cooperatives

Cooperatives are not new to the Tadla area, but the cooperative movement has become progressively more important during the past two decades. There are presently about 94 cooperative branches in the area. They are active in about one-half of the perimeter and have memberships representing about one-third of all farms. The ORMVAT provides management assistance for these cooperatives through appointed directors of cooperatives. This section describes four types of cooperatives, with 74 branches, which are or may in the future be relevant to implementation of project activities.

Multipurpose Cooperatives

At present, 48 multipurpose dairy cooperative branches, with a total membership of some 10,500 farm families, are active in the perimeter. Despite a rapid expansion in its early years of existence, this cooperative movement appears to have stagnated recently for two reasons:

- Within a potential clientele of 24,300 livestock producers—including sheepherders—present membership of 10,500 seems to indicate a level of saturation has been reached; and

- These cooperatives have appeared content to focus most of their efforts on their dairy enterprises, even in the face of declining subsidies from the GOM. Most have demonstrated little imagination or initiative in attempting to diversify their activities or take advantage of the new opportunities posed by the ORMVAT's withdrawal from commercial activities, despite the fact that most have a reliable financial base for such expansion.

There are exceptional cases—for example, the Harchiya Cooperative—in which a cooperative has acquired its own premises, contributed to social projects, supported pilgrimages for members, constructed a school, electrified a hamlet, created a short-term credit fund, launched a cooperative store, or installed a potable water system. However, productive investments to enlarge a cooperative's range of commercial activities and services for members are very rare.

This lack of initiative can be explained in part by the low quality of managerial support offered by ORMVAT personnel in the past. Cooperative directors have had only modest training in cooperative planning and management, which has not prepared them adequately to assume their managerial roles. In many cases, they have been inundated in routine paperwork and have not been encouraged to act as much more than clerical staff for their members. Finally, these managers are too few in number and too overburdened with managing several cooperatives with different structures and objectives.

Under the previous system, cooperative members were not called upon to participate actively in cooperative planning and management. This lack of stimulation and participation has obviously had negative consequences. Moreover, when cooperatives have exceeded certain levels in geographical and social terms, they appear to have had problems with factionalism. Within closely knit in-groups, however, where members have a clear vision of their own interests and potential, some dairy cooperatives have proven very dynamic, setting both social and economic goals and establishing very coherent internal regulation. Properly situated and supported, such cooperatives appear to present real potential.

Project Element 4, therefore, will attempt to assist selected dairy cooperatives in improving their internal management and developing a new and multipurpose approach to servicing their memberships. This choice was made because, of all the existing cooperatives in the Tadla area, these cooperatives appear to have the greatest immediate potential to change current operating practices and effect resource use productivity. They alone have major business enterprises—i.e., dairy production and milk marketing—that provide regular cash flows throughout the year and have enabled them to accumulate relatively large capital holdings. Some have even diversified their sources of income beyond their dairy enterprises—e.g., into agricultural input sales, fuel sales, and custom machinery operations—and are beginning to reduce their dependency on

ORMVAT facilities and management services. Moreover, the constituting decree for these cooperatives permits them to engage in a wide variety of input and service supply, production, marketing, and processing activities. The cooperatives may also own capital and shares in agriculturally-related companies.

Agrarian Reform Cooperatives

The Tadla area has 23 agrarian reform cooperatives, with a total membership of 528, on farms with a total area of 3,625 hectares. Under terms of the Law for Agricultural Investment of 1966, members obtained access to irrigated land in exchange for their mandatory participation in an agrarian reform service cooperative. Members come from different social strata. As far as can be determined, they have no binding kinship, lineage, or tribal relationships between them. Some members had never farmed before getting access to cropland within the perimeter through affiliation with a cooperative. The directors of these cooperatives are appointed by the ORMVAT.

Performance varies greatly between agrarian reform cooperatives. A limited number seem to have developed a real dynamic in supporting their activities, gathering resources, and building social and educational infrastructure—e.g., Cooperative Laayoune. Others have remained moribund since their creation, unable even to undertake group purchases of agricultural inputs, provision of credit to members, or common sales of produce. Moreover, the functional relationships between these cooperatives and the local professional associations—i.e., the ABT, ACT, and AET remain to be developed.

The general impression is that these cooperatives at present are not in a position to play a major role in project activities in the foreseeable future.

Agricultural Equipment Cooperatives

Tadla has nine agricultural equipment cooperatives, with 108 member-farmers on about 703 hectares. They are plagued with a number of problems related to both the reasons for their creation and their current stage of development.

First, there is a widespread belief in the area that farmer-members created these cooperatives simply to take advantage of special government programs available to cooperatives—e.g., access to preferred credit status, as well as subsidies for the purchase of agricultural equipment--without any sense of a cooperative ethic.

Second, while the small size of many farms in the perimeter provides an incentive for farmers to cooperate in the purchase and operation of agricultural machinery, these particular cooperatives have had great difficulty in managing allocation of acquired machinery among member farms within the time constraints for effective plowing, tillage, harvesting, and other agricultural operations.

Third, the existing cooperatives suffer from the lack of a complete range of machinery, and their operations are often ineffective due to a lack of spare parts, fuel and oil, and general management expertise. They are chronically short of operational funds and often dissolve as effective entities when a tractor breaks down or other machinery needs to be replaced.

Fourth, the attractiveness of agricultural equipment cooperatives to members is declining in the face of competition from aggressive private sector agents who provide cheaper and more timely custom machinery services, and as the GOM moves to reduce subsidies on agricultural inputs.

Again, these cooperatives do not appear to be good candidates for significant involvement in project activities.

Purchasing Cooperatives

Five purchasing cooperatives operate within the perimeter, with 148 members on 5,614 hectares. Their very limited number makes it difficult to provide any analysis of their organizational constraints or a prognosis of their future potential. Nevertheless, it is evident that the ORMVAT, in its previous role of purveyor of farm inputs, did not encourage the emergence of this type of cooperative. As a result, these cooperatives have limited themselves to group bulk purchases of diesel fuel. Their potential for the future remains to be investigated.

b. Irrigation Associations

The organization of water users into groups responsible for the maintenance of irrigation systems is not a new idea in Morocco. Traditional systems for community management of water rights in the small and medium-scale perimeters have developed under a highly complex traditional water law and delicately adjusted water management methods. The organization of the *Association Syndicale des Agriculteurs Prévilegiés* (ASAP) under the Law of 1924 fixed water rights and privileges in the Tadla perimeter. Other less formal and more empirical groupings of water users have also existed in Tadla from time to time.

The ASAPs in Tadla and elsewhere in Morocco were instituted by the Dahir of 15 June 1924. They were groups of agricultural landholders—often colonialists—intending to create irrigation infrastructure, either in the public interest or for development of personal property. Since independence and with the transfer of these properties to Moroccans, the ASAP idea has fallen into decline. One ASAP, however, has endured in Tadla but it has engendered considerable mistrust among its farm neighbors, due to abuses by some of its members and the undermining of its earlier objectives.

In 1971, the ORMVAT management attempted to organize farmers in blocks around the tertiary canals, with the objective of electing representatives who could serve as spokespersons in discussing water management issues with ORMVAT staff. Those elected would have been in charge of allocating the irrigation water available to each block. This effort was envisaged primarily as a means to relieve the ORMVAT of the responsibility of this task and not as a vehicle to manage the affairs and problems of the water-user blocks, the latter of which include vandalism and water theft. This effort seems to have worked for about one year but was gradually abandoned thereafter—except in CMV 526, which involved a block of collective land controlled by a closely-related community of water users.

Since the law requiring irrigation associations in large-scale irrigation schemes (LSIs) was promulgated, the process of organizing these groups has been under way. As of October 1991, three irrigation associations had been organized in the ORMVAT perimeter—at Al Massira, a former ASAP; at Al Ittihad in CMV 526; and at Ennajah in CMV 501. Of these, only Al Massira is currently functional. The other two associations—Al Ittihad and Ennajah—are still in the process of electing their officers and disseminating organizational information to potential members.

Irrigation associations have a tightly defined charter that appears to exclude any diversification into income-generating activities. They are presently focused exclusively on water management and canal maintenance activities. The associations are seen by all parties principally as means of shifting the operations and maintenance expenses for the tertiary canals from the ORMVAT to local farmers. The Technical Analysis in Annex E, Part 4 suggests that the ORMVAT's intent is to rehabilitate the tertiary network before it is turned over to the nascent irrigation associations, but this plan may be stymied in the Beni Amir subperimeter due to present uncertainties about the amount and costs of rehabilitation required. PAGI 2 activities in Tadla, as elsewhere, will support the development of irrigation associations and the costs of rehabilitating the tertiary canals. Element 1 of this project will provide much of the information on flow measurements and water handling techniques needed to adjust system functions in accordance with farmer requirements. It is recommended, however, that the ORMVAT proceed slowly with the irrigation association campaign to permit course corrections as needed in organizing the associations and developing management practices.

The irrigation associations are not intended to be state-run bureaucracies. Rather, they are expected to be farmer-run organizations. Toward this end, the project will help train the presidents and board members of the associations in bookkeeping and financial management practices, plus organizational goal and program planning techniques. In addition, a small amount of short-term technical assistance will be made available to the associations, the ORMVAT, and local water commissions to evaluate the financial obligations of the association, determine whether it is in the associations' best interests to seek discounts available on water charges, and how best they can participate in representing farmer interests in the negotiations on crops eligible for surface system water deliveries.

E. Environmental Analysis

The Initial Environmental Examination (I.E.E.), submitted with the Project Identification Document (PID), is included as Annex J. The Near East Bureau's comments on the environmental aspects of the project are included in Annex B (see paragraph 7. of cable State 239553/91). In general, the Bureau's comments call for additional environmental review of certain proposed project activities prior to its finalization and authorization. This additional review has been completed in the course of the final project design. The results of this review are presented in full in the Technical Analysis (Annex E, Part 3). These results serve largely as the basis for the project's Sustainable

Environmental Management component. A summary of these results follows below.

The project is a resource conservation initiative for the ORMVAT irrigation perimeter in Morocco. If successful, it is anticipated that the project will result in positive net effects on the region's natural and physical environment. The major interventions planned for the project specifically address key issues of water and soil management in Tadla–i.e., water quality, particularly as it relates to salinity, nitrates, and other agrochemical pollutants; soil management; the proper storage, use and disposal of agrochemicals; and agro-industrial pollution.

Information collected within the groundwater management and drainage component will allow water system managers to make more informed decisions about the conjunctive use of surface and groundwater leading to decreased incidence of waterlogging, which is already a serious problem in many areas of the perimeter. On-farm demonstrations and pilot activities focus on efficient water management, land-leveling techniques, and more appropriate crop tillage practices aimed at sustained soil resource management.

Long-term monitoring of soil decomposition and water quality will assist resource managers in making more informed decisions, particularly when put in the context of other project elements. For example, the GIS installation planned for this project provides a tool that will help determine high environmental risk areas and advise farmers about agricultural practices they can undertake to reduce these risks over the long term.

Finally, the project will develop recommendations on ways to improve agrochemical storage, use, application and disposal practices in the area, including the introduction of proven integrated pest management techniques where feasible. This information will be communicated through on-farm demonstrations, annual workshops, existing extension channels, and development of a "pollution information network" that will link area institutions dealing with water quality and other environmental issues.

In addition to these direct benefits for the long-term sustainability of local environmental resources, numerous indirect positive effects will also result. Most notable among these is the decrease in pollutants entering the Oued Oum Er Rbia watershed at the Tadla perimeter and mitigation of adverse downstream impacts on the human, livestock, fish and plant populations. This is critically important because the river serves as the source of irrigation water for the

ORMVAD irrigated perimeter and as a source of potable and industrial water for Casablanca before it empties into the ocean at El Jadida.

Finally, because the surface and groundwater resources serve as the primary water sources for the population living in Tadla, decreases in levels of pollution are extremely important to public health and welfare. If successful, project activities will reduce the health hazards currently associated with water from these sources.

Accordingly, if implemented as recommended above, it is concluded that the project will result in significant net beneficial, long-term effects on Morocco's natural, physical and human environment, in accordance with all salient Agency policies and procedures. Therefore, no further environmental review is necessary for this project at this time.

F. Social Soundness Analysis

The social soundness analysis is organized around three distinct but related aspects. The first is the compatibility of the project with the socio-cultural environment in which it is to be introduced—i.e., its socio-cultural feasibility. The second is the likelihood that the new practices or institutions introduced among the initial project target population(s) will be diffused among other groups. And third are the social impacts or distributions of benefits and burdens among different groups, both within the initial project population(s) and beyond.

1. Socio-cultural Feasibility

a. Who Lives Where?

The ORMVAT currently has irrigation water delivery and/or agricultural extension responsibilities for farm families on 325,067 hectares of agricultural and grazing land in the Tadla plain. According to the most recent information (ORMVAT, 1991), there are 27,916 farm families in the Beni Amir and Beni Moussa irrigation subperimeters. During the 1989-90 summer and winter seasons, they planted crops on 114,334 hectares. In addition to the farming community in the irrigation perimeter, there are 26,646 farm families that lie in the area outside the two irrigation subperimeters, but within the total ORMVAT area. They have rainfed crop and livestock enterprises on the remaining 210,733 hectares.

The ORMVAT area comprises portions of the provinces of Beni Mellal and Azilal, with 13 rural communes and the five major towns: Fkih Ben Salah, Souk Sebt, Beni Mellal, Ouaouizerth, and Bzou. The total population of the ORMVAT area is estimated to be 424,000, of which 318,000 are classified as rural inhabitants and 106,000 are urban dwellers. If all rural inhabitants were also enumerated as members of farm families within the ORMVAT, the average size of a rural family would be approximately 6 persons. The overall population density was 118 persons per square kilometer in Tadla at the last population census.

According to statistics from the Ministry of Health office in Beni Mellal, the population in the ORMVAT is quite young, with 42.8 percent younger than 14 years of age, 20.5 percent between 15 and 24, 17.1 percent between 25 and 39, 13 percent between 40 and 59, and 6.6 percent over 60 years of age.

For reasons of forced displacement during the colonial period and in- and out-migrations since then, the farming population of the ORMVAT perimeter is quite heterogeneous. Prior to initiation of irrigated agricultural activities in the early 1930s, the dominant tribal confederations on the Tadla plain were the Banu Amir and the Banu Moussa. These peoples, due to their soldier (*Guich*) status vis-à-vis the Moroccan ruler, had collective access and usufruct rights to the land on both sides of the Oum Er Rbia River.

With irrigation in the Beni Amir subperimeter, the tribal confederations lost many of their land-use rights and were effectively excluded from much of the irrigated area through colonial decree and private "land sales" to outsiders, both colonialist and Moroccan. In the 1990s, however, the tribal confederations still have influence in the ORMVAT, with the eastern and western factions of the Banu Amir tribal confederation having their headquarters in Fkih Ben Salah on the right bank of the Oum Er Rbia River and the several major groups of the Banu Moussa having their center in Souk Sebt on the left bank. Only in parts of CMVs 507 and 509 do members of the Banu Moussa inhabit the right bank of the river. Both confederations descend from the Hilali Arab invasion of Morocco in the 12th century and both were given collective lands in Tadla by the Almohade Dynasty.

Most of the population of the perimeter is said to be of Arab origin but, in the eastern part of the perimeter against the foothills of the Middle Atlas mountains in Azilal Province, three CMVs—525, 529, and 532—have largely Berber populations. Most of the inhabitants are from the Ait Atta tribal factions, but close to Beni Mellal there is a significant population of Berbers of the Ait Rbaa faction.

Ethnicity is a mediating factor that has determined administrative jurisdictions within the Tadla—i.e., there are rough correlations between tribal/factional distributions and the delineation of cercle/commune boundaries—and affected patterns of association and cooperation.

b. How Are They Organized?

The core operational objectives of the project are to, first, evaluate and then effect changes by participants in the management of resources—primarily water and land—in Tadla in the context of a more open Moroccan economy. In this regard, it is essential to have or to develop an understanding of who the landowners and agricultural operators are within the Tadla irrigated perimeter and how they organize their activities. This is so because owners and operators of land in the perimeter are—in matters concerning them—simultaneously interlocutors with the state and direct actors in resource management.

Any meaningful discussion of resource allocation within Tadla must start from a very detailed base of current information about property ownership and actual management of agricultural enterprises and household activities. Unfortunately, at present, this is the area of greatest weakness in the existing literature. Detailed farm-level information of the kind needed to assess and recommend changes in resource allocation is simply lacking for the Tadla perimeter and, while the reasons for this deficiency can be explained, the problem could not be remedied in the course of the project design exercise. The only alternative was to design a series of diagnostic studies into project implementation, which has been done for all four elements of the project.

The information problem at present stems essentially from the approach adopted by the GOM over the past three decades toward agricultural enterprises in all of the nine large-scale Moroccan irrigation perimeters. During that period, the practical reality was that the Moroccan government was not overly concerned about how farm families actually organized themselves because the central thrust of irrigation policy was too narrow and, to the extent possible, eliminated entirely the range of possible management options open for farmer decision-making. In a very real sense, the Moroccan government sought to intervene so massively in the technical, economic, and social operations of the large-scale irrigation perimeters that critical resource allocation decisions were essentially taken by the state on behalf of the farming community, not in collaboration with it or by the farmers themselves.

The operative irrigation model assumed an ideal type of operation in which the following would occur:

- A farm unit of at least 5 hectares was to be maintained as the minimum economic unit for a Moroccan farm family. Subdivisions below this size by either sale or successional division were prohibited by law.

- A unified farm plot was to be operated as a single enterprise, and mandatory land consolidation of parcels was implemented to reassemble properties in a geometric layout.

- A balanced mixed farming operation was to be maintained, within which crop and livestock enterprises were closely integrated.

- A stable farming operation was to be managed by the owner or under a regulated term lease.

Under the operative model, the government did almost everything in the large-scale perimeters. It conceived, constructed, operated, and maintained the on-site and off-site infrastructure used in irrigated production. It chose the crop rotations for the farmers and imposed crop and irrigation techniques on them. It distributed irrigation water on a regulated seasonal schedule and established the unit price for this water. It granted agricultural credit through public financial institutions and bought, transported, and processed the crops for fixed prices. And, finally, through agents at the processing plants, the GOM deducted farmers' credit reimbursements from the crop payments due to them before they received net payments.

The "model" experiment of the last three decades explains in large measure why there is currently such a paucity of detailed farm-level information. Most "farm-level" information recorded at the ORMVAT through the 1980s reports on "actual" agricultural production for the "major" crops vis-à-vis planned targets for the 26 CMVs in the perimeter, accompanied by explanations as to why targets were, or more often, were not attained.

The same type of informational deficiencies apply to questions of land ownership and tenure in the perimeter. It is evident in discussions with ORMVAT staff that government land titling agencies do not always know precisely how many rightful owners there actually are for any given farm parcel, although nominal ownership is usually ascribed to one owner. On the 94 percent of the land that is privately owned nearly always in joint ownership—government officials are often unaware of how each property is actually subdivided among co-inheritors and who among these individuals and other nonowners actually works the land.

In the case of irrigated land, this lack of precise information is detrimental for a number of reasons. First, after consolidation, the overall layout of plots within an irrigation block—with its geometric precision and alignment—gives a false impression of orderliness, when in reality agricultural production enterprises may be scattered among several parcels. Second, the ownership and management functions with respect to any particular field or crop enterprise may actually be divided among several different persons, making agricultural innovation difficult. And third, technical operations within the perimeter are still based in large measure on the facile assumptions of complete respect for the system's original development model—i.e., minimum size of properties, plot operations that respect certain cropping patterns and rotations, and so on—even though everyone acknowledges informally that the underlying organization of plots and farm resource allocation patterns is not and, effectively, cannot be respected.

Despite the undeniable technical successes Moroccan engineers have attained in capturing and controlling water deliveries in the ORMVAT perimeter, the overall large-scale perimeter model bears little resemblance to what is actually happening in the perimeter. Therefore, it rarely attains its stated objectives. This is so in many instances because the theoretical layout and operations of plots within a block do not correspond at all with the realities of farm-level operations. Farm operations are very often smaller than anticipated by the model. Surveys, in fact, show that the average farm holding has only 4.26 hectares, and 47.5 percent of all farms have less than the minimum 5 hectares. The subdivision and amalgamation of plots, by covert private sale and because of inheritance laws, continue apace. Moreover, actual field operations are not always perpendicular within a block as anticipated by the model, and many fields are planted to more than one crop in violation of the anticipated rotation. For all these reasons, the anticipated scheduling of water deliveries to farms based on fixed crop rotations and the water requirements of specific crops under specific cultivation techniques cannot be respected in reality. And, to their credit, ORMVAT system managers have finally recognized this fact and started to modify the water delivery system to accommodate the needs of the farmers. Nonetheless, many more modifications are needed before the system can be fully responsive.

The system described above pertains most directly to the 71 percent of the perimeter land (the 68,787 physical hectares) in 21,396 parcels controlled under private ownership. The variances from the irrigation model are even more complicated on the 14,818 hectares and 963 parcels—15 percent of the total—of state land operated by parastatal enterprises, experiment stations, and agrarian reform cooperatives, and the 13,704 hectares of land in 486 parcels operated as collective or habous lands. In the former case, the majority of the land is operated in large blocks under unified management. In the latter, the land is often leased out to large investment companies for pivot irrigation using water from boreholes. In neither case, though, do actual land management and resource allocations correspond with the theoretical irrigation model.

All of the above, explains, in some measure, why there is not a great deal of useful information available on farm-level organization and why the generation of such information early in the project is of critical importance to the success of project activities. Equally important, the discussion shows why working in Tadla will be such an interesting and stimulating undertaking in the 1990s. GOM decisions taken at the end of the 1980s to revamp the most fundamental elements of its policy toward the large-scale irrigation perimeters will inevitably lead to truly massive reorientations in ORMVAT and GOM thinking and to much improved prospects for meaningful interactions with farmers and other representatives of the private sector. The project elements have been designed specifically to assist with this reorientation process and to make the policy changes concrete realities in Tadla.

c. Resource Allocation Decisions

So little is known about how farm families in Tadla make their resource allocation decisions that speculation on how they might respond to project activities during the next seven years might appear somewhat specious. However, judging by the changing patterns in crop production and agricultural practices recorded in the 1980s, one can already conclude that Tadla farmers are highly knowledgeable about and responsive to economic opportunities and technological innovations they think are in their interest, such as paprika peppers as a new crop or the use of well water combined with water from the gravity system. Conversely, experiences in the perimeter have shown that farmers will actively resist external attempts to impose changes, such as replacement of the traditional robta irrigation system with furrow and siphon systems, increasing cotton cultivation during the summer season, or imposition of fixed crop rotations, where they believe technical and/or economic conditions do not justify such changes.

Beyond adoption choices based strictly on the objective characteristics of the process or technology in question, certain factors may affect some farm groups' responsiveness to innovation. Farm size and the relative degree of dependence on farm production for family subsistence clearly vary widely within the perimeter. Almost one-half of all farms in the perimeter control less than 5 hectares of irrigable land, and many people have expressed the belief that, as farm size in hectares declines below this size, the farm family's dependence on farm production for subsistence increases to the point where such families have an inherently lower capacity to respond to economic changes or to adopt new technologies.

This type of statement can certainly be formulated as a valid hypothesis for testing under the project's Element 2 intensive farm management study but it is far from factual. The conventional wisdom on this issue could easily be proven wrong if, for example, intensive diagnostic efforts documented that families on very small farms receive large in-flows of funds from family members working in off-farm employment and were willing and able to use some of these funds for modernizing farm enterprises or relieving pressures to grow subsistence crops. In these situations, families on small farms might actually prove to be less risk averse than those on larger holdings.

Moreover, in irrigated areas with a large range of possible crop and livestock enterprises operating under open market conditions, there is often no reliable correlation between size of land holdings *per se* and the size and/or profitability of the farm business. Not only is it not true that larger farms necessarily have higher net farm revenues and, hence, profitability than smaller farms, it has often been found that the opposite is true—i.e., because of the constraints they face, families on smaller farms operate their enterprises more intensively, allocate their resources more efficiently, and grow higher percentages of high value crops in rotation than families on larger farms. Suspicions of this sort are certainly relevant in Tadla, where virtually every technician and extension agent interviewed was of the opinion that the largest farms, run by public and parastatal agencies and/or under collective arrangements, were the least efficient allocators of resources in the perimeter and the most unprofitable in terms of enterprises undertaken.

Further, interviews, particularly with government officials, often uncovered very specific views on gender roles in agricultural enterprises. Participants often proceeded from these statements to assumptions about how males and females benefit differentially from on-farm enterprises. Women are often said to benefit most from livestock enterprises-particularly dairy enterprises and less from crop enterprises. Further, because most ORMVAT extension agents are male and tend to relate more directly to male farmers as the ascribed "heads of household", it is usually assumed that women necessarily have diminished-or even no-roles in farm family decisions about resource allocations.

These stereotypes were reinforced in many discussions with expatriates by facile assumptions about how Islamic societies function in comparison with "Western" societies. Often there arose the added assumption that Islamic inheritance laws necessarily lead directly to the fractionalization of land holdings to the point where farms become too small to be viable economic units. Such comments carry with them, of course, the implicit assumption that Islamic societies are, by their nature, so rigid that they have not developed any alternative mechanisms for dealing with these fundamental problems.

All this reiterates the fundamental need for intensive work at the farm level to understand the roles of all family members in decision-making and for flexibility in determining what specific interventions will be designed, tested, and disseminated at this level. It also reinforces the project design decision to mainline all project activities in the initial stages of project implementation. At present, project activities are seen by the team to be sufficiently gender neutral and broad in scope to offer equal opportunities to all potential participants. However, if and when gender discrimination is documented as a specific factor in denying group access to project activities and/or specific activities are shown to favor certain participants unfairly, enough flexibility has been built into the processes for designing and implementing project activities to allow substantial reorientations in approaches and resource allocations.

d. Motivation

Farmers and other groups in Tadla will respond to the incentives provided by GOM policy changes and project activities to the extent they perceive they will benefit from the changes and activities. Conversely, they will respond to the extent that they see negative consequences with inaction on their part. This is important in the current situation because various actors are responding to positive and negative stimuli in differing degrees. For example, farmers in Tadla are already changing their specific crop enterprises and rotations and on-farm practices in response to both positive incentives—e.g., the emergence of the paprika pepper opportunity—and goads to greater efficiency—e.g., elimination of government subsidies on inputs and fixed prices on certain outputs, and ORMVAT/parastatal withdrawals from commercial activities. There is no reason to believe that the same mix of positive and negative incentives will not affect farmer responses to the technological and institutional innovations proposed under the project.

At the ORMVAT level, staff are—and will increasingly be—reacting to both positive and negative incentives. It is clear, for example, that pressures from the national level are increasing for the ORMVAs to accelerate their disengagement from commercial activities and to develop innovative methods for involving farmers and other economic actors in decision-making about water deliveries and agricultural extension needs. At the same time, all ORMVA staff are feeling the spur toward improved performance. In the Tadla case, they are also looking forward to the technical assistance, training, new equipment, methods, and so on to be provided under the project as positive incentives for upgrading their individual and collective capacities, changing outdated work habits, and revamping unsuitable ORMVAT/client relationships.

Private commercial entrepreneurs and firms will participate in the Tadla economic transition to the extent they can identify and profit from new business opportunities. The project will seek to work with these economic factors jointly to test and disseminate new agricultural technologies for farmers, evaluate new market opportunities, and train staff in improved business management practices.

e. Minimum Participator Profiles

Activities in this project cover such a broad range that it is extremely difficult to define a minimum participator profile that would apply in all cases. With respect to on-farm activities, the initial assumption used was that full-time farm families having between 3 to 10 hectares of irrigable land would be the primary beneficiary group. This appears to be the group most likely to have already been affected by the policy changes the GOM has made—i.e., subsidy reductions, market liberalization, withdrawal of ORMVAT commercial services—and most likely to benefit from improved water deliveries and other innovations under the project.

The major unknown with respect to farms having less than 3 hectares is the origin and status of financial and other resource flows to and within the households. If it can be verified that these families receive significant amounts of money from off-farm sources and can secure farm labor on demand, it is possible that they may be highly responsive to new opportunities, particularly with respect to more economic use of agricultural inputs and initiation of new crop enterprises. They would also appear to be the operations most in need of private custom services for mechanical operations such as plowing, secondary tillage, and harvesting. Conversely, they are probably not good candidates for adoption of custom micro-irrigation systems and/or installation of more efficient pumping equipment to facilitate the conjunctive use of ground- and gravity water.

At the upper end of the farm size classifications, most of the land in question is held and/or operated by public and parastatal agencies or in collective arrangements. In the former case, more reliable access to irrigation water will probably be the most effective way of influencing a supply response. Beyond that step, these farms have sufficient access to credit, input supplies, and technical consultants to plan and implement changes in farming operations without extensive support from the project. Whether they will make such changes—after water deliveries improve—has more to do with what they perceive to be their "moral" responsibilities to the government than it does with any lack of resources. Because this "moral contract" philosophy plays such a large role in the decision-making of these agencies, they may end up as the main Tadla producers of sugar beets and cotton long after the smaller, private farms have shifted their enterprises toward more profitable crops.

With respect to the lands under collective arrangements, there appear to be two different approaches. One is to continue the current process of establishing long-term leases with private companies to develop and manage the collective land using water from boreholes and capital-intensive pivot irrigation technology in return for some benefit-sharing arrangement with collective members. The other approach is to find ways of effectively privatizing the landholdings and giving titles to individual farm families.

In the first instance, the large private pivot operations are effectively beyond the influence of most of the interventions planned for the project. In the second, the process is already converting institutions such as the agrarian reform cooperatives into less restricted associations of farm families, each with title to their land. In this status, the households in the cooperatives may not be very different from other private landowners in their responsiveness to the project.

Finally, with respect to the environmental activities under Element 3, there appear to be no minimum requirements for participation. Since all parties in the perimeter appear to contribute to the existing pollution and resource misuse problems observed, all should have at least the potential to contribute to the process of mitigating—and, in some cases, eliminating—the problems. And project activities are designed to generate recommendations for improved environmental management at all levels in the perimeter.

f. Matching Participators with the Project

While the vast majority of Moroccans in Tadla will benefit in some measure from project activities, some groups have the potential to benefit more than others. The major beneficiaries have been identified above, and in Section 3 of the Technical Analysis and in the Economic Analysis (Annex G).

Two groups that stand to benefit indirectly from project activities are seasonal migrants who come into the area to participate in agricultural activities and the populations living downstream from the Tadla. The first group may derive significant employment benefits during a larger portion of each agricultural year as cropping patterns shift toward more labor-intensive crop enterprises. The second group will benefit primarily from project activities that affect the quantities and quality of water available for use downstream.

A certain number of individuals within the perimeter will definitely not benefit from the project and may be adversely affected by the broad policy changes initiated by the GOM and supported by the project. These include employees of public and parastatal agencies within the perimeter—i.e., sugar mills, cotton gins, input suppliers operating under government contracts, and certain ORMVAT staff—whose essential functions will be reduced and/or eliminated in the disengagement process. Many of these people, because they possess valuable skills and experience, may in fact find employment in the private sector or in other government positions, but all will experience job dislocation and possibly loss of status in the transition period.

g. Obstacles to Progress

There do not appear to be any insurmountable obstacles to progress for the project as designed. But there definitely are sensitive issues to be monitored and resolved during project implementation. These revolve around the interrelated problems of a legacy of paternalism, problems with the "industrial" crops, and problems in assessing the benefits and costs involved in the GOM's disengagement/decentralization process.

Since 1986, the GOM has embarked on a process of economic policy change that has already significantly affected power relationships in Tadla. It must be recognized that this process has been—and will continue to be—politically and economically painful for many stakeholders in the previous system. Moreover, the psychological transition from old to new working relationships between ORMVAT staff, farmers, and representatives of the private sector is far from over and has been disturbing for many participants.

In a very real sense, both groups find themselves caught between a comfortable and established system of privileges and responsibilities that is disappearing and a new economic system in which their roles, if any, are uncertain or ill-defined. One measure of the ineffectiveness of the government's economic reorientation efforts to date is that many groups in Tadla feel uncomfortable in the face of the changes. This gives little comfort to those who stand to lose real power—mainly government officials, managers, and staff of public and parastatal agencies—or for those who must manage the transition process so as to avoid serious dislocation in the rapidly changing environment.

In Tadla, there is a constellation of stakeholders whose positions and power are intimately tied to continuance of the local sugar beet and cotton industries. In the past, government attempts to promote production of these two crops have led to development of significant infrastructure and employment and, as important, have altered economic relationships between farmers and the government officials managing these industries. Economic liberalization and the disengagement process have struck at the heart of these relationships. They have broken the essential linkages that shaped the control relationships and, simultaneously, saddled the government with the costs of infrastructure and institutions whose value is declining with each passing year.

As a consequence, it is not surprising at this stage that many of the stakeholders in the old system are the first to raise arguments against the changes under way and make paternalistic statements about the alleged benefits of a declining system for farmers and other groups in Tadla. Many of these comments, although perhaps voiced for the wrong reasons, address real problems that remain unresolved. For example, how can the government handle the transition if it effectively has to write off investments over several decades in the sugar beet and cotton industries? Or, what will be the real balance of political and employment gains from new agricultural enterprises in Tadla versus losses from old industries? And, finally, how will the transition to a new set of political and economic relationships be handled so as to avoid adverse consequences for major constituent groups?

The underlying struggle to resolve these issues affects fundamental political and economic relationships at all levels in Tadla, as elsewhere in the country. And, because the project seeks to assist in the process, it will inevitably be affected by it. The prospect of delays in realizing significant progress—particularly with respect to Elements 2 and 4—cannot be discounted. Only time will tell how strong is the resolve of the government in actually implementing the policy changes it has already announced.

h. Communications Strategies

The rationale for the GOM's irrigation model in the past was to impose a comprehensive technical package of irrigation management and agronomic practices on farmers. Most of the difficulties encountered in this approach can be attributed to three basic flaws in the system. First, communication patterns with farmers, either individually through the extension mechanisms or in groups through the organizations the GOM created, such as cooperatives and professional associations, were one-way: They served only to communicate government decisions and demands to the farmers without recognizing farmers as legitimate participants in a decision-making process, and failed completely to take into account the constraints under which farmers had to operate in the perimeter. Second, the model precluded any effective role for other private sector actors, except as contractors in state-run operations. And, finally, the whole system ran on a set of false economic signals devised by the government and communicated to farmers through a closed market system.

Disengagement will permit farmers and technicians far greater latitude and provide real incentives for both groups to actively foster new economic opportunities within the perimeter and adoption of improved irrigation/cropping practices. The activities designed under Project Element 2 will identify critical constraints in farm-level resource allocation and specify pilot interventions that will be tested on-farm to alleviate these constraints. An examination of existing dissemination mechanisms, both formal and informal, suggests they are appropriate vehicles for disseminating results of project efforts. Their effectiveness has been compromised largely by previous restrictive policies. Mechanisms for disseminating project results have been described in the Implementation Plan, and this analysis sees no real constraints to their success, if they are carried out in the new spirit of partnership and liberalization.

2. Spread Effects: The Dissemination of Innovations

In a formal structural sense, the primary responsibilities for evaluating the results of project activities and disseminating them within the irrigation subsector will lie with government officials in the ORMVAT and the MARA. In the present network of nine ORMVAs, each is geographically defined and faces a different constellation of problems. Each has different methods of addressing its problems, employs different types of irrigation and agricultural technology, and interacts with different client groups.

Since the team necessarily confined its design activities to the ORMVAT, it is difficult to assess the potential relevance of any single project intervention to the other ORMVAs at this time. Presently, it would appear that technical system and farm-level activities in Tadla will have their greatest relevance to those parts of the other ORMVAs where gravity irrigation is practiced. If effective methods are developed in Tadla to manage the conjunctive use of ground- and gravity system water, this would be another area of potential relevance. And, of course, work with more effective use of agricultural inputs for specific crops may have important carryover effects in other ORMVAs.

But, beyond the technical aspects of the project, project efforts to develop and implement new working relationships between ORMVAT staff, farmers, and other representatives of the private sector seem to hold out the greatest possibilities for diffusion and adoption in the other ORMVAs. Prospects in this regard will be strengthened by the working relationships that have been established with the MARA/World Bank projects. These projects, after 1993, will be working with all of the nine ORMVAs on redefining operational roles and improving ORMVA management practices. To the extent that project activities in Tadla generate findings, recommendations, and innovations applicable to the problems in the other ORMVAs, it has already been agreed that the projects will work together in disseminating results throughout Morocco's LSI network.

In addition to the ORMVA network, results from the environmental activities under Element 3 will be disseminated through the network of agencies established during project implementation. In addition to MARA, the network will include the participation of regional agency staffs from the Ministries of Public Works and Health.

Within the project itself, a number of mechanisms are envisaged at the regional and national levels to disseminate project results and to discuss common problems. First, the project, in collaboration with the SVOP of the ORMVAT, will produce and distribute technical papers in French and Arabic to all interested parties. Second, if a regional radio network for agricultural news and commentary is established, the project will supply materials for broadcast. Third, a number of regional and national workshops and seminars will be supported by the project as a forum for discussions and dissemination of project results. And, finally, standard agricultural extension techniques—farmer field days, observational tours, audio-visual presentations, and so on—will be used in Tadla.

3. Social Consequences and Benefit Incidence

a. Access to Resources and Opportunities

The entire purpose of the project is to broaden access to and participation in decision-making about resources and opportunities in Tadla for farmers and other private sector participants. The activities of the project seek to actively support the GOM's twin policies of public agency disengagement from commercial enterprises and reorientation of the ORMVAT toward wholly service activities in water delivery and agricultural extension. The project will also work with local institutions, including cooperatives, professional associations, and irrigation associations, to strengthen their capacities to participate to greater degrees in the economic and political life of the community.

As the GOM's policy changes are implemented in Tadla, farmers will be given much greater responsibility and capacity to run their own farm enterprises in response to the constraints and open market economic signals they are facing. A much greater percentage of agricultural and commercial activity will be in the hands of private sector entrepreneurs and firms. Markets will be operating free of the government-imposed price and quantity distortions of the past—i.e., taxes, subsidies, credit rationing, and water allocations.

All these changes should result in significantly greater net incomes for farm families and increased market shares for private businesses in input supply, provision of agricultural services, commodity processing, and product marketing.

b. Employment Effects

Project activities *per se* in Tadla will probably have only minor impacts on regional employment because the activities have been deliberately designed to work with existing institutions and retrain their personnel to assume new responsibilities. However, the project is intended to assist the GOM in turning national policy decisions into concrete realities at the regional level. If this process proceeds as planned, there will inevitably be very major changes in both employment patterns and the productivity of labor in irrigated agriculture in Tadla.

For example, as the result of the ORMVAT disengagement and the liberalization of markets and perimeter operating procedures, farmers have begun to reallocate the resources under their control to new crop enterprises (paprika peppers, other vegetables, and fruit) and away from lower value crops (sugar beets and cotton). These crops are more labor-intensive to produce and process, but more profitable per unit of labor invested.

The project is aimed at assisting farmers in furthering this process in the 1990s by increasing the access to and reliability of critical agricultural resource delivery systems. It will also develop, test, and disseminate farm-level innovations that will further increase the productivity of existing labor and create new opportunities for on-farm employment of both skilled and unskilled labor. In addition, the new on-farm innovations will create market demands for new goods and services from the private sector, such as needs for new enterprise inputs, consulting services, equipment maintenance, commodity processing, and marketing.

Finally, because of the presence of many small farm units in Tadla whose capital resources are limited and the more general need to create employment opportunities in the Moroccan economy, the project activities have been deliberately oriented toward introducing agricultural innovations that will increase both labor and land intensities. Work on water delivery systems will allow farmers to work their land more intensively. Introduction of innovations in crop tillage and use of inputs such as seed, fertilizers, and other agrochemicals will increase both land and labor productivity while lowering capital costs per unit of output. And, de-emphasis of activities using agricultural machinery will avoid problems of labor displacement in agricultural enterprises.

c. Rural Displacement, Migration, and Urbanization

Although the objective of this section is not to recount the history of the Tadla irrigation systems from the 1930s to the present, it seems useful to remind the reader that the Tadla plain has been the site of rural population displacements and labor in-migrations and out-migrations for a long time. These occurrences have been triggered by many factors over time, e.g., government policies, conditions elsewhere in Morocco and outside it, and the development of very valuable irrigated land in the midst of an area subject to periodic and severe droughts.

Tadla's history necessarily has consequences for the region in the 1990s. The first is, as discussed above, that the farming community in the Tadla perimeter displays a high degree of heterogeneity. It is a complex mosaic of peoples from the Banu Amir and Banu Moussa tribes and the Chorfa and Oulad Abdalla clans, all of whom have occupied the land since the 1930s, and "outsiders" who have acquired access to the land since that time.

The second is that, because irrigated land is by its nature limited and alternative economic opportunities are available elsewhere, there is a continuing pattern of out-migration, primarily by young people, in search of temporary or permanent employment in other parts of Morocco and in Europe. Some of the participants in this out-migration are said to regularly send portions of their earnings back to family members in Tadla; these in-flows may in part explain the apparent paradox of relatively large Moroccan families "surviving" on very small parcels of irrigated land within the perimeter. In this regard, it is reported that transfer of money into the Tadla region from migrant workers in 1989 amounted to approximately 50 percent of farm families' off-farm revenues, but 80.4 percent of these revenues were for farms of less than 2 hectares, and 91.4 percent were for farm families having access to 2 to 5 hectares (Ftouhi, 1989).

The third is that irrigated crop enterprises have generated a continuing demand for seasonal farm labor in-migrations. Although present information on these in-migrations is limited, it appears that much of the seasonal movement involves unskilled female laborers from areas immediately adjacent to the perimeter—i.e., from highland areas of Azilal Province—and from other areas of the country.

In this complex picture and long history of in- and out-migrations, it is very difficult to predict how project activities might ultimately affect net flows. It is evident that improved reliability in irrigation water deliveries, relaxation of prior restrictions on fixed crop rotations, and the anticipated shifts to higher value agricultural enterprises in Tadla will make access to irrigated land a much more valuable asset. Adoption of certain types of agricultural machinery and irrigation techniques will also place premiums on accumulation of blocks of land that are sufficiently large to support the costs of capital investments and modernization. But no clear picture emerges as to whether these changes will result in actual displacements of farm families largely through changes in ownership of private land within the perimeter or whether these families will retain ownership of the land but allow it to be managed in larger blocks under cost/revenue-sharing arrangements.

The major factors that will determine these migration patterns in the future are largely beyond the purview of the project. However, in designing project activities great care was taken to, first, install internal mechanisms, such as the various diagnostic studies, the effort to develop an accurate typology of farm units, and the permanent monitoring and evaluation unit, to develop a much better understanding of what is actually happening to specific groups within the perimeter. Second, effort was made to deliberately introduce agricultural and institutional innovations that, at least in part, will be neutral with respect to the scale of individual farm operations—i.e., making more reliable water deliveries to all farms; concentrating on better use of seeds, fertilizers, and agrochemicals; identifying inputs that are low cost per unit of coverage and investment; and assisting the private sector to lower unit transaction costs to the purchaser through more competitive market conditions.

With respect to in-migration of farm labor, it again appears evident that conditions that engender farm-level shifts to higher value crop and livestock enterprises will also increase local demands for seasonal—and, probably, permanent—farm labor. Increased net farm revenues from these enterprises will also provide the resources and powerful incentives to retain skilled farm labor at higher levels of daily wages and other benefits.

Finally, regarding urbanization effects, the project activities in themselves are anticipated to have no significant effects on the rate of urbanization within the perimeter. Improved business prospects for a variety of private sector input supply, service, processing, and marketing enterprises may result in their growth in the small towns in and around the perimeter, but most of this growth is expected to come from expansion of existing commercial enterprises. The major impacts on the urban populations in Tadla are expected to come from project activities in the environmental field. If successful, the activities will inevitably lead to significant improvements in the quality of life of these populations through pollution abatement and a lowering of environmental risks. These benefits also have potential for extension to other urban populations in Morocco—particularly the Casablanca metropolis—to the extent that pollution abatement activities in Tadla affect the quality of water flowing back into the Oum Er Rbia River and to downstream water filtration plants.

d. Changes in Power and Participation

The project will help empower farmers in the perimeter to participate in decision-making by strengthening the capacity of the groups in which they participate-, e.g., private sector firms, farmer groups, professional associations, cooperatives, and irrigation associations. Project activities will support private sector actors at all levels to fill progressively the vacuum left by ORMVAT disengagement from commercial enterprises and provide mechanisms for farmers, technicians, and others to discuss water management problems in the perimeter and to transfer greater responsibilities for water and soil management to farmers.

