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Consortium for International Development

Water Management Synthesis II

Workplan FY85

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WMS II PROJECT

FY 1985

PLAN OF WORK

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PART I -- ANALYSIS OF PROGRAM OF WORK

FY-85 WORKPLAN

WATER MANAGEMENT SYNTHESIS II PROJECT

Introduction

Improving irrigation water management as a means for increasing agricultural production and farm income throughout the world is the overall goal of the Water Management Synthesis II Project. Irrigated agriculture is of fundamental importance in many LDC's both in the production of required food supplies and in the creation of increased rural employment opportunities. An increased concern with irrigation system performance, often referred to as improving water management, focuses on the need to provide farmers with a reliable, timely, and sufficient water supply and provide the inputs and services for an effective irrigated agriculture.

The Water Management Synthesis II Project is directly concerned with these issues of improving irrigation system performance and water management. The Project's overall purpose is to help AID missions around the world to achieve their objectives of assisting irrigation-related institutions in the LDC's to enhance their capacity to deal with the complex issues of water management. The project views improving LDC capacity to plan and implement water management projects as a principal objective.

Improving the management and performance of irrigation systems requires attention to a broad range of factors--engineering, agronomic, economic, and organizational, at a minimum. That is to say, water management requires an approach that uses several different disciplinary perspectives--a strategy that is at the core of the project's approach to all of its activities. As can be seen in the detailed activity descriptions that follow, WMS II operates on the principle that technical assistance activities, training programs, and special studies in water management are best conducted by interdisciplinary teams focused on common problems.

Such interdisciplinary teams experienced in working with water management issues are relatively scarce. As a means of harnessing the existing professional expertise on this topic, as well as providing a means for expanding the pool of expertise, the Consortium for International Development (CID) has contracted to implement the Water Management Synthesis II Project. Two CID universities--Colorado State and Utah State--and Cornell University are the major participating universities for this project. The project mobilizes resources and personnel to assist USAID Missions in developing programs to meet world needs through technical assistance, training and technology transfer, and special study activities. In addition, the project often takes the lead in identifying LDC water management needs and articulating these to the missions.

FY 85 Workplan Development

In April 1984, AID/Washington formally requested that USAID Missions prepare requests for assistance for the 1985 Fiscal Year. Requests for assistance were received from 13 missions totaling $2.5 million by September 10, 1984. These requests are one basis for the FY 85 Workplan. In addition, these and previous requests, as well as the last two years' experience have suggested additional training, technology transfer, and special study activities in order to meet present and future water management needs throughout the world.

The workplan narrative (Part I) both indicates the focus of FY 85 Synthesis Project activities and presents the underlying philosophy which has guided the selection and conduct of individual activities. In addition, a summary analysis of the workplan budget is presented. This summary presents budgeted amounts by AID Bureau, source of funds, activities by country, activity category, and the university responsible for management. Part II presents a detailed budget for each activity. The budgets are presented by country. Plans for the university initiated activities are provided in Part III. The appendices provide budget sheets for activities previously approved and initiated in FY 84 that are continuing in FY 85.

Focus and Philosophy

The Water Management Synthesis II Project seeks to improve irrigation water management on a worldwide basis and, at the same time, to generate new knowledge which will substantially improve water management in the future. In addition, the Project needs to capture and to institutionalize important "lessons learned" from each activity and to enhance the water management capacities of LDC institutions through professional development. This multiple function creates a dilemma: technical assistance, training and technology transfer support activities must be broadly based, while special studies should be sharply focused on a single theme or research question.

Special Studies are essential for the generation of new knowledge which in turn will lead to improved technology and management. These studies, then, are the intellectual driving force of the Project. However, AID's substantive irrigation program is a present concern. Much irrigation development lags well behind state-of-the-art research, not only in engineering and agronomy, but even more so in the areas of organization, resource allocation, and farmer participation. Thus, the Project must provide the best possible advice and technological support available given current knowledge.

Linking the activities - New knowledge needs to be utilized effectively; it must flow into training and technology transfer and into technical assistance activities. For example, the elements of irrigation distribution, water application, and agricultural production systems (e.g. open channel hydraulics, hydrology, and soil-water-crop fertilizer interactions) are well known, but are frequently not well-utilized. What is not understood is the behavior of these systems in a holistic sense. Thus, the centerpiece of the search for new knowledge is irrigation system

behavior. One cannot study these systems in isolation; yet, the study of actual systems--particularly in overseas settings--is expensive. Thus, TA and training activities can provide data for special studies. The synthesis concept is reflected in this interaction between technical assistance, training and special study activities.

Lessons learned - Participants in project activities not only provide feedback to support special studies and technical assistance, but must also engage in a learning process. Learning about site- and region-specific variables, especially interdisciplinary ones, about different institutional arrangements, and about specific technological adaptations leads to new insights and sharpens the analytical and developmental assistance skills of those participating. USU will be leading a special technology transfer activity which is specifically addressed to recording, organizing and synthesizing the lessons learned from the multitude of project activities.

Increasing water management capabilities - Development assistance has a considerable history of experience and is emerging as an art--a profession in its own right. That support for development assistance is at least quasi-political and involves a bureaucratic process which is not to be lamented, but recognized as an essential element of the process. Like any profession, development assistance has its own semantic base. To be most effective, WMS II Project participants need to understand the nature of important water management improvement strategies, concepts, and principles. Therefore, professional development programs are needed so that those participating in water management activities can benefit from the existing store of information and can gain a deeper understanding of development issues in order to be more effective in their water management efforts.

Involving professionals in WMS activities who are new to development work or new to water management is one approach to increasing the pool of professional capability. For instance, a rural sociology professor has been used in a training course as part of an interdisciplinary team examining an irrigation system in an Asian country. The professor had not previously been involved in overseas assignments, but has now been integrated into a growing pool of interdisciplinary expertise in water management and is being used for additional assignments.