This water management effort will start both at the primary/secondary system level through Element 1 activities and at the tertiary and quaternary levels and with respect to conjunctive use of surface and groundwater in Elements 2 and 3.

Prior to 1986, the ORMVAT, working from directives sent from MARA, set hectarage and production levels for certain "industrial" crops, chiefly cotton in summer and sugar beets in winter. Multi-year crop rotations were then "fixed" around these crops. Field cultivation and irrigation techniques were essentially dictated by the technical constraints of the physical irrigation system and the water distribution amounts and schedules. Finally, the farmers operated in a government system of fixed output price schedules, inputs and agricultural credit tied to certain crops, and closed processing and marketing channels for their agricultural commodities.

In practice, farmers did not always respect the ORMVAT irrigation/crop rotation systems as designed by technicians and engineers. They grew crops out of the prescribed rotation. They installed traditional robta irrigation techniques on land supposedly dedicated to the more "modern" border and furrow systems supplied by siphons. Recently, they have adopted new crops such as paprika peppers, which conflict with cotton as a summer crop.

This highly constraining system is now being relaxed as a result of GOM agricultural policy changes that began in 1986. The government has adopted a policy of disengagement and, as a result, the ORMVAT, among many other agencies, has been instructed to comply. It is now progressively pulling out of all commercial agricultural activities in the perimeters. The ORMVAT plans to turn operations and maintenance management of the tertiary and quaternary canals over to the irrigation associations, which have yet to become viable and sustainable entities. The associations will play a number of key roles: they are expected to control allocations in the tertiary system; work with ORMVAT hydraulic system managers to determine seasonal water allocation plans; develop weekly delivery schedules; and handle the maintenance of lower level canals and drainage ditches.

Achieving reliable water supply through Element 1 is critical to the success of the sustainability of irrigation user groups. At the same time, irrigation associations are a potentially important factor to Element 1 because the success of the technical improvements to the water management system depends on how flexible the latter is in the future with respect to the quantities and timing of water deliveries and how the system is managed at the farm level.

Recent GOM policy changes have put severe pressures on both the ORMVAT and the private sector. ORMVAT staff will need to become client responsive, while the professional associations, cooperatives, irrigation associations, and private firms will need to be developed into entities that can represent their members' interests. A new balance in decision-making between the public and private sectors will have to emerge, and the project should not underestimate the difficulties involved in this process.

Through its diagnostic study and monitoring and evaluation efforts, the project will collect information on the development of the irrigation associations. This information will be used to review and revise project efforts to support the brokering of power between the ORMVAT and the private sector entities.

The project seeks also to strengthen a variety of other private sector organizations, including multi-service cooperatives, professional associations, and others because their organization is consistent with local social groupings and because people receive immediate financial benefits from their activities. Members of these cooperatives have demonstrated their control over resources and the ability to devise strategies to overcome inadequacies of market goods and services. Planned project inputs should further develop their decision-making efforts.

The sixth and seventh covenants will ensure that project audit and evaluation requirements are properly planned for met throughout the duration of the project.

TADLA RESOURCES MANAGEMENT

NO. 608-0213

PROJECT PAPER ANNEXES

USAID/MOROCCO
July 30,1992

Project Paper Annexes

A. Project Logical Framework Matrix
B. PID Approval Message and PD 71 Determination
C. Host Country Letters of Request and Design Comments
D. Statutory Checklist
E. Technical Analysis
F. Financial Analysis
G. Economic Analysis
H. Social Soundness Analysis
I. Administrative Analysis
J. Initial Environmental Examination
K. A.I.D.-Financed Equipment and Supplies
L. Justification for the Non-Competitive Award of a Cooperative Agreement to IIMI
M. Bibliography

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Annex A

LOGICAL FRAMEWORK MATRIX

LOGICAL FRAMEWORK

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Project Goal: To promote the long-term competitiveness and environmental sustainability of Moroccan irrigated agriculture	1. Improved irrigation resources conservation and production practices 2. Enhanced environmental sustainability of irrigation resources management and use 3. Increased private sector participation in irrigation resources allocation, management and use in Morocco 4. Improved irrigation resources management policy framework	Research results Internal and external evaluation reports GOM agricultural and water supply statistics National export statistics and trade reports Project annual and quarterly reports	GOM maintains favorable agricultural sector policies and implements them over the life of the project Positive project results are replicable in other large-scale irrigation perimeters
Project Purpose: To increase the efficiency, economic yield and environmental sustainability of irrigation resources management and use in the Tadla irrigation perimeter of Morocco	End of Project Status (EOPS): 1. Improved regional irrigation resources conservation and production practices 2. Enhanced environmental sustainability of irrigation resources management and use in the Tadla perimeter 3. Increased private sector participation in Tadla resources allocation, management and use 4. Improved irrigation resources management policy framework	Project studies and analyses Project research and demonstration results Project monitoring and evaluation reports Annual work plans and project status reports Records of the ORMVAT permanent agro-economic survey unit and the Cellule de Suivi Records of multi-service cooperatives, professional associations and participating private sector firms ORMVAT Annual Activity Reports	

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Project Outputs: Improved Irrigation System Management 1. More efficient, reliable, flexible and timely delivery of irrigation water 2. Increased availability of critical irrigation system management information to farmers, processors, and other public and private agricultural interests in the region 3. Improved information available for irrigation planning purposes, resulting in increased system productivity from improved decision making	1. Establishment and use of an integrated computer-based water management system within SGRID 2. Formulation and implementation of a detailed water delivery policy with operational criteria and procedures for each subperimeter 3. Increased flexibility of water deliveries as reflected in increased surface water use intensities and efficiencies, i.e., total water savings of up to 68.4 million cubic meters per year from increased canal delivery efficiencies 4. Increased operational efficiency of the system as evidenced by substantial reductions in return water flows 5. Increased farmer involvement in the seasonal irrigation planning and water delivery processes	Evaluation reports Project research results Project monitoring and evaluation reports Annual work plans and project status reports Records of the ORMVAT permanent agro-economic survey unit and the Cellule de Suivi Records of multi-service cooperatives, professional associations and participating private sector firms ORMVAT Annual Activity Reports Direct field observations by external evaluators Interviews with farmers, farmer groups, and local private private sector leaders Ennumeration of physical assets Review of producer delivery and payment records at local agro-industrial enterprises for produce, and at ORMVAT for irrigation water Review of seasonal and annual maps produced by the project GIS	Timing and quality of inputs are to specifications Relatively normal regional weather conditions throughout the life of the project Private agribusiness sector responds to enhanced regional investment opportunities Farmers are responsive to improved commercial opportunities and able to reallocate resources under their control effectively ORMVAT maintains progress in disengagement and restructuring of its functions

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Project Outputs (cont.): **Improved On-Farm Management** 1. Improved definition and understanding of the socio-economic characteristics of the Tadla farming community and of actual cropping, land use and tenure patterns and how they are evolving over time 2. Improved understanding by farmers of the capabilities and limitations of the Tadla water delivery system and how these relate to and affect their enterprise resource allocation decisions 3. Improved understanding by the ORMVAT of farmers' decision-making processes and enhanced Office capability to be more responsive to their clients' requirements 4. A set of tested, improved technologies for dissemination to Tadla farmers to alleviate constraints on resource use efficiencies and economic performance at the farm-level 5. Improved water delivery efficiencies to farms and improved water application/use efficiencies at the farm level	1. Use by farmers of improved irrigation strategies, leading to more effective farm-level decision-making and increases in net farm incomes 2. Use by farmers of improved water application methods leading to greater field use efficiencies, i.e., a total water savings of up to 42 million cubic meters per year from improved field application efficiencies within 15 years 3. Modification of cropping patterns aimed at increased cultivation of higher value crops, and more intensive crop rotations 4. Greater efficiency in technical coefficients between crop output and units of fertilizers and other agrochemicals applied 5. Efficient integration of groundwater resources into overall water use at the farm-level	- do -	- do -

Project Outputs (cont.): **Sustainable Environmental Management** **1. A better understanding of water balance and drainage system efficiencies in the Tadla perimeter** **2. A functional Tadla groundwater model, integrated with the surface water management model, for improved, integrated management of all perimeter water resources** **3. Improved management of groundwater resources and soil decomposition and salinity problems in perimeter areas** **4. A better understanding of water and soil quality issues related to agrochemical use in the Tadla perimeter** **5. An information exchange network to enhance awareness of critical water and soil pollution levels in Tadla** **6. Improved agrochemical storage, handling, use and disposal practices in Tadla** **7. Improved management of water and soil quality problems in the perimeter, through demonstration of improved on-farm and agro-industrial practices and technologies**	**1. Integration and use of water balance data and the groundwater model into the SGRID management process regarding conjunctive use of surface and groundwater resources** **2. Better overall control of groundwater levels and decreased incidence of waterlogging** **3. Integration of water quality data into the groundwater model, and the use of this information in improved resources management in perimeter areas** **4. Establishment of an information exchange network to improve awareness of pollution levels in the region, including development of mechanisms for joint action to mitigate the impacts of these pollutants on human and livestock populations** **5. Decreases in the quantities of agrochemical residues detected in the regional water table and the perimeter drainage system** **6. Increased regional knowledge and capability regarding the wise management and use of agrochemicals**	**- do -**	**- do -**

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Project Outputs (cont.): **Private Sector Strengthening**			
		- do -	- do -
1. A better definition of the role of the regional private sector in the Tadla economy 2. A better understanding of the operative linkages at all stages of irrigated agriculture in Tadla 3. A strengthened private regional capacity to manage agricultural business/service activities and to assume an increased role in the regional economy 4. A more smooth and rapid public private sector transfer of commercial activities in Tadla through the identification and promotion of new and expanded opportunities for private sector provision of agricultural supplies and services 5. Enhanced private regional participation in Tadla resources allocation, management and use decision-making	1. Assumption by private, non-governmental businesses and agricultural interests of improved business/service management practices, such as bookkeeping responsibilities 2. Development of investment plans for private, non-governmental businesses and agricultural interests 3. Increased receipts from sales and services provided by private, non-governmental businesses and agricultural interests 4. Increased market share for private agricultural input, service and processing businesses and interests 5. Development of new and expanded private agricultural enterprises, and increased business volume in higher value crops 6. Improved public-private sector dialogue and information flow, leading to increased private regional participation in perimeter resources decision-making		

Project Inputs:	Magnitude of Inputs ($000s)			Means of Verification	Important Assumptions
	AID	GOM	Other		Project funds are provided as planned
Technical Assistance	7,140	2,400	300	Project Financial Records	
Training	1,335	190	270	USAID Controller Records	
Commodities	2,060	780	820	External Audits	
Indirect Costs	7,465	880	360	Supplier Invoices	
HMI Cooperative Agreement	750	250			
Total Costs	18,750	4,500	1,750		

Annex B

PID APPROVAL MESSAGE

AND

PD 71 DETERMINATION

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ACTION: AID-3 INFO: DCM ECON/5

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VZCZCRA0496FA0343
PP RUFHRA
DE RUEHC #9553/01 2031751
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FM SECSTATE WASHDC
TO AMEMBASSY RABAT PRIORITY 4611
BT
UNCLAS SECTION 01 OF 02 STATE 239553

LOC: 357 000
23 JUL 91 0742
CN: 48675
CHRG: AID
DIST: AID 608-0213

AIDAC

ACTION : ANR
DUE DATE: 07/25
INFO : DIR - DDIR
PROG - PHR - TRNG
CHRON - RF

E.O. 12356: N/A
TAGS:
SUBJECT: WATER AND SOIL RESOURCES CONSERVATION (608-0213)
GUIDANCE CABLE

1. SUMMARY: THE PROJECT REVIEW COMMITTEE (PRC) MET JUNE 27, 1991 TO REVIEW THE SUBJECT PROJECT IDENTIFICATION DOCUMENT (PID). BASED ON THIS REVIEW, THE DAA(NE)/ENE HEREBY APPROVES PID AND DELEGATES AUTHORITY TO THE MISSION TO DEVELOP AND APPROVE THE PROJECT PAPER FOR FY 92 OBLIGATION. THE MAIN ISSUES RAISED DURING THE REVIEW FOCUSED ON ALTERNATE WATER USES, SUSTAINABILITY, DONOR COORDINATION, AND PROJECT REPLICATION. GUIDANCE ON THESE ISSUES AND OTHER CONCERNS DISCUSSED DURING THE REVIEW ARE OUTLINED BELOW. END SUMMARY.

2. PROJECT OVERVIEW: THE PRC COMMENDED THE MISSION FOR DEVELOPING A SOUND PROJECT, ESPECIALLY GIVEN THE DESIGN HISTORY OF THIS PROJECT AND THE COMPLEXITIES SURROUNDING WATER ISSUES AND IRRIGATION SYSTEM MANAGEMENT IN MOROCCO. MISSION REPRESENTATIVES DENNIS CHANDLER, DIRECTOR AND ERIC LOKEN, PROJECT OFFICER MADE A DETAILED AND COMPREHENSIVE PRESENTATION OF THE PROJECT TO THE PRC. ISSUES DISCUSSED DURING THE REVIEW AND GUIDANCE FOR PP DEVELOPMENT ARE PROVIDED BELOW:

ACTION TAKEN
No Action Necessary X
Replied by:
FRL 7/24/91
Initials & Date

3. ALTERNATE WATER USES: THE PID NOTES THAT THE INCREASING DEMAND (IMPLICITLY INCREASED COMPETITION) FOR WATER FROM ALL USERS IN THE RIVER BASIN, INCLUDING NON-AGRICULTURAL USERS IN DOWNSTREAM AREAS, IS AN INCREASINGLY ACUTE PROBLEM. YET THE PID CONSIDERS ONLY ONE POTENTIAL BENEFICIARY OF WATER SAVINGS GAINED THROUGH PROJECT-PROMOTED INCREASED IRRIGATION EFFICIENCIES. THE PRC QUESTIONED WHETHER CONSIDERATION SHOULD BE GIVEN TO FREEING UP WATER RESOURCES FOR ALTERNATE USES INSTEAD OF INVESTING IN ADDITIONAL IRRIGATION FACILITIES FOR QUOTE SAVED UNQUOTE WATER. AS EXPLAINED BY THE MISSION REPRESENTATIVE, THE PROPOSED USES FOR SAVED WATER INDICATED IN THE PID'S PRELIMINARY ECONOMIC ANALYSIS ARE BASED ON THE CURRENT MOST ECONOMICALLY VALUABLE USES OF THIS WATER AS DETERMINED THROUGH THE CURRENT BASIN WATER USE/ALLOCATION MASTER PLAN, WHICH IS AN INTEGRATED PLANNING DOCUMENT COVERING ALL POTENTIAL USES FOR BASIN

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WATER SUPPLIES. IN ADDITION, AS THE BENEFICIARY SYSTEM FOR THESE PROJECTED WATER SAVINGS IS ALSO RESPONSIBLE FOR PROVIDING A PORTION OF THE URBAN SUPPLIES FOR THE CITY OF MARRAKECH, THE PROJECT WILL AT LEAST INDIRECTLY BE ASSISTING IN ALLEVIATING POTENTIAL SHORTAGES IN THIS USE AREA AS WELL. NEVERTHELESS, THE MISSION AGREED THAT THIS IMPORTANT TOPIC WOULD BE CAREFULLY EXAMINED DURING PROJECT EVALUATIONS TO ENSURE THAT WATER SAVINGS GAINED THROUGH THE PROJECT ARE, IN FACT, PUT TO THE BEST POTENTIAL USES.

4. SUSTAINABILITY: THE PID DOES NOT APPEAR TO PROVIDE SUFFICIENT INFORMATION ON HOW VOLUNTARY ORGANIZATIONS INVOLVED IN WATER MANAGEMENT AND INFRASTRUCTURE MAINTENANCE WILL ACHIEVE FINANCIAL SUSTAINABILITY AFTER THE PROJECT IS COMPLETED. CONCERN WAS ALSO VOICED ABOUT THE SUSTAINABILITY OF COMPLEX HYDRAULIC MODEL OF THE TYPE BEING PROPOSED IN THE PID TO BE IMPLEMENTED BY ORMVAT, THE IRRIGATION AUTHORITY RESPONSIBLE FOR THE PROJECT. THE MISSION REPRESENTATIVE INDICATED TO THE PRC THAT FINANCIAL SUSTAINABILITY IS NOT AS MUCH OF AN ISSUE AS THE NEED FOR EFFECTIVE AND SUSTAINABLE SOCIO-ORGANIZATIONAL MECHANISMS FOR PROMOTING ENHANCED NON-GOVERNMENTAL PARTICIPATION IN PERIMETER MANAGEMENT. THE PP DESIGN ANALYSIS SHOULD PROVIDE SUFFICIENT EXPERTISE TO ENSURE THAT CRITICAL PROJECT ORGANIZATIONAL AND FINANCIAL SUSTAINABILITY ISSUES ARE THOROUGHLY ADDRESSED.

5. DONOR COORDINATION: THE PRC NOTED THE CONSIDERABLE ONGOING IBRD PROGRAM ACTIVITIES IN AGRICULTURE AND

IRRIGATION IN MOROCCO, AND THE RELATIVELY GREAT POTENTIAL FOR EFFECTIVE COLLABORATION (AND, CONVERSELY, OVERLAP) BETWEEN THESE ACTIVITIES AND THE USAID PROJECT. DURING PP DESIGN, THE RELATIONSHIP BETWEEN THESE TWO DONOR-ASSISTED EFFORTS SHOULD BE CAREFULLY ASSESSED TO DETERMINE EXACTLY HOW THESE ACTIVITIESHVUVGST EFFECTIVELY WORK TOGETHER TO IMPROVE SECTORAL PERFORMANCE. IN THIS REGARD, THE DESIGN TEAM MIGHT LOOK AT WHAT SUCCESS THE WORLD BANK HAS HAD WITH PAGI I, AND HOW USAID PROJECT WILL BEST SERVE TO COMPLEMENT CONTINUING WORLD BANK EFFORTS IN THIS AREA, I.E., NATIONAL VS. REGIONAL-SPECIFIC DEMONSTRATION OF IMPROVED SECTORAL POLICIES.

6. PROJECT REPLICATION: GIVEN THE STATED OBJECTIVE OF SUBSEQUENT REPLICATION OF PROMISING PROJECT RESULTS IN OTHER GEOGRAPHIC REGIONS AND IRRIGATION SYSTEMS IN MOROCCO, SOME ATTENTION NEEDS TO BE FOCUSED ON HOW WATER SYSTEM IMPROVEMENTS ACHIEVED IN THE TADLA PERIMETER WILL BE SPREAD TO OTHER LARGE-SCALE IRRIGATION SYSTEMS IN THE
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COUNTRY. IN PARTICULAR, WHAT SPECIFIC DISSEMINATION MECHANISMS WILL BE DEVELOPED AND IMPLEMENTED UNDER THE PROJECT TO ENSURE THAT BETTER WATER MANAGEMENT TECHNOLOGIES ARE EFFECTIVELY TRANSFERRED TO OTHER SYSTEM OPERATORS AND WATER USERS THROUGHOUT MOROCCO. THIS DISSEMINATION PROGRAM SHOULD BE FULLY DESCRIBED IN THE PROJECT PAPER.

7. ENVIRONMENT: THE PROJECT INCLUDES A SUBSTANTIAL EFFORT TO ASSESS AND IMPROVE THE ENVIRONMENTAL SUSTAINABILITY OF TADLA PERIMETER WATER AND SOIL RESOURCES MANAGEMENT. HOWEVER, AID/W IS CONCERNED THAT INCREASED WATER AVAILABILITY AND DIFFERENT AND MORE INTENSIVE CROPPING SYSTEMS COULD RESULT IN INCREASED ON-FARM EROSION AND AGRO-CHEMICAL USE AND RUNOFF, AND INCREASED AGRO-PROCESSING WASTEWATER DISCHARGES, WHICH WOULD NEGATIVELY IMPACT DOWNSTREAM RESOURCES AND USERS. FOR THIS REASON, PP DESIGN SHOULD CAREFULLY EXAMINE (A): WHAT MEASURES CAN BE INCORPORATED INTO THE PILOT DEMONSTRATION PROGRAM TO PROMOTE ENVIRONMENTALLY SOUND AND SUSTAINABLE ON-FARM AGRICULTURAL PRACTICES IN PERIMETER AREAS, SUCH AS INTEGRATED PEST MANAGEMENT TECHNIQUES, IMPROVED LAND PREPARATION AND MANAGEMENT TECHNIQUES, PROPER LEVELS AND TYPES OF AGRO-CHEMICAL USE, ETC.; AND, (B) HOW BEST TO ENSURE THAT ENVIRONMENTAL QUALITY CONCERNS ARE PROPERLY INCORPORATED INTO THE PLANNED PERIMETER MONITORING PROGRAM. AN ENVIRONMENTAL EXAMINATION OF THE PROJECT SHOULD BE SUBMITTED TO THE BUREAU ENVIRONMENTAL OFFICER FOR APPROVAL WHEN THE PROJECT IS READY FOR AUTHORIZATION.

8. CROP MIX AND MARKET PRICE: WITH THE EXCEPTION OF SUGAR BEETS AND, TO A LESSER EXTENT, WHEAT, IT APPEARS THAT THE CROPS GROWN IN THE PROJECT TARGET PERIMETER ARE RELATIVELY FREE OF MARKET-DISTORTING INFLUENCES. NEVERTHELESS, IN CONSULTATION WITH THE IBRD, THE PROJECT SHOULD EXAMINE WHAT TYPES OF ANALYSES OR OTHER INTERVENTIONS COULD BE PURSUED TO FURTHER PROMOTE THE SHIFT IN PRODUCTION TO HIGHER-VALUE CROPS IN PERIMETER AREAS, E.G., COMPARATIVE STUDIES REGARDING THE RELATIVE PROFITABILITY AND OPPORTUNITY COSTS OF PRODUCTION OF SUGAR BEETS/WHEAT VS. OTHER, MORE ECONOMIC CROPS AND/OR CROPPING SYSTEMS.

9. IN ADDITION TO THE ABOVE ISSUES, THE FOLLOWING CONCERNS WERE RAISED FOR MISSION CONSIDERATION:

A) PERFORMANCE INDICATORS, PROJECT MONITORING AND EVALUATION: THE PP DESIGN SHOULD CLEARLY DEFINE PROJECT MONITORING SYSTEMS AND HOW THE PROJECT INSTITUTIONAL CONTRACTOR AND COUNTERPART ORGANIZATIONS WILL PROVIDE THE INFORMATION NEEDED FOR EFFECTIVE PROJECT MONITORING AND EVALUATION. IN ADDITION, CAREFUL ATTENTION SHOULD BE DEVOTED TO DEVELOPING AN APPROPRIATE AND COST-EFFECTIVE PROJECT IMPACT MONITORING AND EVALUATION PROGRAM WHICH EFFECTIVELY DEMONSTRATES PROJECT PERFORMANCE IN THE ACHIEVEMENT OF ORIGINAL DESIGN OBJECTIVES, AND ITS EFFECTIVE CONTRIBUTION TOWARDS THE MISSION'S OVERALL COUNTRY STRATEGY OBJECTIVES.

B) PARTICIPANT TRAINING: THE PROJECT SHOULD ATTEMPT TO THE GREATEST EXTENT POSSIBLE TO MAXIMIZE PRIVATE SECTOR TRAINING OPPORTUNITIES, AND THE USE OF HISTORICALLY BLACK COLLEGES AND UNIVERSITIES IN PROJECT-FINANCED PARTICIPANT TRAINING ACTIVITIES.

C) HOST-COUNTRY CONTRIBUTION: ALTHOUGH THE PROJECT APPEARS TO BE IN ACCORDANCE WITH REQUIREMENTS CONCERNING HOST-COUNTRY CONTRIBUTIONS, THE DESIGN COMMITTEE SHOULD KEEP ABREAST OF POSSIBLE EMERGING NEW GUIDANCE ON THIS ISSUE.

D) LESSONS LEARNED: THE PP DESIGN SHOULD CAREFULLY EXAMINE THE RESULTS OF PAST A.I.D. PROGRAMS IN IRRIGATION SYSTEMS MODELLING AND MANAGEMENT TO BENEFIT FROM THE WEALTH OF AGENCY EXPERIENCE IN THIS DEVELOPMENT AREA. WE SUGGEST THE MISSION WORK WITH PPC/CDIE AND THE ISEAN PROJECT TO COMPLETE A SEARCH OF RELEVANT INFORMATION ON THESE TOPICS.

HEREBY APPROVES THE PID AND DELEGATES TO THE MISSION PP APPROVAL AUTHORITY PURSUANT TO THE GUIDANCE PROVIDED ABOVE. ONCE AGAIN, THE MISSION IS COMMENDED FOR A JOB WELL DONE.

11. AGRICULTURE POLICY. APPROVALS REQUIRED BY PD 71 HAVE BEEN OBTAINED. COPIES OF SIGNED ACTION MEMORANDUM HAVE BEEN POUCHED TO MISSION. EAGLEBURGER
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Agency for International Developme.
Washington, D.C. 20523

FILE COPY

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATORS BUREAU FOR PROGRAM, POLICY AND COORDINATION AND BUREAU FOR LEGISLATIVE AFFAIRS

FROM: Charles F. Weden, DAA (NE)/ENE

SUBJECT: Assistance Affecting Agriculture Exports, Policy Directive 71

Action: To approve USAID/Rabat going forward with project design in which the production of sugar beets and citrus fruits is affected, as required by AID Policy Directive 71.

Background: The Government of Morocco (GOM) is currently following an open market and export oriented growth strategy with emphasis on private investment and private management of economic resources. A reliable supply of high quality water is an essential element in achieving the growth objectives of the new economic strategy. Irrigation accounts for the most significant use of water in Morocco. The irrigation sub-sector enables the county to meet domestic employment needs and expand its exports. Since irrigation accounts for 90% of all water uses in the country, efficiency improvements must initially focus on this sector as probably the most wasteful consumer of available supplies. The proposed Water and Soil Resources Conservation Project will focus on the Tadla irrigation perimeter of the Oum Er River basin. The project will provide an integrated program of policy analysis, technology transfer, institutional strengthening and private sector development for improved water and soil resources management and conservation within the Tadla perimeter.

Discussion: We are prepared to recommend approval of a PID for the proposed project, subject to your concurrence with regard to domestic impacts.

At present, crops grown in the Tadla perimeter include sugar beets, cotton and citrus fruits. The project will not be promoting or providing any direct support for increased production of these crops in perimeter areas. In fact, the project seeks to decrease the production of relatively uneconomical sugar beets in favor of increased production of more competitive, higher value crops in perimeter areas. However, it is probable that these crops will also benefit from system-level improvements in perimeter operations realized through project interventions.

USAID/Rabat has analyzed the potential negative impacts on U.S. exports and producers and finds that, at worst, they would be insubstantial. A copy of the USAID analysis (pg. 30 and 31) is attached at TAB A.

AID Policy Directive 71 (PD-71), dated 12 May 1978 requires that A.I.D. examine at the earliest possible time in project development proposed projects involving the production, processing or marketing of sugar, palm oil, citrus or related products for export. The Mission believes that cotton was also added to the list. PD-71 requires that potential negative impacts on U.S. exporters and producers be considered by the regional bureau AA, AA/PPC and AA/LEG, following review by PPC/EA. PPC/EA concurs in the USAID finding. A copy of PD-71 is attached at TAB B.

PD-71 does not prohibit Missions from developing project ideas which involve production of sugar, cotton and citrus fruits if the development rationale for the project is sound and the likely impact on U.S. producers is low. In this instance, the likely impact is judged to be low and may ultimately be positive through changes in the crop mix leading to a decrease in Moroccan production of the above crops in favor of other higher value crops.

Recommendation: That, by indicating your approval below, you concur that, based on Mission analysis, there does not appear to be a negative impact on U.S. exports and producers and USAID/Rabat may, therefore, proceed with project development.

AA/PPC:RBrown

Approve: RJBrown

Disapprove: ______

Date: 7/17/91

AA/LEG:RRandlett

Approve: R Randlett

Disapprove: ______

Date: 7/17/91

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Annex C

HOST COUNTRY LETTERS OF REQUEST

AND

DESIGN COMMENTS

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المملكـة المغربيـة

وزارة الفلاحة والإصلاح الزراعي

ROYAUME DU MAROC

MINISTERE DE L'AGRICULTURE
ET DE LA REFORME AGRAIRE

SECRETARIAT GENERAL

DIVISION DE LA COOPERATION

N° 1351 DC/1

Rabat, le 21 JUIL 1992

LE MINISTRE DE L'AGRICULTURE
ET DE LA REFORME AGRAIRE

O B J E T : Projet de conservation des ressources en eaux et en sols au Tadla.

Monsieur Le Directeur,

Les efforts soutenus entrepris par le Gouvernement du Royaume du Maroc dans le secteur agricole ont permis d'obtenir des résultats tangibles sur les plans de la modernisation du secteur et de la production.

Ces résultats encourageants sont constatés particulièrement dans les périmètres irrigués qui mobilisent un potentiel de surface important ayant fait les frais financiers d'opérations considérables pour le pays.

Cependant, au fur et à mesure que le programme des équipements hydroagricoles se rapproche de sa fin, un besoin impérieux se fait sentir pour une gestion rationnelle des ressources en eau notamment dans les périmètres anciens tel que le Tadla.

En effet, dans ce dernier périmètre, la date des premiers secteurs mis en eau remonte à 1938. Une partie des équipements a été modernisée au moyen de financements extérieurs accordés entre autres par la Banque Mondiale dans le cadre du Projet PAGI, mais demeure insuffisante pour assurer une efficience et une utilisation rigoureuse des ressources en eau et en sol.

MONSIEUR LE DIRECTEUR DE L'U.S.A.I.D.

- RABAT -

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Sur un autre plan, l'ORMVA du Tadla s'engage depuis 1987 dans la voie de la libéralisation des assolements et du désengagement des activités à caractère commercial pour laisser la place au secteur privé appelé à jouer un rôle de relève et avec lequel il établira des relations de partenariat.

Dans le contexte de cette mutation dans la stratégie de développement agricole régional au Tadla, un projet intitulé " Conservation des Ressources en Eau et des Sols au Tadla" a été identifié et évalué en commun avec votre agence.

Aussi, ai-je l'honneur de vous proposer de financer le projet sus-visé dont l'objectif principal est l'amélioration des performances de l'agriculture irriguée dans le périmètre du Tadla et la sauvegarde de l'environnement, et ce, dans le contexte des nouvelles orientations de la politique hydro-agricole dans le domaine de la grande irrigation. Ce projet portera sur les composantes essentielles suivantes :

- Amélioration du service de l'eau
- Amélioration de la productivité des exploitations agricole
- Lutte contre les impacts négatifs sur l'environnement liés à une utilisation non efficiente des ressources.
- Appui à la promotion du secteur privé
- Formation du personnel de l'ORMVAT.

En souhaitant obtenir une suite favorable de votre part, pour le financement dudit projet, veuillez agréer, Monsieur Le Directeur, l'expression de ma haute considération.

Le Ministre de l'Agriculture
et de la Réforme Agraire

B/13 Signé : Ottman DEMNATI

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RI/PA/20/5/92

المملكة المغربية
وزارة الفلاحة والإصلاح الزراعي

ROYAUME DU MAROC

MINISTERE DE L'AGRICULTURE
ET DE LA REFORME AGRAIRE

SECRETARIAT GENERAL

DIVISION DE LA COOPERATION

N° 715 DC/1/USAID/P/006

OFFICIAL FILE

Rabat, le - 2 JUIN 1992

608-0213

LE MINISTRE DE L'AGRICULTURE
ET DE LA REFORME AGRAIRE

ACTION : ANR
DUE DATE: 06/1e
INFO : DIR DIR PROG CHRON RF.

O B J E T : Coopération Maroc-USAID.

R E F E R : V.L. du 1er Avril 1992.

Suite à votre envoi cité en référence relatif à l'évaluation du projet de conservation des ressources en eau et en sol dans le Tadla (608-0213), j'ai l'honneur de vous communiquer les observations suivantes :

Composante n° 1 : Amélioration du service de l'eau

Le réseau de capteurs de niveau que le projet compte installer dans les points névralgiques des canaux d'irrigation des deux périmètres du Tadla devrait tenir compte de l'évolution future de ceux-ci. En effet, dans un avenir proche, ils seront prolongés, au niveau du périmètre des Béni-Moussa, par le canal T2, qui est actuellement en cours de réalisation et qui servira pour le transfert de l'eau vers le périmètre de la Tassaout Aval.

D'ailleurs, dans le cadre de la régulation de cet ouvrage des appareils de mesure du débit sont prévus au niveau de certains points du canal GM ainsi que dans les premiers tronçons du canal D. Aussi, le réseau de capteurs de niveau et de transmission de l'information devrait-il tenir compte de ces dispositifs et devrait surtout être conçu de façon à pouvoir s'intégrer avec le système de régulation du canal T2.

MONSIEUR LE DIRECTEUR DE L'USAID A RABAT

USAID/RABAT
C & R
04 JUIN 1992
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Eldeen, 6/15
Initials & Date

Dans le domaine de la connaissance des besoins en eau des cultures, le nombre des stations agro-climatiques ne peut être valablement arrêté qu'après qu'une étude de la répartition géographique du climat dans les deux périmètres du Tadla ait été réalisée. Cette étude qui sera basée sur les données disponibles vaudra mieux que d'arrêter ce nombre uniquement sur la base des subdivisions de gestion existantes, même si les données climatiques disponibles sont limitées.

S'agissant de l'avertissement à l'irrigation, une concertation étroite entre le projet et celui qui est mené actuellement conjointement par la DER, l'IIMI et l'ORMVA du Tadla s'avère nécessaire. Cette concertation peut s'articuler autour d'une mise au point et d'une exploitation communes du système d'information géographique et des deux logiciels prévus par le projet pour la maîtrise de la distribution de l'eau.

Par ailleurs, il y a lieu d'insister sur la nécessité d'une mise en place progressive du dispositif d'avertissement à l'irrigation.

Composante n° 2 : Amélioration de la productivité des exploitations agricoles.

L'observatoire permanent qui sera installé dans les périmètres du Tadla dans le cadre de cette composante du projet pour suivre le fonctionnement des exploitations agricoles devrait être complémentaire de celui qui sera réalisé par le PAGI 2 et ce, afin d'éviter du double emploi dans ce domaine.

Par ailleurs, l'étude du comportement des agriculteurs vis à vis de l'introduction des innovations devrait donner la priorité aux techniques efficientes d'irrigation sans pour autant négliger les autres aspects. En effet, la maîtrise de l'irrigation au niveau de la parcelle constitue une priorité nationale.

.../...

Composante n° 3 : Lutte contre les impacts négatifs sur l'environnement liés à une mauvaise utilisation des ressources.

Les actions prévues dans le cadre de cette composante ne soulèvent pas d'observation particulière, car elles correspondent à des besoins réels et pressants de l'ORMVA du Tadla dans le domaine en question.

Toutefois, les informations présentées en annexe C (page 165) sur les composantes de la recharge de la nappe dans les périmètres irrigués du Tadla paraissent prématurées, car elles proviennent d'une étude préliminaire sur le bilan de cette nappe. En effet, les variables du bilan ne sont pas encore connues d'une façon suffisamment précise pour permettre d'affirmer ces informations. Du reste, comme il est indiqué dans le rapport lui-même en page 12, la première investigation à mener dans le cadre de cette composante du projet consiste à achever et affiner l'étude du bilan, qui est encore fragmentaire.

Composante n° 4 : Appui au secteur privé

Tout en plaçant les actions à mener dans ce domaine dans le cadre général d'une plus grande implication du secteur privé dans l'économie rurale et l'instauration d'un dialogue effectif entre les différents acteurs du secteur public et du privé dans le contexte d'un désengagement de l'ORMVA du Tadla des activités à caractère commercial, il faudrait concentrer ces actions essentiellement sur les associations d'irrigants ou leurs groupements ou fédérations. Ceci se justifie par plusieurs raisons parmi lesquelles :

- Les associations d'irrigants sont de constitution récente ; elles doivent être renforcées et orientées.
- Elles sont appelées à jouer un rôle capital dans la gestion des ressources en eau qui est l'une des principales préoccupations du projet (distribution de l'eau, maintenance des équipements, maîtrise de l'application de l'eau au niveau de la parcelle etc ...)

.../...

Par ailleurs, dans le cadre de la complémentarité du projet avec le PAGI 2, il faudrait prévoir la promotion de petites entités privées, soit dans le cadre des associations d'irrigants soit dans un autre cadre. Ces entités privées auront un double objectif : d'une part, apporter aux agriculteurs du Tadla des prestations de services en matière de surfaçage des parcelles et d'autre part, commercialiser différents matériels d'irrigation (siphon tubulaires, films en plastique, rampes à vannettes ou équivalents et même, matériel d'irrigation par aspersion ou localisée).

Veuillez agréer, Monsieur Le Directeur, l'expression de ma haute considération.

Le Ministre [illegible] ...griculture
et de la [illegible] Agraire

Signé : [illegible]an DEMNATI

Annex D

STATUTORY CHECKLIST

5C(2) - ASSISTANCE CHECKLIST

Listed below are statutory criteria applicable to the assistance resources themselves, rather than to the eligibility of a country to receive assistance. This section is divided into three parts. Part A includes criteria applicable to both Development Assistance and Economic Support Fund resources. Part B includes criteria applicable only to Development Assistance resources. Part C includes criteria applicable only to Economic Support Funds.

CROSS REFERENCE: IS COUNTRY CHECKLIST UP TO DATE?	**YES**
A. CRITERIA APPLICABLE TO BOTH DEVELOPMENT ASSISTANCE AND ECONOMIC SUPPORT FUNDS	
1. **Host Country Development Efforts** (FAA Sec. 601(a)): Information and conclusions on whether assistance will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (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) Yes, trade will be encouraged through purchase of equipment from the U.S. and through increased production of high-value export crops; (b) Yes, private initiative and competition will be fostered through strengthening the private sector in the Tadla area; (c) Yes, the project will work with cooperatives to strengthen their management and member services; (d) Yes, by strengthening the private sector, facilitating the free flow of information and assisting the disengagement of the State from commercial irrigation activities and services, the project will discourage monopolistic practices; (e) Yes, the project's primary objective is to promote the adoption of a more technically efficient approach to irrigated agriculture in Morocco; (f) No, the project will not work with free labor unions.
2. **U.S. Private Trade and Investment** (FAA Sec. 601(b)): Information and conclusions on how assistance 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).	Most of the goods and services to be provided under the project will be provided by U.S. private enterprises. In addition, the project will actively promote increased private commercial U.S./Moroccan trade and investment in agriculture.

3. **Congressional Notification**

a. **General requirement** (FY 1992 Continuing Resolution; FAA Sec. 634A): If money is to be 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 (unless the notification requirement has been waived because of substantial risk to human health or welfare)?	A Congressional Notification was forwarded to Congress on 6/29/92 and expired on 7/14/92 without comment.
b. **Notice of new account obligation** (FY 1992 Continuing Resolution): If funds are being obligated under an appropriation account to which they were not appropriated, has the President consulted with and provided a written justification to the House and Senate Appropriations Committees and has such obligation been subject to regular notification procedures?	N/A
c. **Cash transfers and nonproject sector assistance** (FY 1992 Continuing Resolution): If funds are to be made available in the form of cash transfer or nonproject sector assistance, has the Congressional notice included a detailed description of how the funds will be used, with a discussion of U.S. interests to be served and a description of any economic policy reforms to be promoted?	N/A
4. **Engineering and Financial Plans** (FAA Sec. 611(a)): Prior to an 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
5. **Legislative Action** (FAA Sec. 611(a)(2)): If legislative action is required within recipient country with respect to an obligation in excess of $500,000, 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?	N/A
6. **Water Resources** (FAA Sec. 611(b); FY 1992 Continuing Resolution): 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, <u>et seq.</u>)? (See A.I.D. Handbook 3 for guidelines.)	Yes

7. **Cash Transfer and Sector Assistance** (FY 1992 Continuing Resolution): Will cash transfer or nonproject sector assistance be maintained in a separate account and not commingled with other funds (unless such requirements are waived by Congressional notice for nonproject sector assistance)?	N/A
8. **Capital Assistance** (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?	N/A
9. **Local Currencies**	
a. **Recipient Contributions** (FAA Secs. 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.	Yes
b. **U.S.-Owned Currency** (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?	No
c. **Separate Account** (FY 1992 Continuing Resolution). If assistance is furnished to a foreign government under arrangements which result in the generation of local currencies:	N/A
(1) Has A.I.D. (a) required that local currencies be deposited in a separate account established by the recipient government, (b) entered into an agreement with that government providing the amount of local currencies to be generated and the terms and conditions under which the currencies so deposited may be utilized, and (c) established by agreement the responsibilities of A.I.D. and that government to monitor and account for deposits into and disbursements from the separate account?	a) N/A b) N/A c) N/A
(2) Will such local currencies, or an equivalent amount of local currencies, be used only to carry out the purposes of the DA or ESF chapters of the FAA (depending on which chapter is the source of the assistance) or for the administrative requirements of the United States Government?	N/A

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(3) Has A.I.D. taken all appropriate steps to ensure that the equivalent of local currencies disbursed from the separate account are used for the agreed purposes? N/A

(4) If assistance is terminated to a country, will any unencumbered balances of funds remaining in a separate account be disposed of for purposes agreed to by the recipient government and the United States Government? N/A

10. **Trade Restrictions**

a. **Surplus Commodities** (FY 1992 Continuing Resolution): 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? N/A

b. **Textiles (Lautenberg Amendment)** (FY 1992 Continuing Resolution): 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 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? No

11. **Tropical Forests** (FY 1992 Continuing Resolution): Will funds be used for any program, project or activity which would (a) result in any significant loss of tropical forests, or (b) involve industrial timber extraction in primary tropical forest areas? a) No b) No

12. **PVO Assistance**

a. **Auditing and registration** (FY 1992 Continuing Resolution): 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 requirements of A.I.D., and is the PVO registered with A.I.D.? N/A

b. **Funding sources** (FY 1992 Continuing Resolution, Title II, under heading "Private and Voluntary Organizations"): 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
13. **Project Agreement Documentation** (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).	The Case-Zablocki Act requirements will be fully complied with.
14. **Metric System** (Omnibus Trade and Competitiveness Act of 1988 Sec. 5164, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance activity use the metric system of measurement in its procurements, grants, and other business related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?	a) Yes b) Yes c) Yes
15. **Women in Development** (FY 1992 Continuing Resolution, Title II, under heading "Women in Development"): Will assistance be designed so that the percentage of women participants will be demonstrably increased?	All project activities will actively promote increased participation by women in the regional economy. Certain private sector assistance activities will be targeted at women-owned enterprises and/or enterprises where women figure prominently in the business or services supplied. Wherever appropriate, project studies, analyses and evaluations will be gender-specific in order to accurately assess the project's impact on women. Many farmers in the project area are women who will receive direct project benefits.

16. **Regional and Multilateral Assistance** (FAA Sec. 209): Is assistance more efficiently and effectively provided through regional or multilateral organizations? If so, why is assistance not so provided? Information and conclusions on whether assistance will encourage developing countries to cooperate in regional development programs.	No. The project will, however, promote enhanced regional/international development cooperation through support to IIMI and through close collaboration with complementary World Bank-sponsored irrigation improvement activities in Morocco.
17. **Abortions** (FY 1992 Continuing Resolution, Title II, under heading "Population, DA," and Sec. 525):	
a. Will assistance be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization?	No
b. Will any funds be used to lobby for abortion?	No
18. **Cooperatives** (FAA Sec. 111): Will assistance help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life?	Yes. The project will provide substantive, direct assistance to strengthen agricultural-related cooperatives in Tadla.
19. **U.S.-Owned Foreign Currencies**	
a. **Use of currencies** (FAA Secs. 612(b), 636(h); FY 1992 Continuing Resolution): Describe steps taken to assure that, to the maximum extent possible, foreign currencies owned by the U.S. are utilized in lieu of dollars to meet the cost of contractual and other services.	U.S. does not own any foreign currency in Morocco.
b. **Release of currencies** (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?	No
20. **Procurement**	
a. **Small business** (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, small businesses will be encouraged to apply for all project technical assistance and commodity procurement contracts, and subcontracts.

b. **U.S. procurement** (FAA Sec. 604(a)): Will all procurement be from the U.S. except as otherwise determined by the President or determined under delegation from him?	Yes
c. **Marine insurance** (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?	Morocco does not discriminate against any marine insurance companies.
d. **Non-U.S. agricultural procurement** (FAA Sec. 604(e)): 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.)	N/A
e. **Construction or engineering services** (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 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.)	No
f. **Cargo preference shipping** (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
g. **Technical assistance** (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. Use of other Federal Agencies is not contemplated.

h. **U.S. air carriers** (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

i. **Termination for convenience of U.S. Government** (FY 1992 Continuing Resolution): 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? — Yes

j. **Consulting services** (FY 1992 Continuing Resolution): 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

k. **Competitive Selection Procedures** (FAA Sec. 601(e)): Will the assistance utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? — Yes

21. **Construction**

a. **Capital project** (FAA Sec. 601(d)): If capital (e.g., construction) project, will U.S. engineering and professional services be used? — N/A

b. **Construction contract** (FAA Sec. 611(c)): If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — N/A

c. **Large projects, Congressional approval** (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 Congressional Presentation), or does assistance have the express approval of Congress? — N/A

22. **U.S. Audit Rights** (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
23. **Communist Assistance** (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
24. **Narcotics**	
a. **Cash reimbursements** (FAA Sec. 483): Will arrangements preclude use of financing to make reimbursements, in the form of cash payments, to persons whose illicit drug crops are eradicated?	Yes
b. **Assistance to narcotics traffickers** (FAA Sec. 487): Will arrangements take "all reasonable steps" to preclude use of financing to or through individuals or entities which we know or have reason to believe have either: (1) been convicted of a violation of any law or regulation of the United States or a foreign country relating to narcotics (or other controlled substances); or (2) been an illicit trafficker in, or otherwise involved in the illicit trafficking of, any such controlled substance?	1) Yes 2) Yes
25. **Expropriation and Land Reform** (FAA Sec. 620(g)): Will assistance preclude use of financing 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
26. **Police and Prisons** (FAA Sec. 660): Will assistance preclude use of financing to provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs?	Yes
27. **CIA Activities** (FAA Sec. 662): Will assistance preclude use of financing for CIA activities?	Yes
28. **Motor Vehicles** (FAA Sec. 636(i)): Will assistance preclude use of financing 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

29. **Military Personnel** (FY 1992 Continuing Resolution): Will assistance preclude use of financing to pay pensions, annuities, retirement pay, or adjusted service compensation for prior or current military personnel? | Yes

30. **Payment of U.N. Assessments** (FY 1992 Continuing Resolution): Will assistance preclude use of financing to pay U.N. assessments, arrearages or dues? | Yes

31. **Multilateral Organization Lending** (FY 1992 Continuing Resolution): Will assistance preclude use of financing to carry out provisions of FAA section 209(d) (transfer of FAA funds to multilateral organizations for lending)? | Yes

32. **Export of Nuclear Resources** (FY 1992 Continuing Resolution): Will assistance preclude use of financing to finance the export of nuclear equipment, fuel, or technology? | Yes

33. **Repression of Population** (FY 1992 Continuing Resolution): Will assistance preclude use of financing 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

34. **Publicity or Propaganda** (FY 1992 Continuing Resolution): Will assistance 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? | No

35. **Marine Insurance** (FY 1992 Continuing Resolution): Will any A.I.D. contract and solicitation, and subcontract entered into under such contract, include a clause requiring that U.S. marine insurance companies have a fair opportunity to bid for marine insurance when such insurance is necessary or appropriate? | Yes

36. **Exchange for Prohibited Act** (FY 1992 Continuing Resolution): Will any assistance be provided to any foreign government (including any instrumentality or agency thereof), foreign person, or United States person in exchange for that foreign government or person undertaking any action which is, if carried out by the United States Government, a United States official or employee, expressly prohibited by a provision of United States law? No

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B. CRITERIA APPLICABLE TO DEVELOPMENT ASSISTANCE ONLY

1. **Agricultural Exports (Bumpers Amendment)** (FY 1992 Continuing Resolution), as interpreted by conference report for original enactment): 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: (1) 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 expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (2) in support of research that is intended primarily to benefit U.S. producers?	1) No 2) No
2. **Tied Aid Credits** (FY 1992 Continuing Resolution, Title II, under heading "Economic Support Fund"): Will DA funds be used for tied aid credits?	No
3. **Appropriate Technology** (FAA Sec. 107): Is special emphasis placed on use of appropriate technology (defined as 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, where appropriate.
4. **Indigenous Needs and Resources** (FAA Sec. 281(b)): Describe extent to which the activity 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 civic education and training in skills required for effective participation in governmental and political processes essential to self government.	The project will rely on Moroccan expertise to the greatest extent possible. The project is specifically oriented towards solving resource use inefficiencies in project areas through increased information flow and greater participation of private local residents in regional decision-making.
5. **Economic Development** (FAA Sec. 101(a)): Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes
6. **Special Development Emphases** (FAA Secs. 102(b), 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	a) The project is specifically designed to increase private regional participation in the Tadla economy by increasing labor-intensive production using appropriate technologies, increasing regional agribusiness

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participation of the poor in the benefits of development on a sustained basis, using appropriate U.S. institutions; (b) encourage democratic 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; and (e) utilize and encourage regional cooperation by developing countries.	opportunities and employment, and increasing the free flow of information for increased farmer involvement in regional resource allocation, management and use decision-making. All of this will be accomplished through joint contracts w/ U.S. and Moroccan firms and institutions; (b) The project will increase the free flow of information within the Tadla agricultural community affording opportunities for greater participation of all community interests in regional decision-making processes; (c) The project is being pursued in direct response to felt GOM needs. It will rely, to the extent possible, on Moroccan expertise; (d) see A.15; (e) see A.16.
7. **Recipient Country Contribution** (FAA Secs. 110, 124(d)): Will the recipient country provide at least 25 percent 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 (see A.9.a. above)
8. **Benefit to Poor Majority** (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, to the extent possible
9. **Abortions** (FAA Sec. 104(f); FY 1992 Continuing Resolution, Title II, under heading "Population, DA," and Sec. 535):	
a. 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
b. 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
c. Are any of the funds to be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or	No

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involuntary sterilization?

d. Will funds be made available only to voluntary family planning projects which offer, either directly or through referral to, or information about access to, a broad range of family planning methods and services? — No

e. In awarding grants for natural family planning, will any applicant be discriminated against because of such applicant's religious or conscientious commitment to offer only natural family planning? — N/A

f. 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

g. Are any of the funds to be made available to any organization if the President certifies that the use of these funds by such organization would violate any of the above provisions related to abortions and involuntary sterilization? — No

10. **Contract Awards** (FAA Sec. 601(e)): Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? — Yes

11. **Disadvantaged Enterprises** (FY 1992 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 40 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)? — 10%

12. **Biological Diversity** (FAA Sec. 119(g): 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

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13. **Tropical Forests** (FAA Sec. 118; FY 1992 Continuing Resolution)

a. **A.I.D. Regulation 16:** Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16?

Yes

b. **Conservation:** Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (1) stress the importance of conserving and sustainably managing forest resources; (2) 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; (3) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (4) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (5) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (6) conserve forested watersheds and rehabilitate those which have been deforested; (7) support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (8) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (9) 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 clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas; (10) seek to increase the awareness of U.S. Government agencies and other donors of the immediate and long-term value of tropical forests; (11) utilize the resources and abilities of all relevant U.S. government agencies; (12) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land; and (13) take full account of the environmental impacts of the proposed activities on biological diversity?

1) N/A
2) Yes
3) N/A
4) Yes
5) Yes
6) N/A
7) N/A
8) N/A
9) N/A
10) N/A
11) N/A
12) Yes
13) Yes

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c. **Forest degradation:** Will assistance be used for: (1) 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; (2) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas; (3) activities which would result in the conversion of forest lands to the rearing of livestock; (4) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undergraded forest lands; (5) the colonization of forest lands; or (6) the construction of dams or other water control structures which flood relatively undergraded 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?

1) No
2) No
3) No
4) No
5) No
6) No

d. **Sustainable forestry:** If assistance relates to tropical forests, will project assist countries in developing a systematic analysis of the appropriate use of their total tropical forest resources, with the goal of developing a national program for sustainable forestry?

N/A

e. **Environmental impact statements:** Will funds be made available in accordance with provisions of FAA Section 117(c) and applicable A.I.D. regulations requiring an environmental impact statement for activities significantly affecting the environment?

N/A

14. **Energy** (FY 1992 Continuing Resolution): If assistance relates to energy, will such assistance focus on: (a) end-use energy efficiency, least-cost energy planning, and renewable energy resources, and (b) the key countries where assistance would have the greatest impact on reducing emissions from greenhouse gases?

a) N/A
b) N/A

15. **Sub-Saharan Africa Assistance** (FY 1992 Continuing Resolution adding a new FAA chapter 10 (FAA Sec. 496)): 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

a) N/A
b) N/A
c) N/A
d) N/A
e) N/A
f) N/A

sustainable, and self-reliant; (b) to be used to promote sustained economic growth, encourage private sector development, promote individual initiatives, and help to reduce the role of central governments in areas more appropriate for the private sector; (c) to be provided in a manner that takes into account, during the planning process, the local level perspectives of the rural and urban poor, including women, through close consultation with African, United States and other PVOs that have demonstrated effectiveness in the promotion of local grassroots activities on behalf of long-term development in Sub-Saharan Africa; (d) to be implemented in a manner that requires local people, including women, to be closely consulted and involved, if the assistance has a local focus; (e) being used primarily to promote reform of critical sectoral economic policies, or to support the critical sector priorities of agricultural production and natural resources, health, voluntary family planning services, education, and income generating opportunities; and (f) to be provided in a manner that, if policy reforms are to be effected, contains provisions to protect vulnerable groups and the environment from possible negative consequences of the reforms?

16. **Debt-for-Nature Exchange** (FAA Sec. 463): If project will finance a debt-for-nature exchange, describe how the exchange will support protection of: (a) the world's oceans and atmosphere, (b) animal and plant species, and (c) parks and reserves; or describe how the exchange will promote: (d) natural resource management, (e) local conservation programs, (f) conservation training programs, (g) public commitment to conservation, (h) land and ecosystem management, and (i) regenerative approaches in farming, forestry, fishing, and watershed management.

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

17. **Deobligation/Reobligation** (FY 1992 Continuing Resolution): If deob/reob authority is sought to be exercised in the provision of DA assistance, are the funds being obligated for the same general purpose, and for countries within the same region as originally obligated, and have the House and Senate Appropriations Committees been properly notified?

N/A

18. **Loans**

a. **Repayment capacity** (FAA Sec. 122(b)): Information and conclusion on capacity of the country to repay the loan at a reasonable rate of interest. — N/A

b. **Long-range plans** (FAA Sec. 122(b)): Does the activity give reasonable promise of assisting long range plans and programs designed to develop economic resources and increase productive capacities? — N/A

c. **Interest rate** (FAA Sec. 122(b)): If development loan is 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

d. **Exports to United States** (FAA Sec. 620(d)): If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20 percent of the enterprise's annual production during the life of the loan, or has the requirement to enter into such an agreement been waived by the President because of a national security interest? — N/A

19. **Development Objectives** (FAA Secs. 102(a), 111, 113, 281(a)): Extent to which activity will: (1) effectively involve the poor in development, by expanding access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out 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; (2) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (3) support the self-help efforts of developing countries; (4) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (5) utilize and encourage regional cooperation by developing countries? — See #6 above

20. **Agriculture, Rural Development and Nutrition, and Agricultural Research** (FAA Secs. 103 and 103A):

a. **Rural poor and small farmers:** If assistance is being made available for agriculture, rural development or nutrition, describe extent to which activity is specifically designed to increase productivity and income of rural poor; or if assistance is being made available for agricultural research, has account been taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made.

The project will develop more efficient on-farm water use practices and more market-oriented crops, thereby increasing productivity and yield, and incomes and employment in the Tadla farming community. The project includes appropriate field testing and an info. dissemination program to adapt results to local conditions.

b. **Nutrition:** Describe extent to which assistance is used in coordination with efforts carried out under FAA Section 104 (Population and Health) to help improve nutrition of the people of developing countries through encouragement of increased production of crops with greater nutritional value; improvement of planning, research, and education with respect to nutrition, particularly with reference to improvement and expanded use of indigenously produced foodstuffs; and the undertaking of pilot or demonstration programs explicitly addressing the problem of malnutrition of poor and vulnerable people.

N/A

c. **Food security:** Describe extent to which activity increases national food security by improving food policies and management and by strengthening national food reserves, with particular concern for the needs of the poor, through measures encouraging domestic production, building national food reserves, expanding available storage facilities, reducing post harvest food losses, and improving food distribution.

Cheaper production costs, more efficient use of water resources, and more marketable crops will be grown in sustainable and environmentally supportable ways, thereby contributing to Morocco's long-term agriculural competitiveness and food security.

21. **Population and Health** (FAA Secs. 104(b) and (c)): If assistance is being made available for population or health activities, describe extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems, and other modes of community outreach.

N/A

22. **Education and Human Resources Development** (FAA Sec. 105): If assistance is being made available for education, public administration, or human resource development, describe (a) extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, and strengthens management capability of institutions enabling the poor to participate in development; and (b) extent to which assistance provides advanced education and training of people of developing countries in such disciplines as are required for planning and implementation of public and private development activities.

a) N/A
b) N/A

23. **Energy, Private Voluntary Organizations, and Selected Development Activities** (FAA Sec. 106): If assistance is being made available for energy, private voluntary organizations, and selected development problems, describe extent to which activity is:

a. concerned with data collection and analysis, the training of skilled personnel, research on and development of suitable energy sources, and pilot projects to test new methods of energy production; and facilitative of research on and development and use of small scale, decentralized, renewable energy sources for rural areas, emphasizing development of energy resources which are environmentally acceptable and require minimum capital investment;

N/A

b. concerned with technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

The project will be implemented under contract to U.S. and Moroccan institutions. Project implementation will be closely coordinated with relevant activities of other regional and international development organizations (see A.16. above).

c. research into, and evaluation of, economic development processes and techniques;

Research, demonstration, and field trials will be conducted on new crops and techniques leading to increased productivity and incomes for farmers in Tadla. All project assistance will be subject to periodic evaluation.

d. reconstruction after natural or manmade disaster and programs of disaster preparedness;

N/A

e. for special development problems, and to enable proper utilization of infrastructure and related projects funded with earlier U.S. assistance; N/A

f. for urban development, especially small, labor intensive enterprises, marketing systems for small producers, and financial or other institutions to help urban poor participate in economic and social development. N/A

Annex E

TECHNICAL ANALYSES

Annex E

TECHNICAL ANALYSES

I. ELEMENT 1—SYSTEM WATER CONTROL AND MANAGEMENT

The canal systems of the ORMVAT are vital links for conducting water to the farmers within the irrigation perimeter. Originally the physical irrigation system was installed to operate under a specified crop rotation. Policy changes call for the liberalization of crop rotation, however, and therein require corresponding changes in the management of irrigation water distribution.

In the project context of conserving water and increasing productivity, this analysis proceeds in three steps: discussion of the physical and operational characteristics of the existing system; the demands imposed on the system by policy changes; and how project interventions address new system demands and limitations.

A. Findings—Physical and Operational Characteristics of the Existing System

1. Perimeter Description

The perimeter is divided into two hydraulically separate subperimeters by the Oum Er Rbia River (see Maps 1 and 2 in the preface). The Beni Amir subperimeter is located on the right bank and encompasses about 27,000 hectares irrigated from the Oum Er Rbia River via the Kasba Tadla diversion dam, which was constructed in 1929. The reservoir has an operating storage of about 120,000 cubic meters and provides water to the irrigated subperimeter through a canal along the left bank of the river connected to a small regulating reservoir of 100,000 cubic meters at Kasba Zidania, which is about 20 kilometer downstream of the dam. Water discharges from this reservoir either through a small hydro-electric plant or into a siphon under the Oum Er Rbia River and then into the main irrigation canal, at a maximum capacity of 14 cubic meters per second. During summer months, river flows may drop below principal canal capacity, especially in light of recent upstream water use developments at Dechra El Oued. These capacity constraints place distribution managers in the difficult position of trying to meet the expectations of water users amid the realities of limited and uncertain water supplies. Water from this source has a salinity of 1.2 to 1.6 grams per liter and carries enough silt to fill the Kasba Zidania reservoir completely in about four months. These water characteristics pose significant maintenance challenges—sedimentation and corrosion—for the canal operators and restrict the selection of crops within the subperimeter. This subperimeter, developed between 1938 and 1940, is the oldest Grande Hydraulic subperimeter in Morocco. Rehabilitation efforts were begun in the early 1970s, and a possible expansion of 6,000 hectares is presently being studied.

The Beni Moussa subperimeter is located on the left bank of the Oum Er Rbia River and covers about 70,000 hectares of irrigated land using water from the Bin El Ouidane Dam on the Oued El Abid in Azilal Province. This dam was completed in 1954 and, with a height of

132.5 meters, was the highest dam in Africa at the time of its completion. It has a total storage capacity of 1,500 million cubic meters and a regulated storage capacity of 1,100 million cubic meters. Of this, 720 million cubic meters are allocated to the Beni Moussa subperimeter and 235 million cubic meters will be allotted to the lower Tessaout perimeter in ORMVAH upon the completion of the T2 transit canal in the next few years. This will impose new constraints on the water supply from the Bin El Ouidane Dam. The hydro-electric plant associated with the dam has a maximum capacity of 135 megawatts, with a mean annual production of 200 million kilowatt hours. The irrigation works were completed in 1974.

Water for the Beni Moussa irrigation subperimeter is supplied from a compensating dam at Ait Ouarda immediately downstream of the Bin El Ouidane Dam and then passes through a tunnel 10.5 kilometers long to the second hydro-electric plant at Afourer. This latter plant has a maximum capacity of 86 megawatts with a mean annual production of 400 million kilowatt hours. Water from the hydro-electric plant at Afourer discharges directly into the two main canals - GM and D—of the subperimeter. The upper reaches of both main canals serve as in-line storage reservoirs with a capacity of 300,000 cubic meters, which meets evening peak hydro-electric generation needs while supplying the irrigation system's relatively constant demands. The principal hydraulic infrastructure for the two large-scale subperimeters, in addition to those mentioned above, include 200 kilometers of main canal, 360 kilometers of primary and secondary canals, and 1,800 kilometers of tertiary canals in addition to many more kilometers of unlined field ditches—or quaternary canals. Drainage is provided by a network of surface drains totaling 1,700 kilometers in length.

The principal crops produced in the ORMVAT perimeter are cotton, sugar beets, cereals, forage, vegetables, citrus, and olives. Recently a private initiative has been presented introducing paprika peppers, which are processed locally. Minor acreages of maize, soybeans, and roses demonstrate the possible diversity of crops the region can support.

Approximately 28,000 individual farms are contained within the perimeter. Farm size varies considerably, with 82 percent less than 5 hectares (totaling 41 percent of the total area), and 2 percent of the farms more than 20 hectares (covering 27 percent of the total area). This diversity in farm sizes and types and the sheer number of farmers stresses water distribution managers' ability to respond to farmers' requests for water.

2. The Irrigation Water Distribution Design

The irrigation systems of the ORMVAT were designed to meet the crop water requirements of specified crop rotation patterns through continuous-flow day-and-night irrigation during peak periods. Canals and turnout structures sized to meet this peak demand are the structural elements of the existing system. The patterns, as specified under the Trame A and Trame B design specifications, reflect the effort of designers to provide a means of meeting national production goals with efficient and equitable water distribution while accommodating large variations in individual landownership patterns (Ait Kadi, 1986).

Trame B calls for the layout of each irrigation block of about 30 hectares with farmer landholdings running across the layout of quaternary canals. These canals supply water not to the farm holdings but to a field containing one crop and extending across the farmer landholdings parallel to the quaternary canal. Water then is supplied not to individual farm holdings, but to a crop in a block—all of which is planted along a single quaternary, eliminating excess water losses from filling many quaternaries to irrigate the same crop and field area (see Figures E-1 and E-2). Canal spacing is set based on soil permeability and slope to provide good application efficiencies under border and furrow irrigation. Distribution system scheduling based on the fixed cropping pattern is concerned not with farmer requests, but with the crop rotation in the block. Water is allocated not to farms but to the crop. This rational layout has experienced problems mostly related to the violation of the fundamental assumption that farmers would cooperatively maintain the same crop along each quaternary and that all farmers would agree to receive water at the same time for these fields. Because of variations from this rational crop layout, delivering water based on the standard crop rotation could not be justified and other methods of irrigation water ordering were developed. In Tadla, this takes the form of a paperwork-intensive system of farmer water ordering and control, using form MV-I for water ordering and form MV-II for arranging the gate settings.

3. Hydraulic Characteristics of the Canal Network

Physical control of the irrigation water distribution system is accomplished through the use of upstream control. All canal control structures are designed to maintain a relatively constant upstream water level regardless of the flow rate through the structure. Water offtakes, therefore, are designed to deliver standard flow rates over this limited range of water levels. Operationally, this means that water released at the canal head is not held in reserve. If inflows and outflows are not balanced, water either passes through the system—flooding either farmers and/or drains—or is diverted to upstream users only. Balancing of system inflows and outflows requires the advance scheduling of system flows.

The control structures used in the Tadla irrigation distribution system to maintain constant upstream water levels are long-crested weirs and vanne amil automatic level control gates. Flow rates through the turnouts are controlled using "modules a masque", or constant flow distributors of a mixed weir-and-orifice type, which results in a small range of flow rate variation when upstream water levels are within the range of the gate operation.

The main canals in the system are concrete lined and trapezoidal in shape. The smaller canals in the system are semicircular and are mounted on concrete support piers. Some sections may be elevated as much as 2 to 3 meters to maintain sufficient elevation to cross low areas and provide sufficient head for irrigation of areas downstream. Maintenance of this type of canal system requires replacement of broken canal sections, supports, and seals, although visual checks on canal leaks are greatly facilitated. Canal leaks or overflow can result in settling in support piers and resultant changes in canal slope. Field access is maintained by using many inverted siphons, generally at the same location as the turnout gates. When waters contain high sediment loads, siphon plugging can be a significant problem.

General Canal Layout

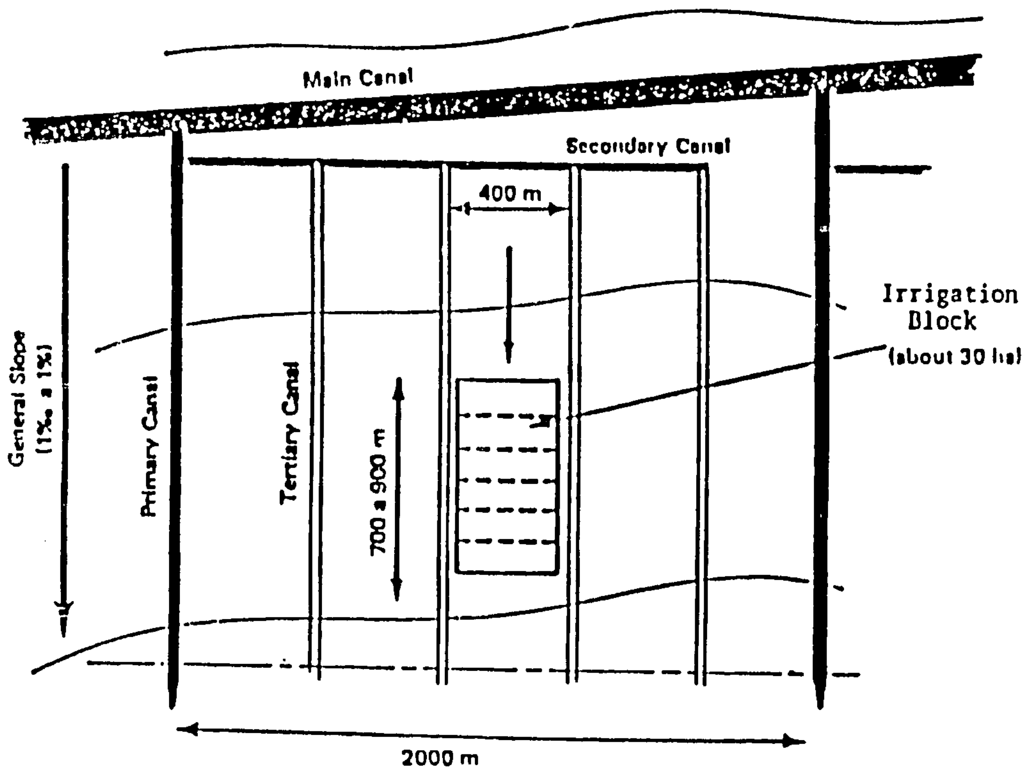
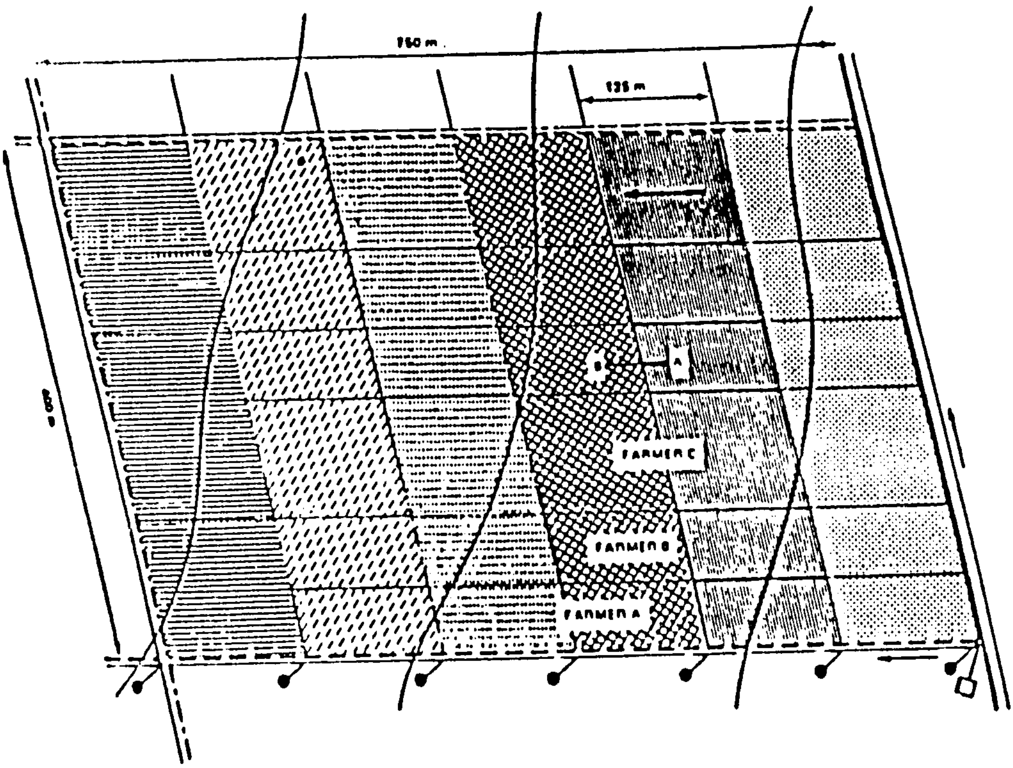


Figure E-2

"Trame B" layout of a 30 ha Irrigation Block



4. Administration of Irrigation Water Distribution

Irrigation water distribution falls under the direction of the SGRID. The head of SGRID answers directly to the director of the ORMVAT. SGRID is charged with operations and maintenance of the irrigation and drainage infrastructure, the control of groundwater pumping development, water pricing, and all water rights related issues.

The SGRID organizational structure consists of three major bureaus at the headquarters--maintenance, irrigation techniques, and operations. The Bureau of Irrigation Techniques is charged with the monitoring of soil and groundwater evolution and field testing of irrigation techniques and practices. The Operations Bureau is in charge of working out general operating plans for the irrigation network, organizing the distribution of water based on the needs expressed by the CMVs, and participating in the identification of water rights and measures for their expropriation. This operational mandate also includes the collection and use of accurate water distribution statistics for improving the distribution of water in the future.

Field-level implementation, in particular the scheduling of irrigation water distribution, is carried out by three subdivisions—Beni Amir, East Beni Moussa, and West Beni Moussa. Subdivisions are areas of the perimeter that are, in general, within the same hydraulic branch or branches, as opposed to the CMVs, which may cross hydraulic system boundaries. Each subdivision is responsible for providing water to approximately 8,000 individual farm units on approximately 33,000 hectares.

Subdivision structure divides the canal system hydraulically under the control of three head aiguadiers and a head of canal for managing flows in the main canal. Irrigation scheduling operations are performed by aiguadiers, under the supervision of a head aiguadier for a canal secondary branch. Actual distribution operations are performed by the gardes vanne for principal canals, under the direction of the head of canal, and by distribution agents within secondaries and tertiaries, under the direction of the head aiguadiers. Water distribution schedules as implemented are used by an ORMVAT billing office as the basis for water charges.

5. Organizational Control of Irrigation Water Distribution

The Tadla's water distribution policy was set based on the fixed cropping rotation specified in the area irrigation system's design. Advance system schedules, necessary for proper management of upstream regulated systems, could easily be set based on the rotation of crops and standard system flow rates.

Implementation of this fixed rotation was disrupted, however, by farmer deviation from the prescribed patterns. As a result, in the ORMVAT, the schedule of gate settings is now determined using a method of ordering water that requires that requests be made the week before water is to be delivered. The system of water ordering implemented by the MV-I form groups farmers by tertiary canal. Water orders are arranged by an aiguadier who is responsible for, on average, 500 farmers.

Before a period of severe water shortages in 1981 to 1983, allocation was based on farmer requests for water up to available system capacity. This period of water stress within the system stimulated a policy change for water allocation based on a more rational method, to be defined instead by registered cropped area for each farmer, estimated crop water use, and available water supply. This water distribution policy has continued to be used in times of adequate water supplies.

The registered cropped area for each farmer is collected at the beginning of each cropping season from each CMV. The area registered by each farmer is used for the purpose of obtaining seeds, fertilizers, and agrochemical supplies. Crops for which water will be allocated are limited to the approved crops specified under the design crop rotation patterns. The CMVs use a maximum area for each crop so that during peak periods, the time of flow per hectare is limited only by the design canal network capacity.

Crop water use, a stochastic parameter, is estimated on a weekly basis at the head management level. When reported data from Ouled Ganou experimental station is available, the Blaney-Criddle formula based on local experimental data can be used. Some of the feel for this is reinforced by the feedback received from farmers by the aiguadiers and subdivisionaire. For example, if water needs are underestimated, requests for complementary or supplementary irrigation would be up on a general basis as farmers observe water stress in their crops.

The length of the water rotation is set based on the average readily available water holding capacity of the soil and average crop water use for the total subdivision. In Beni Amir, this is valid until water supply limitations are experienced.

The water allocated to a farmer is then calculated by the aiguadier as the registered area times the determined crop water demand times the number of days in the rotation. The amount is then increased to account for distribution efficiency. An efficiency of 70 percent is the recommended value, but personnel realize 50 percent is a more realistic number. For alfalfa, a reduction is made in all allocations to account for lower water use in that part of a field that has been recently harvested. This is translated from a volume to a number of hours at the standard flow rate of 30 liters per second. The order of rotation among farmers served by the same outlet is then determined and each farmer starts and stops at the times set. Normally, the rotation operates from the farmer nearest to the outlet to the farmer most distant from it so that the earth canal is filled progressively and the last farmer does not have to fill the entire canal with water for his turn. It is in the rotation that the aiguadier has room for flexibility, sometimes allowing a longer rotation for an outlet since all gate changes must be made between 8 and 18 hours. All schedules are then reviewed by the chef aiguadier for approval and the farmer is issued a water order (bon), which he signs, indicating not only acknowledgement of the time, but an agreement to pay for that given amount of water.

Three types of adjustments can be made to this allocation amount with approval of the subdivisionaire. First, in the case in which it is documented that water is not delivered to the farmer in the quantity agreed (for example a "chute d'un element" or "bouchage de siphon", in which flow is interrupted and is confirmed by an aiguadier in a repair request) the farmer will be granted compensation at no extra charge to complete his allocation. This is done as soon as there is water in the secondary by either altering the end-of-week schedule or including the compensation in the beginning of the next week. Second, farmers who find that the water allocated was insufficient to irrigate their entire cropped area, but cannot document that the water supplied is less than the amount indicated in the water order, can request complementary water. Consideration is given to whether other farmers are experiencing the same problem so that such requests are met fairly. This water is added to the amount of the water order for billing. Third, a farmer can request supplemental water, which is in a sense unjustified additional water. From the perspective of the aiguadier and subdivisionaire, complementary and supplementary water are the same thing.

Available water supply is an especially important factor for the Beni Amir subperimeter when river flows are below demand. For Beni Moussa, annual allocation from the dam is set at 720 million cubic meters. There is a strong dependence in both cases on the system design and fixed cropping patterns as the last word in allocation. No planning mode exists to allow a variable cropping pattern or to select an optimal pattern based on available water. For Beni Amir, when the system capacity or expected water supply will not meet demand, the number of days in the rotation is lengthened until supply and demand match as calculated on the MV-I. In essence, the standard rotation allocation amount is used but the rotation is lengthened, resulting in periods when tertiary canals are closed. Another method would be to reduce the water supplied to each farmer using the standard rotation. The subdivisionnaire interviewed indicated that he preferred to lengthen the period between rotations since water losses would be less than water losses for more frequent irrigations with a smaller amount.

Distribution of the water allocation is worked out on the MV-II form, accumulating the tertiary outlet flows from the MV-I, and using these tertiary sums to determine secondary channel flow and adding water to account for losses in the secondary canals. No consideration is given to the dynamic hydraulic system characteristics such as time required for upstream flow adjustments to travel downstream. Gates down to the tertiary level are only adjusted from 8 A.M. to 6 A.M. by the distribution agents. Main canal offtakes are watched by agents who live at a house next to the offtake. These offtakes could be adjusted at night but probably are not. Aiguadiers are praised for arranging their rotations so that the flow of water into secondaries is relatively constant. Regulation of the principal canal is done by observing water levels at the offtake for the canal median, and the offtake for secondary 17. Radio communication is maintained between these two gates and the main canal intake located just before the main siphon under the river. Comments were made that it is necessary to maintain some spill to know that the system is delivering full water to the last outlet. This is also used as the cushion from which compensation can be extracted. Complementary irrigation may be fit into the end of the week, when, in general, total demand is declining.

The water supply limitations of the Beni Amir subperimeter force the use of several real-time management practices to ensure that water is distributed equally throughout the system. When supply is falling within the week, secondary canals may be cut for 24 hours, delaying all irrigations on those secondaries, to adjust supply to demand. This delay is rotated among secondaries until it is unnecessary—i.e., the supply flow stabilizes or a new week begins and adjustments are made in the whole system. When supply is rising, complementary water can be given more freely.

The incorporation of rainfall in management is done using the local observations of the aiguadiers for local events. Widespread and seasonal rainfall may result in complete cutting of the canal flow. No indication is given of a rainfall measurement network being used as a basis for these decisions. Rather, observation and interaction with farmers appear to be the basis for such decisions. The responsiveness of managers to farmer requests not to receive water after rainfall events depends on the timing of the rainfall. If the irrigation schedule for the week has been set and is in progress, the tendency is to force farmers to take the agreed upon delivery and pay for water they will not use, rather than make changes in the predetermined schedule.

B. Analysis--Demands Imposed on the System by Policy Changes

The policy changes calling for liberalization of the fixed-rotation type of cropping pattern enables farmers to receive water for a larger variety of crops and the managers of ORMVAT water distribution to recognize the variety of crops and cropping patterns being practiced in the ORMVAT irrigation perimeter. Responding to these cropping patterns in a way that promotes the wise use of limited water requires consideration of the following factors:

- The feasibility of irrigation water delivery in meeting crop water demands can no longer be assumed;
- Farmers grow crops requiring a flexible water delivery schedule for high productivity;
- The demand for water will increase, increasing tension in the water distribution system; and
- Distribution system managers will be expected to meet the water demands of the farmers, not of the fixed crop rotation.

Meeting these changes in a wise manner is best described as a demand for efficiency, flexibility, reliability, and timeliness in irrigation water delivery.

Water distribution efficiency in an irrigation water conveyance system is a measure of the proportion of water released into the system that is delivered to outlets for use by crops. In an upstream controlled system, operational losses are directly related to the ability of the operators to balance the flow of water in the canals in a dynamic manner based on an understanding of the dynamic response of the canal to the release of water. In a system as complex as Tadla, computationally limited techniques of regulation can only seek to maintain the system as near as possible to steady-state conditions or run the risk of severe efficiency penalties and even damage to system components. Increased ability to model dynamic operational conditions can result in safe and efficient operation of the system in a flexible manner. From the point of view of the agency operating the canal, losses incurred at the farm level are beyond the scope of their control. Field losses, however, can be minimized through on farm actions if the canal system is operated in a flexible, reliable, and timely manner; if not, field losses will increase.

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Flexibility in irrigation water distribution means that varying water demand patterns can be accommodated and that adjustments to a changing demand pattern can be made on short notice. Water demand and supply are defined at the outlet level by flow rate, duration, and time of water delivery. In the upstream controlled systems of the Tadla, flexibility is limited by the flow dynamics of the canal system, the abilities of the system controllers to understand and use these properties in system control, the ability to communicate changes in scheduled gate operations to gate operators on short notice, and the ability of system operators to anticipate flow changes in the system. Anticipation is crucial, since changes made at the head of the canal may take one or two days to reach the lower levels of the system. Information management and analysis that will allow more effective short-term planning are crucial to anticipating changing conditions and enhancing the ability to make short-notice changes in delivery schedules. Such changes are essential for implementing decisions that will result in higher system efficiencies.

The setting of a water delivery schedule in an upstream controlled system becomes a water delivery contract when this schedule is communicated to farmers. Reliability is the fulfillment of this water delivery contract in terms of flow rate and duration at the time agreed upon. Given that no consideration has been given to flow dynamics in present system operation, modeling should also result in considerable increases in reliability as flow lag times are considered in setting gate operation schedules.

Timeliness insures that flexibility and reliability do not overlook the essential fact that water arrives when the plants need it. In Tadla, distribution system capacity constraints may limit the timeliness of water under certain water demand patterns. The integration of this factor into the irrigation planning process will result in meeting crop water needs in a timely manner for higher production.

1. System Planning

The existing canal network has flow limitations as indicated by the criteria used to design the peak capacities. Changes in cropping patterns may result in water demands in excess of canal capacity at any level of the canal system. This results in constraints on flexibility, reliability, and timeliness once the cropping pattern has been set. While liberalization will result in farmer choice of crops, these flow limits still exist and need to be addressed.

Water supply limitations can also occur at a system level. In the Beni Amir subperimeter, river flows may descend below crop water demand in the most crucial period of cotton growth. In the Beni Moussa subperimeter, reservoir supplies may be limited so that the total allocation of water accorded to the ORMVAT may not be available. Pre-season planning should address both of these supply issues and balance the risk of loss of productivity from shortages with the risk of loss of productivity from limited water demand cropping patterns. With liberalization, this may involve the provision of information to farm-level decision makers as opposed to central decision making.

2. System Scheduling

In order to increase distribution efficiency and to ensure that water is distributed throughout the system, it is necessary to use arranged water deliveries, in which a schedule of gate settings is determined in advance. This schedule takes into account the flow dynamics of the system and the ability of system operators to make the necessary adjustments in distributing water released into the canal head to meet water demands. It is characteristic of this distribution method that the system is operated by the irrigation distribution agency to ensure that the gate operation schedule is followed.

The time required to develop a water delivery schedule has a significant impact on the quality of water delivery. With the present system, weather data from the previous week is being used to determine water deliveries for the following week. This lag time can result in significant changes in farmers' needs for water from the time of ordering water to the time of receiving it. Attempts to make large changes in system schedules can result in poor balancing of flows in the system, therein reducing efficiency and/or reliability. Poor predictions of water needs within the system can also have the same effects.

When changes need to be made in system flows on short notice due to canal breaks or plugging, rainfall, or changes in farmer water demand, operational losses of water will occur and/or farmers will not receive needed water at the proper time. Short-term changes in the water distribution pattern change the flows required after water has been released in the head of the system, and losses can only be minimized if the water can be used on short notice by users in another part of the system. Present scheduling techniques require that farmers notify the aiguadier. Modifications are then made and checked by the head aiguadier and subdivisionaire for their effect on main system flows. A water order is then issued and any changes in gate settings are communicated to the distribution agents. Approval of the changes depends on the subdivisionaire's evaluation of the system's ability to respond to the change. This is the reason for arranging a small water cushion in the form of system discharge to the drains.

A rapid evaluation of required system changes and hydraulic limitations will result in better decisions with less water loss and more flexible response to farmers. Decisions will not be made as much to preserve the steady flow of the system, as is the case when farmer requests not to receive water already ordered are denied, but to reduce the loss of water from the system. Measurements of the water being lost will provide incentive to avoid the distribution and billing of water to farmers who no longer need and will not use the water delivered to them. Flexible response will also minimize delays in the delivery of water to meet critical water demands for increased productivity with efficient water delivery in a timely manner.

The dynamic hydraulic characteristics of an upstream controlled water distribution system also greatly influence the quality of irrigation water delivery. Systems are most easily operated in a rigid mode, with all flows adjusted until the system achieves a steady state. Changing flow rates within the system for flexible operation with a minimal loss of efficiency requires an understanding of the lag times required for flow adjustments to proceed down the canal. If changes in flow require upstream and downstream changes to keep the flows in the system balanced, upstream changes must be made in advance of the downstream changes. In the case of flow increases, opening both gates at the same time will deprive downstream water users of water until the upstream change reaches the downstream gate. When flows are decreased,

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excess water will be spilled from the system until the upstream change travels downstream. Multiple changes result in flow patterns that are not easily assessed. Hydraulic modeling will be necessary to deal with the possible complex interactions resulting from increasing system flexibility.

C. Recommendations—How Project Interventions Address System Demands and Limitations

In the context of physical system limitations and present operating procedures, addressing demands for quality irrigation water delivery—i.e., efficiency, flexibility, reliability, and timeliness in distribution system operation—is based on the following principles.

1. Operational Policy

Changes in any major element of current operational policy requires the reformulation of operational policy and general operating criteria that system operators—ORMVAT/SGRID and/or irrigation associations—must take into account in determining detailed operational procedures. Diagnostic analysis is a basic tool for assessing existing procedures and the role of all the actors involved. Cursory evaluations based on informal interviews with some of the actors involved are an insufficient tool for system diagnosis. Involving actors from all levels in the evaluation process will result in the discovery of how the system actually works as opposed to how each actor would like the system to work. It will provide a basis from which policy changes can best be made.

Policy changes will also necessarily reflect the availability of the improved database and ability of system operators to use the information and operations analysis capabilities. GIS organization and analysis of soils, crops, groundwater, farming systems, and other possible future data will lead to policies that incorporate spatial variations in these factors, eliminating the consistent inaccuracies related to using spatially lumped data in policy formulation.

Present policies supporting rigid system operation rules and allowing for inefficiency as necessary for system operation will be changed. The ability to model system operations will lead to formulation of policies based on the dynamic capabilities of the system. Flexibility and efficiency will be balanced in a modeling environment, and short-term supply and demand predictions will be included as operational criteria.

Reduced time requirements for operational procedures, particularly water ordering and setting of the gate operation schedules, will be reflected in a policy of accommodating farmer requests on a more timely basis—i.e., a service orientation. The present system of water ordering requires excessive paperwork by the aiguadiers, who in essence take water orders, set the time and duration of water delivery for every farm, calculate the flow of water in all tertiaries, secondaries, and primaries, and, in the process, try to maintain steady flow rates in primary and secondary canals. A policy of making short-term adjustments will be possible through the use of computers.