Another means of increasing water management capability is the development of graduate students. This can be done through research projects, technical assistance activities, or training efforts. Recently the Indonesian Mission sent a cable to AID/Washington praising the work done by two graduate students used on a project design team. Other graduate students have developed expertise working alongside senior professionals teaching training courses. Still others have had the opportunity to be involved in action research for completion of their degrees and for adding to the knowledge base of water management.

Integrating university programs - The WMS II Project is currently managed by three universities, but it is also concerned with irrigation water management knowledge generally--within and outside of the university community. In this context, it is important that the efforts of the three

universities add up to a coherent whole and that systematic involvement of other CID universities and other organizations be accomplished. The Project seeks to bring this about not simply through administrative coordination and negotiation, but also through shared scientific concepts and a common approach to the generation of new knowledge--an approach which is sharply focused, realistic about its objectives, and which addresses the important central issues of water management.

While the need for an integrated approach is paramount, the problem of unnecessary duplication of effort must be avoided. Therefore, each university plays a distinct role in the Project. CSU uses an interdisciplinary team to focus on water management beginning at the farm level and working up the distribution system, while USU focuses on the water supply, conveyance and delivery subsystem. Integration of the first two components into a solid conceptual base is the assignment of a task force chaired by Jack Keller of USU. Involvement of CSU personnel in USU studies and vice versa is utilized to help integrate these distinct emphases. Cornell continues to concentrate on small-scale, community-managed irrigation systems and on the related issues of local organization and farmer participation. Individuals from USU and CSU continue to join Cornell personnel in these studies to integrate the commonalities between the small community-managed and larger government-managed systems.

There are important linkages among these discrete themes. Many strategies for small-scale irrigation development, for example, may be applicable to larger systems at the farm or tertiary canal level. Because of the more diffuse focus of many technical assistance and of some training activities, these can serve to integrate the distinct themes treated in special studies.

Synthesis

A major training effort of this project is to synthesize knowledge from project activities that can contribute to a holistic approach to water management. The two major project themes are one approach to this synthesis. Activities are organized around discrete, but interrelated ideas that contribute to the growing understanding of small scale irrigation and irrigation system management. Technical assistance, training and technology transfer activities serve as a basis for the integration of these themes.

Activities specifically aimed at developing this synthesis of ideas in FY 85 include an activity to develop a process to capture lessons learned from technical assistance and training activities. Another activity specifically focuses on rehabilitation and attempts to examine through case studies the present understanding of rehabilitation efforts and suggest future directions for advancing understanding of principles, methods, and evaluation of rehabilitation projects in irrigation management. Another seminar examines current research needed in water management.

Project personnel and AID representatives will share the lessons learned on project design teams in a seminar to develop a better understanding of the principles and methods of project design teams.

The objective of these synthesis activities is to develop a coherent water management strategy for improved agricultural production throughout the developing world.

Special Studies

WMS II special studies for FY 85 relate to the Project's two major themes: irrigation system management, and small-scale, community-managed irrigation systems.

Special study activities at USU focus on the irrigation conveyance and delivery systems because (1) the sociotechnical characteristics of irrigation conveyance systems and how they actually work are not well understood, (2) selection of irrigation technology does not usually take into account social, political or cultural factors, and (3) lessons from experience have not been effectively used to present better technological alternatives. These complex problems cannot be solved by the deductive approaches widely used in engineering and agronomy, but solutions must also be based on empirically derived information. The conceptual model for the conveyance subsystem is not be exclusively physical, but includes human and social variables, although the physical model is the first step.

Insights for conceptualization are derived in part from examination of existing projects in conjunction with TA and diagnostic analysis activities. These are done in diverse social and physical settings with special emphasis on Southeast Asia. This approach tests the model's validity for describing and managing systems. Variability among projects tests sensitivity and predictive capability. Action research programs test the model's usefulness as a development tool. (See Part III for more detailed activity description.)

USU is completing the development of a comprehensive computer assisted main system management model. This program includes: water supply reservoir operational and conjunctive use subroutines; main system hydraulic networks delivery driver routines; and unit command area demand/supply hydrographs which are developed from on-farm water requirement-production economics subroutines. This program will be demonstrated and tested in the field early in FY85 and utilized in India, Thailand, Morocco, and Sri Lanka during the year.

The complete conveyance system model must take into account on-farm water management. Special studies at CSU will build on Pakistan experience, recent developments in Egypt, and on knowledge generated by Water Management Synthesis I to study irrigation system management at the farm level and at the unit command level interfacing the farm level to the main system.

Physical and biological models for farm systems are available as are social and organizational models that integrate technical factors. CSU's special studies will seek to refine these models and to apply them by water management improvement strategies through diagnostic analysis and development of solution activities and through the implementation of these strategies in

selected projects in Sri Lanka, and/or Pakistan. Thus, CSU's special studies will build on previous experiences and TA efforts, be integrated into training activities, and will be oriented toward the improvement of water management in the field in an action research effort.

Cornell University special studies will focus heavily on policies and programs for small-scale irrigation systems and on issues of local organization and farmer participation, in general. Attention will also be given to the issues of the appropriate levels of management and investment intensities.

The primary goal of the continuing studies of small-scale irrigation is the identification of critical engineering, economic, organizational and administrative factors contributing to the design and implementation of policies and programs for small-scale irrigation. Particular emphasis will be placed on investigation of the impacts on employment. The studies will draw heavily upon field research in Asia and West Africa.

It is expected that special studies at all three universities will continue to inform and to be informed by technical assistance and training and technology transfer activities. We also anticipate increasing interchange among the three universities with the participation of individuals from each in studies generated and carried out by the others. Additionally, technical reports and trip reports are circulated among project personnel.

Training and Technology Transfer

Professional development of the cadre of personnel engaged in water management programs is an urgent need. Training in WMS II is seen as two-way interaction. Input from participants, as well as instructors, is essential to the learning process. Project training efforts must be cumulative and integrated with related technical assistance, technology transfer, and special studies activities in particular countries providing a focal point. Improvement of irrigation management is a high priority in our professional development activities.

Professional development activities in the 1985 workplan include the following.