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2. Operating Plans

Quality irrigation delivery is necessarily preceded by the preparation of the annual and seasonal operating plans. Good estimations of water supply and crop water demand derived from the cropping pattern or a set of precisely defined water allocation principles increase the feasibility of quality delivery. The development of databases in hydrology, climate, cropping patterns, and soil properties is aimed at providing information to aid the planning process. Ultimately, it is farmers who set the cropping pattern and whose informed participation in the planning process will provide the best possibility of defining a feasible cropping pattern and allocation process. These databases will also provide a valuable tool for aiding farmers in assessing their enterprise decisions and will be made accessible through the use of the presentation capabilities of the GIS system.

Database developments necessarily require efficient means of data collection and tools that make the data collected readily available for analysis. Computerized systems provide this advantage when developed, maintained, and managed by well-trained personnel. Equipment must be matched to the required tasks and training in hardware maintenance and software use included. The result will be up-to-date information bases and easily accessible decision-making information. Decision makers will then be able to integrate factors such as soil property variability or cropping pattern and farm size correlations that previously were inaccessible due to information lags and limited computational ability. The integration of these elements into the planning process is illustrated in Figure E-3.

3. Operational Procedures

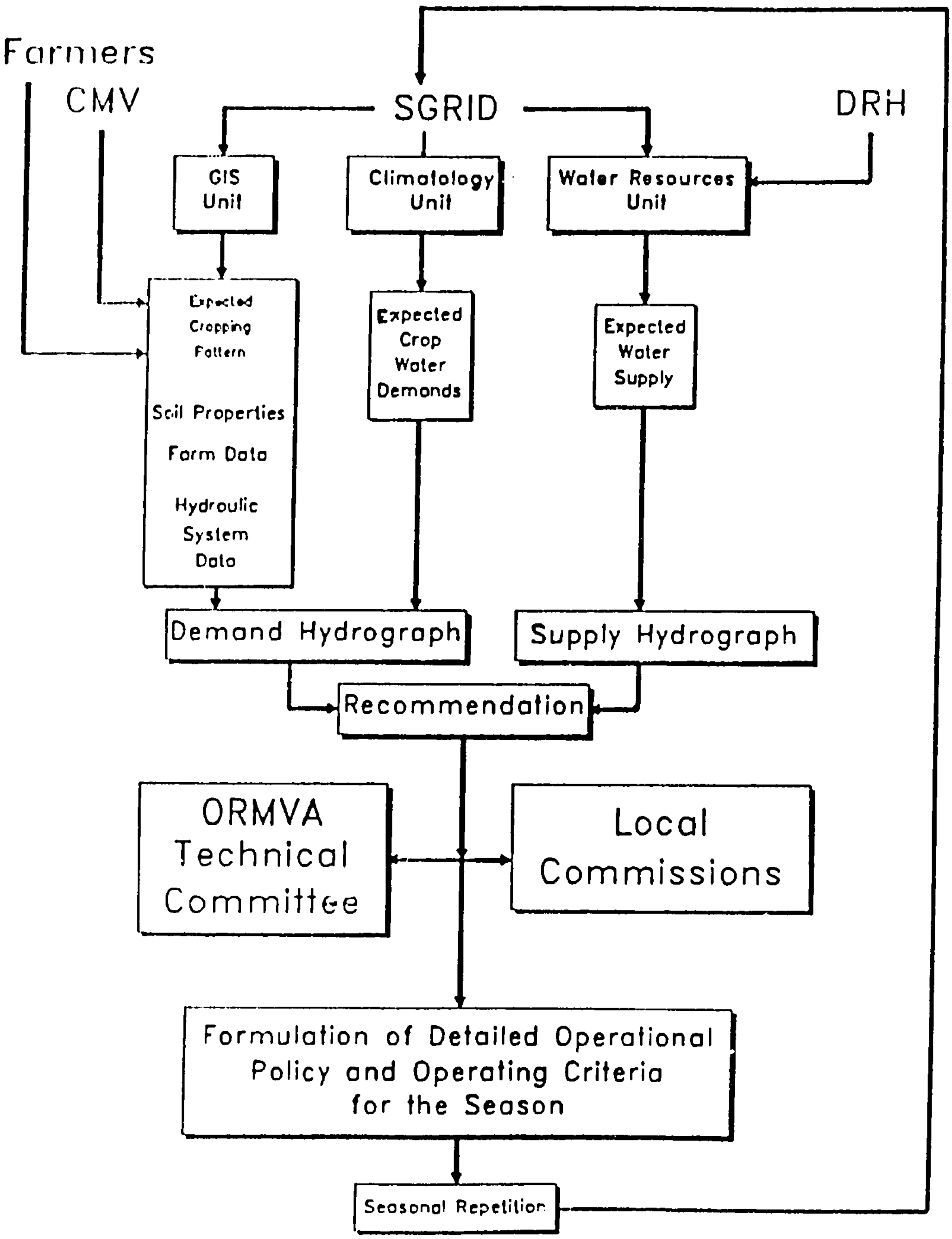
Quality operation of a system with upstream control requires the preparation of a specific set of procedures to operate the head works and the conveyance and delivery systems. This requires an understanding of the actual hydraulic happenings in the system since all control events, except accidents, are specifically caused by system operators.

Hydraulic modeling, along with field calibration of the hydraulic system, provides a feasible way of determining system operational possibilities. Procedures will no longer be defined in terms of maintaining steady-state conditions but by dynamic operation and control for maximum efficiency, flexibility, reliability, and timeliness. Operational patterns will be tested and optimized based on these quality criteria. Real-time operation of the models will result in field-tested results and higher confidence in model-based decisions.

The gate scheduling process is also a key element in defining operational procedures, especially in making the system flexible and efficient. The present system requires a large amount of repetitive paperwork by the very people who are the interface between the ORMVAT and the users of system water. Computerization of this process will increase flexibility and free the aiguadiers to monitor system operation and to communicate with farmers. A computerized system will replace the function of the MV-I and MV-II forms and

Figure E-3

The Seasonal Planning Process



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provide a simple way of generating the notices given to farmers regarding the water they will receive.

Ultimately, reliability is not measured by good intentions but by actual delivery performance. Development of procedures to monitor the actual water distribution in the system will indicate if the system is performing according to the operational plan, give feedback for improvements in gate setting procedures, and indicate needed adjustment of the water delivery schedule. Real-time measurements of the system at crucial points will make adjustments of operations to reduce losses possible on a timely basis. The operation and feedback process is illustrated in Figure E-4.

Crucial measurement points within the system, determined in discussions with ORMVAT personnel, by consideration of the network layout and by site visits, are described below and shown in Figure E-5.

Along the single principal canal in the Beni Amir system, installation of automated flow measuring structures and/or instrumentation of existing structures are recommended for five locations in the system. These locations are as follows:

- At the outlet of the siphon at Zidania. Installation of a Replogle type broad-crested weir with automated water level recorder and radio data transmitter.
- At the head of Canal Median. Installation of a Replogle type broad-crested weir with automated water level recorder and radio data transmitter.
- At the end of Canal Median where it spills into the Bir Ouargedanne drain. Installation of a sharp-crested V-notch weir in a box at the exit of the two pipe outlets of the spillway with an automated water level indicator and radio transmitter.
- At the head of offtake 23. Installation of a Replogle type broad-crested weir with an automated water level recorder connected to a data-logger and radio transmitter shared with the installation at the security siphon outflow.
- At the outflow of the security siphon just upstream of the end of the principal canal. Installation of a Replogle type broad-crested weir with an automated water level recorder connected to the data-logger and radio transmitter shared with the station on offtake 23.

Along the two principal canals of the Beni Moussa perimeter, four points of measurement are recommended to define the flows in the system. These points are as follows:

- At regulator R-1 on canal D. Installation of an automated water surface level indicator in the existing stilling well for the downstream control of the vanne mixte. This indicator should be linked to a data-logger and a radio transmitter. This installation will also require calibration of the gate by canal cross-section with a propeller meter and integration of velocity distribution just downstream of the gate. This gate is located at Station de Pompage Timoulilut.

Figure E-4

System Operation and Feedback Process

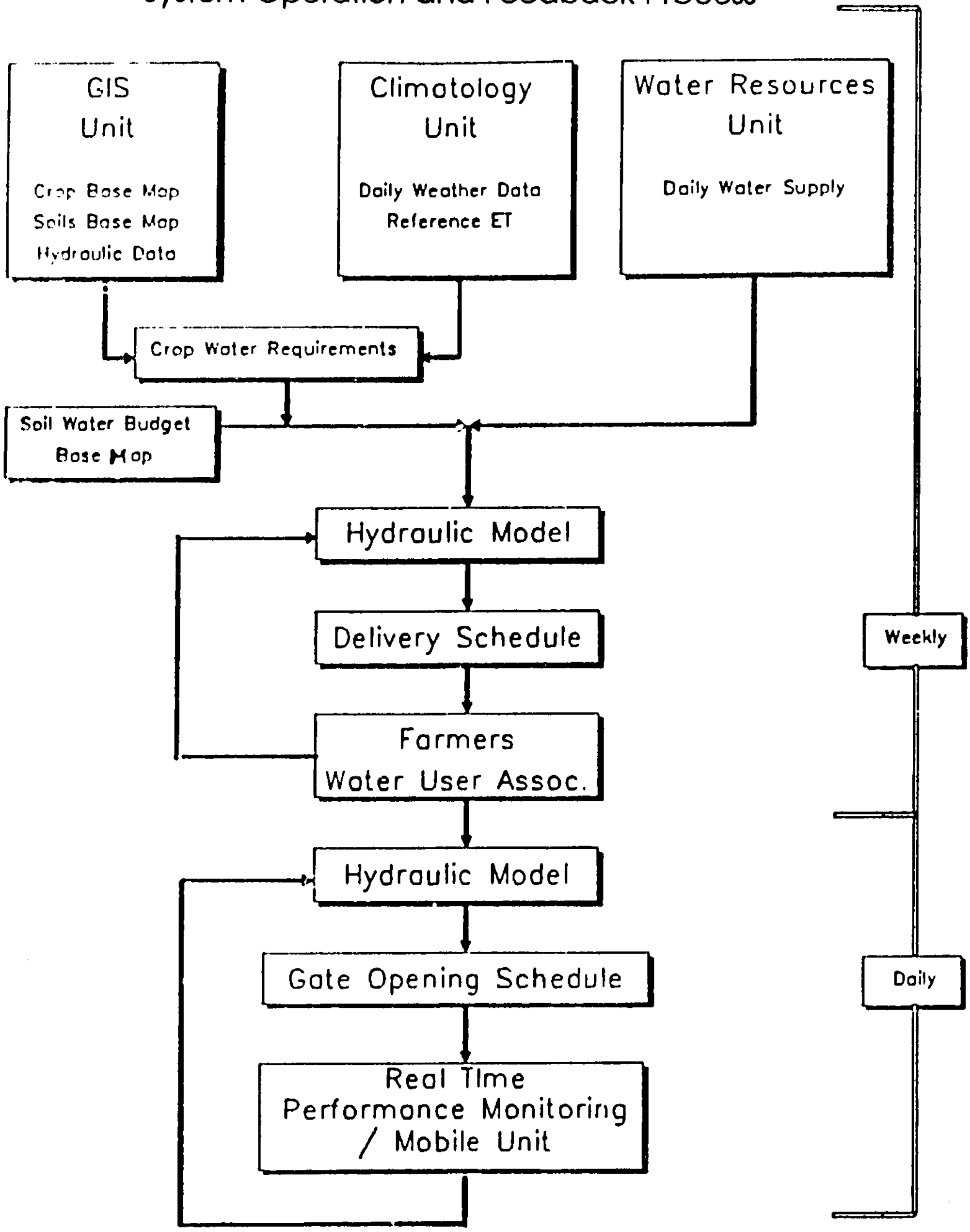
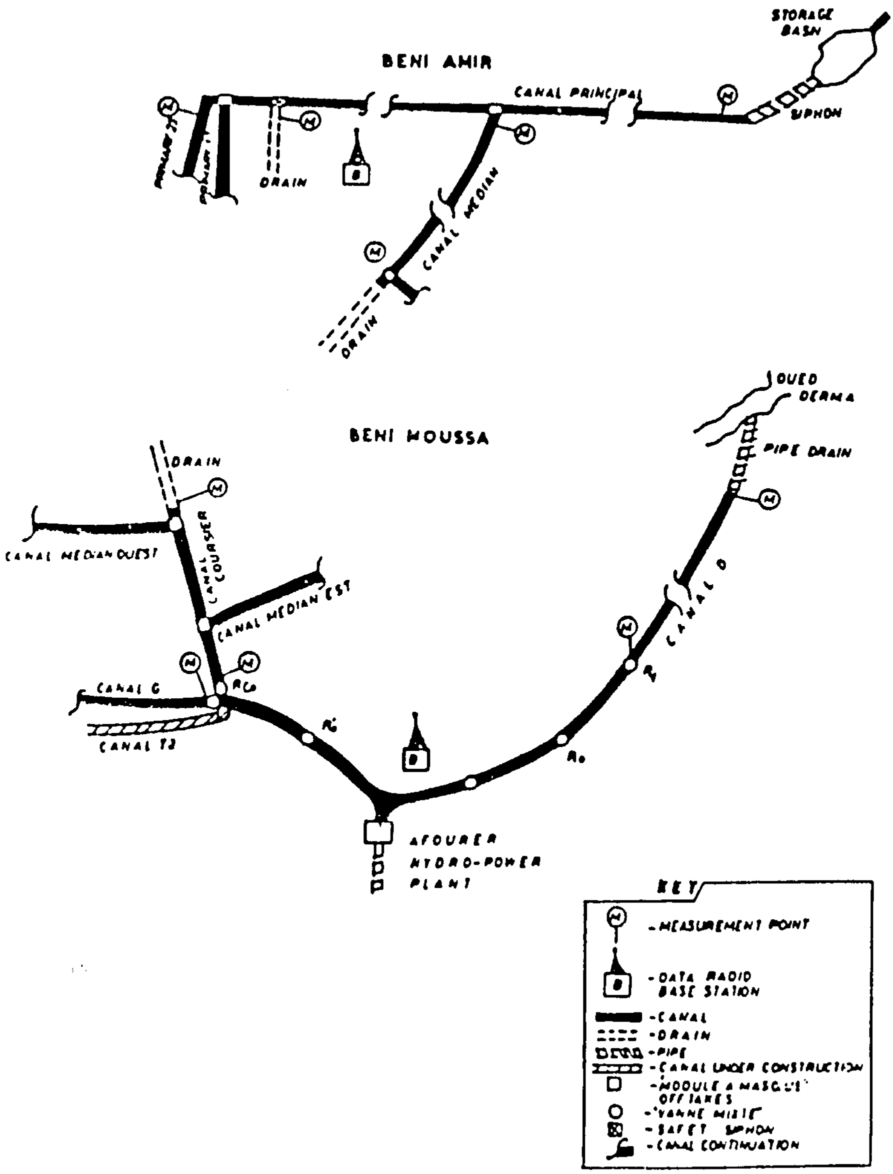


Figure E-5

Real Time Flow Measurement Points



- At the termination of canal D. A duckbill weir is being installed at this point to provide a long broad-crested weir that can be instrumented with an automated water level recorder and calibrated to provide real-time measurement of flow spilled into the Oum Er Rbia River.

- At the point along canal GM where it splits into canal G and Canal Coursier. A vanne mixte at this point that is identical to the one at location R-1 in canal D, which controls flow into canal G. Thus, this flow can be measured by installation of an automated water level recorder in the downstream stilling well and downstream calibration of the gate using canal cross-section and velocity distribution by propeller meter. This recorder will be linked to a data-logger and radio transmitter shared with the measuring system at the head of Canal Coursier.

- The head of Canal Coursier is actually two trapezoidal canals. At a point sufficiently downstream from the diversion from GM, it is recommended that a Replogle type broad-crested weir be installed in each canal with automated water level recorders linked to a data-logger and radio transmitter shared by the recorder located in canal G. At the end of Canal Coursier, where a new duckbill weir is being installed, a Replogle type broad-crested weir should be installed just downstream of this structure and instrumented with an automated water level recorder linked to a radio transmitter.

The actual system status, as evaluated by the mobile monitoring units, will provide additional truthing of the quality of irrigation distribution as evaluated by the hydraulic model coupled with the gate schedule and real-time system measurements. These units will be able to calibrate any existing structure within the irrigation network and will also measure systems flows for comparison with the real-time system status provided by the hydraulic model.

II. ELEMENT 2--ON-FARM RESOURCE MANAGEMENT AND INNOVATION

A. Introduction

Project Element 1 activities are designed to develop a comprehensive understanding of the hydraulics and hydrology of the ORMVAT irrigation system and to use this knowledge in the design and implementation of a more responsive systemwide water management system. Project Element 3 will be concerned with the environmental impacts that irrigated agriculture has had and is having on soil and water resources. And Project Element 4 will address the potential for an expanded private sector role in the Tadla perimeter.

However, the potential for innovation and development in the agricultural economy of the Tadla perimeter will not be fully realized without an intimate link with and responsiveness to the evolving situation at the farm level. The activities under Project Element 2 thus are designed to integrate all project elements at the farm level.

To bring forth a more productive and sustainable economy, the project must establish clear priorities and focus its attention on problems that have a high potential for responding to improved management. In this context, three activities are fundamental.

First, ORMVAT managers must begin to operate a water delivery system that is much more oriented to the needs of the client-farmers in the subperimeters. Second, they must start to factor in water quality and soil resource preservation considerations in their management decisions. And third, farmers as participants in the Tadla irrigation system must have a much better understanding of the technical capacities and managerial constraints of that system and their implications for farm-level enterprises and resource allocation patterns.

The key point is that neither ORMVAT managers nor client-farmers will be able to make efficient resource allocation decisions without first having comprehensive and reliable information on the workings of the whole perimeter system and, second, having a structured and continuous dialogue on system operations in the context of a common and accurate base of knowledge.

The four activities under Project Element 2 are designed first to find out what is presently occurring at the farm level in the ORMVAT in terms of the owner/manager/household decision-making process(es) for selecting and managing crop, livestock, and off-farm enterprises, allocating available resources—e.g., land, labor, capital, and managerial expertise—to these enterprises to attain household objectives, and selecting which techniques to adopt and which inputs to purchase over time. Second, the activities are intended to help local decision makers assess what is technically, financially, economically, environmentally, and socially possible in the future.

Detailed farm-level knowledge is critical to the dialogue process. This is so because even brief tours through the subperimeters leave one with two strong impressions. The first is that the actual farming practices, crop rotations, and resource allocation patterns bear little or no resemblance to the almost Cartesian precision of the crop rotations anticipated when the ORMVAT irrigation systems were designed. The second is that the farming systems are quite heterogeneous both between the subperimeters and within each of them. This means that one cannot talk about or relate to farm households in Tadla as if they were one homogeneous population. One must define the interests, motivations, and capacities of each subpopulation before accurate assessments can be made of future potentials.

For all of the discussion in the Moroccan irrigation literature about the benefits of the Trame A and Trame B irrigation systems—or variants thereof—it seems evident that farmers, at least on the Tadla perimeter, have succeeded in modifying the original rigid engineering approach to irrigation to meet their own technical and socio-economic objectives and resource constraints. Recognition of this basic fact is central to being able to design successful interventions at the system and farm levels in Tadla. It is also clear that the managers at the ORMVAT, while possessing much factual information about the perimeter, have less than adequate knowledge of the motivations and objectives of the farm households in the perimeter or of the probable directions agricultural enterprises will take under conditions of a more liberal and market-oriented economy.

On one level, farm management information will be important to the development of the systemwide hydraulic management model, because it will determine if and how the system can be operated to respond more adequately to changing demands of the water users. Since farm enterprises have evolved considerably since the Tadla system was originally designed and constructed, the ORMVAT needs to know how these enterprises are currently constituted, how they actually function as decision-making units, what farmers perceive as their scarce resource(s) and the constraints they face, and, finally, what they see as their prospects for the future in the changing economic environment.

In sum, the managers at the ORMVAT need to know their clients much more intimately than they do now if they are to be successful in discharging the more focused water delivery management and soil/water resource stewardship mandate that they will have in the medium-term.

In addition to addressing the immediate informational requirements of the ORMVAT, Element 2 will also actively seek to broaden the knowledge base of the farm community as to what is technically possible and economically feasible within the Tadla perimeter. This element would address the reverse of the problem described above—i.e., it would instruct farmers as to the technical constraints imposed upon their farming operations by the physical and managerial realities inherent in the Tadla hydraulic system as designed. The objective would be to present farmers with practical information as to how far they can stretch the capabilities of the Tadla irrigation system in their attempts to better adapt their farm enterprises to new market forces, the central premise being that successful farmers as entrepreneurs need increasingly detailed and precise information on all aspects of the economic environment in which they must operate if they are to make sound resource allocation decisions.

At a third level of interaction, it is envisaged that the results from the activities under Element 2 would be regularly and broadly disseminated through local cooperatives, professional organizations, and private sector input suppliers and output buyers. Moreover, the anticipated pilot field interventions, wherever feasible, will be designed, jointly funded, executed, and evaluated in collaboration with private sector input suppliers and firms promoting development of specialized cropping systems.

Element 2, therefore, will consist of four principal activities:

- Developing an accurate and current inventory and typology of all farm enterprises in the Tadla perimeter and conducting an intensive diagnostic study of a representative sample of those farm enterprises (200 to 300 farms) over, at least, two full cropping cycles—i.e., winter and summer crop rotations over a two-year period.

- Using the intensive diagnostic studies and other sources to identify critical constraints in farm-level resource allocations and to identify and test pilot interventions at the farm and ORMVAT levels to alleviate these constraints. Results of these pilot interventions at the farm level will be disseminated to farmers, ORMVAT personnel, cooperatives, professional organizations, and private sector firms.

- Assisting the newly created Agro-Economic Monitoring and Evaluation Studies Service at the ORMVAT to develop a permanent local capacity follow-up on the two-year intensive diagnostic study and to collect and analyze relevant, high quality information on different types of farm households and their operations in the perimeter over time.

- Supporting a series of assessments of special topics of mutual interest to USAID, the ORMVAT, and/or other participants in the project. These assessments could include studies of particular agricultural and irrigation policy issues, detailed appraisals of discrete crop production/harvesting/processing/marketing chains (i.e., filieres) assessments of farmers' attitudes toward particular types of innovation, and so on.

With respect to the first activity, ORMVAT staff have already amassed a considerable amount of inventory information on the types and distributions of farm enterprises in the Tadla perimeter. The design team has reviewed this information and proposed an initial farm typology for consideration. After detailed review and updating of these inputs and other information, a farm enterprise typology would be developed and used to draw a representative sample of farms to be studied in detail under the intensive diagnostic study. This activity would be completed in the first six months of Project Year 1.

The intensive diagnostic study will be conducted during the first two full agricultural years after the start of the project. Specifically, the study period would be from the start of the first winter crop season in Project Year 2 to the end of the second summer crop season in Project Year 3. The study would be designed in such a way that data collected could be fully processed and analyzed on a season by season basis. Data collected during the first full agricultural year of the project would also constitute a baseline information file to be used by the project monitoring and evaluation unit at subsequent points in the project to assess any changes quantitatively in economic activities at the farm level.

The function of the intensive diagnostic study, as noted above, would be to serve as a factual basis for identifying farm-level constraints in resource allocation and specifying pilot interventions to be tested and evaluated to alleviate the constraints over the life of the project. Given the paucity of detailed farm enterprise data from the Tadla perimeter at present, it is impossible to specify and in detail what constraints farmers see as impinging upon their resource allocation decisions or what specific pilot interventions might best address their needs in the medium-term.

From the outsider's perspective, it would appear that farmers might face significant constraints on their supply responsiveness and resource allocation in the following areas:

- The trade-offs between providing for the subsistence requirements of the extended farm household and being fully responsive to commercial opportunities and market forces;

- Problems posed by the increasing fractionalization of landholdings within the perimeter and the potential divorce of the ownership and management functions in resource allocations;

- Problems involved in matching water deliveries from the system level with crop requirements and efficient water use at the farm enterprise level;

- Inadequate knowledge of crop production techniques and potential on the one hand and real market possibilities on the other;

- Financial constraints on reorientation of the farm enterprise in the face of new opportunities; and

- Labor constraints with respect to producing, harvesting, and marketing higher value crops.

A series of pilot interventions at the farm level will be designed and implemented on the basis of information available after the first year of the intensive diagnostic study is completed. The interventions in Project Years 2 and 3 are expected to focus primarily on making more efficient the fundamental water/soil relationships at the level of the farmers' fields and on demonstrating more efficient conjunctive use of groundwater and water from the gravity system. Other pilot demonstrations will be designed and implemented as more detailed information on farm-level constraints becomes available in the second year of the intensive diagnostic study and, subsequently, from the permanent ORMVAT Agro-Economic Studies Service.

In all activities, information generated and recommendations advanced will be thoroughly discussed and debated at a series of annual workshops. Participation in these workshops will be open to all interested parties, including ORMVAT personnel; representatives of farmer groups, cooperatives, and professional organizations; and private sector input suppliers and output buyers. In addition, the project will work closely with extension agents, professional organizations, and other interested parties to develop and disseminate both orally and in written form summaries of the information collected with detailed recommendations as appropriate. Field days will be organized for relevant farmer and other groups to visit pilot demonstration sites and discuss with project staff and participating farmers how new interventions could be adopted. This process of dialogue and dissemination will start immediately after Element 2 has generated useful information and recommendations and will continue throughout the project.

B. Preliminary Farm Typology for the Intensive Diagnostic Study Sample Frame

After several field trips and review of the existing literature, the design team proposes consideration of the following farm typology when the intensive diagnostic study sample frame is drawn. The team thinks that the critical variables that define the ORMVAT farm population for the purposes of the study are as follows:

1. Farm size in arable hectares
2. Type of land tenure
3. Type of access to gravity system irrigation water
4. Capacity of use of groundwater for irrigation
5. Importance of livestock enterprises in the farming system

Within these variables, the team has attempted to identify the key points of functional distinction between different farming systems in the perimeter as follows:

1. Farm Size in Arable Hectares

   a. 0 to 3 arable hectares
   b. 3 to 20 arable hectares
   c. Greater than 20 arable hectares

2. Type of Land Tenure

   a. Private tenure—Melk
   b. Collective land
   c. Private state land—domaine prive de l'etat—i.e., state farms and parastatal companies
   d. Land allotted to cooperatives under agrarian reform regulations

3. Type of Access to Gravity System Irrigation Water

   a. Priority access by contractual arrangement
   b. Normal access—i.e., farms well situated in the perimeter with respect to outlet canals
   c. Restricted access—i.e., farms poorly situated in the perimeter
   d. No access to gravity system irrigation water

4. Capacity of Use of Groundwater for Irrigation

   a. Wells fewer than 20 meters in depth with good water
   b. Wells fewer than 20 meters in depth with saline water
   c. Wells fewer than 20 meters in depth in areas with drainage problems
   d. Wells greater than 20 meters in depth
   e. No access to groundwater

5. Importance of Livestock Enterprises in the Farming System

   a. High—i.e., farms with intensive dairy or livestock fattening enterprises and regular commercial sales
   b. Low—i.e., farms with traditional, subsistence livestock enterprises and occasional commercial sales
   c. None—i.e., farms with no livestock enterprises

C. Cropping Strategies in the Tadla Perimeter

1. Cropping Percentages in the Tadla Perimeter

Cropping percentage refers to the ratio of area of crops grown to the total area available. In the case of the ORMVAT perimeter, where the climate is Mediterranean and where "area available" refers to irrigated land, it would be expected that the cropping percentage would be well above 100 percent. This is because the Tadla perimeter is climatically a winter crop production region. But with irrigation, summer cropping is also possible. Cropping percentage is a measure of the intensity of rotations. Theoretically, a cropping percentage of 200 percent could be achieved by growing both a winter annual crop and a summer annual crop on every parcel of land.

A major problem for intensive rotations on the perimeter is the excessive amount of time during which some crops occupy land. Cotton and paprika peppers are both nine-month crops at Tadla. Consequently, they seriously infringe on planting schedules for winter crops. The sugar beet harvest continues well into July. Only 20 percent of the land used for sugar beets is subsequently planted to a summer crop. The introduction of a short season summer crop that could follow sugar beets would have an immediate positive impact on cropping percentage. During the past several years, there has been an inconclusive effort to use soybeans in this role.

The key crops for calculating cropping percentage are the annual crops, since a perennial crop will always have a cropping percentage of exactly 100 percent unless it is increased by intercropping. When only annual crops are included in the calculation, the cropping percentage reached 146 percent in 1990 (see Table E-1). Given the constraints, this has to be considered a good performance. It indicates that farmers are aggressively managing their resources. It also indicates that perimeter farmers will be quick to exploit opportunities that are presented by the removal of constraints on their performance.

2. Cropping Patterns in the ORMVAT Perimeter

The GOM has liberalized its policy on mandated cropping, thus putting an official end to the Trame A and Trame B cropping patterns. It is anticipated that this policy change will result in a move by farmers to more profitable crops. This judgment is based on the fact that, while these plans had already undergone extensive modification at the farm level, the fundamental idea of mandating the production of specific crops had been kept in force by means of water allocation policies. Table E-2 summarizes the resulting cropping patterns as they currently exist on the ORMVAT perimeter.

Most attention relative to the effect of liberalization on perimeter cropping patterns centers on the possible negative impacts liberalization might have on the areas planted to the two major government-mandated industrial crops, sugar beets and cotton. While this effect is important, government policies limiting the areas planted to perennial crops -- i.e., olives and citrus -- have also been an important factor in shaping cropping patterns in the perimeter. Based on the high number of applications for permission to plant olives and citrus, it is expected that liberalization will result in a shift to these crops. It is also expected that the area planted to alfalfa will increase as a result of liberalization. Alfalfa is a high priority perennial crop that has significant potential for improved yields. Current yields vary from 4 to 13 tons of dry matter per hectare. Potential yields are about 20 tons of dry matter per hectare (Ameziane et al., 1978; Baya, 1989).

Table E-1
Cropping Percentages for the ORMVAT Perimeter
(in thousands of hectares)

	1988	1989	1990
Total Area Irrigated	97.8	97.8	97.8
Total Area of Crops Produced	123.7	128.2	128.2
Cropping Percentage	126%	131%	131%
Total Area Irrigated for Annual Crops	68.4	67.2	66.3
Total Area of Annual Crops Produced	94.3	97.6	96.7
Cropping Percentage for Annual Crops	138%	145%	146%

Note: Data provided by the Service de la Production Agricole (SPA) (ORMVAT, 1991)

These possible changes in the patterns of perennial cropping have important implications for more efficient water use. The only significant use of high efficiency, individualized irrigation systems in Tadla is in citrus production. Alfalfa is the field crop most adapted to improved gravity irrigation methods.

Annual cropping patterns are best analyzed on the basis of season -- i.e., as summer annual crops and winter annual crops. Since all annual rainfall comes during the mild winter in Tadla, traditionally it had only a winter cropping season, which is characteristic of agriculture in a Mediterranean climate. A comparison of Table E-3 with Table E-4 shows that, decades after the introduction of irrigation, winter cropping is still strongly dominant. On average, during the past three cropping seasons, about four times as much land has been planted in major winter crops as in major summer crops. With irrigation, the summer growing season is superior to the winter growing season in a Mediterranean climate. The fact that the winter growing season has remained dominant at Tadla is an indicator of the effect of the constraints imposed on farmers by mandated farming and restricted availability of irrigation water during the summer growing season.

A further comparison of Tables E-3 and E-4 shows a high level of stability in the cropping patterns of the major winter crops; hard and soft wheats and sugar beets. But there is not any apparent stability in the cropping patterns of the major summer crops; cotton is falling, paprika peppers are increasing rapidly, and the area devoted to lesser crops is fluctuating annually. Both the potential, on a per unit area basis, and the problems of the summer growing season are greater than those of the winter growing season. Consequently, the cropping patterns of the summer growing season are less stable than those of the winter growing season.

Table E-2
Cropping Patterns in the ORMVAT Perimeter

Crop	Area in Thousands of Hectares			Percent Change	
	1988	1989	1990	1989	1990
Annual					
Cereals	46.9	45.4	47.5	- 3.2	+ 4.4
Sugar Beets	19.4	19.6	19.4	+ 1.0	- 1.0
Forages	6.3	8.5	7.1	+ 34.9	- 16.5
Vegetables	9.8	11.2	11.2	+ 15.3	- 1.0
Cotton	11.9	11.5	11.5	- 3.0	0.0
Subtotal	94.3	97.6	96.7	+ 3.5	- 1.0
Perennial					
Alfalfa	10.3	10.3	10.9	0	+ 5.8
Citrus	6.8	6.9	7.0	+ 1.5	+ 1.4
Olives	11.5	12.6	12.8	+ 8.7	+ 1.6
Other Fruit	0.4	0.4	0.4	0	0
Roses	0.4	0.4	0.4	0	0
Subtotal	29.4	30.6	31.5	+ 3.9	+ 2.9
Total	123.7	128.2	128.2	+ 3.5	0

Note: Data provided by the Service de la Production Agricole (SPA) (ORMVAT, 1991)

The winter growing season has unexploited potential for improved efficiency and economic return. In fact, Ameziane et al (1976) saw wheat as "la culture pratiquee dans le perimetre la plus susceptible de voir augmenter ses rendements." The recommendations for use of supplemental irrigation and fertilizer practices are as valid now as they were in 1976. Karama (1985) achieved more than a 50 percent improvement in wheat yields by means of proper timing of supplemental irrigation.

One further comparison between winter annual crop production and summer annual crop production is that the total number of hectares in winter crops has remained stable during the past three years. But the number of hectares in summer annual crops has shown significant increases. It is important to note that this represents an absolute increase in the number of hectares farmed per year -- and thus an improvement in cropping percentage -- and not an increase in hectares devoted to summer annuals at the expense of hectares devoted to winter annuals--or for that matter, in the number of hectares devoted to perennial crops. Apparently, the increase in the number of wells during the past decade and the reduced emphasis on mandated cropping are already leading to increased exploitation of the highly favorable summer growing season.

In the context of summer annual crops, the recent history of cotton and paprika pepper production is the most interesting. Since data for these two crops is available for 1991, it is included in Table E-4. The data substantiate the view that of the two mandated industrial crops--sugar beets and cotton—cotton is the most vulnerable to the consequences of liberalization. Cotton is outside the purview of this project, but brief mention will be made here of the two most obvious sources of the vulnerability of its status as a major crop in the Tadla. First and foremost, cotton production in the perimeter is poorly executed. Second, cotton is probably going to face stiff competition from higher value summer crops, with paprika peppers giving the first solid evidence of this trend.

A decline in hectares devoted to cotton is not new. A similar phenomenon occurred in the late 1960s and again in the late 1970s and early 1980s. In each of those instances, cotton production recovered the hectares it had temporarily lost. This recovery may happen again, but there have been some major changes in the intervening years. Specifically, there has been liberalization and the accompanying probability that there is going to be serious, sustained competition from higher value horticultural crops, as evidenced by the fact that the private sector has made a significant investment in dehydrator plants in the Tadla region.

In order for their potential to be fully exploited, the new dehydrators will need a steady supply of appropriate agricultural commodities. Tomatoes, another summer crop, would be a likely candidate. Steps are now being taken by the private sector to establish a research program that will identify crops and varieties that are promising relative to maximizing the return on the investment in dehydrators. Winter crops will also be needed for the dehydrators, but the first point of impact for expanded production of higher value crops will be on summer annuals.

Table E-4 summarizes the very rapid expansion of paprika pepper production during the past four years. Apparently, Tadla has benefited from an improvement in its competitive position relative to Spain, which has been a major paprika pepper producer. A significant amount of the current crop is being trucked to Spain for processing. On the negative side, only about half of the paprika pepper production in Tadla in 1991 is being grown under forward-contracting arrangements, and the demand for agricultural commodities such as paprika pepper is notoriously volatile.

Current trends in summer annual crop production favor improved irrigation efficiency. The general trend to increased summer crop production, despite a limited supply of irrigation water, will necessitate more efficient use of available water. Crops such as paprika peppers and tomatoes are well adapted to efficient, individualized irrigation methods.

Table E-3
Evolution of Cropping Patterns
for Selected Major Winter Annual Crops
in the ORMVAT Perimeter

Crop	Area in Thousands of Hectares			Percent Change	
	1988	1989	1990	1989	1990
Soft Wheat	38.4	36.8	37.6	- 4.2	+ 2.2
Hard Wheat	6.9	6.9	7.2	0	+ 4.3
Sugar Beets	19.4	19.6	19.4	+ 1.0	- 1.0
Berseem Clover	1.4	1.3	1.5	- 7.1	+ 15.4
Forage Barley	4.5	6.5	5.1	+ 44.4	- 21.5
Potatoes	1.9	1.5	1.4	- 21.1	- 6.7
Onions	2.1	2.1	2.1	0	0
Total	74.6	74.7	73.3	+ 0.1	- 1.9

Note: Data provided by Service de la Production Agricole (SPA) (ORMVAT, 1991)

Table E-4
Evolution of Cropping Patterns
for Selected Major Summer Annual Crops
in the ORMVAT Perimeter

Crop	Area in Thousands of Hectares			Percent Change	
	1988	1989	1990	1989	1990
Cotton	11.9	12.8	11.5	+ 8.0	- 10.2
Maize (Grain)	2.1	1.7	2.7	- 19.0	+ 58.8
Maize (Forage)	0	0	2.8	0	---
Paprika Peppers	0.4	1.5	2.9	+ 275	+ 93.3
Sesame	0.5	0.9	0.6	+ 80.0	- 33.3
Beans	1.3	1.9	1.2	+ 46.1	- 36.8
Total	14.2	18.8	21.7	+ 32.4	+ 15.4

Note: Cotton area in 1991 was 7,400 hectares, down by 35.7 percent from 1990; paprika pepper area was 6,800 hectares, up 134 percent. Data provided by the Service de la Production Agricole (SPA) (ORMVAT, 1991)

D. Water Management Strategies

1. Crop Water Sources in the Tadla Perimeter

Rainfall, canal water, and groundwater are the three sources of water available for cropping in Tadla. The fact that all of the 350 millimeters of annual rainfall comes during the winter ensures that winter cropping will be more extensive than summer cropping, whose expansion is constrained primarily by an inadequate water supply. Improvement in the responsiveness of the canal water delivery system will reduce losses resulting from inconvenient scheduling and allow for an increased emphasis on timeliness in irrigation applications.

Wells, as the comparatively new water source in the perimeter, are not as yet either understood or exploited as an alternative source of water. The number of wells tapping the shallow perched groundwater under the perimeter doubled to 9,220 during the last decade. In most cases, these wells are a source of flexibility and security for irrigated farming. In other cases, this shallow aquifer is an immediate threat to some soils and may be a long-term threat to others. This problem will be the direct concern of Project Element 3.

The cost of well water is a function of pumping cost and is calculated to be about three times the cost of canal water. Pumping systems used for wells are often inefficient. The cost of well water would be reduced by using more efficient pumps to lift it. Efficient pumping is an important factor for drainage on some land. Project Element 2 will include testing of drainage pumps.

2. Application of Irrigation Water in the ORMVAT Perimeter

The presence of the robta irrigation method and the lack of land leveling, field maintenance, and efficient gravity irrigation have been a recurring matter of concern for decades in Tadla. Robta is a system that virtually eliminates the need for an ongoing process of field maintenance and leveling. It accomplishes this at a cost in water-use efficiency by using a series of header ditches for a given field, thus reducing the length of each run. While robta is a traditional system, its use is not limited to traditional farms. The system was observed as the primary method of gravity irrigation on large, well-financed, high-tech farms, both in and off the Tadla perimeter.

Robta is criticized because using a series of header ditches wastes both land and water. Yet, given the constraints farmers face, robta at its best may be a better application system than the syphon method.

If robta is going to be replaced by more efficient methods of gravity irrigation, the latter process will have to be considered carefully. A possible point of departure would be the use of level ground borders and checks for alfalfa production. Given the fact that alfalfa is a perennial crop, once leveled, the grade of the field would not be disturbed by field operations. Since this method is only efficient if large quantities of water are applied quickly, well water could be combined with canal water to cover the field in the shortest possible time. When this method was described to officials in the extension service, it was stated that there are already farmers in the perimeter who are using this method on alfalfa.

Timeliness of water application is another area that should have a high potential for improvement. Irrigation applied at the right stage of crop development can have a high rate of return. This concept is not very important for summer cropping, where a regular cycle of irrigations is necessary to keep a crop alive and growing. But it is very important in the context of supplemental irrigation of winter crops. As illustrated by Tables E-5 and E-6, a strategic irrigation or two at critical stages in crop development can have a major impact on wheat yields.

The responsiveness of the canal delivery system to requests for water is of obvious importance to timeliness in water application. If canal water is not available at a particularly critical stage of crop development, the economic return to an irrigation might justify the use of well water.

Improvements in water-use efficiency could be realized by the use of individualized irrigation systems. These are expensive, comparatively high technology solutions, but they can save a lot of water and are better adapted to the production of many high value horticultural crops. They are used mainly on citrus in Tadla, but if inadequate water supplies become a major constraint to the expansion of high value summer annual horticultural crops, these systems may be accepted on a much wider scale. Given the requirements of these systems, wells would be a much more practical source of water for their use than the canal system.

E. Agricultural Chemical Strategies

There exists a growing awareness in Morocco of the adverse environmental impacts that can result from intensive irrigated agriculture. Pesticide use on cotton and fertilizer use on sugar beets are invariably the problem areas that are mentioned relative to the ORMVAT perimeter. These crops are focused upon partly because the concern is justified and partly because only very limited information and controls on chemical use on other crops are available.

One of the first project activities will be an attempt to inventory and describe chemical use in the perimeter as a means for setting priorities in this area. Efficient, economic, and responsible fertilizer and pesticide use will be a part of all recommended production packages (see below). The broader issues of safety and pollution will be addressed by Project Element 3.

Table E-5
Effect of Water Regimes on 1985 Soft Wheat Grain and Straw Yields
(in tons of dry matter per hectare in the ORMVAT perimeter)

Crop Yield/ Treatment	R1	R2	R3	R4
Grain	2.0	4.1	4.4	5.9
Straw	2.9	4.7	5.0	6.5

Source: Karama (1985, draft)

Notes: R1 = Precipitation only: 215.4 millimeters; R2 = one irrigation: flowering; R3 = two irrigations: flowering and grain filling; R4 = control. No water stress is involved. Four irrigations take place: tillering, stem elongation, flowering, and grain filling.

Table E-6
Effect of Date of Irrigation on Wheat Grain Yield

Type	Plant Growth Stage					Yield in Tons/ Hectare	Percent Change
	ET	TE	EH	HF	FM		
0						1.3	0
1	55	55				2.1	62.2
2		55	55			2.4	92.1
3			55	55		3.3	158.8
4				55	55	2.1	68.5
5		110				2.1	62.3
6			110			2.4	8.6
7				110		2.1	6.5
8					110	1.7	3.4

Note: Based on the Marrakech region. In a simulation, 1973 climatic data were used. Rainfall for 1973 corresponded to median precipitation (Ben LHamdani, 1991).

F. The Development and Promotion of Production Packages

It is anticipated that farm-level improvement in the efficient use of water and other inputs will contribute to the overall economic benefits of this project. The potential for a positive impact is obviously present on the farms of the ORMVAT perimeter. A more responsive canal delivery system and the integration of well water into cropping programs will be the basic elements of production packages within the context of this project. For winter crops, the emphasis will be on the extensive application of timely supplemental irrigation. For summer crops, the emphasis will be on highly efficient irrigation of high value crops. A perennial crop alfalfa--will probably be used to initiate a first step toward improved gravity irrigation in the perimeter. Other crops that are likely to be a part of production packages are wheat, paprika peppers, and other vegetables.

The long periods of time required to test and demonstrate improved production technology is the most important problem to be overcome if proposed innovations are going to have a significant impact during the life of the project. Testing of innovations that are essentially new or that appear particularly promising will start in Project Year 2. Testing will be done on farms to give farmers the opportunity to evaluate a given technology long before it is officially recommended or rejected.

To the extent possible, testing will be done in cooperation with agribusinesses that have commercial interests in Tadla. This would allow for the promotion of a given technology and required services, inputs, and equipment by the private sector long before a formal recommendation would be promulgated as a result of project activities.

III. ELEMENT 3--ENVIRONMENTAL MONITORING AND MITIGATION

A. Introduction

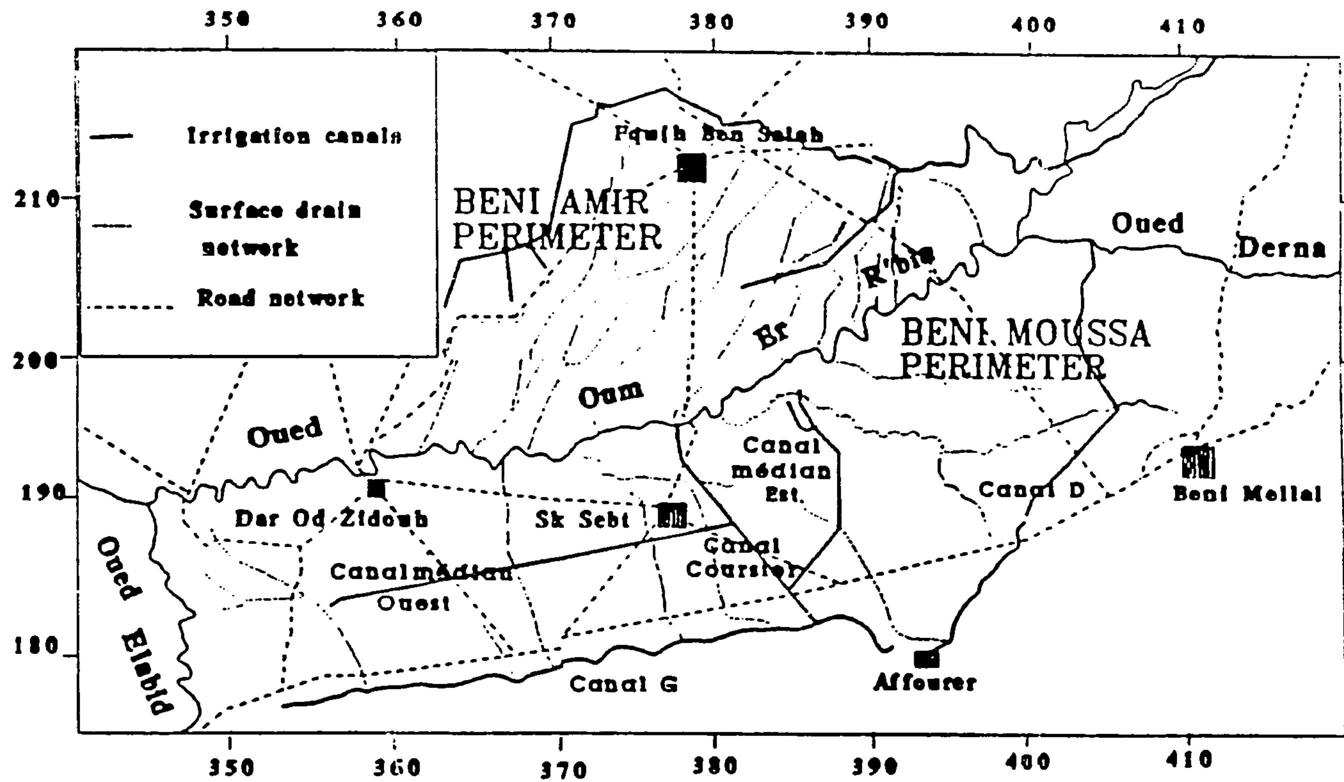
The Tadla irrigation perimeter is one of the largest and oldest of the modern large irrigation schemes of Morocco. As illustrated in Figure E-6, it is composed of two relatively hydraulically independent subperimeters:

- The Beni Amir subperimeter on the right bank of the main river, with a total irrigated area of 27,500 hectares, whose water is diverted from the Kasba Tadla diversion dam upstream of the perimeter on the Oum Er Rbia River; and

- The Beni Moussa subperimeter on the left bank, with an irrigated area of 69,500 hectares, whose water is diverted from the large dam of Bin El Ouidane on Oued El Abid. An additional 5,000 hectares are irrigated in small and medium-scale perimeters, and 12,000 hectares are irrigated using groundwater.

22b

Tadla Perimeter infrastructure



Source: Debbarh et al, (1991)

Figure F-6

Irrigation development in the Tadla area has enhanced the agricultural productivity and diversification of the cropping systems. This has been accomplished through the intensification of the farming activities and the heavy use of fertilizers and pesticides, especially on the "industrial" crops—i.e., cotton and sugar beets—and vegetables. Intensive agro-industry activities have accompanied this agricultural development. These agro-economic developments have also directly affected the growth of a large urban center in the area (see Figure E-6). Those changes can be classified as direct benefits of the Tadla irrigation perimeter in achieving the overall goals of increasing food production, income generation, and employment. Accompanying these beneficial changes have been many adverse effects whose impacts might be of significant importance in the long run, if not addressed appropriately.

The observed environmental impacts discussed in this section are classified into three categories: groundwater and drainage system management, soil modification and water quality, and agrochemical storage, use, and disposal. The first two categories are related to the direct environmental impacts at the irrigated perimeter level; the last category falls into environmental impacts of regional significance.

B. Groundwater and Drainage System Management

Prior to the start of irrigation in the Beni Amir perimeter in 1938, the water table depth varied between 50 meters at upstream locations and 15 meters at downstream sites. Water leakage through the earth distribution canals network in conjunction with excess irrigation water uses has resulted in a significant water table rise since 1974. The southwest part of the perimeter has been severely damaged by surface waterlogging problems. The construction of a surface drainage system between 1950 and 1960 helped to reduce this effect, but has not eliminated it, as shown by Table E-7.

This situation has also been improved by the rehabilitation of the main irrigation transport canals--e.g., use of cement instead of earth—started in 1973. The construction of approximately 145 kilometers of surface drains between 1975 and 1979 has enabled better control of the water table below 1 meter over the major part of the perimeter and has completely eliminated surface waterlogging over 1,990 hectares.

In the Beni Moussa perimeter, the water table fluctuation varies from the eastern to the western parts of the area separated primarily by the main central canal—Canal Coursier. In the eastern part, following the introduction of irrigation in 1954, the water table began to rise at a very rapid rate—2 to 3 meters a year—and reached the soil surface in many areas.

It is also worthwhile mentioning that prior to irrigation, waterlogging problems were already known in the area. Many of the waterlogging effects have been solved by the construction of secondary and main drainage outlets and ditches to strengthen the existing

Table E-7
Evolution of the Area Affected by Waterlogging, 1950-69

Year	Month of Observation	Location of Water Table Level	
		0-1 meter	1-2 meters
1950	January	3,170 hectares	11,070 hectares
1955	October	6,950 hectares	16,870 hectares
1957	April	7,030 hectares	18,020 hectares
1963	September	1,540 hectares	14,880 hectares
1969	February	3,200 hectares	19,000 hectares

Source: The ORMVAT, 1980.

natural drains of the Oueds Day, Takerzouzt, and El Arich. In addition, a series of eight pumping stations has been installed in the critical areas of El Arich and Sidi Jabeur, whose transmissivity characteristics are very high—well discharges at these sites vary from 100 to 250 liters per second. As a result of this organized pumping activity, combined with the construction of 4 kilometers of surface drains, the rise of the water table level was slowed between 1975 and 1980.

In the west Beni Moussa subperimeter, waterlogging problems occurred mainly in the sector of Oulad Zidouh where the water table level was less than 5 meters prior to irrigation. In the absence of a drainage network, the water table began to rise continuously beginning in 1970. Surface drainage works have since been implemented over approximately 1,900 hectares. Table C-8 shows that even with the construction of this drainage system, the situation did not improve, and the potential waterlogging area has increased from 3,763 hectares in 1976 to 3,940 hectares in 1979—i.e., the area where the water table is located between 0 and 1 meter below the soil surface.

The maximum area with potential waterlogging problems in 1990 was approximately 20,000 hectares—13,000 with the water table located at 1.5 meters below soil surface and 7,000 hectares between 1.5 and 2.0 meters. This situation improved significantly during the 1979-84 drought years (see Figures E-7 to E-10), due to the combined effects of drought and the pumping of water from the aquifer by the growing number of privately constructed wells. These wells now exceed 9,000 in the Tadla perimeters.

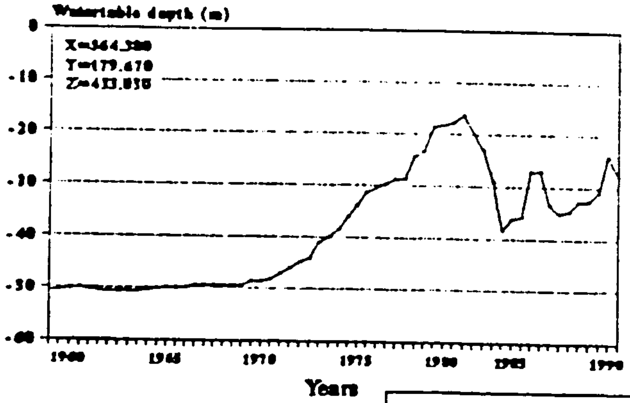
Table E-8
Waterlogging Due to the Presence of the Water Table
Between 0 and 1 Meter

Sectors	Hectarage Affected by the Aquifer (0-1 meters)	
	1976	1979
Oulad Jabri		30
Khelalta	887	495
Oulad Ayad	348	320
Beni Moussa I	287	568
Beni Moussa II	1,228	1,309
Souk Sebt I	-	36
Oulad Illoul	405	400
Dar Oulad Zidouh	608	782
Total	3,763	3,940

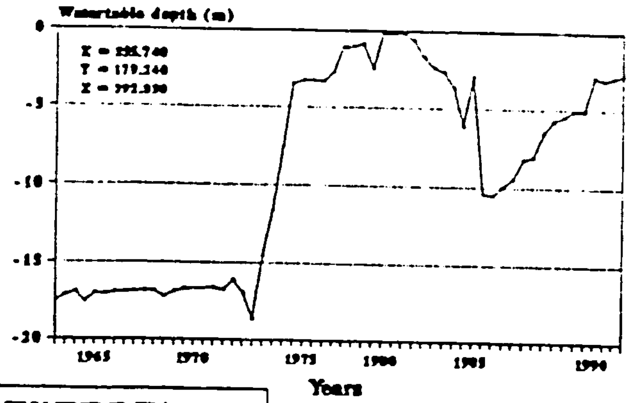
Source: The ORMVAT, 1980.

A recent study done by Debbarh et al. (1991) has shown that the irrigation return flow is the major factor that figures in the recharge of the Beni Moussa shallow aquifer (see Figures E-11 to E-13). The major sources of outflow are drainage and private well withdrawals (Figures E-14 to E-16). The Debbarh study illustrated that the net water balance is positive for the Beni Moussa aquifer (Figure E-17) during the normal rainy years of 1970 to 1980 and 1986 to 1990. There is, hence, a net increase of the storage volume of the aquifers, leading to the multiplication of risky agricultural lands with potential waterlogging and/or drainage and salinity problems. Figure E-18 shows an example of the spatial distribution of water table levels in June 1990. The monitoring of these two aquifers is done separately by DRH and SGRID of the ORMVAT. The existing monitoring system is insufficient, however: approximately 56 piezometers and observation wells are measured bimonthly by DRH, and a similar number of observation wells are measured by SGRID personnel. There is no systematic exchange of information between the two institutions, nor is there any rigorous database to enable the perimeter's managers to get a more complete picture of the dynamics of the groundwater systems of the Tadla area. Comprehensive strategies of integrated surface and groundwater management could be investigated once a database is established and real-time management models are developed.

Well N° 239/36
CMV 532

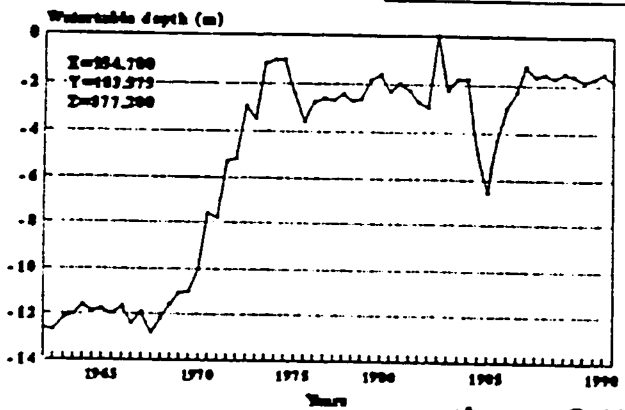


Well N° 248/36
CMV 533



EVOLUTION OF WATERTABLE LEVEL IN BENI MOUSSA PERIMETER

Well N° 638/36
CMV 537



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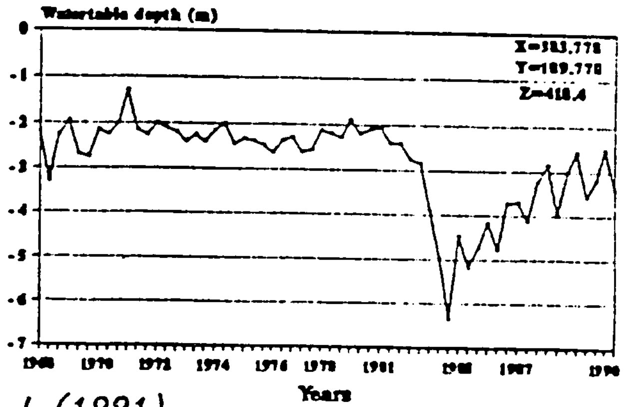
CMV 527



Source: Debbarh et al, (1991)

Figure E-11: Groundwater recharge components. 1975-1980

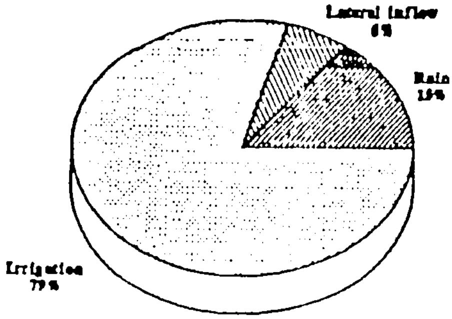


Figure E-12: Groundwater recharge components. 1981-1984

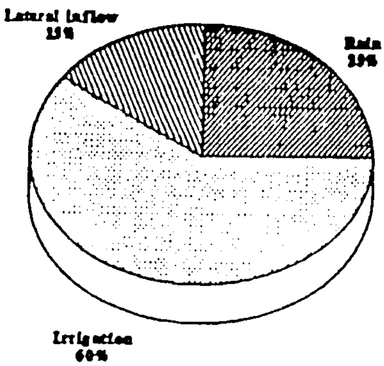
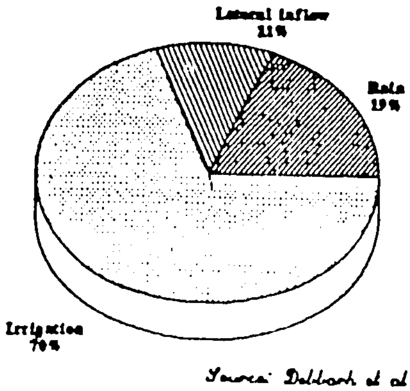


Figure E-13: Groundwater recharge components. 1985-1990



Source: Dabbagh et al., (1991)

Figure E-14: Groundwater withdrawal components. 1975-1980

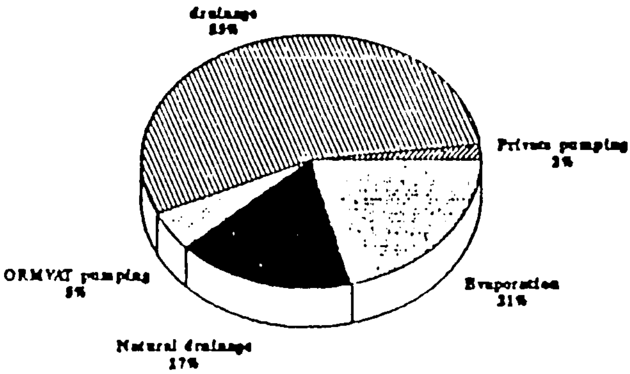


Figure E-15: Groundwater withdrawal components. 1981-1984

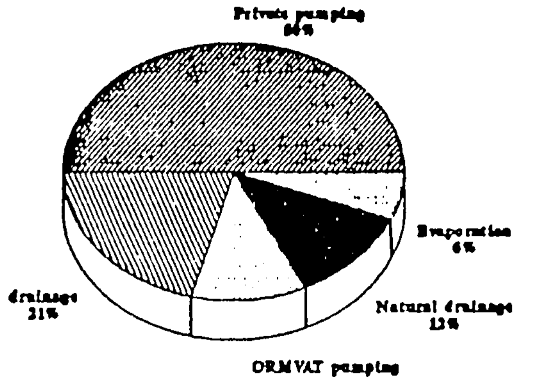
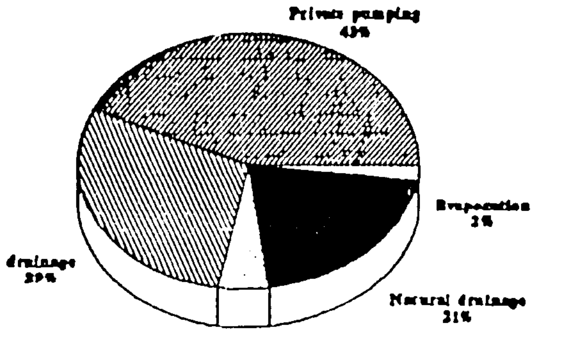


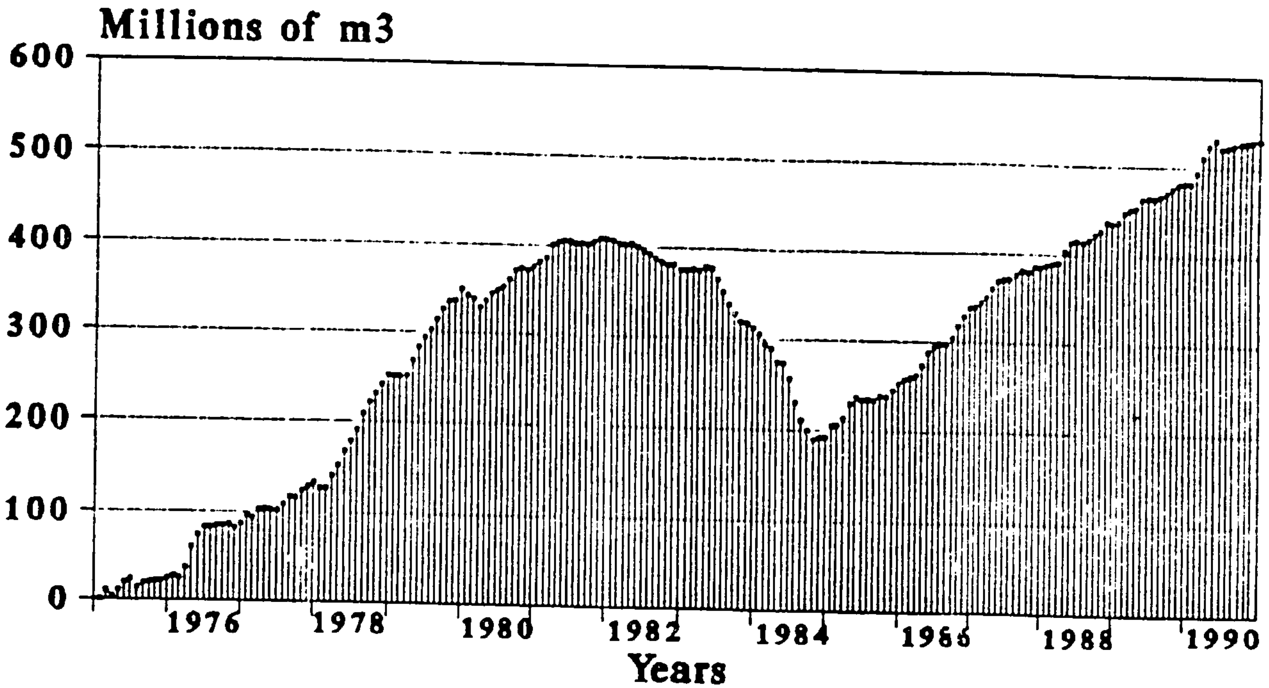
Figure E-16: Groundwater withdrawal components. 1985-1990



Source: Dubbard et al. (91)

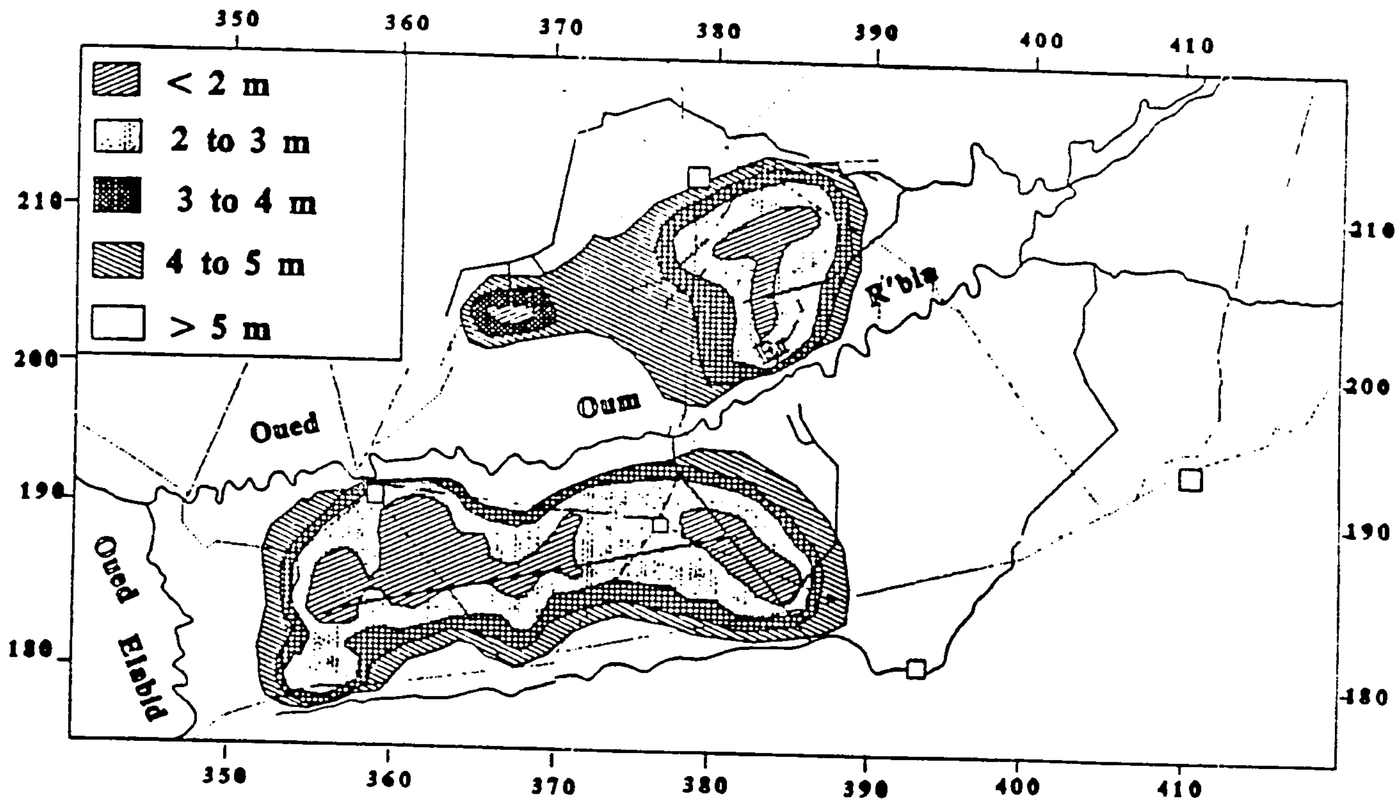
Figure E-17

Sum of the storage regulation volumes of Beni Moussa shallow aquifer



Source: Debbarh et al, (1991)

Spatial distribution of watertable level
in the Tadla perimeter; June 1990



Source: Debbarh et al, (1991)

Figure E-18

The drainage system constructed by ORMVAT in the two perimeters is mainly a surface drainage network with a large spacing of 400 to 700 meters between consecutive ditches. The depths of the ditches and the outlets vary between 1.5 to 2.5 meters. Around 1,700 kilometers of drainage ditches and outlets need to be rigorously and continuously maintained. The ORMVAT is currently only able to handle about 200 kilometers a year, most of which are concentrated in the critical areas of west Beni Moussa. Maintenance is both mechanical—i.e., a dredging exercise—and chemical, using one of the following products: Weedazol powder, and Weedazol or Roundup liquid concentration. The insufficient maintenance actions of the ORMVAT and the wide spacing of the drainage ditches may be the main constraints to the appropriate functioning of this drainage network. A more rigorous assessment and monitoring of this system would allow for better estimates of its real efficiency and possible ways to improve it. Alternating solutions of various drainage systems, including conjunctive surface and groundwater resources, should be investigated in such a way that the water table does not pose any serious waterlogging problems for the sustainability of agricultural activities in the Tadla subperimeters.

C. Soil Modification and Water Quality

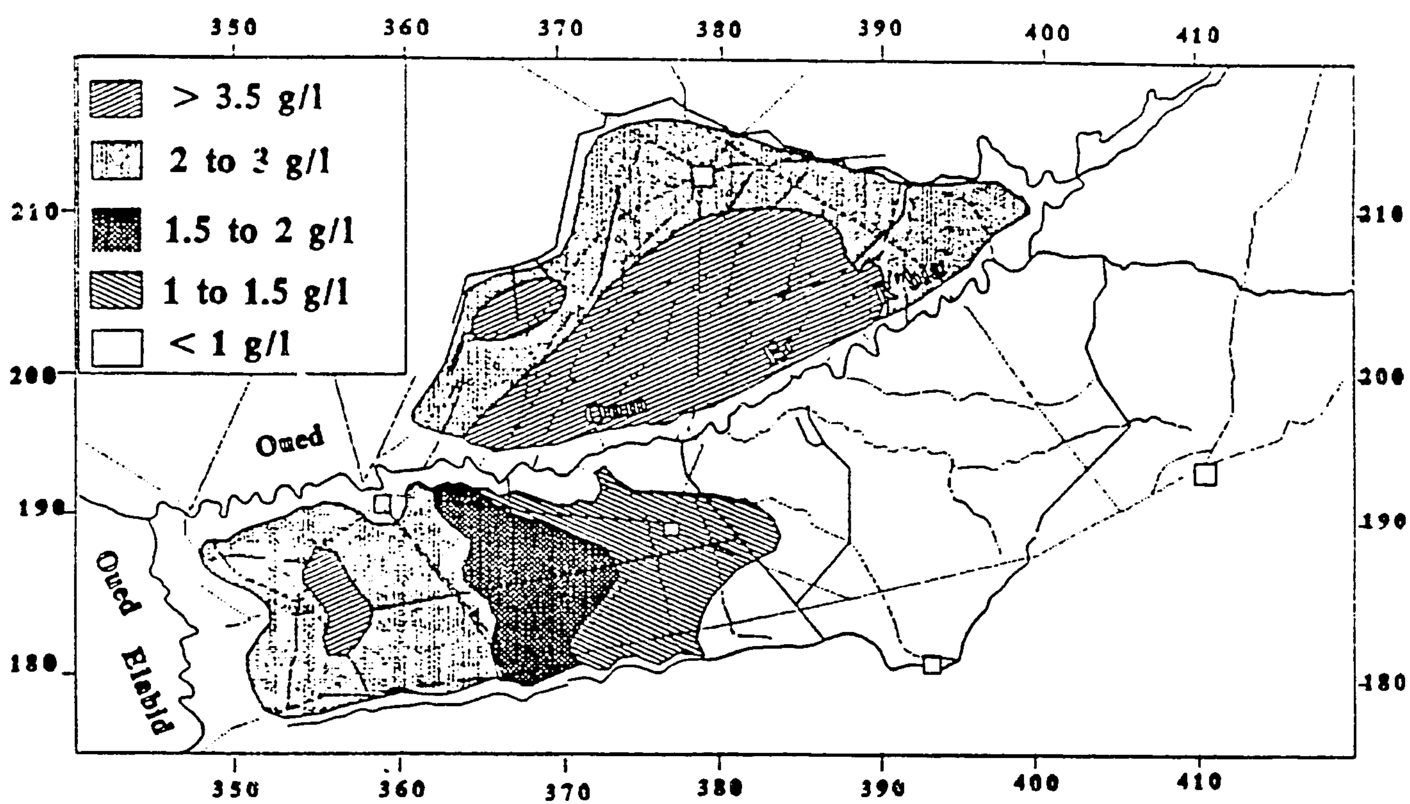
The development of irrigation in the Tadla area has resulted is an intensification and modernization of agricultural farming systems, which has led to—among other factors—increased use of large amounts of fertilizers, pesticides, and other agrochemicals to increase agricultural productivity. The low return flow from irrigation to the aquifer (about 50 percent) contributes to the leaching of salt, nitrates, and chemical pollutants from these practices through the relatively high permeable soils of the Tadla.

The salinity of the soils has not yet reached critical values in the two subperimeters. The situation may worsen in the future, however, especially in the areas where irrigation water of high salt content is used--i.e., the reuse of drainage water by pumping along outlets and ditches, salty groundwater, and so on. Not enough data are available on soil evolution, under irrigation, that would help assess the effective salinization or the negative impacts of irrigation on soils.

Significant salt accumulations have occurred in the shallow aquifer areas of the two subperimeters—where the water table depth is less than 1.5 meters. Maximum concentrations reached so far are approximately 3.5 grams per liter. Figure E-19 illustrates the spatial distribution of the groundwater salt content during July 1991. This is the result of the combination of soil leaching—irrigation water with relatively high salt content from Oum Er Rbia River—and evaporation from shallow water tables in the Beni Amir subperimeter. For the west Beni Moussa, the high content of salt might be explained by evaporation from the shallow aquifer and by the salt composition of some geological formations through which water flows and that constitute part of the lateral boundaries of the groundwater reservoir.

The nitrate pollution of the aquifers is directly related to the intensive agricultural activities in the area. In fact, recent investigations by the Direction de la Recherche et de

Spatial distribution of groundwater salt contents
in the Tadla aquifers. Period of July 3-17, 1991



Source: Debbarh et al, (1991)

Figure E-19

la Planification de l'Eau (El Haiba et al., 1990) have shown that approximately 4,000 metric tons of nitrates are annually leached and are enriching the water tables. As a consequence, an annual rate of nitrate accumulation of about 5 milligrams per liter has been measured in many observation wells. This has led to the multiplication of large areas with high—above 50 milligrams per liter—nitrate concentrations. The highest concentration zones have been located around Fkih Ben Salah in the Beni Amir subperimeter and at sites downstream of the Beni Moussa aquifer. The enrichment of the shallow water tables by nitrates has evolved in parallel with the doses of nitrates used in the agricultural sector. The annual rate of nitrate accumulation has increased from 15 to 30 milligrams per liter of water in 1981, to 20 to 50 milligrams per liter in 1990, while the application of nitrogen for agricultural uses has increased from 64 kilograms per hectare per year to 104 kilograms per hectare per year during the same period.

The agro-industries, including the three sugar factories in the Tadla, also contribute to the enrichment of the aquifers by nitrates and pollutants. An estimated annual amount of 2,000 metric tons of nitrates are discharged with the raw sewage effluent of the SUBM, SUNAT, and SUTA factories (El Haiba et al., 1990). Part of this nitrate recharges the aquifer during the transport of the industrial effluent, along the existing drainage system, to the Oum Er Rbia River. The urban centers also contribute, in smaller proportions, to this pollution load.

Water quality is also affected by the raw sewage flowing into the existing drainage system from the urban centers of Tadla perimeters—Beni Mellal, Afourer, Dar Oulad Zidouh, Fkih Ben Salah, and Souk Sebt. Pollution levels are unequally distrihuted in the two subperimeters. Along the main effluent drains—Beni Amir canal, G12, and Takerzouzt outlets—the sewage water of the cities and sugar factories has caused significant localized water pollution as measured in the form of high nitrate and salt contents, important microbiological infestations often associated with high water temperature, significant amounts of suspended matter, and a low biological oxygen demand consumption rate. Pollution levels along the Oum Er Rbia River, however, are within acceptable Moroccan limits. Hence, the water of the El Massira Dam, downstream from Tadla, does not threaten public health, nor the socio-economic activities of the water users in the Doukkala and Casablanca regions.

The construction of the storage dam at Dechra El Oued (see Section I of this Annex), upstream from Kasba Tadla, is likely to exacerbate the pollution problem when water quantities that contribute to the natural flushing and dilution actions of the Oum Er Rbia River are significantly reduced. The increasing level of pollution and decreasing water quality, in combination with water stagnation along the irrigation canals and drainage network, may also contribute to the development of water-related diseases in Beni Amir. In fact, schistosomiasis, in continuous regression—154 infestations in 1990 as opposed to 483 in 1986—is mainly located in the Beni Amir subperimeter around the Sidi Aissa and Fkih Ben Salah communes. Other waterborne diseases have also been reported, such as malaria and cholera. Other sources of infection might be related to the quality of the source of potable water, which, for the rural population, is primarily obtained from private wells in the perimeters. The monitoring activities of water quality and soil modifications are not systematic and are only partially undertaken by the various local or regional technical departments or services—SGRID of ORMVAT, DRH, the SH, and the sugar factories. A comprehensive database would enable a better assessment of soil and water salinity, nitrates, and chemical pollutants in the perimeters. Such a tool would enhance integrated surface and groundwater management and could help offset some of the negative environmental impacts brought on by irrigation and agricultural activities within the perimeters.

D. Agrochemical Storage, Use, and Disposal

Agrochemicals—i.e., fertilizers, pesticides, herbicides, and fungicides—unless carefully controlled and safely handled and used, can put human and livestock populations at serious risk. This is in addition to causing long-term, and perhaps irreversible, damage to the region's water, soils, flora, and fauna. Water quality, as noted in the discussions above, is already seriously threatened in the Beni Amir and Beni Moussa subperimeters, through the combination of fertilizer applications and uncontrolled fluctuations in the perched water tables. The random field observations of the assessment team confirmed the lack of knowledge in the Tadla concerning storage, application, and disposal of agrochemicals. A discussion of the economic and welfare costs associated with environmental pollution in the Tadla can be found in Appendix G.

Agrochemicals are widely used in the two Tadla subperimeters, a fact borne out by team discussions with the ORMVAT SPA. Although there is little supervision or monitoring of these chemicals in terms of storage, application, and disposal, ORMVAT personnel said farmers "probably did apply the dosages of the chemical as prescribed because they were expensive to buy." Even if this is the case, little is done—or in fact known—about how individual farmers store, prepare, mix, apply, and eventually dispose of the agrochemicals that they do use.

These points were reiterated in discussions with the Direction de la Protection Végétale, du Controle Technique et de la Repression des Fraudes in Rabat. Staff here noted that control was less of a problem for major crops such as cotton and sugar beets, on which the government oversees the application of agrochemicals. But for market vegetables, roses, alfalfa, sesame, and the like, no one has any real idea of what is going on. As an example, in the course of its field visits, the team observed more than one instance of farmers applying chemicals to their crops—using backpack sprayers—with no protective clothing in the heat of the day and under fairly windy conditions. The team also observed the ORMVAT-controlled aerial spraying of cotton fields. Although this was being done primarily in the early morning hours, many of the fields being sprayed were less than one-quarter hectare in size and were often adjacent to irrigation canals, homes, and villages.

As the ORMVAT moves through the disengagement process, ensuring the safe use of agrochemicals is apt to become even more problematic, and the modicum of control for these chemicals that currently exists will be put at even greater risk. The sheer volume and types of chemicals now applied are little more than "guesstimates." Cotton fields alone, for example, were treated with more than a dozen different pesticides in 1988-91. As the perimeter farmers produce more crops in response to market demands and as agro-industries participate more in disengagement, the use of agrochemicals is liable to increase. This raises major policy issues regarding environmental and public health safeguards on the distribution and use of these materials, not just for the ORMVAT, but for all of Morocco. What, if any, are the points of control for agrochemicals? And who will be responsible for monitoring these controls? When environmental damage does occur, or when public health is endangered, what is the assessment process, and who is ultimately responsible for paying the costs?

These are not, obviously, questions that can be answered by the activities proposed for this project. Public awareness about the risks of unsafe handling and use of agrochemicals and water pollution in particular—is only now beginning in Morocco. In its Environmental Discussion Paper, the World Bank (1990) calls attention to these facts. In preparation for PAGI 2, the bank specifically provides terms of reference for assessing environmental impacts of the nine ORMVAs (World Bank, 1991). Enhancing this awareness—especially among the rural populations living in the Tadla perimeters—is at a level of detail that is beyond the scope of the PAGI 2. It is an area, however, where interventions of this project can contribute to the environmental pollution debate.

It is granted that many of the chemicals used on the two subperimeters are relatively safe and environmentally benign, particularly when they are used in a controlled manner. It is also known that the ORMVAT has centralized storage points—the CMVs—for agrochemicals used with major crops, and that the Service de Vulgarisation et Organisation Professionelle, with the SPA, provides basic instruction and guidance to farmers on agrochemical use. The Direction de la Protection Végétale also cooperates with the ORMVAT to analyze and test the agrochemicals that are to be applied to the major crops. Very little information exists in the ORMVAT about practices associated with agrochemical storage and disposal. There are no standards established for how these materials should be stored or in what manner they should be destroyed. There is no monitoring system that details where these sites are—a problem area that will grow as disengagement continues—or if safety precautions are followed. The team was unable to determine what practices were employed, or precautions taken, concerning the disposal of these materials.

At the farm level, the ORMVAT/SPA has established guidelines for the dosages of agrochemicals to use with a host of crops. There is no reliable knowledge, however, on whether farmers adhere to the suggested dosage guidelines, and whether they supplement these agrochemicals with others that are readily available in the local markets (the latter's presence strongly suggests that supplements are used).

One of the principal activities of the ORMVAT is the management of water resources, yet it has been only minimally involved with other area institutions that monitor water quality and have a direct interest in environmental pollution. The DRH and the ONEP in the Ministry of Public Works, the Direction des Eaux et Forets et de la Conservation de Sol (DEFCS) in the Ministry of Agriculture and Agriculture Reform, and the SH in the Ministry of Public Health are the major local government institutions with a stake in these issues. Presently, the ORMVAT only has a working relationship with the SH in Beni Mellal. The Médecin Chef, in talks with the team, noted that this has been a fruitful collaboration that has had a direct impact on the decreased incidence of waterborne diseases in the area. He also voiced strong concern about how little is known about the toxic effects of agrochemicals used in the Tadla perimeter on human and livestock health. The SH, even with its solid network of rural health care workers, does not have the capacity to monitor these types of public health risks.

The DRH, in conjunction with the ONEP, is charged with monitoring the quality of water in the Oum Er Rbia River basin. It currently has established a monitoring system in the Beni Amir and Beni Moussa subperimeters and along the Oum Er Rbia River at several points in the Tadla perimeter. It has subcontracted with the Laboratoire Public d'Essais et d'Etude (Centre des Etudes et Recherches sur l'Environnement et les Pollutions, 1990a, 1990b, 1991) to conduct analyses of surface and groundwater quality at these monitoring points for a number of chemicals and pollutants against the list of Moroccan water quality standards (El Jebbari, 1991).

Efforts such as this directed by the DRH provide an excellent example of where regional collaboration and information among the different environmental interest groups could occur. The tasks and functions of each of these groups are often complementary. A regional network designed to foster collaboration and dialogue would be a big step in raising environmental consciousness and would help to ensure the sustainability of agro-economic development.

IV. ELEMENT 4 – PRIVATE SECTOR RESOURCE ALLOCATION, MANAGEMENT, AND USE

The activities in Element 4 have been chosen to support the disengagement of the ORMVAT and other parastatals from commercial activities and the promotion of the private agribusiness sector. Elements 1, 2, and 3 will help create opportunities for cooperatives, professional associations, and private companies to supply agricultural inputs and services. Element 4 provides short-term technical assistance and training, with minor material support, to strengthen the private sector's capacity to turn opportunities into expanded cooperative, association, and company operations. The activities in Element 4 result from a reconnaissance of the organizations that make up the current web of participants in agribusiness—i.e., parastatals, membership cooperatives, professional associations, companies, and representative bodies such as the Chamber of Agriculture (Beni Mellal) and the Chamber of Commerce and Industry (covering Beni Mellal and Azilal). The major companies are given in the format of a database file integrated with the USAID agribusiness database. A list of input distributors is filed separately. In addition, an examination was made of the likelihood of a private water market being established during the life of this project.

The reconnaissance was intended to identify those organizations and companies that could have a major impact on the flexibility, efficiency, and environmental sustainability of use of water and soil resources. The operating assumptions were that impact would be closely tied to broad spatial representation in the perimeter, the financial health as measured by capital reserves and the willingness of banks to extend lines of credit, the presence of an established market or the potential to build one, a charter that permits flexibility in choice

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of commercial activities and investments, and management capable of undertaking strategic planning and following through with a business plan and its execution.

A. The Agribusiness Landscape

The ORMVAT, through its CMVs, has broad area coverage and control of key assets. The disengagement process is shifting commercial activities to the nongovernmental and private sectors. The commodity-specific parastatals—the Compagne Marocain de la Commercialisation des Produits Agricoles (COMAPRA) in cotton and oilseeds, and SUTA, SUBM, and SUNAT in sugar—also have broad coverage and have absorbed substantial parts of the seed and input delivery services and crop transport services from the ORMVAT. These industries are strategic ones from the GOM's perspective, because they provide export revenue—e.g., long-staple Pima cotton— and provide import substitution and security of the national sugar supply, and salaried jobs for skilled and unskilled labor. Even though the parastatals' charters permit investment in other activities, they have not done so, primarily for financial reasons. While they could have a tremendous impact on water, soil, and input use efficiencies, they do not need direct support from this project.

The sugar industry is financing its own research and development effort to improve production and plant efficiencies, and all three sugar plants are on the block for privatization. New management will quickly be forced to seek ways to make sugar a more profitable crop for all concerned.

The cotton industry is facing similar pressures from the liberalization of crop rotations. Cotton has lost ground to paprika peppers, which now are said to be grown on 6,000 to 8,000 hectares, providing a stimulus for COMAPRA to find ways to reduce production costs, improve productivity, and return to cotton.

The Société Nationale de Commercialisation des Semences (SONACOS), the state seed parastatal, is also being put on the auction block. It currently operates through the region in both dryland and irrigated areas, principally filling orders passed on from the ORMVAT, the Direction Provinciale de l'Argiculture (DPA), and the Centres de Travaux, and executing the importation of sugar beet and potato seed. Regional volume is about 1,400 to 1,500 metric tons annually. Discussions with SONACOS's regional staff suggest that whoever takes over SONACOS will radically restructure its operations.

The ORMVAT is charging for transport, storage, and distribution services that it once provided at no charge. Major incentives now exist for establishing wholesaling operations within and outside the perimeter and for contracting for distribution with retailers. Looking only at wheat seed sales, it is likely that SONACOS—or its purchaser—will find that its volume will be cut in half, unless the government continues to contract or guarantee seed supply in excess of the seed stock renewal practices of farmers. Here too, the national catalogue system of varietal licensing greatly slows the introduction of new varieties of the major cereal crops and sugar beets.

The parastatal land management companies—the Société de Developpement Agricole (SODEA) and the Société de Gestion des Terres Agricoles (SOGETA)—are both reviewing their operations and restructuring their farms. Like other tree crop producers with a predominance of citrus trees, SODEA is hesitating to make new investments in citrus crops until 1993—the year in which Spain and Portugal become fully integrated into the Common Agricultural Policy (CAP) of the European Community. SOGETA, with much greater land in annual crops, is diversifying into new crops in the Tadla and planning to invest in pressurized irrigation systems to boost yields, reduce water losses and dependence on the surface irrigation system, and, it hopes, reduce operating costs. SOGETA is tightly bound to national plan objectives of strategic crop production, so it has reduced flexibility in crop choice.

While this management constraint is likely to change over time, neither SODEA, SOGETA, nor land they manage is available for lease or sale, limiting privatization possibilities. However, both parastatals represent markets for input and custom service suppliers, and suppliers of pressurized irrigation systems—e.g., sprinkler, pivot, and trickle irrigation.