1) Responses to mission - requested activities in training.

2) Responses to the project objective of developing relevant workshops and seminars to improve water management.

3) Upgrading and improving short-term training courses in support of mission programs.

4) Increasing the capabilities of professionals to implement improved water management programs.

These activities tend to fall into two categories: 1) training programs in host countries which have as their primary objective the professional

development of host country personnel while providing feedback about that country and its water management concerns to the project personnel; and 2) training programs which have a primary purpose to increase the capacity of project personnel to provide more effective technical assistance, technology transfer or research.

Professional development must also be linked to institution building. Participants in training programs cannot be expected to change complex organizations. Training programs must be viewed as one important means for providing a base for further project activities in host country irrigation systems. A sequence which might well be altered to fit specific host country and mission requirements would be to teach a Diagnostic Analysis Workshop for middle level personnel and then proceed to a Senior Officers Workshop which would utilize data and insights gathered during the field-oriented diagnostic analysis. Outcome of that initial sequence would then provide a base for a follow-up.

Training programs for FY 85 in host countries which have as their primary objective the professional development of host country personnel in local country contexts include the following.

1) Presentation of Diagnostic Analysis Workshops.

2) Presentation of a Senior Officers Workshop will be given in Pakistan as requested.

3) A seminar on rehabilitation is being developed with participation from the lead universities, LDC researchers and donor agencies.

4) Seminar on current research in irrigation to be co-sponsored by the International Irrigation Management Institute in Sri Lanka.

Training activities for FY 85, which have a primary purpose of increasing the capacity of project personnel to understand key issues in water management or to conduct training programs more effectively, include a Diagnostic Analysis Trainers Workshop. Planning for this activity began in FY 84. Another activity initiated in FY 84 that will be held in FY 85 is a WMS II Training Strategies Seminar. A workshop to review the experiences of project personnel in assisting missions design new irrigation projects is a major effort this year to both capture those lessons learned from WMS II personnel's participation in project design teams and to synthesize those lessons into a more organized approach to future design efforts. This workshop is intended to develop guidelines for the activities and procedures of future design teams.

Another key aspect of the project's training program is to provide opportunities for both project personnel and host country professionals to improve their capability in water management through such activities as participating in technical assistance teams, conducting Diagnostic Analysis Workshops, improving language skills, and participating in issue-related seminars.

There is a recognized need to more carefully collect and synthesize the "lessons learned" through WMSII and other irrigation assistance activities. Effort along this line is necessary to improve our collective efficiency in building on past experience in order to better emphasize strategies leading to positive performance and minimize problem situations in irrigation development. In view of this, USU will be leading a technology transfer activity which was begun under WMSI and specifically addresses the recording, organizing and synthesizing of the approaches used and lessons learned by various disciplines individually and collectively in addressing irrigation development activities.

Technology transfer takes place in training activities as well as through other means. It is associated with social change and is generated through a change in human behavior. A number of materials will be developed during FY 85 to improve on-going training programs and to assist project personnel in supporting mission programs on farmer participation, irrigation structure design, and farmer training. A set of 40+ videotape modules will be completed on irrigation water management. Additional modules may also be prepared in conjunction with other activities. Much of the AID initiated technical transfer work comes from India this year as the mission there prepares for a major training effort in water management.

Technical Assistance

The operative language in the WMS II Project goal statement is "increased effectiveness with which irrigation water resources are being developed and used." This goal is shared by every AID irrigation project and by all AID Mission Strategies where irrigation is included in the portfolio. Thus, a substantial part of the project's activity is allocated to technical assistance.

The Project's purpose is not served by waiting until additional technology and information is available. Instead, the best state-of-the-art technologies should be introduced in the planning, design and implementation of irrigation development assistance programs. WMS II Project and other AID-sponsored irrigation water management studies have already developed new knowledge and information in the water management field. Of particular significance are interdisciplinary approaches which include human and social variables in analysis and design. Each of the three universities uses a formal or informal interdisciplinary management team for project planning and implementation. Interactions through seminars at each university, the Project Management Team, all-university task forces, the implementation teams and workshops explore current water management principles and synthesize new concepts. While not always possible, at least one, but usually several members of each technical assistance team has WMS II experience or orientation, either directly or as an earlier WMS II team member. Thus, a water management synthesis focus is given to technical assistance activities.

To focus the scope of the TA activities to always be complimentary with special studies is not possible considering the diverse needs of Missions around the world. WMS II management attempts to optimize assignments by taking into account the particular experience and interest of each

university, and current availability of personnel. Because of short lead-times, scheduling has been a problem and will doubtless continue to be.

Current requests for technical assistance mostly fall into the following categories:

1. Project design with preparation of project implementation documents and project papers

2. Project implementation assistance including long-term assignments

In addition, there are numerous requests for specific kinds of other technical assistance. Project designs will permit the use of water management improvement strategies and state-of-the-art concepts and principles. Project implementation will allow the improvement of these strategies under field conditions. Synthesis of the "lessons learned" will be more effective in the continuing long-term implementation programs in India and Sri Lanka. These results should also facilitate both special studies and technology transfer.

There will doubtless continue to be some uncertainty in the timing of TA. This frequently leads to some degree of expediency. This will be kept to a minimum by expanding and diversifying our capability. WMS II management is expanding the project's information portfolio about qualified people both in universities and in the private sector. This should substantially increase the project's capability to field effective teams, although policy will continue to be that at least one and preferably more, team members on larger teams will be regular university faculty. WMS II is conscious of the urgency of mission needs and the importance that these are met with effective responses. The project will continue to make every reasonable effort to assist in meeting these needs. What is important is that TA personnel be well qualified, informed of current project technical output and that they report their experiences in ways that can contribute to project synthesis work.

Budget Summary Analysis

This section summarizes the major aspects of the workplan including activity category, source of funds, summary line item budget, and a summary of activities managed by each university. The results will be used to present important aspects of the workplan.