Outside of the parastatal sector, there are two major booms occurring in the Tadla. One is the rapid expansion of center pivot irrigation schemes. The second is the rapid expansion of paprika pepper production and processing. The center pivot program is supported by the Ministry of Interior. Pivots are being installed primarily on collective lands on which leases for up to 19 years are negotiated for annual rents equivalent to the value of between five and seven quintals of wheat per hectare. Currently, about 3,500 hectares have been developed for pivot irrigation. About another 5,300 hectares are in various stages of development by private companies and individuals. Beyond these 8,800 hectares, another 3,000 hectares have been identified as apt for center pivot irrigation. About 13 major investment groups are involved. The installed and planned surface area offers a good opportunity for suppliers of irrigation equipment, pumps and motors, inputs, custom services, and maintenance and repair services. The larger hardware and agricultural equipment stores in Beni Mellal already carry an impressive array of motors and turbine pumps for tubewells.

The paprika pepper growth has been phenomenal during the past three years. Four years ago, there was essentially no paprika pepper production in the Tadla perimeter. Since 1989, the paprika pepper production area has jumped from 400 hectares to somewhere between 6,000 and 8,000 hectares. This crop is tied to an export market for oleoresin and red colorant for food and cosmetics. A dehydration plant treats some peppers in the Tadla before shipment to Larache. A second operation ships field-dried peppers directly to Spain for colorant extraction. The logistics of this operation has spurred the extension of transportation services well after the normal peak period of the sugar beet harvest. The success of this operation reflects the broader changes in the agribusiness investment climate, particularly the opening up of ownership of Moroccan companies to foreign participation and the liberalization of the trucking industry.

The major postharvest packing operations in the Tadla are the Primagrume packing house, and a rudimentary packing operation attached to a new and sophisticated cold storage facility. Much of the tree fruit production in the Tadla is sold as standing crop on the tree and hauled to one of the 23 packing houses operating in the Casablanca area.

In addition there are approximately 300 traditional olive oil presses, or maasra, 8 low-capacity rolling stone mill olive oil presses, and a large, but difficult to enumerate, set of buying agents, collectors, and accumulators of olives for table olive processing and oil milling from the major plants in El Kelaa, Marrakech, Fes, and Meknes.

The modern milk marketing and processing market is primarily defined by Halib Tadla, the former cooperative pasteurization and yogurt plant that is now owned and managed by the Centrale Laitière as a pasteurization and milk product distribution center. Other than tetrapack pasteurized milk (about 50,000 liters a day), all other milk (an additional 50,000 to 80,000 liters a day) is shipped to the Centrale Laitière facilities in Casablanca for processing. The dairy production industry is dominated by the cooperatives, which are run by ORMVAT cooperative directors. A dairy cattle artificial insemination program and bred heifer importation program are also run by the AET. Animal health services are provided by nine private veterinarians located in the rural communes of the Tadla perimeter.

Horticultural diversification is under way in the Tadla, with a rose cut flower and rosebush export industry that has strong links to French firms. Many small producers and packers of onions and potatoes for the national market also operate in Tadla, as well as a few producers of table grapes. Small country accumulators buy this production, although the two major cold storage facilities in the Tadla perimeter also purchase and store potatoes and handle apples produced in the piedmont—Dir—at the foot of the Atlas Mountains near Beni Mellal.

Obviously, the production and postharvest operations create a large market for agricultural input supply, harvesting services—e.g., the mechanized harvesting of wheat and manual labor for other crops—and transportation services. Input supply is in a state of flux. The parastatals still dominate local markets, but with increasing numbers of small and medium-scale distributors—53 by current ORMVAT count—particularly for fertilizers and pesticides.

Approximately 95 agricultural cooperatives operate in the Tadla area. These range from the very old Société Cooperative Marocaine Agricole—which is the largest single buyer of wheat in the region but now runs more like a parastatal since the cooperative has lost essentially all of its members—to small fuel supply cooperatives. The most widespread cooperatives are multiservice ones. These have been built up from a nucleus of dairy collection points and consumer cooperatives since the Plan Laitier was put into effect in the early 1970s. ORMVAT staff now point to 48 cooperatives and 11 private collection centers as a network of economic activity. Dairy operations have remained their core activity, but most have developed other substantial business operations. Several have agricultural machinery services, with machinery selected to meet the highest demand periods for mechanization, land preparation, and cereal harvesting. Others have a service station for diesel fuel and kerosene supply. Most now play a growing role in the sales of fertilizers, seeds, and plant protection chemicals. Because they are organizations made up of farmers, they are very close to the point of making decisions about soil and water use. Their central role in the livestock industry brings them even closer to key water and soil issues.

Besides the 120,000 head of cattle in the perimeter, there are nearly 600,000 sheep, and 50,000 goats. Alfalfa production takes place on 18,000 hectares and is managed both as an input into the local herd and as a valuable forage "exported" from the perimeter. Tadla has one major animal feed plant and another eight small units. Additionally, the sugar beet mills produce a substantial quantity of beet pulp molasses for area herds. Several cooperatives also have small feed mills, but use is low.

The multi-purpose cooperatives have grown to be some of the strongest local organizations on the perimeter. They have arrived at this point with major assistance from the GOM. Initially, dairy operations were almost wholly subsidized by the government. Gradually, the cooperatives began to take on more of the financial cost of their operations, paying the energy costs of refrigerating milk, paying feed costs, obtaining and servicing loans for equipment, constituting revolving funds for procurement of stock for the cooperative store, and so on. Today, their capital and cash flow positions are relatively strong. The strongest cooperatives are already moving out of the CMVs, obtaining land, and building new cooperative complexes. They fulfill most of the conditions sought. However, the cooperatives have a significant weakness in that they still depend heavily on the ORMVAT for general management and accounting, business strategy, and the development of new enterprises.

While there are many associations in the Tadla, only a few are of particular interest to this project. The oldest and strongest is the Association des Producteurs des Agrumes du Maroc (ASPAM). It represents the growers and packers who export the largest export crop Morocco grows. While ASPAM has always had a strong government presence, it also has the most highly developed technical support operation of any association in the country. It spawned a technical services and laboratory analysis service, which supports the citrus growers but has also expanded to include consulting and analytic work for vegetable growers. ASPAM and its technical service have a regional office in Beni Mellal.

The other agricultural associations of direct concern to this project are the Association des Eleveurs du Tadla (AET), the Association des Cotonniers du Tadla (ACT), the Association des Betteraviers du Tadla (ABT), the Association des Maraichers du Tadla (AMT), the Association Régionale des Multiplicateurs de Semence and the Conseil Oleicole Provincial.

A common thread among some of these associations is that they represent producers who raise what are called "integrated" livestock or crops—those crops for which there is one principal marketing channel. Each is supported by an automatic levy from the receipts of product delivery. Existing statutes ensure that when and if the cotton and sugar parastatals are privatized, the levy on production will still be applied, ensuring each association receives an income to carry out its member representation services. To move beyond the general representational level requires that the associations offer services of financial value to their members.

It is expected that each of these associations will help lead the development of the vertically integrated industry in the region. Of the four, ASPAM fulfills this role already. AFT probably has the best chance of delivering value-added services to its members, primarily because the dairy industry provides a year-round cash flow to producers. The social soundness analysis (Annex H) provides more details on how representative these associations are and what the likelihood is that they can assist in the federation of producer cooperatives into larger economic units.

Two things are striking about this picture of the Tadla. The first is the relatively small amount of packinghouses and processing facilities in the fruit, vegetable, and olive industry. While many reasons for this are advanced, the answer seems to boil down to the strength of the companies and packinghouses in Casablanca and the major agroprocessing cities of the interior. Much of this strength is financial and is reinforced by banking practices that demand high levels of loan guarantees—up to three times the loan amount—for lines of credit and operating capital, creating a high entry cost into the marketplace. The second major point is the size of the input and service markets in the Tadla surface irrigation perimeter and the center pivot extension areas. While much of the input supply is still run through parastatals, their privatization should provide the opportunity for restructuring the industry. Diversification of crops and irrigation technologies should create a strong demand for new services.

The design team judged that the greatest project impact could be achieved from major investment in the cooperatives and the associations, with smaller project investment in promoting private sector firm activities. The cooperative and association focus will permit the project to move water and soil management technologies quickly from demonstration to broad application. The project will, however, also promote a diversity of private sector supply of inputs and services as individually owned businesses and corporations are likely to be able to respond to a rapid growth in opportunity most quickly.

B. Concentration on Strengthening Cooperatives and Associations

Three Element 4 activities focus short-term technical assistance and training on strengthening cooperatives and associations to improve their management of costs and services, to develop their ability to plan and undertake commercial operations, and to help them develop a strategy for sustainability based on current and new economic activity.

The 48 multi-service dairy cooperatives were selected as targets because:

- They have the best spatial coverage of the perimeter;
- They operate on a cooperative decree, which gives them broad choice of business activity;
- Dairy production is one of their major business enterprises, providing them with a regular cash flow throughout the year;

- They have a diversified business base, including sales of consumer goods, agricultural input supply, fuel supply, and custom machinery services that provide additional year-round cash flows;
- They have accumulated capital reserves; and
- They are targeted for accelerated disengagement by the ORMVAT—i.e., movement out of or rental of the CMV facilities used as collection, storage, and retail space and the transfer of cooperative directors' salaries and accounting costs—which rapidly eat into cash flow and capital reserves.

With proper management of the transition to independent, business-based operations, these cooperatives could invest in the input supply and custom service opportunities resulting from Element 2 activities and from the upcoming sale of SONACOS and the two sugar mills and one sugar refinery. Development of good cooperative management skills may also enable these cooperatives to provide cost-shared management services to the other cooperatives in the Tadla that are handicapped by seasonal and/or low cash flows.

Strengthening of the AET was selected because of the large potential impact of its principal activities—e.g., livestock breed improvement—on efficiency of water and soil resource use. Crossbred dairy cattle produce more than 4 times as much milk per lactation as local breeds, and purebred cattle produce about 1.6 times as much milk per lactation as crossbred animals. The ORMVAT's 1986 plan for disengagement includes an artificial insemination program as one of the local enterprises targeted for privatization. The artificial insemination program is well organized in eight regular circuits. It performs nearly 20,000 inseminations annually. Transfer of the service will need to be managed carefully to ensure that the same or an increased level of service is provided. A successfully implemented activity will provide a service to members and serve as an example to the other three associations housed in the Beni Mellal association building as to how to structure and operate a member-oriented business.

Irrigation associations are the newest local organizations on the Tadla landscape. They are being asked to take on both management and financial loads that even the ORMVAT has been only partially able to evaluate. They have been mandated from above by a decree which greatly limits their choice of economic operations in return for a 20 percent rebate on member water charges, which is supposed to cover operations and maintenance costs and result in a small profit.

Three irrigation associations have been formed and are planned to undertake their responsibilities in 1992. The design options were to concentrate project resources on irrigation associations with the intensity of the cooperative effort, or to provide a lower level of assistance while the main system is adjusted to provide more reliable and responsive water supply, which is essential for successful local management of water and maintenance of secondary and tertiary canals, seguia, and drains. The design choice was to help prepare irrigation associations and their partners in water management through management planning, management training, and short-term technical assistance. This action will lay the groundwork for more effective turnover of the system when this project can help provide reliable water supply and PAGI 2 can provide funding for rehabilitation.

C. Promotion of the Private Sector

In Morocco, disengagement of the state from commercial activities and privatization of parastatal enterprises in the agricultural sector are managed by the state. It is managed in a step-wise fashion to avoid shocks to production and unwanted impacts on consumer prices and employment. The public sector seeks assurances that a transferred operation will continue to run and provide the same or increased services and products. Consequently, there is a tendency to define two policy options for disengagement, then to award the transfer of a commercial activity to a group in the form of a tacit or explicit contract that provides advantages to the group or company in return for adherence to national or local plan objectives.

Element 4 of the project is designed to broaden the options for transfer of commercial activities run by the state and the creation of new ones. It builds on the work of the first three elements, which will identify input and service requirements, fund new environmental monitoring activities, and demonstrate the market potential for input supply and services that improve resource use on the farm. Element 4 is designed to provide a small quantity of catalyzing technical assistance to help the private sector define and evaluate the market potential for expanded or new input supply and services. Potentially large markets exist for land leveling, pressurized irrigation systems, mechanically assisted harvesting, and pesticide consulting and application. Seed and fertilizer supply will soon have the potential for major restructuring, providing the opportunity for expanded operations of distributors in the Tadla, whether they be cooperatives or corporations. The options of providing credit for these operations was rejected because financing is available from the Caisse Nationale de Credit Agricole (CNCA) through established lending programs.

Banks, agricultural and commercial chambers, and individual investors have remarked on the relatively low levels of new capital flow into the Tadla for packing and processing. This is partly due to the strength of competing centers for packing and processing in Marrakech, Fes, Meknes, and especially Casablanca. It is also due to the high guaranty requirements imposed by banks for operating capital or lines of credit, and the fact that much private capital flows to the coastal cities or into nonagricultural investments in real estate or commerce.

The new examples of capital inflow are center pivot irrigation programs, of which state encouragement is very strong, and in paprika pepper production and export. Once again, financing sources are available for center pivots, so no credit activities were considered. New horticultural or other crop development and processing investment appears to require an external investor who also brings a marketplace to a partnership. Element 4 will provide a small amount of technical assistance to develop feasibility studies and business plans and to assist in start-up for projects that fall outside of the horticultural sector. Project technical assistance will direct horticultural opportunities to the USAID Morocco

Agribusiness Promotion Project (MAP), rather than attempting to set up a parallel promotion structure for the Tadla.

D. Water Markets

The Supreme Water Council for Morocco is gradually helping to create conditions for water for all uses to be treated as a public utility. However, given the need for the publicly operated Tadla perimeter to rework its current operations to permit it to operate more reliably and efficiently; the incipient transition to decentralized operations and maintenance; and the need for time to carry out the disengagement process, the feasibility of USAID investments in exploring the potential of a water utility for the Tadla is probably low at this time. The issue should be examined again at the mid-term evaluation, when it will be seen whether the physical control works of the perimeter can respond to a contract-driven water demand schedule and whether users are able to attribute accurately the costs and benefits to water supply and secondary and tertiary system operations and maintenance.

Annex F

FINANCIAL ANALYSIS

Annex F

FINANCIAL ANALYSIS

1. Cost Estimates

The total cost of the project is estimated at $25 million. The project will be supported by contributions from A.I.D., the participating GOM agencies and the Tadla private sector. Table F-1 below presents a summary of total project costs by major input category and contributor.

Table F-1

TRM Project Budget Summary
($000s)

Item/Source	A.I.D.	GOM	Other	Totals
Technical Assistance	7,140	2,400	300	9,840
Training	1,335	190	270	1,795
Commodities	2,060	780	820	3,660
Indirect Costs	7,465	880	360	8,705
IIMI Cooperative Agreement	750	250		1,000
TOTAL COSTS	**18,750**	**4,500**	**1,750**	**25,000**

Details of each of these respective contributions are described in Chapter 3. Additional information on the planned contributions to the project is provided in Tables F-2 to F-5 below.

2. Financial Plan

Most project activities will be implemented through a direct A.I.D. institutional contract. USAID-managed funds for special studies, evaluations and audits will be implemented through project buy-ins to centrally-managed A.I.D. projects and Indefinite Quantity Contracts (IQCs) and/or through purchase orders, where warranted by the size and source of the procurement. Disbursement of A.I.D. project funds will be through both direct payment and reimbursement. Table 3.6 (in Chapter 3) summarizes the expected project implementation and financing methods for the disbursement of A.I.D. funds.

3. Project Audit Requirements

The project includes funds for the completion of two external audits throughout its life, i.e., one audit for each three years of project implementation. These audits will be comprehensive financial audits of all project operations and accounts. They will be conducted by a reputable Moroccan financial management firm under the supervision of the A.I.D. Regional Inspector General's Office based in Dakar, Senegal. These audits will comply with current U.S. government financial audit requirements.

A.I.D. also reserves the right to conduct additional external audits throughout the project's duration as it deems appropriate.

4. Recurrent Costs and Flow of Funds

a. GOM

Recurrent cost obligations incurred by the GOM as a direct result of project activities are expected to be modest. These obligations will consist primarily of the additional staff and operations and maintenance costs resulting from the new system-level, on-farm and environmental quality monitoring systems developed under the project. These additional O&M costs are estimated to be approximately $750,000 per year in real terms.

Given that the ORMVAT is progressively divesting itself of the cost of many commercial activities at the same time that its gross revenues are increasing due to higher irrigation water fees and better collection procedures, it should be in an excellent position to assume these projected additional recurrent cost obligations by the end of the project. As mentioned above, ORMVAT is now collecting water revenues sufficient to cover all current O&M costs plus about 40% of system capital investment costs.

b. Private Sector

No significant additional recurrent cost obligations are anticipated for private sector firms or individuals as a result of their participation in the project.

c. A.I.D.

Once funds are obligated for the project, earmarking, commitments, and disbursements will proceed according to the expenditure schedule presented in Table 3.2 (Chapter 3). Flow of A.I.D. funds will be subject to standard A.I.D. rules and regulations.

Table F-2: TRM Project Budget Summary
($ 000)

Item/Source	A.I.D. FX	A.I.D. LC	GOM FX	GOM LC	OTHER FX	OTHER LC	TOTAL FX	TOTAL LC	TOTAL PROJECT
Technical Assistance	7,140			2,400		300	7,140	2,700	9,840
Training	1,333			190		270	1,333	460	1,793
Equipment & Supplies	2,063		125	655		820	2,188	1,475	3,663
Indirect Costs	7,465		6	872		362	7,471	1,234	8,705
– *Overhead*	*4,893*						*4,893*		*4,893*
– *Contractor Fee*	*843*						*843*		*843*
– *Contingency*	*509*		*6*	*162*		*70*	*516*	*232*	*747*
– *Inflation*	*1,220*			*710*		*293*	*1,220*	*1,002*	*2,222*
IIMI Cooperative Agreement	750			250		0	750	250	1,000
TOTAL COSTS	18,750		131	4,367		1,752	18,881	6,119	25,000

Table F-3: Tadla Resources Management Project
($ 000)

Item	FY-93 AID	FY-93 HC	FY-94 AID	FY-94 HC	FY-95 AID	FY-95 HC	FY-96 AID	FY-96 HC	FY-97 AID	FY-97 HC	FY-98 AID	FY-98 HC	Total AID	Total HC	TOTAL PROJECT
1. Technical Assistance	1,051	450	1,534	450	1,519	450	1,265	450	1,113	450	656	450	7,140	2,700	9,840
- *LTTA*	577	450	846	450	846	450	846	450	704	450	387	450	4,206	2,700	6,906
- *STTA*	474		688		673		419		409		269		2,934		2,934
2. Training	108	50	309	90	323	90	247	90	227	90	122	50	1,333	460	1,793
3. Equipment & Supplies	491	140	572	125	319	260	347	310	187	350	147	415	2,063	1,600	3,663
Sub-total:	1,650	640	2,415	665	2,160	800	1,859	850	1,526	890	925	915	10,535	4,760	15,295
4. Overhead & Fees	883	–	1,292	–	1,181	–	1,023	–	849	–	509	–	5,736	–	5,736
5. Contingency	82	32	121	33	108	40	93	43	76	45	29	46	509	238	747
6. Inflation	–	–	121	64	221	77	293	172	329	283	256	407	1,220	1,002	2,222
Sub-total:	965	32	1,533	97	1,510	117	1,409	214	1,254	327	793	453	7,465	1,240	8,705
7. IIMI Coop Agreement	225	50	225	75	225	75	75	50	–	–	–	–	750	250	1,000
TOTAL	2,840	722	4,173	837	3,895	992	3,343	1,114	2,781	1,217	1,718	1,368	18,750	6,250	25,000

Note: 5% Contingency for AID
5% Contingency for HC
5% Compound inflation for AID
10% Compound inflation for HC

Table F-4: Tadla Resources Management Project -- Detailed A.I.D. Costs

Component, Inputs and Activities	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	TOTAL
1. IRRIGATION SYSTEM MGMT							
A. Long-term TA							
– Irrigation Engineer	142 500	190,000	190,000	190,000	190,000	142,500	1,045,000
B. Short-term TA	170,000	180,000	80,000	80,000			510,000
– GIS	15,000	45,000		30,000			90,000
C. Training							
– LT Overseas	6,000	72,000	66,000				144,000
– ST Overseas	20,000	40,000	40,000	20,000	20,000		140.000
D. Equipment & Supplies	100,000	300,000	96,100				496,100
– Vehicles	75,000			25,000			100,000
2. ON-FARM MANAGEMENT							
A. Long-term TA							
– Agric Economist	142,500	190,000	190,000	190,000	142,500		855,000
B. Short-Term TA	30,000	120,000	120,000	60,000	60,000	30,000	420,000
C. Training							
– Regional Workshops		10,000	10,000	10,000	10,000	10,000	50,000
– Study Tours		20,000	30,000	40,000	40,000	30,000	160,000
D. Equipment & Supplies							
– Demo Equipment		50,000	50,000	50,000	50,000	50,000	250,000
– Radio B'dcast Support		10,000	10,000	10,000	10,000	10,000	50,000
– Vehicles	25,000			25,000			50,000

Table F-4 (Cont.)

Component, Inputs and Activities	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	TOTAL
3. ENVIRONMETAL MGMT.							
A. Long-term TA							
B. Short-Term TA	100,000	130,000	110,000	60,000	60,000	40,000	500,000
– Lab Analysis Services	24,240	78,360	78,360	54,360	54,360	24,360	314,040
C. Training							
– ST Overseas	20,000	20,000	20,000	20,000	20,000		100,000
D. Equipment & Supplies	30,000	50,000	25,400				105,400
– Vehicles	25,000			25,000			50,000
4. PRIV SECTOR STRENGTHENING							
A. Long-term TA							
– Priv Sector Coordinator	95,000	190,000	190,000	190,000	95,000		760,000
B. Short-Term TA	60,000	60,000	60,000	60,000	60,000	50,000	350,000
C. Training							
– ST Overseas (study tours)	20,000	40,000	50,000	50,000	30,000	30,000	220,000
– ST In-country	30,000	75,000	75,000	75,000	75,000	30,000	360,000
D. Equipment & Supplies							
– Training	5,000	12,000	2,000	2,000	2,000	2,000	25,000
– Office Equipment		10,000	20,000	20,000	10,000	10,000	70,000
– Vehicles	25,000			25,000			50,000

Component, Inputs and Activities	FY-93	FY-94	FY-95	FY-96	FY-97	FY-98	TOTAL
5. PROJ MANAGEMENT							
A. Long-term TA							
– Chief of Party	142,500	190,000	190,000	190,000	190,000	190,000	1,092,500
– Admin Assistant	7,500	10,000	10,000	10,000	10,000	7,500	55,000
– Accountant	7,500	10,000	10,000	10,000	10,000	7,500	55,000
– Secretary	5,250	7,000	7,000	7,000	7,000	5,250	38,500
– Secretary/Translator	6,000	8,000	8,000	8,000	8,000	6,000	44,000
– Chauffeur	4,500	6,000	6.000	6,000	6,000	4,500	33,000
– Chauffer/Expeditor	3,750	5,000	5,000	5,000	5,000	3,750	27,500
– Monit/Eval Specialist	20,000	40,000	40,000	40,000	40,000	20,000	200,000
B. Short-Term TA							
– Special Studies	75,000	75,000	75,000	75,000	75,000	75,000	450,000
– Evaluations			100,000		100,000		200,000
– Audits			50,000			50,000	100,000
C. Training							
– Start-up Workshop	10,000						10,000
– Annual Workshops		20,000	20,000	20,000	20,000	10,000	90,000
– National Workshops		10,000	10,000	10,000	10,000	10,000	50,000
– C'tpart Lang. Training	1,500	1,500	1,500	1,500	1,500	1,500	9,000
D. Equipment & Supplies	100,000	25,000		25,000			150,000
– Supplies/Communications	50,000	75,000	75,000	75,000	75,000	50,000	400,000
– Vehicles	25,000			25,000			50,000
– Vehicle O&M	21,000	30,000	30,000	30,000	30,000	15,000	156,000
– Project Support Services	10,000	10,000	10,000	10,000	10,000	10,000	60,000
6. IIMI Cooperative Agreement	225,000	225,000	225,000	75,000			750,000
TOTAL	1,874,740	2,639,860	2,385,360	1,933,860	1,526,360	924,860	11,285.040

Table F-5: Tadla Resources Management Project -- Activity Levels

Component/Activity and Input	Units	FY-93				FY-94				FY-95				FY-96				FY-97				FY-98				TOTAL			
		US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.
1. **IRRIGATION SYSTEM MGMT**																													
A. Long-term TA																													
– Irrigation Engineer	py	0.75				1				1				1				1				0.75				5.5			
B. Short-term TA	pm			17				18				8				8												51	
– GIS	pm	1				3								2												6			
C. Training																													
– LT Overseas	pm		2				24				22																48		
– ST Overseas	pm		2				4				4				2				2								14		
D. Equipment & Supplies	$000s				100				300				96.1																496.1
– Vehicles	No.				3												1												4
2. **ON-FARM MANAGEMENT**																													
A. Long-term TA																													
– Agric Economist	py	0.75				1				1				1				0.75								4.5			
B. Short-Term TA	pm			3				12				12				6				6				3				42	
C. Training																													
– Regional Workshops	Events								1				1				1				1				1				5
– Study Tours	pm						2			1	2			2	2			2	2			1	2			6	10		
D. Equipment & Supplies																													
– Demo Equipment	$000s								50				50				50				50				50				250
– Radio Broadcast Support	$000s								10				10				10				10				10				50
– Vehicles	No.				1												1												2

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Table F-5 (Cont.)

Component/Activity and Input	Units	FY-93				FY-94				FY-95				FY-96				FY-97				FY-98				TOTAL			
		US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.
3. **ENVIRONMENTAL MGMT.**																													
A. Long-term TA	PY																												
B. Short-Term TA	pm			10				13				11				6				6				4				50	
– Lab Analysis Services	Samples(000)				12.12				39.18				39.18				27.18				27.18				12.18				157.02
C. Training																													
– ST Overseas	pm		2				2				2				2				2								10		
D. Equipment & Supplies	$000s				30				50				25.4																105.4
– Vehicles	No.				1												1												2
4. **PRIV SECTOR STRENGTHENING**																													
A. Long-term TA																													
– Priv Sector Coordinator	PY	0.5				1				1				1				0.5								4			
B. Short-Term TA	pm			6				6				6				6				6				5				35	
C. Training																													
– ST Overseas (study tours)	pm		2			1	3			2	3			2	3			1	2			1	2			7	15		
– ST In-country	Individuals				300				750				750				750				750				300				3,600
D. Equipment & Supplies																													
– Training	$000s				5				12				2				2				2				2				25
– Business Equipment	$000s								10				20				20				10				10				70
– Vehicles	No.				1												1												2

Table F-5 (Cont.)

Component/Activity and Input	Units	FY-93				FY-94				FY-95				FY-96				FY-97				FY-98				TOTAL			
		US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.	US	M	E	No.
5. PROJ ADMINISTRATION																													
A. Long-term TA																													
– Chief of Party	PY	0.75				1				1				1				1				1				5.75			
– Admin Assistant	PY		0.75				1				1				1				1				0.75				5.5		
– Accountant	PY		0.75				1				1				1				1				0.75				5.5		
– Secretary	PY		0.75				1				1				1				1				0.75				5.5		
– Secretary/Translator	PY		0.75				1				1				1				1				0.75				5.5		
– Chauffeur	PY		0.75				1				1				1				1				0.75				5.5		
– Chauffer/Expeditor	PY		0.75				1				1				1				1				0.75				5.5		
– Monitoring/Eval Specialist	PY		0.50				1				1				1				1				0.50				5		
B. Short-Term TA																													
– Special Studies	pm	5				5				5				5				5				5				30			
– Evaluations	pm											10								10								20	
– Audits	pm										5												5				10		
C. Training																													
– Start-up Workshop	Event				1																								1
– Annual Workshops	Event								2				2				2				2				1				9
– National Workshops	Event								1				1				1				1				1				5
– C'part Lang Training	PY		10				10				10				10				10				10				60		
D. Equipment & Supplies	$000s				100				25								25												150
– Supplies/Communications	$000s				50				75				75				75				75				50				400
– Vehicles	No.				1												1												2
– Vehicle O&M	Veh yrs				3.5				5				5				5				5				2.5				26
– Project Support Services	$000s				10				10				10				10				10				10				60
6. IIMI Cooperative Agreement	$000s				225				225				225				75												750

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Annex G

ECONOMIC ANALYSIS

Annex G

ECONOMIC ANALYSIS

I. INTRODUCTION

This section of the report presents an economic analysis of the anticipated project interventions with respect to the net benefits from increased water efficiency savings in quantitative terms, and qualitative analyses of the potential supplementary benefits from improvements in factor allocations in agricultural and agro-industrial enterprises and from the environmental component. In the quantitative analysis, the value of the water savings is compared with the anticipated USAID grant investment and the total project cost stream. In the qualitative analyses, the potentials for additional benefits derived from better allocations of the factors of production, shifting to higher value crops at the farm level, more private sector involvement in agribusiness at the regional level, and improved environmental management are discussed.

A. Water Savings under the Project

A study of irrigation efficiency in the ORMVAT funded by the Belgium government (ORMVAT, 1990a) determined that canal delivery efficiency in the perimeter was approximately 80 percent--i.e., 80 percent of the water entering the head end of the canal was available at farmers' fields--and that field application efficiencies were 60 to 65 percent--i.e., 60 to 65 percent of the water applied to the field finds its way to the root zone, where it can be used by the crop. The overall efficiency of the system, therefore, was estimated between 48 to 52 percent.

Estimates of the field application efficiency and the overall efficiency appear high. Based on team observation of irrigation techniques in the Beni Moussa and Beni Amir subperimeters, it was estimated that field application efficiencies are more likely to be about 40 percent, with an overall efficiency of 35 to 40 percent.

In addition to estimating efficiencies, the Belgian study determined that 6 percent of the irrigation water entering the head end of the main canals was being lost at the end of the canals due to the ORMVAT's inability to manage the perimeter canal system dynamically. This 6 percent loss was recorded in the 80 percent delivery efficiency estimate noted; if all of the 6 percent were to be saved, the delivery efficiency would be increased to 86 percent.

The magnitude of this problem was confirmed during the team visits to the ORMVAT. Engineers responsible for canal management indicated that a substantial amount of water was being lost out the end of the canals because the existing system has a long response time before changes in system demand are reflected at the farm level (10 days to 2 weeks).

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The ORMVAT Activity Report for 1989 (ORMVAT, 1989 and ORMVAT, 1990)—the annual ORMVAT Activity Report is issued in two sections, each covering six months—reports that 710 million cubic meters of water was diverted from Ben El Ouidane Dam through the Beni Moussa irrigation subsystem. Based on this report, it is estimated that an additional 290 million cubic meters of water was diverted via the Kasba Tadla diversion dam from the Oum Er Rbia river through the Beni Amir irrigation subsystem. Total water diversions for irrigation in the Tadla perimeter from the two sources was, therefore, 1,000 million cubic meters for 1989.

The 1988 and 1990 Activity Reports (ORMVAT, 1988, ORMVAT, 1989, ORMVAT, 1990, and ORMVAT, 1991) provide similar figures for the perimeter. In addition, an ORMVAT brochure (ORMVAT, 1990) indicates that groundwater pumping provides about 160 million cubic meters of water each year in the perimeter—i.e., 70 million in the Beni Amir subperimeter and 90 million in the Beni Moussa subperimeter. This water does not travel in the sub perimeter canal systems. For this reason, no savings in groundwater efficiency can be derived from improved canal delivery efficiencies. Field application efficiencies, however, can be affected through improved farm-level water and soil management.

The project interventions to improve canal management should result in complete elimination of water losses out of the end of the canals. This would result in maximum annual water savings estimated at 60 million cubic meters, or 6 percent of the 1,000 million cubic meters. One member of the consultant team further estimates that a significant proportion of these savings could be achieved within two years after initiating implementation of an improved ORMVAT canal management strategy. By the end of Project Year 3, therefore, it is projected that this type of water loss would be reduced to 4.5 percent of the total and to 3 percent at the end of Project Year 4. Thereafter, water savings would increase linearly, so that by the end of Project Year 7 such losses would be completely eliminated.

These project interventions do not directly address other aspects of canal delivery efficiency, which account for an additional water loss of 14 percent. However, assuming that 14 percent of the water is lost by leakages and other related causes throughout the system, if improved management results in 60 million cubic meters of water no longer flowing out the end of the system, then the fraction of this amount that was previously lost by leakage would also be saved. Thus, there is a direct savings of 14 percent of 60 million cubic meters, or another 8.4 million cubic meters of water per year. These savings would be achieved at the same rate as those above—i.e., 50 percent achieved by the end of Project Year 4 and 100 percent by the end of Project Year 7.

Water savings will be enhanced by the anticipated PAGI 2 interventions to be financed by the GOM and the World Bank. These interventions are to be directed at rehabilitating sections of the Tadla canal system and reducing losses from canal leakage. While PAGI 2 addresses field application efficiencies directly with infrastructural interventions—e.g., gated pipe, field leveling, and use of siphon tubes—the benefits from these improvements cannot be fully realized without the improved knowledge of crop requirements, provided by the project intervention with automated meteorologic stations and the improved canal management.

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With the project interventions and those of PAGI 2 in place, overall system efficiency in the ORMVAT should be increased from 50 percent to about 70 percent—with canal delivery efficiency at 90 to 95 percent and field application efficiency on the order of 70 percent. One member of the consultant team believes that with such improvements, it is reasonable to attribute half the projected gain in field application efficiency to the PAGI 2 infrastructure interventions and half to the interventions under the project. However, it is doubtful that the PAGI 2 interventions in and of themselves would achieve improvements in field application efficiencies.

If after the projected water savings in the Tadla perimeter, net water flows into the two subperimeters remained at the current level of 931.8 million cubic meters per year and the canal delivery efficiency was 90 percent, the amount of water arriving at the field level would be 838.6 million cubic meters per year. A field application efficiency of 60 percent would then mean that 335 million cubic meters per year—40 percent of 836.6 million cubic meters—would be lost due to inefficiencies in water application at the field level. If this efficiency rate is increased to 70 percent, the loss is reduced to 251 million cubic meters, a savings of 84 million cubic meters per year. If one attributes 50 percent of this cost saving to project interventions, this savings would amount to 42 million cubic meters per year.

The above field application savings, however, are projected over a longer time period than those for canal management savings. One consultant estimates that 10 percent of the total could be achieved in Project Year 3 and that this savings would increase linearly to 50 percent of the field level cost savings by the end of the project. One hundred percent of projected savings would be achieved 15 years after Project Year 1, with annual linear increases from years 8 to 15. This longer period is necessary because the process of achieving higher field efficiencies is seen as more evolutionary—i.e., it will involve a considerable number of changes in the way the ORMVAT and farmers "currently" interact—and it presupposes a certain level of farmer responsiveness to new information.

Finally, the project interventions will save groundwater through improvements in pumping and field application efficiencies. Given that current groundwater use amounts to 160 million cubic meters per year and assuming no canal losses are associated with this type of water use, a current field application efficiency of 60 percent implies that 64 million cubic meters of this groundwater are lost to irrigation after being pumped to the field surface. An increase in field application efficiency to 70 percent would reduce this field loss to 48 million cubic meters per year—i.e., a net savings of 16 million cubic meters per year, with 8 million cubic meters of this savings attributable to project interventions. The rate of achievement of these savings is projected to be the same as that for the field efficiency savings of canal water above.

Table G-1 presents a summary of projected water savings in millions of cubic meters by year.

B. The Value of Water Savings Compared with Project Costs

The value of the projected water savings in the ORMVAT perimeter depends on how the water saved is actually used. Since experts believe that water has its highest average value per cubic meter in Morocco—i.e., approximately 0.85 dirhams or $0.11 at the current exchange rate per cubic meter—when used for irrigation purposes, this analysis confines itself to

Table G-1
Projected Water Savings from Project Interventions
(in m^3 per year)

Year from Start of Project	Water Savings from Improved System-level Canal Management	Water Savings from Improved Farm-level Water Management	Water Savings from Improved Groundwater Management	Total Annual Water Savings
1	0	0	0	0
2	0	0	0	0
3	17.1	4.2	0.8	22.10
4	34.2	8.4	1.6	44.20
5	45.6	12.6	2 4	60.60
6	57.0	16.8	3.2	77.00
7	68.4	21.0	4.0	93.40
8	68.4	23.6	4.5	96.50
9	68.4	26.2	5.0	99.60
10	68.4	28.8	5.5	102.70
11	68.4	31.4	6.0	105.80
12	68.4	34.0	6.5	108.90
13	68.4	36.6	7.0	112.00
14	68.4	39.2	7.5	115.10
15	68.4	42.0	8.0	118.40
16	68.4	42.0	8.0	118.40
17	68.4	42.0	8.0	118.40
18	68.4	42.0	8 0	118.40
19	68.4	42.0	8.0	118.40
20	68.4	42.0	8.0	118.40

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irrigation as the assumed end use for water saved. However, within this end use category, ORMVAT system managers would have the option of using water saved within the Tadla perimeter in two ways: to develop new irrigated lands within the Tadla perimeter--i.e., extension in the Dir area around Beni Mellal—or to provide supplementary water allotments to existing irrigated fields.

The working assumption in this analysis is that the marginal value of water applied on newly irrigated land is significantly higher than that of supplementary water allocated to existing fields. To illustrate this difference, the team used 1.10 dirhams, or $0.139, per cubic meter as the marginal value of water over the range in question when applied to new irrigation areas, and 0.70 dirhams, or $0.089, as the value of water applied to existing fields. Since the Tadla perimeter has approximately 6,000 hectares of land with irrigation potential remaining to be developed, the team would postulate that the best use of the water saved would be in developing this area and that this infrastructure could be in place by Project Year 7. Therefore, after Project Year 7, one could assume that 60 million cubic meters of the water saved by project interventions would be allocated to 6,000 hectares of new irrigation and the remainder used for supplementary allotments on existing fields. Based on these assumptions, Table G-2 presents the value of projected water savings under the project. Table G-3 presents a comparison of the projected benefits and costs of the project.

In the quantitative analysis, the value of the water savings was compared with the anticipated USAID grant investment in the project ($18.75 million) and the total project cost stream - i.e., USAID, GOM ($4.5 million), and private sector contributions ($1.75 million) to the project over six years. To add further reality to these figures, the working assumption was made that the GOM, through ORMVAT, would incur recurrent costs equivalent to $0.750 million per year after Project Year 6 to maintain the level of activities institutionalized by the project.

In the case of USAID grant investment alone, and without consideration of GOM recurrent costs, the present values of the net benefit stream discounted at 10, 20, 30, and 40 percent are, respectively, $48.00 million, $14.79 million, $4.09 million, and $0.10 million. The internal rate of return on the investment was computed at 40.4 percent.

In the case of total project investment without consideration of GOM recurrent costs, the present values of the net benefit stream discounted at 10, 20, 30, and 40 percent are, respectively, $43.61 million, $11.55 million, $1.59 million, and ($1.90) million. The internal rate of return on the investment was computed at 33.4 percent.

In the case of total project investment with consideration of GOM recurrent costs, the present values of the net benefit stream discounted at 10, 20, 30, and 40 percent are, respectively, $10.49 million, $10.39 million, $1.09 million, and ($2.15) million. The internal rate of return on the investment was computed at 32.4 percent.

It appears, therefore, that the water savings to be derived from Project Elements 1 and 2 are more than sufficient in themselves to justify approval and implementation of this project on

Table G-2
Value of Projected Water Savings under the Project
($ millions)

Year from Start of Project	Value of Water Savings from Improved System-level Canal Management	Value of Water Savings from Improved Farm-level Water Management	Value of Water Savings from Improved Groundwater Management	Value of Total Annual Water Savings
1	0	0	0	0
2	0	0	0	0
3	1.52	0.37	0.07	1.96
4	3.04	0.75	0.14	3.93
5	4.06	1.12	0.21	5.39
6	5.07	1.50	0.28	6.85
7	6.09	1.87	0.36	8.32
8	9.09	2.10	0.40	11.59
9	9.09	2.33	0.45	11.87
10	9.09	2.56	0.49	12.14
11	9.09	2.79	0.53	12.41
12	9.09	3.03	0.58	12.70
13	9.09	3.26	0.62	12.97
14	9.09	3.49	0.67	13.25
15	9.09	3.74	0.71	13.54
16	9.09	3.74	0.71	13.54
17	9.09	3.74	0.71	13.54
18	9.09	3.74	0.71	13.54
19	9.09	3.74	0.71	13.54
20	9.09	3.74	0.71	13.54

Table G-3
Projected Project Benefits and Costs
($ millions)

Year from Start of the Project	Total Project Costs	Total Value of Water Savings	Net Benefit Stream for Water Savings
1	3.562	0	- 3.56
2	5.010	0	- 5.01
3	4.888	1.96	- 2.93
4	4.457	3.93	- 0.53
5	3.998	5.39	1.39
6	3.085	6.85	3.76
7	0.750	8.32	7.57
8	0.750	11.59	10.84
9	0.750	11.87	11.12
10	0.750	12.14	11.39
11	0.750	12.41	11.66
12	0.750	12.70	11.95
13	0.750	12.97	12.22
14	0.750	13.25	12.50
15	0.750	13.54	12.79
16	0.750	13.54	12.79
17	0.750	13.54	12.79
18	0.750	13.54	12.79
19	0.750	13.54	12.79
20	0.750	13.54	12.79

economic grounds. This would be so even if there were to be no additional benefits forthcoming from Project Elements 2, 3, and 4—which certainly will not be the case, as explained below.

Moreover, the projected net benefits from water savings alone provide a very substantial cushion for adding in a higher estimate of the additional recurrent costs to the ORMVAT incurred in assuming project activities over a 20-year period and/or lowering the assumed values for irrigation water applied to existing or new fields over the same period. Since essentially all of the technical personnel required to implement the project activities are already in place at the ORMVAT, it is not anticipated that recurrent expenditures for personnel will be a very significant cost item. Some expenditures over time will be needed to replace and/or update system-level equipment and computer hardware and software, and possibly to secure the services of Moroccan consultants for short-term special assignments at the ORMVAT after the project ends.

II. ASSESSMENT OF COMPLEMENTARY BENEFIT STREAMS FROM AGRICULTURAL AND AGRO-INDUSTRIAL ENTERPRISES

The assessment above concentrated on the net benefits to be derived solely from water savings in the Tadla perimeter. The Element 2 and 4 interventions, however, are expected to have positive effects on other aspects of the regional economy. At least five other potential benefit streams were identified by the design team. These potential additional benefits flow from the following:

- Cost savings from more efficient pumping and conjunctive use of groundwater;

- Increases in net farm incomes derived from a gradual shift away from uneconomic industrial and food crops, such as sugar beets, hard and soft wheats, and cotton, to higher value crops, such as forages, fruits, vegetables, and specialty crops, in the Tadla perimeter;

- Efficiency gains and cost savings to be derived from increased private sector participation in agribusiness in the regional economy and privatization of inefficient government public and parastatal businesses;

- Efficiency gains and cost savings to the government from the ORMVAT's disengagement from commercial activities and better management of its residual mandate; and

- Efficiency gains in PAGI 2 infrastructural investments derived from complementary activities undertaken in the project.

Because the internal rate of return calculations above already take into account the total USAID, GOM, and private sector project investment costs—and, in the third case, an estimate of the ORMVAT recurrent costs as well—any quantifiable benefits from these additional benefit streams would have the effect of further increasing the economic attractiveness of the project.

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Annex H

SOCIAL SOUNDNESS ANALYSIS

Annex H

SOCIAL SOUNDNESS ANALYSIS

I. INTRODUCTION

The social soundness analysis is organized around three distinct but related aspects. The first is the compatibility of the project with the socio-cultural environment in which it is to be introduced--i.e., its socio-cultural feasibility. The second is the likelihood that new practices or institutions introduced among the initial project target population will be diffused among other groups. The third concerns the social impacts or distributions of benefits and burdens among different groups, both within the initial project population and beyond.

A. Socio-cultural Feasibility

1. Population

The ORMVAT currently has irrigation water delivery and/or agricultural extension responsibilities for farm families on 325,067 hectares of agricultural and grazing land in the Tadla plain. According to the most recent information (ORMVAT, 1991), there are 27,916 farm families in the Beni Amir and Beni Moussa irrigation subperimeters. During the 1989-90 summer and winter seasons, they planted crops on 114,334 hectares. In addition to the farming community in the irrigation perimeter, there are 26,646 farm families in the area outside the two irrigation subperimeters, but within the total ORMVAT area. These families have rainfed crop and livestock enterprises on the remaining 210,733 hectares.

The ORMVAT area comprises portions of the provinces of Beni Mellal and Azilal, with 13 rural communes and 5 major towns: Fkih Ben Salah, Souk Sebt, Beni Mellal, Ouaouizerth, and Bzou. The total population of the ORMVAT area is estimated to be 424,000, of which 318,000 are classified as rural inhabitants and 106,000 are urban dwellers. If all rural inhabitants were also enumerated as members of farm families within the ORMVAT, the average size of a rural family would be approximately 6 persons. The overall population density was 118 persons per square kilometer in the Tadla at the last population census.

According to statistics from the Ministry of Health office in Beni Mellal, the population in the ORMVAT is quite young, with 42.8 percent younger than 14, 20.5 percent between 15 and 24, 17.1 percent between 25 and 39, 13 percent between 40 and 59, and 6.6 percent older than 60.

For reasons of forced displacement during the colonial period and in- and out-migrations since then, the farming population of the ORMVAT perimeter is quite heterogeneous. Prior to initiation of irrigated agricultural activities in the early 1930s, the dominant tribal confederations on the Tadla plain were the Banu Amir and the Banu Moussa. These peoples, due to their soldier--Guich--status vis-à-vis the Moroccan ruler, had collective access and usufruct rights to the land on both sides of the Oum Er Rbia River.

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With irrigation in the Beni Amir subperimeter, the tribal confederations lost many of their land use rights and were effectively excluded from much of the irrigated area through colonial decree and private "land sales" to outsiders, both colonialist and Moroccan. In the 1990s, however, the tribal confederations still have influence in the ORMVAT, with the eastern and western fractions of the Banu Amir tribal confederation having their headquarters in Fkih Ben Salah on the right bank of the Oum Er Rbia River and the several major groups of the Banu Moussa having their center in Souk Sebt on the left bank. Only in parts of CMVs 507 and 509 do members of the Banu Moussa inhabit the right bank of the river. Both confederations descend from the Hilali Arab invasion of Morocco in the 12th century and both were given collective lands in the Tadla by the Almohade Dynasty.

Most of the population of the perimeter is said to be of Arab origin but, in the eastern part of the perimeter against the foothills of the Middle Atlas mountains in Azilal Province, three CMVs—525, 529, and 532—have largely Berber populations. Most of the inhabitants are from the Ait Atta tribal faction, but close to Beni Mellal there is a significant population of Berbers of the Ait Rbaa faction.

Ethnicity is a mediating factor that has determined administrative jurisdictions within the Tadla—i.e., there are rough correlations between tribal/fractional distributions and the delineation of cercle/commune boundaries—and affected patterns of association and cooperation.

2. Organization

The core operational objectives of the project are to, first, evaluate and then effect changes by participants in the management of resources—primarily water and land—in Tadla in the context of a more open Moroccan economy. In this regard, it is essential to have or to develop an understanding of who the landowners and agricultural operators are within the Tadla irrigated perimeter and how they organize their activities. This is so because owners and operators of land in the perimeter are—in matters concerning them—simultaneously interlocutors with the state and direct actors in resource management.

Any meaningful discussion of resource allocations within the Tadla must start from a very detailed base of current information about property ownership and actual management of agricultural enterprises and household activities. Unfortunately, at present, this is the area of greatest weakness in the existing literature. Detailed farm-level information of the kind needed to assess and recommend changes in resource allocations is simply lacking for the Tadla perimeter and, while the reasons for this deficiency can be explained, the problem could not be remedied in the course of the project design exercise. The only alternative was to design a series of diagnostic studies into project implementation which has been done for all four elements of the project.

The information problem at present stems essentially from the approach adopted by the GOM over the past three decades toward agricultural enterprises in all of the nine large-scale Moroccan irrigation perimeters. During that period, the practical reality was that the Moroccan government was not overly concerned about how farm families actually organized themselves because the central thrust of irrigation policy was to narrow—and, to the extent possible, eliminate entirely—the range of possible management options open for farmer decision making. In a very real sense, the Moroccan government sought to intervene so massively in the technical, economic, and social operations of the large-scale irrigation perimeters that critical resource allocation decisions were essentially taken by the state on behalf of the farming community, not in collaboration with it or by the farmers themselves.

The Moroccan model for large-scale perimeter development entailed a very high level of internal technical rationality and coherence that made it intellectually very appealing to the government engineers who designed the physical infrastructure and largely ran the agricultural operations. The "solutions" it proposed for agricultural production problems were elegant in concept and obeyed a compelling internal technical logic. Unfortunately, those same solutions essentially ignored the farmer as a legitimate participant in decision-making processes and the complexities of his situation. The working out of the model also led to persistent attempts to make local market operations and the general economic environment conform to an idealized technical solution for large-scale irrigation perimeters, instead of adapting the model(s) employed to the economic realities faced by farmers and/or Morocco in general.

The large-scale perimeter model sought to link coherently the size of irrigation systems, the precise layouts of fields within irrigation blocks, the selection of specific crops and crop rotations, and the location of agro-industrial enterprises servicing the agricultural producers. As a result, the model generated a strong internal propulsion toward highly centralized management, which was seen as the only way to ensure that systems worked efficiently.

The magnitude of the public investments expended in creating and running the irrigation systems reinforced the government's perceived need for centralized authority. As a consequence, many obligations were imposed on farmers in the guise of a "moral contract" between them and the government to produce for the good of the Moroccan "public." The responsibilities of the parties to the "contract" were spelled out precisely in the Agricultural Investment Code of 25 July 1969. The crop rotations, production norms, and cultivation techniques were established by annual decrees published in the GOM's *Official Bulletin*. They were mandatory for all farmers and carried graduated sanctions—including expulsion from one's land—in the event they were violated.

The operative irrigation model assumed an ideal type of operation in which the following is true:

- A farm unit of at least five hectares was to be maintained as the minimum economic unit for a Moroccan farm family. Subdivisions below this size by either sale or successional division were prohibited by law.

- A unified farm plot was to be operated as a single enterprise, and mandatory land consolidation of parcels was implemented to reassemble properties in a geometric layout.

- A balanced mixed farming operation was to be maintained, within which crop and livestock enterprises were closely integrated.

- A stable farming operation was to be managed by the owner or under a regulated term lease.

Under the operative model, the government did almost everything in the large-scale perimeters. It conceived, constructed, operated, and maintained the on-site and off-site infrastructure used in irrigated production. It chose the crop rotations for the farmers and imposed crop and irrigation techniques on them. It distributed irrigation water on a regulated seasonal schedule and established the unit price for this water. It granted agricultural credit through public financial institutions and bought, transported, and processed the crops for fixed prices. And, finally, through agents at the processing plants, the GOM deducted farmers' credit reimbursements from the crop payments due to them before they received net payments.

Implementation of such a techno-economic irrigation model obviously provided neither encouragements nor incentives for government officials to view farmers as legitimate participants in the process of discussion and formulation of perimeter activities or to investigate how farm enterprises actually functioned in the perimeter. To the contrary, as the model proved itself increasingly fragile in implementation because there were simply too many factors for any centralized management to control, many officials perceived their institutional roles as defenders of the system. They spent little or no time investigating actual farm conditions--or why the model was not yielding the results anticipated.

The "model" experiment of the last three decades explains in large measure why there is currently such a paucity of detailed farm-level information. Most "farm-level" information recorded at the ORMVAT through the 1980s reports on "actual" agricultural production for the "major" crops vis-à-vis the plan targets for the 26 CMVs in the perimeter, accompanied by explanations as to why targets were or, more often, were not attained.

The same type of informational deficiencies apply to questions of land ownership and tenure in the perimeter. It is evident in discussions with ORMVAT staff that government land titling agencies do not always know precisely how many rightful owners there actually are for any given farm parcel, although nominal ownership is usually ascribed to one owner. On the 94 percent of the land that is privately owned—nearly always in joint ownership—government officials are often unaware of how each property is actually subdivided among co-inheritors and who among these individuals and other nonowners actually works the land.

In the case of irrigated land, this lack of precise information is detrimental for a number of reasons. First, after consolidation, the overall layout of plots within an irrigation block—with its geometric precision and alignment—gives a false impression of orderliness, when in reality agricultural production enterprises may be scattered among several parcels. Second, the ownership and management functions with respect to any particular field or crop enterprise may actually be divided among several different persons, making agricultural innovation difficult. And third, technical operations within the perimeter are still based in large measure on the facile assumptions of complete respect for the system's original development model—i.e., minimum size of properties, plot operations that respect certain cropping patterns and rotations, and so on—even though everyone acknowledges informally that the underlying organization of plots and farm resource allocation patterns is not and, effectively, cannot be respected.

Despite the undeniable technical successes Moroccan engineers have attained in capturing and controlling water deliveries in the ORMVAT perimeter, the overall large-scale perimeter model bears little resemblance to what is actually happening in the perimeter. Therefore it rarely attains its stated objectives. This is so in many instances because the theoretical layout and operations of plots within a block do not correspond at all with the realities of farm-level operations. Farm operations are very often smaller than anticipated by the model. Surveys, in fact, show that the average farm holding has only 4.26 hectares, and 47.5 percent of all farms have less than the minimum 5 hectares. The subdivision and amalgamation of plots, by covert private sale and because of inheritance laws, continue apace. Moreover, actual field operations are not always perpendicular within a block as anticipated by the model, and many fields are planted to more than one crop in violation of the anticipated rotation. For all these reasons, the anticipated scheduling of water deliveries to farms based on fixed crop rotations and the water requirements of specific crops under specific cultivation techniques cannot be respected in reality. And, to their credit, ORMVAT system managers have finally recognized this fact and started to modify the water delivery system to accommodate the needs of the farmers. Nonetheless, many more modifications are needed—as detailed in the description of Element 1 activities in Chapter Two of the main report—before the system can be fully responsive.

The system described above pertains most directly to the 71 percent of the perimeter land (68,787 hectares) in 21,396 parcels controlled under private ownership. The variances from the irrigation model are even more complicated on the 14,818 hectares and 963 parcels—15 percent of the total—of state land operated by parastatal enterprises, experiment stations, and agrarian reform cooperatives, and the 13,704 hectares of land in 486 parcels operated as collective or habous lands. In the former case, the majority of the land is operated in large blocks under unified management. In the latter, the land is often leased out to large investment companies for pivot irrigation using water from boreholes. In neither case, however, do actual land management and resource allocations correspond with the theoretical irrigation model.

All of the above, explains, in some measure, why there is not a great deal of useful information available on farm-level organization and why the generation of such information early in the project is of critical importance to the success of project activities. Equally important, the discussion shows why working in Tadla will be such an interesting and stimulating undertaking in the 1990s. GOM decisions taken at the end of the 1980s to revamp the most fundamental elements of its policy toward the large-scale irrigation perimeters will inevitably lead to truly massive reorientations in ORMVAT and GOM thinking and to much improved prospects for meaningful interactions with farmers and other representatives of the private sector. The project elements have been designed specifically to assist with this reorientation process and to make the policy changes concrete realities in Tadla.

Now that the GOM has adopted a disengagement policy and the ORMVAT is pulling out of commercial agricultural activities in the perimeter, it is important that this disengagement be accompanied by the development of new institutional working relationships that finally understand and address farmers' constraints and needs.

3. Resource Allocation Decisions

So little is known about how farm families in Tadla make their resource allocation decisions that speculation on how they might respond to project activities during the next seven years might appear somewhat specious. However, judging by the changing patterns in crop production and agricultural practices recorded in the 1980s, one can already conclude that Tadla farmers are highly knowledgeable about and responsive to economic opportunities and technological innovations they think are in their interest, such as paprika peppers as a new crop or the use of well water in conjunctive use with water from the gravity system. Conversely, experiences in the perimeter have shown that farmers will actively resist external attempts to impose changes like replacement of the traditional robta irrigation system with furrow and siphon systems, increasing cotton cultivation during the summer season, or imposition of fixed crop rotations—where they believe technical and/or economic conditions do not justify such changes.

Beyond adoption choices based strictly on the objective characteristics of the process or technology in question, certain factors may affect some farm groups' responsiveness to innovation. Farm size and the relative degree of dependence on farm production for family subsistence clearly varies widely within the perimeter. Almost one-half of all farms in the perimeter control less than 5 hectares of irrigable land, and many people have expressed the belief that, as farm size in hectares declines below this size, the farm family's dependence on farm production for subsistence increases to the point where such families have an inherently lower capacity to respond to economic changes or to adopt new technologies.

This type of statement can certainly be formulated as a valid hypothesis for testing under the project's Element 2 intensive farm management study but it is far from a proven fact. The conventional wisdom on this issue could easily be proven wrong if, for example, intensive diagnostic efforts documented that families on very small farms receive large in-flows of funds from family members working in off-farm employment and were willing and able to use some of these funds for modernizing farm enterprises or relieving pressures to grow subsistence crops. In these situations, families on small farms might actually prove to be less risk averse than those on larger holdings.

Moreover, in irrigated areas with a large range of possible crop and livestock enterprises operating under open market conditions, there is often no reliable correlation between size of land holdings per se and the size and/or profitability of the farm business. Not only is it not true that larger farms necessarily have higher net farm revenues and, hence, profitability than smaller farms, it has often been found that the opposite is true—i.e., because of the constraints they face, families on smaller farms operate their enterprises more intensively, allocate their resources more efficiently, and grow higher percentages of high value crops in rotation than families on larger farms. Suspicions of this sort are certainly relevant in Tadla, where virtually every technician and extension agent interviewed was of the opinion that the largest farms, run by public and parastatal agencies and/or under collective arrangements, were the least efficient allocators of resources in the perimeter and the most unprofitable in terms of enterprises undertaken.

Further interviews, particularly with government officials, often uncovered very specific views on gender roles in agricultural enterprises. Participants often proceed from these statements to assumptions about how males and females benefit differentially from on-farm enterprises. Women are often said to benefit most from livestock enterprises-particularly dairy enterprises—and less from crop enterprises. Further, because most ORMVAT extension agents are male and tend to directly relate more to male farmers as the ascribed "heads of household," it is usually assumed that women necessarily have diminished—or even no—roles in farm family decisions about resource allocations.

These stereotypes were reinforced in many discussions with expatriates by facile assumptions about how Islamic societies function in comparison with Western societies. Often there arose the added assumption that Islamic inheritance laws necessarily lead directly to the fractionalization of land holdings to the point where farms become too small to be viable economic units. Such comments of course carry with them the implicit assumption that Islamic societies are, by their nature, so rigid that they have not developed any alternative mechanisms for dealing with these fundamental problems.

All this reiterates the fundamental need for intensive work at the farm level to understand the roles of all family members in decision making and for flexibility in determining what specific interventions will be designed, tested, and disseminated at this level. It also reinforces the project design decision to mainline all project activities in the initial stages of project implementation. At present, project activities are seen by the team to be sufficiently gender neutral and broad in scope to offer equal opportunities to all potential participants. However, if and when gender discrimination is documented as a specific factor in denying group access to project activities and/or specific activities are shown to favor certain participants unfairly, enough flexibility has been built into the processes for designing and implementing project activities to allow substantial reorientations in approaches and resource allocations.

4. Motivation

Farmers and other groups in Tadla will respond to the incentives provided by GOM policy changes and project activities to the extent they perceive they will benefit from the changes and activities. Conversely, they will respond to the extent that they see negative consequences to inaction on their part. This is important in the current situation because various actors are responding to positive and negative stimuli in differing degrees. For example, farmers in Tadla are already changing their specific crop enterprises and rotations and on-farm practices in response to both positive incentives—e.g., the emergence of the paprika pepper opportunity—and goads to greater efficiency—e.g., elimination of government subsidies on inputs and fixed prices on certain outputs, and ORMVAT/parastatal withdrawals from commercial activities. There is no reason to believe that the same mix of positive and negative incentives will not affect farmer responses to the technological and institutional innovations proposed under the project.

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At the ORMVAT level, staff are—and will increasingly be—reacting to both positive and negative incentives. It is clear, for example, that pressures from the national level are increasing for the ORMVAs to accelerate their disengagement from commercial activities and to develop innovative methods for involving farmers and other economic actors in decision making about water deliveries and agricultural extension needs. At the same time, all ORMVA staff are feeling the spur toward improved performance. In the Tadla case, they are also looking forward to the technical assistance, training, new equipment, and methods, to be provided under the project as positive incentives for upgrading their individual and collective capacities, changing outdated work habits, and revamping unsuitable ORMVAT/client relationships.

Private commercial entrepreneurs and firms will participate in the Tadla economic transition to the extent they can identify and profit from new business opportunities. The project will seek to work with these key economic actors to test and disseminate new agricultural technologies for farmers, evaluate new market opportunities, and train staff in improved business management.

5. Minimum Participator Profiles

Activities in this project cover such a broad range that it is extremely difficult to define a minimum participator profile that would apply in all cases. With respect to on-farm activities, the initial assumption used was that full-time farm families having between 3 to 10 hectares of irrigable land would be the primary beneficiary group. This appears to be the group most likely to have already been affected by the policy changes the GOM has made--i.e., subsidy reductions, market liberalization, withdrawal of ORMVAT commercial services—and most likely to benefit from improved water deliveries and other innovations under the project.

The major unknown with respect to farms having fewer than 3 hectares is the origin and status of financial and other resource flows to and within the households. If it can be verified that these families receive significant amounts of money from off-farm sources and can secure farm labor on demand, it is possible that they may be highly responsive to new opportunities—particularly with respect to more economic use of agricultural inputs and initiation of new crop enterprises. They would also appear to be the operations most in need of private custom services for mechanical operations such as as plowing, secondary tillage, and harvesting. Conversely, they are probably not good candidates for adoption of custom micro-irrigation systems and/or installation of more efficient pumping equipment to facilitate the conjunctive use of ground and gravity water.

At the upper end of the farm size classifications, most of the land in question is held and/or operated by public and parastatal agencies or in collective arrangements. In the former case, more reliable access to irrigation water will probably be the most effective way of influencing a supply response. Beyond that step, these farms have sufficient access to credit, input supplies, and technical consultants to plan and implement changes in farming operations without extensive support from the project. Whether they will make such changes—after water deliveries improve--has more to do with what they perceive to be their "moral" responsibilities vis-à-vis the government than it does with lack of resources. Because this "moral contract" philosophy plays such a large role in the decision making of these agencies, they may end up as the main Tadla producers of sugar beets and cotton long after the smaller, private farms have shifted their enterprises toward more profitable crops.

With respect to the lands under collective arrangements, there appear to be two different approaches. One is to continue the current process of establishing long-term leases with private companies to develop and manage the collective land using water from boreholes and capital intensive pivot irrigation technology in return for some benefit sharing arrangement with collective members. The other is to find ways of effectively privatizing the landholdings and giving titles to individual farm families.

In the first instance, the large private pivot operations are effectively beyond the influence of most of the interventions planned for the project. In the second, the process is already converting the agrarian reform cooperatives and similar institututions into less restricted associations of farm families, each with title to their land. In this status, the households in the cooperatives may not be very different from other private landowners in their responsiveness to the project.

Finally, with respect to the environmental activities under Element 3, there appears to be no minimum requirements for participation. Since all parties in the perimeter contribute to the existing pollution and resource misuse problems observed, all should have at least the potential to contribute to the process of mitigating—and, in some case, eliminating—the problems. Further project activities are designed to generate recommendations for improved environmental management at all levels in the perimeter.

6. Matching Participators with the Project

While the vast majority of Moroccans in Tadla will benefit in some measure from project activities, some groups have the potential to benefit more than others. The major beneficiaries have been identified above and in the Economic Analysis (Annex G).

Two groups that stand to benefit indirectly from project activities are seasonal migrants who come into the area to participate in agricultural activities and the populations living downstream from the Tadla. The first group may derive significant employment benefits during a larger portion of each agricultural year as cropping patterns shift toward more labor-intensive crop enterprises. The second group will benefit primarily from project activities that affect the quantities and quality of water available for use downstream.

A certain number of individuals within the perimeter will definitely not benefit from the project and may be adversely affected by the broad policy changes initiated by the GOM and supported by the project. These include employees of public and parastatal agencies within the perimeter—i.e., sugar mills, cotton ginneries, input suppliers operating under government contracts, and certain ORMVAT staff—whose essential functions will be reduced and/or eliminated in the disengagement process. Many of these people, because they possess valuable skills and experience, may in fact find employment in the private sector or in other government positions but all will experience job dislocation and possibly loss of status in the transition period.

7. Obstacles to Progress

There do not appear to be any insurmountable obstacles to progress for the project as designed. But there definitely are sensitive issues to be monitored and resolved during project implementation. These revolve around the interrelated problems of a legacy of paternalism, problems with the "industrial" crops, and problems in assessing the benefits and costs involved in the GOM's disengagement/decentralization process.

Since 1986, the GOM has embarked on a process of economic policy change that has already significantly affected power relationships in the Tadla. It must be recognized that this process has been and will continue to be -- politically and economically painful for many stakeholders in the previous system. Moreover, the psychological transition from old to new working relationships between ORMVAT staff, farmers, and representatives of the private sector is far from over and has been disturbing for many participants.

In a very real sense, both groups find themselves caught between a comfortable and established system of privileges and responsibilities that is disappearing and a new economic system in which their roles, if any, are uncertain or ill-defined. One measure of the ineffectiveness of the government's economic reorientation efforts to date is that so many groups in Tadla feel uncomfortable in the face of the changes. This gives little comfort for those who stand to lose real power—mainly government officials, managers and staff of public and parastatal agencies—or for those who must manage the transition process so as to avoid serious dislocation in the rapidly changing environment.

In Tadla, there is a constellation of stakeholders whose positions and power are intimately tied to continuance of the local sugar beet and cotton industries. In the past, government attempts to promote production of these two crops have led to development of significant infrastructure and employment and, as important, have altered economic relationships between farmers and the government officials managing these industries. Economic liberalization and the disengagement process have struck at the heart of these relationships. They have broken the essential linkages that shaped the control relationships and, simultaneously, saddled the government with the costs of infrastructure and institutions whose value is declining with each passing year.

As a consequence, it is not surprising at this stage that many of the stakeholders in the old system are the first to raise arguments against the changes under way and make paternalistic statements about the alleged benefits of a declining system for farmers and other groups in Tadla. Many of these comments, although perhaps voiced for the wrong reasons, address real problems that remain unresolved. For example, how can the government handle the transition if it effectively has to write off investments over several decades in the sugar beet and cotton industries? Or, what will be the real balance of political and employment gains from new agricultural enterprises in Tadla versus losses from old industries? And, finally, how will the transition to a new set of political and economic relationships be handled so as to avoid adverse consequences for major constituent groups?

The underlying struggle to resolve these issues affects fundamental political and economic relationships at all levels in Tadla—as elsewhere in the country. And, because the project seeks to assist in the process, it will inevitably be affected by it. The prospect of delays in realizing significant progress—particularly with respect to Elements 2 and 4—cannot be discounted. Only time will tell how strong is the resolve of the government in actually implementing the policy changes it has already announced.

8. Communications Strategies

The rationale for the GOM's irrigation model in the past was to impose a comprehensive technical package of irrigation management and agronomic practices on farmers. Most of the difficulties encountered in this approach can be attributed to three basic flaws in the system. First, communication patterns with farmers either individually through the extension mechanisms or in groups through the organizations the GOM created, such as cooperatives, and professional associations, were one-way: they served only to communicate government decisions and demands to the farmers without recognizing farmers as legitimate participants in a decision-making process, and failed completely to take into account the constraints under which farmers had to operate in the perimeter. Second, the model precluded any effective role for other private sector actors, except as contractors in state-run operations. And, finally, the whole system ran on a set of false economic signals devised by the government and communicated to farmers through a closed market system.

Disengagement will permit farmers and technicians far greater latitude and provide real incentives for both groups to actively foster new economic opportunities within the perimeter and adoption of improved irrigation/cropping practices. The activities designed under Project Element 2 will identify critical constraints in farm-level resource allocation and specify pilot interventions that will be tested on-farm to alleviate these constraints. An examination of existing dissemination mechanisms, both formal and informal, suggests they are appropriate vehicles for disseminating results of project efforts. Their effectiveness has been compromised largely by previous restrictive policies. Mechanisms for disseminating project results have been described in the Implementation Plan, and this analysis sees no real constraints to their success, if they are carried out in the new spirit of partnership and liberalization.

B. Spread Effects: The Dissemination of Innovations

1. Leadership/Authority

In a formal structural sense, the primary responsibilities for evaluating the results of project activities and disseminating them within the irrigation subsector will lie with government officials in the ORMVAT and the MARA. In the present network of nine ORMVAs, each is geographically defined and faces a different constellation of problems. Each has different methods of addressing its problems, employs different types of irrigation and agricultural technology, and interacts with different client groups.

Since the team necessarily confined its design activities to the ORMVAT, it is difficult to assess the potential relevance of any single project intervention to the other ORMVAs at this time. Presently, it would appear that technical system and farm-level activities in Tadla will have their greatest relevance to those parts of the other ORMVAs where gravity irrigation is practiced. If effective methods are developed in Tadla to manage the conjunctive use of ground and gravity system water, this would be another area of potential relevance. And, of course, work with more effective use of agricultural inputs for specific crops may have important carryover effects in other ORMVAs.

But, beyond the technical aspects of the project, project efforts to develop and implement new working relationships between ORMVAT staff, farmers, and other representatives of the private sector seem to hold out the greatest possibilities for diffusion and adoption in the other ORMVAs. Prospects in this regard will be strengthened by the working relationships that have been established with the MARA/World Bank projects. These projects, after 1993, will be working with all of the nine ORMVAs on redefining operational roles and improving ORMVA management practices. To the extent that project activities in Tadla generate findings, recommendations, and innovations applicable to the problems in the other ORMVAs, it has already been agreed that the projects will work together in disseminating results within the network.

In addition to the ORMVA network, results from the environmental activities under Element 3 will be disseminated through the network of agencies established during project implementation. In addition to MARA, the network will have participation from agency staffs from the ministries of Public Works and Health.

Within the project itself, a number of mechanisms are envisaged at the regional and national levels to disseminate project results and to discuss common problems. First, the project, in collaboration with the SVOP of the ORMVAT, will produce and distribute technical papers in French and Arabic to all interested parties. Second, if a regional radio network for agricultural news and commentary is established, the project will supply materials for broadcast. Third, a number of regional and national workshops and seminars will be supported by the project as a forum for discussions and dissemination of project results. And, finally, standard agricultural extension techniques—farmer field days, observational tours, audio-visual presentations, and so on—will be used in Tadla.

2. Patterns of Mobility

The Tadla area is served by an excellent network of paved roads. These roads link the area to all the major cities in the central plain—Fes and Meknes in the north, Marrakech in the south, and Casablanca and Rabat to the west. The area also has excellent information system links with the rest of Morocco and other countries via telephone and telex, and postal facilities. No major impediments to the circulation of people and information exist within the area or within other areas in the country.

3. Effects of Previous Projects

To the design team's knowledge, USAID has never had an agricultural or natural resources project in the Tadla area. The only major donor assistance to the ORMVAT in the recent past has come through the MARA/World Bank PAGI 1. Activities under the latter project were directed at improving the management of the ORMVA network throughout Morocco in support of the objectives of the GOM's structural adjustment processes at the macro-economic

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and sectoral levels GOM/World Bank experiences under PAGI 1 were sufficiently encouraging to lead to the development of the two new irrigation subsector projects described elsewhere in this paper.

C. Social Consequences and Benefit Incidence

Farm families in the Tadla perimeter will be the principal project beneficiaries. Improved water management will result in better allocation and timing of water deliveries in response to farmer-generated demands. Farmers will also benefit from agronomic packages to be introduced by the project. Abrupt disengagement of the ORMVAT from its previous functions, without the innovations planned under the project, would probably threaten farmers' well-being more than it would enhance their economic prospects.

The GOM has set a priority on the creation of job opportunities in the private sector. The confluence of the project and disengagement activities offers new opportunities to young entrepreneurs who deal in custom services to farmers. Few of these business operations presently exist in the perimeter, but project activities under all elements will assist in identifying and promoting such opportunities.

Families in both urban and rural areas within the perimeter and downstream of it should benefit from Element 3 environmental monitoring and other activities that will protect their water supplies from pollutants and toxic agrochemical residues. Information and education on management and storage of toxic products provided through the new regional environmental network will reduce the risks of health hazards for all users.

ORMVAT personnel—particularly in the SGRID, SPA, SPP, and SVOP—will benefit from training and improved work systems. Given the difficult tasks and reorientations in working procedures they face, these staff members should benefit enormously and collectively create a completely new working environment in Tadla.

Urban populations in Casablanca, El Jadida, and Safi will benefit from higher water quality and greater protection from toxic chemicals in their water, as the water treatment plant serving these cities is immediately downstream from the ORMVAT. Farmers in ORMVAD and ORMVAH will also benefit from improved and/or higher quality of water entering their perimeters.

1. Access to Resources and Opportunities

The entire purpose of the project is to broaden access to and participation in decision-making about resources and opportunities in the Tadla for farmers and other private sector participants. The activities of the project seek to actively support the GOM's twin policies of public agency disengagement from commercial enterprises and reorientation of the ORMVAT toward wholly service activities in water delivery and agricultural extension. The project will also work with local institutions—cooperatives, professional associations, irrigation associations, etc.—to strengthen their capacities to participate to greater degrees in the economic and political life of the community.

Annex K

A.I.D.-FINANCED EQUIPMENT AND SUPPLIES

ANNEX K (Cont.)

A.I.D.-Financed Equipment and Supplies

Item Description	Number of Units	Unit Cost ($)	Total Cost ($)
Project Management, Monitoring, Evaluation and Audit			
Office Equipment			150,000
•Office Furniture	1 set		
•Computer Work Stations with LAN System	12		
•Laptop Computers	3		
•Computer Software	misc.		
•Printers and Accessories	3		
•Copiers	3		
•Calculators	2		
•Facsimile Machines/Type-writer/etc.	misc.		
Office Supplies/Communications	misc.	see Ch. 3	
Project Support Services	misc.		60,000
Vehicles			
•All-Terrain, 4x4, Diesel	10	25,000	250,000
Vehicle Operations and Maintenance	misc.	see Ch. 3	

Annex L

JUSTIFICATION FOR THE NON-COMPETITIVE AWARD

OF A

COOPERATIVE AGREEMENT

TO THE

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

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As the GOM's policy changes are implemented in Tadla, farmers will be given much greater responsibility and capacity to run their own farm enterprises in response to the constraints and open market economic signals they are facing. A much greater percentage of agricultural and commercial activity will be in the hands of private sector entrepreneurs and firms. Markets will be operating free of the government-imposed price and quantity distortions of the past--i.e., taxes, subsidies, credit rationing, and water allocations.

All these changes should result in significantly greater net incomes for farm families and increased market shares for private businesses in input supply, provision of agricultural services, commodity processing, and product marketing.

2. Employment Effects

Project activities per se in the Tadla will probably have only minor impacts on regional employment because the activities have been deliberately designed to work with existing institutions and retrain their personnel to assume new responsibilities. However, the project is intended to assist the GOM in turning national policy decisions into concrete realities at the regional level. If this process proceeds as planned, there will inevitably be very major changes in both employment patterns and the productivity of labor in irrigated agriculture in Tadla.

For example, the result of the ORMVAT disengagement and the liberalization of markets and perimeter operating procedures, farmers have begun to reallocate the resources under their control to new crop enterprises—i.e., paprika peppers, other vegetables, and fruit—and away from lower value crops—i.e., sugar beets and cotton. These crops are more labor-intensive to produce and process but more profitable per unit of labor invested.

The project is aimed at assisting farmers in furthering this process in the 1990s by increasing the access to and reliability of critical agricultural resource delivery systems. It will also develop, test, and disseminate farm-level innovations that will further increase the productivity of existing labor and create new opportunities for on-farm employment of both skilled and unskilled labor. In addition, the new on-farm innovations will create market demands for new goods and services from the private sector—such as needs for new enterprise inputs, consulting services, equipment maintenance, commodity processing, and marketing.

Finally, because of the presence of many small farm units in Tadla whose capital resources are limited and the more general need to create employment opportunities in the Moroccan economy, the project activities have been deliberately oriented toward introducing agricultural innovations that which will increase both labor and land intensities. Work on water delivery systems will allow farmers to work their land more intensively. Introduction of innovations in crop tillage and use of inputs—i.e., seed, fertilizers, and other agrochemicals—will increase both land and labor productivity while lowering capital costs per unit of output. And, deemphasis of activities using agricultural machinery will avoid problems of labor displacement in agricultural enterprises.

3. Rural Displacement, Migration, and Urbanization

Before the construction of infrastructure to manage the water resources from the Oum Er Rbia River in 1928 and initiation of irrigated agriculture in the early 1930s, the Tadla plain was an area devoted primarily to transhumant livestock grazing, with some rainfed production of cereals such as wheat and barley. The plain was seen by the French colonial government as "asleep on its riches," and it was said that, "The day when French plows trace their furrows in the plain and French farmhouses enliven the landscape . . . the region will become one of the most prosperous and fertile in Morocco" (Swearingen, 1987).

From the start, the Beni Amir project had to contend with the "strength and bellicosity" of the tribes in the area, and "sensitive political manipulations . . . were needed to lay the foundations for this new development." These manipulations led to the creation of three "perimeters" of official colonization on the plain covering some 45,000 hectares downstream from the new diversion dam at Kasba Tadla. The "perimeters" were "deducted from the native lands."

The official colonization program in Beni Amir, however, soon ran into difficulties over problems that were to persist. The first was the slow procedure for expropriating "native lands." Before land could be delivered for colonization, it needed to be surveyed and registered, its boundaries delimited and established by decree, and "native" residents settled elsewhere. As these steps were taking place, however, "clever adventurers" swept in the area, attracted by the promise of government-supplied irrigation water and anxious to acquire large holdings before the government could conduct land registration.

Lively land speculation occurred throughout the irrigable portion of the Beni Amir plain. The collective, unsurveyed status of the land made it easy for abuses to take place. Speculators were able to obtain titles for small sums from Moroccans willing to sell land out from underneath their fellow tribal members or land of which they did not even share possession. This process was described as follows by one French administrator (Swearingen, 1987):

> "A veritable field day of land-grabbing, which the public powers could only oppose with feeble means due to the confused legal status of the land, soon ended with a few individuals--most agents of powerful land investment companies--amassing an important part of Beni Amir's patrimony."

This situation led to a number of reformulations of the Beni Amir colonization scheme over the next 15 years, with certain groups advocating complete privatization and French occupation of the perimeters and others arguing for "native" settlements as an answer to the problem of drought vulnerability and as a means of labor resources to cultivate "strategic, labor-intensive crops."

Ironically, the second problem the Beni Amir colonization program encountered was the inherent salinity in the middle course of the Oum Er Rbia River, which initially placed the whole project in doubt. By 1936, however, test results from the experiment station at Dar Oulad Zidouh led to the conclusion that the Oum Er Rbia's salinity would present no obstacle whatsoever to agriculture. The tests also had "discovered" that the permeable soils in the Beni Amir plain would permit removal of accumulated salts by off-season flushing. These findings rekindled flagging colonial interests in the area, and land speculation again broke out in the plain.

The above, brief recounting of the Tadla irrigation systems' history is useful in reminding the reader that the plain has been the site of rural population displacements and labor in-migrations and out-migrations for a long time. As can be seen, these occurrences have been triggered by many factors over time, including government policies, conditions elsewhere in Morocco and outside it, and the development of very valuable irrigated land in the midst of an area subject to periodic and severe droughts.

There are consequences of these factors in Tadla in the 1990s. The first is, as discussed above, that the farming community in the Tadla perimeter displays a high degree of heterogeneity. It is a complex mosaic of peoples from the Banu Amir and Banu Moussa tribes, and the Chorfa and Oulad Abdalla clans, all of whom have occupied the land since the 1930s and "outsiders" who have acquired access to the land since that time.

The second is that, because irrigated land is by its nature limited and alternative economic opportunities are available elsewhere, there is a continuing pattern of out-migration, primarily by young people, in search of temporary or permanent employment in other parts of Morocco and in Europe. Some of the participants in this out-migration are said to regularly send portions of their earnings back to family members in Tadla; these in-flows may in part explain the apparent paradox of relatively large Moroccan families "surviving" on very small parcels of irrigated land within the perimeter. In this regard, it is reported that transfer of money into the Tadla region from migrant workers in 1989 amounted to approximately 50 percent of farm families' off-farm revenues, but 80.4 percent of these revenues for farms of less than 2 hectares, and 91.4 percent for farm families having access to 2 to 5 hectares (Ftouhi, 1989: *Les Revenus des Agriculteurs dans le Périmètre Irrigué du Tadla*. IAV, Rabat, Morocco. pp. 30 and 89).

The third is that irrigated crop enterprises have generated a continuing demand for seasonal farm labor in-migrations. Although present information on these in-migrations is limited, it appears that much of the seasonal movement involves unskilled female laborers from areas immediately adjacent to the perimeter—i.e., from highland areas of Azilal Province—and from other areas of the country.

In this complex picture and long history of in- and out-migrations, it is very difficult to predict how project activities might ultimately affect net flows. It is evident that improved reliability in irrigation water deliveries, relaxation of prior restrictions on fixed crop rotations, and the anticipated shifts to higher value agricultural enterprises in Tadla will make access to irrigated land a much more valuable asset. Adoption of certain types of agricultural machinery and irrigation techniques will also place premiums on accumulation of blocks of land that are sufficiently large to support the costs of capital investments and modernization. But no clear picture emerges as to whether these changes will result in actual displacements of farm families largely through changes in ownership of private land within the perimeter or whether these families will retain ownership of the land but allow it to be managed in larger blocks under cost/revenue-sharing arrangements.

The major factors that will determine these migration patterns in the future are largely beyond the purview of the project. However, in designing project activities great care was taken to, first, install internal mechanisms--i.e., the various diagnostic studies, the effort to develop an accurate typology of farm units, and the permanent monitoring and evaluation unit—to develop a much better understanding as to what is actually happening to specific groups within the perimeter. And, second, to deliberately introduce agricultural and institutional innovations that, at least in part, will be neutral with respect to the scale of individual farm operations—i.e., more reliable water deliveries to all farms; concentration on better use of seeds, fertilizers, and agrochemicals, identifying inputs that are low cost per unit of coverage and investment; and assistance to the private sector to lower unit transaction costs to the purchaser through more competitive market conditions.

With respect to in-migration of farm labor, it again appears evident that conditions which engender farm-level shifts to higher value crop and livestock enterprises will also increase local demands for seasonal—and, probably, permanent--farm labor. Increased net farm revenues from these enterprises will also provide the resources and powerful incentives to retain skilled farm labor at higher levels of daily wages and other benefits.

Finally, regarding urbanization effects, the project activities in themselves are anticipated to have no significant effects on the rate of urbanization within the perimeter. Improved business prospects for a variety of private sector input supply, service, processing, and marketing enterprises may result in their growth in the small towns in and around the perimeter, but most of this growth is expected to come from expansion of existing commercial enterprises. The major impacts on the urban populations in Tadla are expected to come from project activities in the environmental field. If successful, the activities will inevitably lead to significant improvements in the quality of life of these populations through pollution abatement and a lowering of environmental risks. These benefits also have potential for extension to other urban populations in Morocco—particularly the Casablanca metropolis—to the extent that pollution abatement activities in Tadla affect changes in the quality of water flowing back into the Oum Er Rhia River and to downstream water filtration plants.

4. Changes in Power and Participation

The project will help empower farmers in the perimeter to participate in decision making by strengthening the capacity of the groups in which they participate—private sector firms, farmer groups, professional associations, cooperatives, and irrigation associations. Project activities will support private sector actors at all levels to fill progressively the vacuum left by ORMVAT disengagement from commercial enterprises and provide mechanisms for farmers, technicians, and others to discuss water management problems in the perimeter and to transfer greater responsibilities for water and soil management to farmers.

This water management effort will start both at the primary/secondary system level through Element 1 activities and at the tertiary and quaternary levels and with respect to conjunctive use of surface and groundwater in Elements 2 and 3.

Prior to 1986, the ORMVAT, working from directives sent from MARA, set hectarage and production levels for certain "industrial" crops, chiefly cotton in summer and sugar beets in winter. Multiyear crop rotations were then "fixed" around these crops. Field cultivation and irrigation techniques were essentially dictated by the technical constraints of the physical irrigation system and the water distribution amounts and schedules. Finally, the farmers operated in a government system of fixed output price schedules, inputs and agricultural credit tied to certain crops, and closed processing and marketing channels for their agricultural commodities.

In practice, farmers did not always respect the ORMVAT irrigation/crop rotation systems as designed by technicians and engineers. They grew crops out of the prescribed rotation. They installed traditional robta irrigation techniques on land supposedly dedicated to the more "modern" border and furrow systems supplied by siphons. Recently, they have adopted new crops such as paprika peppers, which conflict with cotton as a summer crop.

This highly constraining system is now being relaxed as a result of GOM agricultural policy changes that began in 1986. The government has adopted a policy of disengagement and, as a result, the ORMVAT, among many other agencies, has been instructed to comply. It is now progressively pulling out of all commercial agricultural activities in the perimeters. The ORMVAT plans to turn operations and maintenance management of the tertiary and quaternary canals over to the irrigation associations, which have yet to become viable and sustainable entities. The associations will play a number of key roles: they are expected to control allocations in the tertiary system; work with ORMVAT hydraulic system managers to determine seasonal water allocation plans; develop weekly delivery schedules; and handle the maintenance of lower level canals and drainage ditches.

Achieving reliable water supply through Element 1 is critical to the success of the sustainability of irrigation user groups. At the same time, irrigation associations are a potentially important factor to Element 1 because the success of the technical improvements to the water management system depends on how flexible the latter is in the future with respect to the quantities and timing of water deliveries and how the system is managed at the farm level.

Recent GOM policy changes have put severe pressures on both the ORMVAT and the private sector. ORMVAT staff will need to become client responsive, while the professional associations, cooperatives, irrigation associations, and private firms will need to be developed into entities that can represent their members interests. A new balance in decision making between the public and private sectors will have to emerge, and the project should not underestimate the difficulties involved in this process.

Through its diagnostic study and monitoring and evaluation efforts, the project will collect information on the development of the irrigation associations. This information will be used to review and revise project efforts to support the brokering of power between the ORMVAT and the private sector entities.

The project seeks also to strengthen a variety of other private sector organizations, including multiservice cooperatives, professional associations, and others because their organization is consistent with local social groupings and because people receive immediate financial benefits from their activities. Members of these cooperatives have demonstrated their control over resources and the ability to devise strategies to overcome inadequacies of market goods and services. Planned project inputs should further develop their decision-making efforts.

Annex I

ADMINISTRATIVE ANALYSIS

Annex I

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I. INTRODUCTION

The key GOM counterpart agency for this project will be the ORMVAT, which is one of the oldest and best established regional irrigation authorities in Morocco. It has a solid reputation for sound perimeter management and a positive orientation toward implementation of the country's new irrigation policies. In addition to the ORMVAT, a number of other GOM agencies will collaborate in specific project activities, particularly with respect to implementing Elements 1 and 3. Also, the project will encourage participation from private entrepreneurs and agribusiness firms, professional associations, the Chambers of Commerce and Agriculture, and nongovernmental organizations, particularly in activities under Elements 2 and 4. And, finally, selected cooperatives and irrigation associations will participate in project activities.

A variety of mechanisms for involving all of these agencies in project activities are described in the Project Implementation Plan (see Chapter Four of the text). These mechanisms are designed to ensure that project participants are fully prepared to assume their roles in the pursuit of the project's objectives.

A. The ORMVAT

Development of large-scale irrigation (LSI) projects constitutes the central thrust of Moroccan efforts in irrigated agriculture. Nine LSI projects operate in Morocco, with a potential irrigated area of 780,000 hectares. Approximately 500,000 of these hectares have been completely equipped to date. The LSIs range in area from 20,000 hectares to 250,000 hectares and represent major investments in infrastructure for water regulation and distribution.