Major activities are being implemented in Asia because of the importance of irrigation in Asia, the Asia Bureau contribution to core project funds, and the Mission buy-ins (Table 1). The other major emphasis is preparation of training materials, conducting of workshops, and special studies to synthesize knowledge and improve future efforts in water management on a worldwide basis. In addition, WMS II will continue to carry out key irrigation activities in Latin America and the Near East. A major effort will be made to initiate a substantial program in Africa with the assistance of Africa Bureau funding. That effort will be added to the workplan as activities are requested throughout FY 85.

A summary of activities by activity, country and source of funds is presented in Tables 2a-e. The results show that India, Indonesia and Sri Lanka are major countries for WMS II activities both in terms of central funds and mission funding. These countries also are implementing water management projects with short and long-term WMS II assistance. India in particular is developing projects, providing training and implementing projects with major assistance from WMS II.

The source of funds for the various budget activity categories are presented in Table 3. Many of the training and technology transfer activities are to assist India in launching its major effort in water management training.

Missions can be requested to pay an administration fee when the buy-in activity is to be financed from a country project source. Missions are not requested to pay an administrative fee when buy-in activities are financed with PD and S funds. In no case will the payment of an administration fee be insisted upon as a condition for WMS II response to a request for an activity. The justification for an administrative fee is to lessen the burden of administrative costs on project core funds when the administrative and support activity is directly associated with a buy-in activity. The financial burdens of such directly associated administrative and support costs are particularly important to consider when the buy-in activity is fairly large in a financial sense. AID/W can approve the use of the funds for specific administrative budgets and the funds released from those administrative budgets can then be reprogrammed for subject matter related activities.

Table 1. Summary of budgeted amounts: Type of Funding by General Areas of Expenditure and Source of Funds.

Bureau	FY85 Core	Activity Buy-in**	Funding Total	Mission Contribution*
Africa	59,621		59,621	7,000
Asia	840,830	1,492,969	2,333,799	38,100
Latin America	142,893	63,318	204,211	51,837
Near East	87,400	41,268	128,668	16,870
Worldwide	768,165	66,723	834,888	
Administration	863,509		863,509	
TOTAL	2,762,418	1,664,278	4,424,696	107,307

*Mission contributions are the estimated value of services in kind which are provided by AID missions to WMS II personnel and include such items as transportation, copying service, secretarial support, etc. While none of the mission contributions are monetary, they are reported here to reflect an estimated magnitude of such support. Mission contributions are not formally part of the WMS II budget.

**Refer to Table 8 for details

TABLE 2A. AFRICA BUREAU (02/15/85)

Country	Activity	Code #	Univ.	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
MAURITANIA	PEACE CORPS ASSISTANCE	1-02-061-85	CU	4,930		4,930		
			Total:	4,930	0	4,930	0	0
NIGER	TRAD. & DEV. SSI STUDY	3-04-052-85	CU	42,484		42,484		7,000
			Total:	42,484	0	42,484	0	7,000
SWAZILAND	IRRIGATION ASSISTANCE	1-02-029-85	USU	12,207		12,207	500	
			Total:	12,207	0	12,207	500	0
			Total:	59,621	0	59,621	500	7,000

TABLE 2B. ASIA BUREAU (02/15/85)

Country	Activity	Code #	Univ.	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
INDIA	DEM/WORKSHOP OF COMPUTER ISM	2-14-040-85	USU	40,731	16,740	57,471		
	DEVELOPMENT OF HANDBOOKS	2-13-027-85	CSU	79,956		79,956		
	FARMER ORGANIZATION WORKSHOP	2-14-017-85	CU		81,141	81,141		
	HYDRAULIC CONDUCTIVITY	1-02-024-85	USU		31,750	31,750	500	
	INDIA MAIN SYSTEM CASE STUDY	3-04-043D85	USU	31,928		31,928		
	INNOVATIVE TEACHING	2-03-012-85	USU		138,090	138,090	2,000	
	MAIN SYSTEMS TRAINING	2-14-015-85	USU		65,372	65,372	1,000	
	PRIORITY RESEARCH	1-02-014-85	CSU		113,877	113,877		
	RAPID APPRAISAL	1-02-016-85	USU		75,853	75,853	1,500	
	RESERVIOR OPERATION STUDIES	1-02-025-85	USU		36,990	36,990	500	
	TECHNOLOGY TRANSFER	2-06-022-85	CSU		164,971	164,971		
	TRAINING MATERIALS	2-13-020-85	CSU		435,210	435,210		
	TRAINING OF TRAINERS	2-14-019-85	CSU		37,594	37,594		
	UNIV. CURRICULA	1-02-013-85	USU		26,472	26,472		
	WATER BALANCE	2-14-023-85	USU		40,333	40,333	500	
			Total:	152,615	1,264,393	1,417,008	6,000	0
INDONESIA	ASSESSMENT TEAM	1-02-009-85B	CSU					
		1-02-009-85C	USU					
	SSI WORKSHOP & TECH. ASSIST.	1-02-009-85A	CU	145,658	55,000	200,658		
			Total:	145,658	55,000	200,658	0	0
NEPAL	NEPAL DA OF IRRG. SYS.	2-02-031-85	CSU	126,479		126,479		
			Total:	126,479	0	126,479	0	0
PAKISTAN	EXTENSION TRAINING - RECON.	2-06-063-85	CU					
	MANAGEMENT TRAINING - PLANNING	2-01-065-85	CSU		99,881	99,881		
			Total:	0	99,881	99,881	0	0
SRI LANKA	CENTRAL SUPPORT	1-02-003-85	CSU		73,695	73,695		
	INTERFACING ON-FARM WM	3-04-036B85	CSU	130,907		130,907		
	LANDSAT 85-RAPID RECONNAISANCE	3-04-038-85	CSU	34,442		34,442	16,600	
	MODEL CALIBRATION	1-02-005-85	USU	37,600		37,600	500	
	SOCIOECONOMIC STUDIES FOR REHAB.	1-02-004-85	CU	82,672		82,672	15,000	
			Total:	285,621	73,695	359,316	32,100	0
THAILAND	THAILAND CASE STUDY	3-04-043B85	USU	44,067		44,067		
			Total:	44,067	0	44,067	0	0
WORLDWIDE	INTERFACING OFWM BACKSTOPPING	3-04-036A85	CSU	86,390		86,390		
			Total:	86,390	0	86,390	0	0
			Total:	840,830	1,492,969	2,333,799	38,100	0