In the development of the LSIs, Morocco adopted an interventionist type of irrigation policy. The policy was supported by a comprehensive set of measures, included in the 1969 Code of Agricultural Investment, which constituted a framework for promoting the rational use of resources within the LSIs. The government regarded the code as a contract between the state and the farmers to build the national economy through irrigation development. It paid for the dams, the irrigation networks, and necessary on-farm development. The GOM also provided credit, selected seeds, farm equipment, and certain mechanized operations at subsidized prices. Finally, it guaranteed the prices of crops—i.e., sugar beets, sugar cane, rice, hard and soft wheat, and cotton—through contracts between farmers and parastatal agribusinesses. In turn, the farmer was obligated to farm his irrigated land "in the national interest", to follow the norms dictated by the hydraulic system within his perimeter block, and to repay the state through a land improvement tax and water charges.

From the beginning, Morocco strove to develop administrative structures to implement its program in an integrated manner. In 1961, an independent Office Nationale des Irrigations (ONI) was created. It had full responsibility for irrigated agricultural development throughout

Morocco. The ONI brought under the same roof all the various GOM agencies involved with irrigation development. It introduced specialized crops—principally sugar beets, sugar cane, and cotton—and, in 1962, developed the land consolidation model known as Trame B. This model was used as the basic design in all subsequent LSI projects. In 1965 and 1966, ONI was dissolved in favor of a more decentralized approach to irrigation management and autonomous regional offices (ORMVAs) were created and attached to the MARA. The ORMVAT is one of these regional offices.

The ORMVAs were constituted as civil agencies, with legal autonomy to manage their own personnel, property, and legal and financial affairs. They were and remain today administratively responsible to the MARA. In addition to the tutorial role played by MARA, the Ministry of Finance also assists the ORMVA in budgeting and ensuring regular financial audits.

As originally conceived, the mandate of each ORMVA was to develop and manage the irrigated perimeter under its control and to improve agricultural production within it. In this role, the ORMVAs developed a double character as public utility and parastatal commercial enterprise. Then, as now, the ORMVAs were responsible for the design, construction, operations, and maintenance of the irrigation networks within their perimeters. In addition, ORMVA technicians directly supervised farming operations for the "industrial" crops and assisted in the establishment and monitoring of agricultural cooperatives.

All productive services required by farmers were integrated under one management structure. ORMVAs were responsible for distributing inputs, providing extension and agricultural equipment services to farmers, supervising seasonal crop credit, and running genetic improvement and health control services for livestock within the perimeter. The ORMVAs also had powers of land expropriation as public utilities and/or powers of temporary occupation. They also had powers of eminent domain, with respect to water resources to be developed for agricultural use, as delegated to them by the Ministry of Public Works (Décret Royal No. 810-67 of 29 December 1967).

This original mandate has changed recently, with modifications to GOM economic policies. In the future, the role of the ORMVAs is to be substantially reduced in scope to center on water management and agricultural extension. Therefore, all ORMVAs have been ordered to withdraw progressively from direct involvement in commercial activities. These activities are to be taken over by the private sector. The World Bank projects discussed in this report—i.e., PAGI 1 and 2—were designed to reinforce these new policies by strengthening the ORMVAs as autonomous, client-oriented service agencies with decentralized decision-making authority and a "pay-as-you-go" status in financial management. Interventions in this project are designed to make these new policy orientations concrete realities in the Tadla perimeter.

Within each ORMVA, the ORMVA director is responsible to a Board of Directors—i.e., the Conseil d'Administration, which consists of the Minister of the MARA (or his designee), the Provincial Governor(s), the President of the Provincial Assembly, and the President of the local Chamber of Agriculture. This council has major responsibilities, as defined by Article 9 of the ORMVA constitution, for planning the ORMVAs' program and allocating and managing their budgets.

The council is assisted in these tasks by an ORMVA Technical Committee—i.e., Comité Technique. In the case of the ORMVAT, this committee is chaired by the Governor of Beni Mellal Province and is composed of local representatives of all of the concerned national Ministry Departments and local farmer representatives. It meets once a month—or more often if necessary—to examine local issues and problems affecting the ORMVAT.

The ORMVAT is divided into departments, or services, with several bureaus or sections (see Figure 4.1 of the PP text). Agricultural extension activities, which used to be under the auspices of a bureau within the Service de Production Agricole (SPA), has been recently upgraded to the service level as the Service de Vulgarisation et de l'Organisation Professionnelle (SVOP), reflecting its new status and place in the ORMVAT's strategic mission.

All ORMVAs operate through Centres de Mise en Valeur (CMVs). The CMVs are the basic units through which the ORMVAs attempt to integrate crop and livestock development activities within each perimeter. Each CMV has a manager, appropriate office staff, and several extension agents. In the Tadla perimeter, the ORMVAT has established three administrative subdivisions, which supervise the activities of the 26 CMVs operating within the irrigated perimeter. [Note: There are actually 31 CMVs in the total area under control of the ORMVAT but 5 of these are in rainfed agricultural areas bordering the irrigated perimeter and, therefore, are not to be involved in direct project activities.] The subdivisions also coordinate the field-level activities of the various ORMVAT services—i.e., the Service de Gestion du Réseau d'Irrigation et de Drainage (SGRID), SPA, the Service de l'Elevage (SE), and SVOP.

The project has been designed to institutionalize new activities and staff capacities within existing services of the ORMVAT. All activities to be implemented by the project will address integral parts of the new mandate of the ORMVAT. The implementation of project activities, therefore, will not involve creation of any new administrative responsibilities within the ORMVAT, but simply the rearrangement of existing staff in new and more appropriate configurations. New processes and mechanisms will be installed to facilitate discussion and interaction among project participants and partners within the existing organizational structure, as described in Chapter Four of the text.

The project will be concerned with engendering activity sustainability—i.e., the continuing capacity of the ORMVAT to manage effectively its enhanced responsibilities beyond USAID support—and with ORMVAT's adaptation to changing needs in the irrigation subsector. Implementation of the project will be geared toward building staff capacity to ensure full involvement in project activities and fostering action-oriented mechanisms within the existing organizational structure of the ORMVAT. Since it is the ORMVAT staff who will make the integrated activities work, attention must be directed toward creating not only a positive organizational culture, but also toward developing positive staff attitudes in coordinating activities and dialogue with farmer-clients and other partners.

The activities proposed for each of the intervention areas under Project Elements 1 and 3 will be centered in the SGRID. This service is charged with the operations and maintenance of the irrigation and drainage network, control of groundwater pumping, water pricing, and all water-rights-related issues.

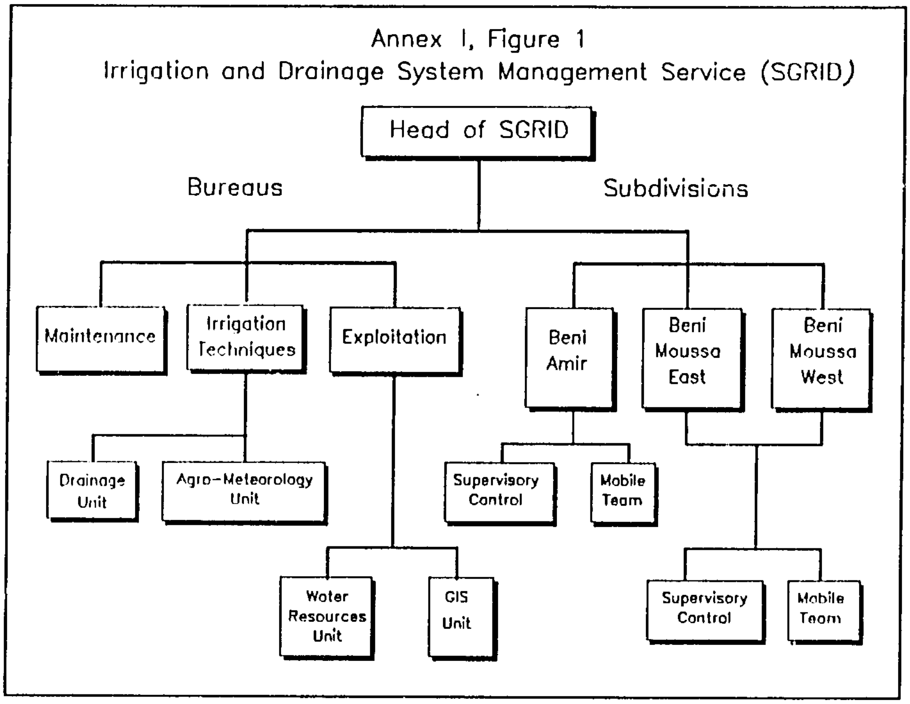
The SGRID is structured (see Figure I-1) in three major bureaus—the Bureau des Techniques des Irrigations et de Drainage (BTI), the Bureau d'Exploitation (BE), and the Maintenance Bureau. The BTI is charged with monitoring soil and groundwater conditions and field testing irrigation techniques and practices. The project will establish within the BTI two operating units—the Agro-Meteorological Unit and the Drainage Unit.

The BE is charged with general operational planning for the irrigation network, distribution of irrigation water, and identification of water rights issues. Its operational mandate also includes the collection and use of accurate water distribution statistics for improving future water distribution. The project will consolidate within the BE two operating units—a Water Resources Unit and a Geographical Information System (GIS) Unit. The responsibilities of these two units are described in detail in the Project Implementation Plan (Chapter Four).

Field-level implementation—i.e., the scheduling of irrigation water distribution—is carried out by the three ORMVAT subdivisions in Beni Amir, Beni Moussa East, and Beni Moussa West. The subdivisions are areas of the perimeter defined within the same hydraulic branch or branches, as opposed to the CMVs, which are administratively defined and may cut across hydraulic system boundaries. Each subdivision is responsible for providing water to approximately 8,000 farms that have on average 33,000 hectares. Subdivisions divide the canal system under the control of three head aiguadiers and a head of canal for managing flows in the main canal. Water scheduling operations for each canal secondary branch are performed by aiguadiers, under the supervision of a head aiguadier. Actual distribution operations are performed by the gardes vanne for principal canals under the direction of the head of canal and by the agents de distribution within secondaries and tertiaries under the direction of the head aiguadiers. The water distribution schedules are used by the ORMVAT billing office as the basis for water charges. Two units will be established, one in the office of the Subdivisionnaire of the Beni Amir subperimeter at Fkih Ben Salah, and one in the office of the Subdivisionnaire of the Beni Moussa subperimeter at Afourer. Each unit will be divided into a Real-Time Remote System Monitoring Team and a Mobile Monitoring Team. Units will provide a better understanding ot the hydraulics of the canal system through hydraulic modeling, canal calibration, and real-time system monitoring.

Element 1, in integrating the many different information-gathering and processing units into a coordinated management system, will work with the head of the BE and the heads of each of the three subdivisions to formulate operational policies, prepare annual and seasonal operating plans, prepare procedures for water delivery schedule preparation, and formulate an interactive process for improving system operational procedures based on real-time system measurements and field monitoring.

Project Element 2 will work within the context of a systematic program of consultation and reporting. Planning, implementation, evaluation, and dissemination of results for Element 2 activities will be centered in the SPA, which under the PAGI 2/Système d'Information Pour la Gestion (SIG) restructuring plan is soon to be converted into the Service des Etudes Agro-Economique (SEAE). To facilitate work within the ORMVAT and the private sector, a small



working committee will be formed with the participation of ORMVAT staff from the Service de l'Expérimentation de l'Hydraulique Agricole (SEHA), the SGRID, the SVOP, and relevant private sector agents for each activity.

There is a precedent for such local technical committees in that similar committees are presently organized by the ORMVAT SPA to deal with problems related to specific high priority crops--i.e., cotton and sugar beets. During each agricultural season, these committees assemble all interested parties and experts weekly to discuss problems and recommend solutions. In the case of the local Sugar Beet Technical Committee, for example, participants include the head of the Bureau des Plantes Sucrières of SPA, a representative of the l'Institut National de la Recherche Agricole (INRA), a representative of the MARA Direction de Protection des Végétaux, representatives of the three sugar factories in the perimeter, and a representative of the sugar beet professional association. This committee is chaired by the SPA representative. The committee makes management decisions with respect to technical actions—i.e., crop dusting, planting dates, seed varieties to distribute, harvest dates, and the calendar for farming practices. When the committee cannot achieve consensus, at the request of a member, the problem may be referred to the ORMVAT Comité Technique for resolution.

In addition, a Commission Locale de Mise en Valeur is situated at each cercle level. It is chaired by the "super-caid", who is the committee's reporter. It meets whenever necessary to examine the issues and problems the ORMVAT faces locally. According to the agenda and the nature of the problem, the commission will be composed of representatives from the subdivisions and CMVs; representatives from the SGRID, the SPA, and the SE; local caids;

agents from agro-industrial plants; representatives of professional associations; representatives of the local Chamber of Agriculture; a representative of INRA; and elected representatives of the concerned communes.

The super-caid is responsible for disseminating decisions the commission takes with respect to agricultural campaign issues—e.g., decisions on the mobilization of local labor resources, the type of crop rotation schedule to follow in the area, starting or stopping irrigation, or resolution of conflicts between farmers.

In the design team's opinion, all of the committees described above are potentially useful vehicles for furthering project objectives. Given the nature of their membership and mandates, they can be used to foster discussions and constructive dialogue on many of the issues raised by the GOM's new policies toward the irrigation subsector and the increased roles envisaged for private sector participants. They can also facilitate coordination of project activities and dissemination of results to all interested parties.

B. Other GOM Organizations

Under Element 1, the project will consolidate within the BE of SGRID a Water Resources Unit. This unit will be responsible for surface water hydrology, groundwater hydrology, and water quality. Surface hydrology activities will require agreements between ORMVAT and ORMVAH, the Ministry of Public Works, and the Office National d'Electricité (ONE). In order to develop and maintain a database of flows in the Oum Er Rbia River at Kasba Tadla diversion dam and the inflows into Bin El Ouidane Dam, an agreement will be established with Direction Régionale Hydraulique (DRH) of the Ministry of Public Works for the regular importation of such data into the ORMVAT database. The Oum Er Rbia River flow data is available in computer format from the Administration de l'Hydraulique (AH), a division of the DRH in Beni Mellal. Data for the Bin El Ouidane Dam flows will come from the DRH in Rabat.

Statistical analysis of the flow data on the Oum Er Rbia River will yield the expected hydrograph of water available for diversion into the Beni Amir main canal for use in the seasonal planning and water delivery scheduling process for the subperimeter. Statistical analysis of inflows into the Bin El Ouidane Dam will serve as a basis for reviewing the operating rules for the dam and power plant at Afourer, taking into account the new constraints of supplies to canal T2 as part of the "corrected manifest of Bin El Ouidane" between the ORMVAT, ORMVAH, and ONE.

Activities under Element 3 will focus on the development and active use of a permanent monitoring system and database of groundwater fluctuations and water quality, and drainage system efficiency in the Tadla perimeter. In Project Years 1 and 2, the institutional contractor will work with the ORMVAT SGRID to establish the groundwater and drainage monitoring network. A minimum of 100 permanent sample points will be established to monitor water table fluctuations. SGRID personnel will ensure that these sample points are established in a manner that will complement the 56 points currently being monitored within the subperimeters by the DRH in Beni Mellal under the Ministry of Public Works. It is paramount that close collaboration and information sharing occur between the SGRID and the DRH.

Two activities under Element 3 will focus on monitoring soil modification and water quality in the subperimeters:

- Establishing a monitoring system for water quality and soil decomposition from salinity and leaching, including—but not limited to—nitrates and other pollutant flows in the groundwater, drainage systems, and the soil profile; and

- Integrating soil and water quality data into the groundwater model to enhance real-time management of soil and water resources in the subperimeters.

The first activity will establish permanent sampling points for collecting soil, water quality, and agrochemical residue data during Project Years 1 and 2. It is estimated that soil data collection will consist of three samples per site from a minimum of 20 sites within the subperimeters three times per year over the life of the project. Analyses of these samples will include pH, salinity, total nitrate, mineral nitrate, and cation exchange capacity. Water samples will be collected from 200 sample points once a month for Project Years 1, 2, and 3 and bimonthly—six times per year—in subsequent years. The water samples will be analyzed for pH, dry residue, nitrate, nitrite, and salinity. Agrochemical residues will be analyzed in Project Years 2 through 5 from 100 different sample points taken three times per year. It is assumed that the analyses will be done to determine the presence of a minimum of five toxic substances selected and prioritized in conjunction with the ORMVAT SPA, agro-industries operating in the area, and the Ministry of Health's SH in Beni Mellal.

It is further assumed that the analyses of these samples will be done through a project subcontractor. The project will investigate alternatives for sustainability of this activity. One option is to use a private sector laboratory. A second option is to supplement existing equipment and strengthen the capacity of the existing ORMVAT soils and water laboratory in Fkih Ben Salah. Costs to the project will be the primary criterion for making a final decision but present estimates indicate that the second option might be the least expensive alternative, even with equipment purchases, maintenance, and training included.

The second activity will integrate these data into the real-time management process of the SGRID. Results from the soil and water quality monitoring will be part of the ORMVAT GIS. These data, when viewed with other overlays of real-time farming practices—e.g., current crop areas and their agrochemical demands—and surface and groundwater use, will enhance the decision-making capabilities of the SGRID managers.

To gain a more comprehensive knowledge of on-farm and agro-industrial practices of handling, application, and disposal of agrochemicals, the contractor will provide technical assistance to survey these groups in the Tadla. The contractor's environmental specialist(s) will work with the ORMVAT SVOP to synthesize the information from storage/disposal database and the on-farm survey to develop recommendations for improving the management of agrochemicals in the Tadla perimeter. This will be completed by the end of Project Year 3. In order to improve awareness of the impact of these pollutants among the local population, the contractor's environmental specialist will work with the SVOP to develop informational materials and a network in conjunction with other institutions in Beni Mellal Province. This network—most logically composed of the SVOP and the other water quality action-oriented institutions of the DRH, the ONEP, and the SH—will serve to inform the local population about improved management of agrochemicals. This network, to be developed by the end of Year 5, will also provide a mechanism for taking joint action to mitigate the impacts of pollutants on human and animal health when and where they occur within the Tadla perimeter.

Data collected under the Element 3 environmental monitoring systems will be integrated into the GIS being developed for the ORMVAT under Element 1. The contractor and SGRID personnel will need to ensure that the information from these monitoring systems will interface with the outputs from Project Element 1.

This integration will be enhanced by the study to be conducted in Project Years 4, 5, and 6 to examine the conjunctive use of surface and groundwater and drainage system alternatives. Using the data collected in Element 3, complemented with outputs from Elements 1 and 2, the contractor, in association with SGRID, will develop different strategies of water use and determine priorities for establishing subsurface drainage systems and vertical drainage priorities. This will be of particular importance during drought periods and will also be valuable as more efficient use of water from the Bin El Ouidane Dam becomes mandatory when the transfer canal to the upper Tessaout diversion in ORMVAH is operational.

C. Private Sector Firms, Professional Associations, and Other Support Agencies

1. Private Sector Firms

Project Element 2 will work within the context of a systematic program of consultation and reporting. Planning, implementation, evaluation, and dissemination of results for the activities in Element 2 will be centered in the SPA, which under the PAGI 2/Système d'Information Pour la Gestion restructuring plan is soon to be converted into the Service des Etudes Agro-Economiques (SEAE). To facilitate work within the ORMVAT and with the private sector, a small working committee will be formed with the participation of ORMVAT staff from the SEHA, the SGRID, the SVOP, and the private sector representatives relevant to each activity undertaken.

Starting in Project Year 1, a detailed work plan will be drawn up by the working committee and presented at a workshop. Participants at the workshop will include members of the Element 2 working committee; representatives who have been selected at the CMV level by farmers; private sector agribusiness people selected for their interests in the perimeter; professional association and cooperative representatives; and representatives of other concerned institutions within the GOM and the donor community. Starting in Project Year 2, these annual workshops will include a presentation of Element 2 accomplishments to date vis-à-vis work plan objectives. These workshops will provide the major forum for a general flow of information and feedback. In addition to its information dissemination function, it is anticipated that the dialogue generated will serve as a vehicle to catalyze cooperation between the project and the participant representatives for the following year's work. This will reduce costs and increase the interest and impact generated by the project.

As work under Element 2 proceeds, results are generated, and recommendations are formulated, other formats will be used for information dissemination. Working with the SVOP and private sector groups—e.g., input suppliers, cooperatives, and so on—these will include demonstrations of improved technical packages in farmer's fields, farmer field days, and group-specific training sessions. This last activity is seen as especially important for informing the private sector of potential clients and business opportunities.

Information and recommendations with respect to discrete innovations and/or technical packages being proposed for specific farmer groups will be summarized as crop technical reference sheets Référentiels Techniques (RT). These sheets, as well as any other occasional bulletins generated by Project Element 2, will be circulated to all concerned parties, including farmers, private sector firms, professional associations, cooperatives in French and Arabic. In addition to the means for disseminating information outlined above, Element 2 will also seek to participate in radio broadcasts of agricultural information if current plans for regional agricultural radio programming materialize.

Increasing the private sector supply of agricultural inputs and services will be realized by the combined effects of all four elements. The Element 4 description in Chapter Two of the main body of the report details direct procurement of goods and services from the private sector for materials, services, and laboratory analyses. Element 2 will generate and disseminate information that will identify market opportunities in input, equipment, and service supply. Element 4 will provide short-term technical assistance to the cooperative and incorporated private sector on input and service supply in such areas as fertilizer and pesticide supply, storage, use, and disposal. Both the chief of party and the agricultural economist will work with the private sector as the ORMVAT disengages and major input and service suppliers, such as SONACOS, the two sugar beet mills (SUBM and SUNAT), and the sugar refinery (SUTA), are privatized during the next few years. They will help identify and define options for these and other transitions ranging from service contracts with parastatals, cooperative or association takeover of supply and custom services, contracts with private service providers, expansion of companies to the Tadla, and start-up operations. Short-term technical assistance will be used to prepare marketing and business plans, financing packages, and credit dossiers. These services will be provided on a 50/50 cost-sharing basis.

2. Professional Associations

Morocco has a long history of professional associations—i.e., Associations Interprofessionelles. These organizations borrow from models created in Europe, where there are often close ties and a continuum of interest among the individual, company, regulatory agency, ministry, research and educational participants. In Morocco, professional associations have benefited from a public interest charter. This charter identifies their public responsibilities to support programs in the national interest, while granting them a large measure of operating autonomy. While they are required to communicate and coordinate with public agencies, their directors do not have to be civil servants, nor are their day-to-day operations or financial management subject to supervision by public agency staff, as is the case with most cooperatives.

There are four major professional associations representing producers in the Tadla: the Association des Betteraviers du Tadla (ABT), Association des Eleveurs du Tadla (AET), Association des Maraichers du Tadla (AMT), and Association des Producteurs de Coton (ACT). There is some doubt about the representivity of these associations, despite the fact that they can mobilize significant resources, because the names of certain local personages appear frequently in the hierarchies of all four associations. With the support of local authorities, these people have accumulated both technical resources and political power. Farmers in general, however, remain passive because of a lack of information and the lack of association efforts to mobilize them.

The associations do not provide high quality technical expertise—e.g., ACT has only one trained technician, an adjoint technique, and ABT has just two local technicians whose time is largely occupied with administrative work. Additionally, each association is burdened with unnecessarily high administrative costs. For this reason they would do well to share a secretarial pool as they share the building in Beni Mellal. The associations also often incur costs for unnecessary expenses due to poor managerial decision making. For example, ACT hired a permanent pilot for crop spraying operations, despite the fact that it does not own an airplane. This man spends his time supervising the operations of his previous employer, who actually does the crop spraying on a contractual basis.

The essential role envisaged for professional associations vis-à-vis project activities is to disseminate information about technical packages and crop recommendations developed, to participate and backstop project activities and research, as feasible, and to support the interests of their memberships during the period of ORMVAT disengagement. The associations can deploy real resources for these tasks if properly stimulated, but they need to become more representative to be fully credible and effective.

The project will work primarily with the professional association that appears to have the greatest potential for affecting the efficiency of soil and water resources in and around the perimeter--AET. AET currently plays a role in organizing the importation and distribution of purebred cattle. In the future, it may also assume a role as manager of the dairy cattle artificial insemination program when the latter transferred from the ORMVAT to the private sector.

3. Other Support Agencies

Under the anticipated implementation schedule, the project will start implementation fully two years ahead of the World Bank PAGI 2 and PSDAGI. This means that the project will be generating important results and initiating pilot activities well before World Bank project activities come on-line. The present planning in the MARA and at ORMVAT is to use the USAID project information and results to target the PAGI 2 and PSDAGI activities more precisely, both in Tadla and, as relevant, in the other ORMVAs. For this reason, the USAID design team has worked in close collaboration with GOM representatives at both the ORMVA and MARA levels to ensure—to the maximum extent possible—that all elements of the

USAID project are not only fully compatible with PAGI 2 and PSDAGI as designed to date, but that they will also be contribute to the future planning and implementation of those activities after 1993.

There are two research projects operating in the ORMVA Tadla perimeter at present. One is jointly sponsored by the International Irrigation Management Institute (IIMI), the Service de l'Expérimentation de l'Hydraulique Agricole (SEHA) in the Direction de l'Equipement Rural (DER) of MARA, and ORMVAT. The other is a collaborative study sponsored by Wye College and the Institut Agronomique et Vétérinaire Hassan II (IAV).

USAID design team members had several discussions with the IIMI country representative about this project and the means of coordinating activities in Tadla. As a result of the highly complementary nature of these respective planned activities, it has been decided to provide direct support to the IIMI program under the USAID project. Details of this planned inter-donor collaboration in Tadla are provided in the PP text.

The Morocco project director for the Wye College study was the co-team leader of this project design team, and his presence on the team ensured that anticipated project activities would be compatible with—and not duplicative of—Wye College activities.

D. Cooperatives and Irrigation Associations

1. Cooperatives

Cooperatives are not new to the Tadla area, but the cooperative movement has become progressively more important during the past two decades. There are presently about 94 cooperative groups in the area. They are active in about one-half of the perimeter and have memberships representing about one-third of all farms. The ORMVAT currently provides the cooperatives with management assistance through an appointed Director of Cooperatives. This section describes the types of cooperatives that may be relevant to implementation of project activities.

a. Multipurpose Dairy Cooperatives

Multipurpose dairy cooperatives have operated in Tadla since 5 December 1970, when the first such cooperative was created. It had 114 members. At present, 48 dairy cooperatives, with a total membership of about 10,500 farm families, are active in the perimeter. Despite a rapid expansion in their early years of existence, this cooperative movement appears to have stagnated recently for two reasons:

- Within a potential clientele of 24,300 livestock producers—including sheepherders—present membership of 10,500 seems to indicate a level of saturation has been reached; and

- These cooperatives have appeared content to focus most of their efforts on their dairy enterprises, even in the face of declining subsidies from the GOM. Most have demonstrated little imagination or initiative in attempting to diversify their activities or take advantage of the new opportunities posed by ORMVAT's withdrawal from commercial activities, despite the fact that most have a reliable financial base for such expansion.

There are exceptional cases—for example, the Harchiya Cooperative—in which a cooperative has acquired its own premises, contributed to social projects, supported pilgrimages for members, constructed a school, electrified a hamlet, created a short-term credit fund, launched a cooperative store, or installed a potable water system. However, productive investments to enlarge a cooperative's range of commercial activities and services for members are very rare.

This lack of initiative can be explained in part by the low quality of managerial support offered by ORMVAT personnel in the past. Cooperative directors have had only modest training in cooperative planning and management, which has not prepared them adequately to assume their managerial roles. In any cases, they have been inundated in routine paperwork and have not been encouraged to act as much more than clerical staff for their members. Finally, these managers are too few in number and too overburdened with managing several cooperatives with different structures and objectives.

Under the previous system, cooperative members were not called upon to participate actively in the planning and management of their cooperatives. This lack of stimulation and active participation has obviously had negative consequences. Moreover, when cooperatives have exceeded certain levels in geographical and social terms, they appear to have had problems with factionalism. Within closely knit in-groups, however, where members have a clear vision of their own interests and potential, some dairy cooperatives have proven very dynamic, setting both social and economic goals and establishing very coherent internal regulation. Properly situated and supported, such cooperatives appear to present real potential.

Project Element 4, therefore, will attempt to assist selected dairy cooperatives in improving their internal management and developing a new and multipurpose approach to servicing their memberships. This choice was made because of all the existing cooperatives in the Tadla area, these cooperatives appear to have the greatest immediate potential to change current operating practices and effect resource use productivity. They alone have major business enterprises—i.e., dairy production and milk marketing—that provide regular cash flows throughout the year and have enabled them to accumulate relatively large capital holdings. Some have even diversified their sources of income beyond their dairy enterprises—e.g., into agricultural input sales, fuel sales, and custom machinery operations—and are beginning to reduce their dependency on ORMVAT facilities and management services. Moreover, the constituting decree for these cooperatives permits them to engage in a wide variety of input and service supply, production, marketing, and processing activities. The cooperatives may also own capital and shares in agriculturally related companies.

b. Agrarian Reform Cooperatives

There are 23 Agrarian Reform cooperatives in the Tadla area. They have 528 members on farms with a total area of 3,625 hectares. Under terms of the Law for Agricultural Investment of 1966, members obtained access to irrigated land in exchange for their participation in an agrarian reform service cooperative. Members come from different social strata. As far as can be determined, the members have no binding kinship, lineage, or tribal relationships between them. Some members had never farmed before getting access to cropland within the perimeter through affiliation with a cooperative. The directors of these cooperatives are appointed by the ORMVAT.

Performance varies greatly between these cooperatives. A limited number seem to have developed a real dynamic in supporting their activities, gathering resources, and building social and educational infrastructure—e.g., Cooperative Laayoune. Others have remained moribund since their creation, unable even to undertake group purchases of agricultural inputs, provision of credit to members, or in common sales of produce. Moreover, the functional relationships between these cooperatives and the local professional associations—i.e., the ABT, ACT, and AET—remain to be developed.

The general impression is that these cooperatives probahly are not in a position to play any major role in project activities in the unforeseeable future.

c. Agricultural Equipment Cooperatives

There are 9 of these cooperatives in Tadla, with 108 member-farmers on about 703 hectares. They are plagued with a number of problems related to both the reasons for their creation and their current stage of development.

First, there is a widespread belief in the area that farmer-members created these cooperatives simply to take advantage of special government programs available to cooperatives—e.g., access to preferred credit status, as well as subsidies for the purchase of agricultural equipment—without any sense of a cooperative ethic.

Second, while the small size of many farms in the perimeter provides an incentive for farmers to cooperate in the purchase and operation of agricultural machinery, these cooperatives have had great difficulty in managing allocation of acquired machinery among member farms within the time constraints for effective plowing and other agricultural operations.

Third, the existing cooperatives suffer from the lack of a complete range of machinery, and their operations are often ineffective due to a lack of spare parts, fuel and oil, and general management expertise. They are chronically short of operational funds and often dissolve as effective entities when a tractor breaks down or other machinery needs to be replaced.

Fourth, the attractiveness of these cooperatives to members is declining in the face of competition from aggressive private sector agents who provide cheaper and more timely custom machinery services, and as the GOM moves to reduce subsidies on agricultural inputs.

Again, these cooperatives do not appear to be good candidates for involvement in project activities.

d. Purchasing Cooperatives

There are five of these cooperatives within the perimeter, with 148 members on 5,614 hectares. Their very limited number makes it difficult to provide any analysis of their organizational constraints or a prognosis of their future potential. Nevertheless, it is evident that the ORMVAT, in its previous role of purveyor of farm inputs, did not encourage the emergence of this type of cooperative. As a result, these cooperatives have limited themselves to group bulk purchases of diesel fuel. Their potential for the future remains to be investigated.

2. Irrigation Associations

The organization of water users into groups responsible for the maintenance of irrigation systems is not a new idea in Morocco. Traditional systems for community management of water rights in the small and medium-scale perimeters have developed under a highly complex traditional water law and delicately adjusted water management methods. The organization of the Association Syndicale des Agriculteurs Prévilegiés (ASAP) under the Law of 1924 fixed water rights and privileges in the Tadla perimeter. Other less formal and more empirical groupings of water users have also existed in Tadla from time to time.

The ASAPs in Tadla and elsewhere in Morocco were instituted by the Dahir of 15 June 1924. They were groups of agricultural landholders—often colonialists—intending to create irrigation infrastructure, either in the public interest or for the development of their personal property. Since independence and with the transfer of these properties to Moroccans, the ASAP idea has fallen into decline. One ASAP, however, has endured in Tadla but it has engendered considerable mistrust among its farm neighbors, due to abuses by some of its members and the undermining of its earlier objectives.

In 1971, the ORMVAT management attempted to organize farmers in blocks around the tertiary canals, with the objective of electing representatives who could serve as spokespersons in discussing water management issues with ORMVAT staff. Those elected would have been in charge of allocating the irrigation water available in each block. This effort was envisaged primarily as a means to relieve the ORMVAT of the responsibility of this task and not as a vehicle to manage the affairs and problems of the water-user blocks, the latter of which include vandalism and water theft. This effort seems to have worked for about one year but was gradually abandoned thereafter—except in the CMV 526, which involved a block of collective land controlled by a closely related community of water users.

Since the law requiring irrigation associations in large-scale irrigation schemes (LSIs) was promulgated, the process of organizing these groups has been under way. As of October 1991, three irrigation associations had been organized in ORMVAT perimeter--e.g., at Al Massira, a former ASAP; at Al Ittihad in CMV 526; and at Ennajah in CMV 501. Of these, only Al Massira is currently functional. The other two associations—Al Ittihad and An Najah—are still in the process of electing their officers and disseminating organizational information to potential members.

Irrigation associations have a tightly defined charter that appears to exclude any diversification into income-generating activities. They are presently focused exclusively on water management and canal maintenance activities. The associations are seen by all parties

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principally as means of shifting the operations and maintenance expenses for the tertiary canals from the ORMVAT to local farmers. The Technical Analysis in Part 4 of Annex E suggests that the ORMVAT's intent is to rehabilitate the tertiary network before it is turned over to the nascent irrigation associations, but this plan may be stymied in the Beni Amir subperimeter due to present uncertainties about amount and costs of rehabilitation required. PAGI 2 activities in Tadla as elsewhere will support the development of irrigation associations and the costs of rehabilitating the tertiary canals. Element 1 of this project will provide much of the information on flow measurements and water handling techniques needed to adjust system functions in accordance with farmer requirements. It is recommended, however, that the ORMVAT proceed slowly with the irrigation association campaign to permit course corrections as needed in organizing the associations and developing management practices.

The irrigation associations are not intended to be state-run bureaucracies. Rather, they are expected to be farmer-run organizations. The project will help train the presidents and board members of the associations in the bookkeeping and financial management practices, plus organizational goal and program planning techniques. In addition, a small amount of short-term technical assistance will be made available to the associations, the ORMVAT, and local water commissions to evaluate the financial obligations of the association, determine whether it is in the association's best interests to seek discounts available on water charges, and how best to participate in representing farmer interests in the negotiations on crops eligible for surface system water deliveries.

INITIAL ENVIRONMENTAL EXAMINATION (I.E.E.)

1. Project Country:	Morocco
2. Project Title and Number:	Water and Soil Resources Conservation, 608-0213
3. A.I.D. Project Funding:	$12.0 million
4. Life of Project:	FY 1992-1999 (7 years)
5. I.E.E. Prepared By:	E. R. L. 6/14/91 Eric R. Loken, Mission Environmental Officer
6. Recommended Environmental Threshold Decision:	Negative Determination (Per 22 CFR 216.3(a)(2)(iii)
7. USAID Concurrence:	Dennis M. Chandler Dennis M. Chandler, USAID Director 6/14/91 Date
8. Near East Bureau Environmental Coordinator's Decision:	Approved: ___ Disapproved: ___ Date: ___

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INITIAL ENVIRONMENTAL EXAMINATION

The project proposes to increase the efficiency, economic yield and environmental sustainability of water and soil resources management and use in the Tadla irrigation perimeter of Morocco. This will be accomplished through an integrated program of policy analysis, technology transfer, institutional strengthening and private sector development in the perimeter area. Key A.I.D.-financed project inputs include technical assistance, training and limited commodity support. No construction activities will be financed under this project, with the minor exceptions of insignificant equipment installation and storage works.

The project is fundamentally a natural resources management initiative. Accordingly, all of the project's proposed interventions are being designed to promote the attainment of its improved natural resources management and conservation objectives. Similarly, all project activities will be executed under the oversight of skilled natural resources management experts, with the fullest possible public participation throughout the activity planning and implementation process. Therefore, if successful, it is anticipated that the project will actually result in a significant positive net effect on the regional natural and physical environment. In addition, the final design of the project's environmental component in the Tadla perimeter area will benefit greatly from the results of the "programmatic" environmental assessment currently being completed as a part of the appraisal process for the World Bank's new PAGI II Project discussed above (see Section II. C.).

Based on all of the above, the project will clearly be designed and implemented in strict accordance with the intent, if not the letter, of the Agency's Environmental Regulations, i.e.,, 22 CFR 216. Therefore, pursuant to Section 216.3(a)(2)(iii) of said Procedures, the USAID recommends a negative environmental threshold determination for this project.

Annex M

BIBLIOGRAPHY

Annex L

MEMORANDUM

FROM: John Schamper, Acting Chief, ANR

THRU: Dennis M. Chandler, Mission Director

TO: Mary Reynolds, Grants Officer

PROBLEM: To justify that competition is not required for the award of a cooperative agreement to the International Irrigation Management Institute (IIMI) under the Tadla Resources Management Project (No. 608-0213).

BACKGROUND: In May 1992, IIMI representatives met with Mission ANR Office staff to request A.I.D. funding support under the TRM Project for ongoing IIMI program activities in the Tadla irrigation perimeter which were complementary to certain aspects of the planned A.I.D. project. The primary purpose of this proposed IIMI program is to research, demonstrate and disseminate information on improved on-farm water management techniques in Tadla for selected representative crops and cropping systems. Following further definition of the proposed uses of the requested A.I.D. funding support, extensive discussion both within the USAID and with the GOM of this proposed project support for IIMI activities in Tadla, and reference checks on IIMI with several other Agency missions and offices who have prior or current experience in working with IIMI, the Mission has decided to approve this proposed TRM Project support to IIMI through the award of an A.I.D. direct cooperative agreement.

DISCUSSION: As described in the Project Paper, IIMI is a non-profit international agricultural research organization based in Colombo, Sri Lanka. IIMI's mandate is specifically to strengthen national efforts to improve and sustain the performance of irrigation systems in developing countries. Founded in 1987, IIMI has pursued this manadate in over 10 different developing countries, including several countries which are also supported by A.I.D. assistance programs, i.e., Pakistan, Nepal, Sri Lanka, India, and the Philippines.

This international scope, together with a mandated focus exclusively on improved irrigation management in developing countries, ensures that IIMI possesses the best available expertise for the proposed on-farm irrigation improvement program, which is a critical element of the greater A.I.D. TRM Project activity. Moreover, based on its extensive experience in many other developing country situations, IIMI is one of the best available sources of "lessons learned" information on the development of irrigated agriculture in developing country situations. The results of the Mission's reference check on prior IIMI activities conducted with A.I.D. assistance in other countries provides strong corroboration of IIMI's excellent technical competence in implementing similar irrigation improvement programs in similar country situations in accordance with A.I.D. policies and procedures.

In addition to this international experience, IIMI also possesses a unique knowledge and understanding of irrigated agriculture in Morocco, in general, and in the Tadla target area, in particular, following almost three years of preliminary research in Tadla and other large-scale irrigation perimeters of Morocco in an attempt to establish a country program here. As a result of this work, IIMI now has established close working relationships with national and regional irrigation officials in Tadla, who will serve as key counterparts for the implementation of both the proposed cooperative program and the TRM Project. This preliminary work has enabled IIMI to establish a good degree of confidence among the proposed program target population of Tadla farmers as well - a critical ingredient for any successful farm-level development initiative. Finally, this work ensures that this proposed IIMI activity has been designed based on a solid understanding of the unique technical, socio-economic and other characterisitics of both the Moroccan national and Tadla-specific irrigation context. Few, if any, other comparable organizations can claim this detailed level of country-, regional-, and subject-specific knowledge.

JUSTIFICATION: Exception for the non-competitive award of a cooperative agreement under the TRM Project with IIMI is justified on the grounds of IIMI's predominant capability to undertake the proposed program of work. This predominent capability is based on: (1) IIMI's extensive experience and demonstrated technical expertise and competence in implementin similar irrigation improvement programs in similar country situations; (2) IIMI's wealth of international information and experience regarding the proposed cooperative program of work, including extensive prior experience in collaborating with A.I.D.-assisted activities in similar developing country situations; (3) IIMI's existing established working relationships with national and Tadla target area counterparts, and farmer beneficiaries; and (4) IIMI's excellent knowledge and understanding of Moroccan irrigated agriculture, including, most particularly, the technical, socio-economic and other unique characteristics of the proposed program and project target area.

AUTHORITY: A.I.D. Handbook 13, 2B.4.b. gives the Grants Officer the authority to review and approve justifications for non-competitive awards upon written submission by the cognizant Technical Office or Officer. Only in cases where the Grants Officer rejects the justification need the matter be referred to the responsible Assistant Administrator or Office Director.

STANDARD: A.I.D. Handbook 13, Chapter 2, Section 2A.3.b states the conditions under which competition is not required in the selection of recipients of grant awards. The circumstances permitting an exception to competitive procurement procedures, which are directly applicable to the cooperative agreement with IIMI, are "Assistance awards for which one recipient is considered to have exclusive or predominant capability, based on experience, specialized facilities or technical competence, or based on an existing relationship with the cooperating country or beneficiaries" .

Approved: Mary Reynolds

Mary Reynolds, Grants Officer

Date: JUL 30 1992

ANNEX K (Cont.)

A.I.D.-Financed Equipment and Supplies

Item Description	Number of Units	Unit Cost ($)	Total Cost ($)
Sustainable Environmental Management			
Groundwater/Drainage Monitoring			77,000
·Piezometer	140		
·Sonar Water Levels	5		
·Dataloggers	30		
·Guaging Station Construction	30		
·Limnographs	30		
·Equipment D&M	10		
·Datalogger Batteries	420		
·Datalogger Feed Wiring	2000 m		
Water/Soil Monitoring			4,000
·Sampling Bottles	300		
·Portable Refrigerator	1		
·Soil Sampling Bags/Tools			
Computers and Peripherals			24,500
·Computer (80MB & copr)	2		
·Standard Printers	2		
·Graphics Printer	1		
·Voltage Regulators	2		
·Specialized Software			
·Portable Field Computer	1		
·Computer Supplies			
Private Sector Strenghtening			
Business Management Equipment	misc.	see Ch. 3	
Training Equipment			15,000
·Video Camera	1		
·VCR	1		
·Video Monitor	1		
·SLR Camera	1		
·Slide Projector/Screen	1		
·Computer with Graphics	1		
Display System	1		
·Materials and Supplies	misc.	see Ch. 3	

ANNEX K

A.I.D.-Financed Equipment and Supplies

Item Description	Number of Units	Unit Cost ($)	Total Cost ($)
Improved Irrigation Systems Management			
Computers			
•IBM or Compatible, VGA, 33MHZ, 4MB RAM, 80MB Hard Drive or more	7	10,000	70,000
•Dedicated GIS Workstations, Peripherals and Software	1	150,000	150,000
Software			
•Statistical - Time Series and Experimental Analysis	1	3,000	3,000
•Data Acquisition - Flow Rates and Weather	3	400	1,200
•Hydraulic Modeling	1	5,000	5,000
•Computerized Delivery Procedure	3	1,000	3,000
Data Acquisition Hardware			
•Data Receiving Radio and Computer Connections	3	700	2,100
•Meteorlogical Stations Sensing, Logging and Transmission	3	5,400	16,200
•Water Level Sensing, Logging and Transmission	8	3,200	25,600
•Construction - Flow Measurement Weirs (8 total, different sizes)	misc.		100,000
•Flow Measuring Flumes and Meters, Instruments and Equipment	2	25,000	50,000
Vehicles			
•All-Terrain, 4x4, Diesel	2	35,000	70,000
Improved On-Farm Management			
Demonstration Equipment, Materials and Supplies	misc.	see Ch. 3	
Radio Station Support	misc.	see Ch. 3	

Annex M

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Annex J

INITIAL ENVIRONMENTAL EXAMINATION