TABLE 2C. LATIN AMERICA BUREAU (02/15/85)

Country	Activity	Code #	Univ.	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
BOLIVIA	COURSE SSI - DESIGN & OPERATION	2-14-010-85	USU	41,333		41,333	12,575	
	ON-FARM WATER MANAGEMENT	2-01-011-85	USU	55,813	25,555	81,368	21,870	
			Total:	97,146	25,555	122,701	34,445	0
DOMINICAN REPUBLIC	ON-FARM WATER MGMT. COURSE	2-14-030-85	USU		9,909	9,909	200	
			Total:	0	9,909	9,909	200	0
EL SALVADOR	PID PREPARATION	1-02-059-85	CSU		22,500	22,500		
			Total:	0	22,500	22,500	0	0
HONDURAS	IRRIG. DEVEL. PROJECT	1-02-060-85	USU	8,955	5,354	12,309		
			Total:	8,955	5,354	12,309	0	0
JAMAICA	PLANNING ACTIVITIES	1-02-007-85	USU	11,970		11,970	5,100	
	SYSTEMS STUDY	1-02-008-85	USU	24,822		24,822	12,092	
			Total:	36,792	0	36,792	17,192	0
			Total:	142,893	63,318	204,211	51,837	0

TABLE 2D. NEAR EAST BUREAU (02/15/85)

Country	Activity	Code #	Univ.	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
Egypt	Water Use & Mgmt Eval.	1-02-066-85	USU		41,268	41,268		
			Total:	0	41,268	41,268	0	0
JORDAN	JORDAN ADVISORY SERVICES	1-02-028-85	USU	10,338		10,338	9,200	
			Total:	10,338	0	10,338	9,200	0
MOROCCO	MOROCCAN CASE STUDIES	3-04-043C85	USU	29,433		29,433	5,670	
	PID DEVELOPMENT	1-02-002-85	USU	47,629		47,629	2,000	
			Total:	77,062	0	77,062	7,670	0
			Total:	87,400	41,268	128,668	16,870	0

TABLE 2E. WORLDWIDE BUREAU (02/15/85)

Country	Activity	Code #	Univ.	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
WORLDWIDE	FRENCH LANGUAGE TRAINING	2-11-041-85	USU	10,650		10,650		4,000
	IMS - WORKSHOP	3-04-043E85	USU	27,848		27,848		
	ISM - DEVELOPMENT	3-04-043A85	USU	87,623		87,623		50,000
	JOINT SEMINAR CURRENT RESEARCH	2-14-050-85	CU	94,372		94,372		
	LESSONS LEARNED ISM	2-14-039-85	USU	103,209		103,209		
	MANAGEMENT INTENSITIES	3-04-056-85	CU	69,615		69,615		9,500
	MEETING RECURRENT COSTS OF IS	1-02-062-85	CU		51,345	51,345		
	MICRO COMPUTER WORKSHOP	2-14-032-85	CSU	44,594	15,378	59,972		
	PHASE I - COMPARATIVE ANALYSIS	3-04-053-85	CU	15,031		15,031		
	PHASE II COMPARATIVE ANALYSIS	3-04-054-85	CU	97,099		97,099		
	RAPID IRR PROJ.- REMOTE SENSING	3-04-042-85	USU	73,710		73,710		
	REHABILITATION, GAME SIMULATION	2-13-048-85	CU	33,444		33,444		
	RURAL EMPLOYMENT	3-04-055-85	CU	16,150		16,150		
	SEMINAR ON IRRG SYS REHAB #1	2-05-033-85	CSU	53,030		53,030		
	WORKSHOP LESSONS LEARNED: PDA	2-14-049-85	CU	41,790		41,790		
			Total:	768,165	66,723	834,888	0	63,500
			Total:	768,165	66,723	834,888	0	63,500

TABLE 2F. ADMINISTRAION BUREAU (02/15/85)

Country	Activity	Code #	Univ.	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
WORLDWIDE	CSU ADMINISTRATION	0-02-998-85	CSU	231,641		231,641		
	CU ADMINISTRATION	0-02-996-85	CU	206,932		206,932		
	EPD	0-01-999-85B	OVERALL					
	EPD ADMINISTRATION	0-01-999-85A	EPD	191,810		191,810		
	USU ADMINISTRATION	0-02-997-85	USU	233,126		233,126		
			Total:	863,509	0	863,509	0	0
			Total:	863,509	0	863,509	0	0

Table 3. Summary of budgeted activities: catagorized by activity area and source of funds.

	TA	TR/TT	SS	Adm. & Support	Total
FY85 Core	$ 386,781	725,401	786,727	863,509	2,762,418
Percent	14%	26%	28%	32%	100%
Activity Buy-in	534,104	1,130,174	-	-	1,664,278
Percent	32%	68%			100%
Total Funding	918,885	1,855,575	786,727	863,509	4,424,696
Percent	20%	42%	18%	20%	100%
Contribution	46,892	38,145	22,270	-	107,307
Percent	44%	36%	20%		100%
Total	$ 965,777	1,893,720	808,997	863,509	4,532,003
Percent	21%	42%	18%	19%	100%

Table 4 summarizes the budgeted activities by responsibility for management and activity category. The results provide the totals and percentages for each activity category as distributed across management responsibility.

Tables 5a-c summarizes each university's activities by category, country and source of funds. A line item budget for each management unit is presented in Table 6. Table 7 shows FY 84 activities that will be continued in FY 85.

Table 4. Summary of budgeted activities by responsibilities for management and activity category.

	CSU	CU	USU	Overall	Total
Technical Assistance					
FY85 Core	$ -0-	$ 233,260	$ 153,521		$ 386,781
Percent		60%	40%		100%
Buy-In	210,072	106,345	217,687		534,104
Percent	39%	20%	41%		100%
Total	210,072	339,605	369,208		918,885
Percent	23%	37%	40%		100%
Training & Tech. Trans.					
FY85 Core	304,059	169,606	251,736		725,401
Percent	42%	23%	35%		100%
Buy-In	753,034	81,141	295,999		1,130,174
Percent	67%	7%	26%		100%
Total	1,057,093	250,747	547,735		1,855,575
Percent	57%	13%	30%		100%
Special Studies					
FY85 Core	251,739	240,379	294,609		786,727
Percent	32%	31%	37%		100%
Buy-In	-	-	-		-
Percent					
Total	251,739	240,379	294,609		786,727
Percent	32%	31%	37%		100%
Administration					
FY85 Core	231,641	206,932	233,126	191,810	863,509
Percent	27%	24%	27%	22%	100%
Buy-In	-	-	-	-	-
Percent					
Total	231,641	206,932	233,126	191,810	863,509
Percent	27%	24%	27%	22%	100%
Total					
FY85 Core	787,439	850,177	932,992	191,810	2,762,418
Percent	29%	31%	34%	6%	100%
Buy-In	963,106	187,486	513,686	-	1,664,278
Percent	58%	11%	31%		100%
Total	$1,750,545	$1,037,663	$1,444,678	$191,810	$4,424,696
Percent	40%	23%	33%	4%	100%

Table 5a. Colorado State University Activities by Category, Country, and Source of Funds 02/15/85

TECHNICAL ASSISTANCE

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
El Salvador	PID Preparation	1-02-059-85		22,500	22,500		
India	Priority Research	1-02-014-85		113,877	113,877		
Sri Lanka	Central Support	1-02-003-85		73,695	73,695		
	TOTAL			210,072	210,072		

TRAINING AND TECHNOLOGY TRANSFER

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
India	Training of Trainers	2-14-019-85		37,594	37,594		
	Training Materials	2-13-020-85		435,210	435,210		
	Technology Transfer	2-06-022-85		164,971	164,971		
	Development of Handbooks	2-13-027-85	79,956		79,956		
Nepal	Nepal DA of Irrg. Sys.	2-02-031-85	126,479		126,479		
Pakistan	Mgmt Officials Trng.-Planning	2-01-065-85		99,881	99,881		
Worldwide	Seminar On Irrg. Sys. Rehab #1	2-05-033-85	53,030		53,030		
	Micro Computer Workshop	2-14-032-85	44,594	15,378	59,972		
	TOTAL		304,059	753,034	1,057,093		

SPECIAL STUDIES

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Sri Lanka	Interfacing on-farm Water Mgmt.	3-04-036B85	130,907		130,907		
	Landsat 85-Rapid Reconnaisance	3-04-038-85	34,442		34,442	16,600	
Worldwide	Interfacing OFWM Backstopping	3-04-036B85	86,390		86,390		
	TOTAL		251,739		251,739	16,600	

ADMINISTRATION

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Worldwide	CSU Administration	0-02-998-85	231,641		231,641		
	TOTAL		231,641		231,641		
TOTAL CSU			787,439	963,106	1,750,545	16,600	

Table 5b.. Cornell University Activities by Category, Country, and Source of Funds 02/15/85

TECHNICAL ASSISTANCE

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Indonesia	SSI Workshop & Tech. Assist.	1-02-009-85	145,658	55,000	200,658		
Mauritania	Peace Corps Assistance	1-02-061-85	4,930		4,930		
Sri Lanka	Socioeconomic Studies for Rehab.	1-02-004-85	82,672		82,672	15,000	
Worldwide	Meeting Recurrent Costs of IS	1-02-062-85		51,345	51,345		
	TOTAL		233,260	106,345	339,605	15,000	

TRAINING AND TECHNOLOGY TRANSFER

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
India	Farmer Organization Workshop	2-14-017-85		81,141	81,141		
Worldwide	Rehabilitation, Game Simulation	2-13-048-85	33,444		33,444		
	Workshop Lessons Learned: PDA	2-14-049-85	41,790		41,790		
	Joint Seminar Current Research	2-14-050-85	94,372		94,372		
	TOTAL		169,606	81,141	250,747		

SPECIAL STUDIES

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Niger	Trad. & Dev. SSI Study	3-04-052-85	42,484*		42,484		7,000
Worldwide	Phase I-Comparative Analysis	3-04-053-85	15,031		15,031		
	Phase Core-Comparative Analysis	3-04-054-85	97,099		97,099		
	Rural Employment	3-04-055-85	16,150		16,150		
	Irrig. Systems Performance	3-04-056-85	69,615*		69,615		9,500
	TOTAL		240,379		240,379		16,500

ADMINISTRATION

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Worldwide	CU Administration	0-02-996-85	206,932		206,932		
	TOTAL		206,932		206,932		
TOTAL CU			850,177	187,486	1,037,663	15,000	16,500

* FY85 budget includes carryover from the fy84 budget which has been reduced by an offsetting amount.

Table 5c. Utah State University Activities by Category, Country, and Source of Funds 2/15/85

TECHNICAL ASSISTANCE

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Egypt	Water Use & Mgmt. Eval.	1-02-066-85		41,268	41,268		
Honduras	Irrig. Devel. Project	1-02-060-85	8,955	5,354	12,309		
India	Reservior Operation Studies	1-02-025-85		36,990	36,990	500	
	Univ Curricua	1-02-013-85		26,472	26,472		
	Rapid Appraisa	1-02-016-85		75,853	75,853	1,500	
	Hydrauic Conductivity	1-02-024-85		31,750	31,750	500	
Jamaica	Planning Activities	1-02-007-85	11,970		11,970	5,100	
	Systems Study	1-02-008-85	24,822		24,822	12,092	
Jordan	Jordan Advisory Services	1-02-028-85	10,338		10,338	9,200	
Morocco	PID Development	1-02-002-85	47,629		47,629	2,000	
Sri Lanka	Model Calibration	1-02-005-85	37,600		37,600	500	
Swaziland	Irr. Components in Ag. Proj.	1-02-029-85	12,207		12,207	500	
	TOTAL		153,521	217,687	369,208	31,892	

TRAINING AND TECHNOLOGY TRANSFER

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Bolivia	Course SSI - Design & Operation	2-14-010-85	41,333		41,333	12,575	
	On-Farm Water Management	2-01-011-85	55,813	25,555	81,368	21,870	
Dom. Republic	On-Farm Water Mgmt. Course	2-14-030-85		9,909	9,909	200	
India	Dem/Workshop of Computer ISM	2-14-040-85	40,731	16,740	57,471		
	Innovative Teaching	2-03-012-85		138,090	138,090	2,000	
	Main Systems Training	2-14-015-85		65,372	65,372	1,000	
	Water Balance	2-14-023-85		40,333	40,333	500	
Worldwide	Lessons Learned ISM	2-14-039-85	103,209		103,209		
	French Language Training	2-11-041-85	10,650*		10,650		4,000
	TOTAL		251,736	295,999	547,735	38,145	4,000

Table 5c. Utah State University Activities by Category, Country, and Source of Funds 2/15/85

SPECIAL STUDIES

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
India	Main System Case Study	3-04-043D85	31,928		31,298		
Morocco	Case Studies	3-04-043C85	29,433		29,433	5,670	
Thailand	Case Study	3-04-043B85	44,067		44,067		
Worldwide	Rapid Irr Proj-Remote Sensing	3-04-042-85	73,710		73,710		
	ISM - Development	3-04-043A85	87,623*		87,623		50,000
	ISM - Workshop	3-04-043E85	27,848		27,848		
	TOTAL		294,609		294,609	5,670	50,000

ADMINISTRATION

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Worldwide	USU Administration	0-02-997-85	233,126		233,126		
	TOTAL		233,126		233,126		
TOTAL USU			932,992	513,686	1,444,678	75,707	54,000

*FY85 budget includes carryover from the fy84 budget which has been reduced by an offsetting amount.

Table 5d. Overall Activities by Category, Country, and Source of Funds 2/15/85

ADMINISTRATION

Country	Activity	Code #	FY85 Core	Buy-ins	Funding Total	Mission Contributions	Carry Over
Worldwide	EPD Administration	0-01-999-85	191,810			191,810	
	TOTAL		191,810		-	191,810	-
TOTAL OVERALL			191,810			191,810	

Table 6. Line Item Budget.

	CSU	CU	USU	Overall	Total
Salaries & Benefits	$ 794,451	$ 303,867	$ 641,753	$119,400	$1,859,471
Travel	331,101	244,807	206,971	10,000	792,879
Consultants	30,880	33,826	87,229	-	151,935
Other Direct	105,012	88,060	93,009	26,000	312,081
Equipment	5,000	-	1,000	-	6,000
Indirect Costs	350,929	299,617	309,109	18,975	978,630
Institution Costs	1,617,373	970,177	1,339,071	174,375	4,100,996
CID G&A & DBA	133,172	67,486	105,607	17,435	323,700
Funding Total	$1,750,545	$1,037,663	$1,444,678	$191,810	$4,424,696

Table 7. FY 84 ACTIVITIES CONTINUING IN FY 85 02/15/85

Country	Activity	Code #	Univ.	WMS II Core	Buy-Ins	Funding Total	Mission Contributions
	SPECIAL STUDIES						
Niger	Small Scale Irr. & WM	3-04-098-84	CU	5,508		5,508	
Sri Lanka	Rehabilitation	3-04-097-84	CU	26,492		26,492	20,094
Worldwide	Interdisp. Irr. System Selection	3-04-062-84	USU	62,430		62,430	
	Small Scale Irrigation	3-04-069-84	CU	57,059		57,059	
	Compartive Analysis of Farmer Part.	3-04-046-83	CU	17,535		17,535	
	TOTAL			169,024		169,024	20,094
	TECHNICAL ASSISTANCE						
Africa	Irr. Strategy Program	1-02-108-84	USU	54,300	85,000	139,300	
Haiti	Irrigation Sector Survey	1-04-017-84	USU	21,000	47,072	68,072	20,000
India	Madya Pradesh Minor	1-01-025-84A	USU		226,229	226,229	
	Soc/Tech Feasibility Study	1-02-023-84	USU		174,989	174,989	
	Maharashtra Irrig. T & M	1-01-021-84A	USU		226,229	226,229	
	Eval. & Strategy Review	1-02-103-84	USU	174,716	35,000	209,716	
Pakistan	Command Water Management	1-02-114-84	CSU		774,905	774,905	315,544
Peru	Plan Meris	1-01-112-84	USU		642,215	642,215	
Sri Lanka	Design Team	1-02-102-84	CSU		172,000	172,000	
	Long Term Water Mgmt. Specialist	1-01-109-84	CSU		216,137	216,137	
	TOTAL			250,016	2,599,776	2,849,792	335,544
	TRAINING AND TECHNOLOGY TRANSFER						
Ecuador	Finishing Orig. Training Modules	2-03-054-84	USU	129,176	32,000	161,176	
India	Senior Officer's Workshop	2-04-053-84A	USU	74,337		74,337	
Pakistan	Senior Officer's Workshop	2-04-019-84	CSU	10,064	80,828	90,892	74,625
Worldwide	Irrig. Sys. Mgmt. Task Force	2-14-060-84A	USU	44,284		44,284	
	Small Scale Irrig. Task Force	2-14-065-84A	CU	20,741		20,741	
	Professional Visitors	2-11-068-84	CU	9,673		9,673	
	Microcomputer Applications	2-10-051-84	CSU	62,615		62,615	
	Survey and Strategy for Training	2-09-049-84	CSU	27,378		27,378	
	Brochures; Newsletters; Pub.	2-12-044-84	CSU	39,976		39,976	
	Instructors Guide for DA Workshop	2-13-042-84	CSU	24,881		24,881	
	DA Trainers Workshop	2-08-040-84	CSU	29,736		29,736	
	Prof. Visitors & Networking	2-11-039-84	CSU	10,284		10,284	
	TOTAL			483,145	112,828	595,973	74,625
	TOTAL			902,185	2,712,604	3,614,789	430,263

TABLE 8. ANTICIPATED BUY-IN (02/15/85)

Country	Activity	Code #	Budget Status	Activity Buy-in	Adm. Fee	PIO/T Total
BOLIVIA	ON-FARM WATER MANAGEMENT	2-01-011-85	OVERALL REQ.	25,555		25,555.00
			Total:	25,555	0	25,555.00
DOMINICAN REPUBLIC	ON-FARM WATER MGMT. COURSE	2-14-030-85	OVERALL REQ.	9,909	1,041	10,950.00
			Total:	9,909	1,041	10,950.00
EGYPT	WATER USE & MGMT EVAL.	1-02-066-85		41,268	4,325	45,593.00
			Total:	41,268	4,325	45,593.00
EL SALVADOR	PID PREPARATION	1-02-059-85	VERBAL APP.	22,500		22,500.00
			Total:	22,500	0	22,500.00
HONDURAS	IRRIG. DEVEL. PROJECT	1-02-060-85	OVERALL REQ.	5,354		5,354.00
			Total:	5,354	0	5,354.00
INDIA	DEM/WORKSHOP OF COMPUTER ISM	2-14-040-85	OVERALL REQ.	16,740	6,351	23,091.00
	FARMER ORGANIZATION WORKSHOP	2-14-017-85	OVERALL REQ.	81,141		81,141.00
	HYDRAULIC CONDUCTIVITY	1-02-024-85	OVERALL REQ.	31,750	3,540	35,290.00
	INNOVATIVE TEACHING	2-03-012-85	OVERALL REQ.	138,090	15,015	153,105.00
	MAIN SYSTEMS TRAINING	2-14-015-85	OVERALL REQ.	65,372	7,062	72,434.00
	PRIORITY RESEARCH	1-02-014-85	OVERALL REQ.	113,877	12,551	126,428.00
	RAPID APPRAISAL	1-02-016-85	OVERALL REQ.	75,853	8,373	84,226.00
	RESERVIOR OPERATION STUDIES	1-02-025-85	OVERALL REQ.	36,990	4,088	41,078.00
	TECHNOLOGY TRANSFER	2-06-022-85	OVERALL REQ.	164,971	18,531	183,502.00
	TRAINING MATERIALS	2-13-020-85	OVERALL REQ.	435,210	31,451	466,661.00
	TRAINING OF TRAINERS	2-14-019-85	OVERALL REQ.	37,594	4,165	41,759.00
	UNIV. CURRICULA	1-02-013-85	OVERALL REQ.	26,472	2,771	29,243.00
	WATER BALANCE	2-14-023-85	OVERALL REQ.	40,333	4,449	44,782.00
			Total:	1,264,398	118,347	1,382,740.00
INDONESIA	SSI WORKSHOP & TECH. ASSIST.	1-02-009-85A	OFFICIAL APP.	55,000		55,000.00
			Total:	55,000		55,000.00
PAKISTAN	MANAGEMENT TRAINING - PLANNING	2-01-065-85	OVERALL REQ.	99,881		99,881.00
			Total:	99,881	0	99,881.00
SRI LANKA	CENTRAL SUPPORT	1-02-003-85	OVERALL REQ.	73,695		73,695.00
			Total:	73,695	0	73,695.00
WORLDWIDE	MEETING RECURRENT COSTS OF IS	1-02-062-85	OVERALL REQ.	51,345		51,345.00
	MICRO COMPUTER WORKSHOP	2-14-032-85	OVERALL REQ.	15,378		15,378.00
			Total:	66,723	0	66,723.00
			Total:	1,664,278	123,713	1,787,991.00

TABLE 9. ACTIVITY FUNDING SUMMARY FY85 (02/15/85)

Activity Type	Country	Activity	Code #	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
ADMINISTRATION	WORLDWIDE	CSU ADMINISTRATION	0-02-998-85	231,641		231,641		
		EPD	0-01-999-85B					
		USU ADMINISTRATION	0-02-997-85	233,126		233,126		
		CU ADMINISTRATION	0-02-996-85	206,932		206,932		
		EPD ADMINISTRATION	0-01-999-85A	191,810		191,810		
			Total:	863,509	0	863,509	0	0
SPECIAL STUDIES	INDIA	INDIA MAIN SYSTEM CASE STUDY	3-04-043D85	31,928		31,928		
	MOROCCO	MOROCCAN CASE STUDIES	3-04-043C85	29,433		29,433	5,670	
	NIGER	TRAD. & DEV. SSI STUDY	3-04-052-85	42,484		42,484		7,000
	SRI LANKA	INTERFACING ON-FARM WM	3-04-036B85	130,907		130,907		
		LANDSAT 85-RAPID RECONNAISANCE	3-04-038-85	34,442		34,442	16,600	
	THAILAND	THAILAND CASE STUDY	3-04-043B85	44,067		44,067		
	WORLDWIDE	MANAGEMENT INTENSITIES	3-04-056-85	69,615		69,615		9,500
		RAPID IRR PROJ.- REMOTE SENSING	3-04-042-85	73,710		73,710		
		ISM - DEVELOPMENT	3-04-043A85	87,623		87,623		50,000
		IMS - WORKSHOP	3-04-043E85	27,848		27,848		
		PHASE I - COMPARATIVE ANALYSIS	3-04-053-85	15,031		15,031		
		PHASE II COMPARATIVE ANALYSIS	3-04-054-85	97,099		97,099		
		RURAL EMPLOYMENT	3-04-055-85	16,150		16,150		
		INTERFACING OFWM BACKSTOPPING	3-04-036A85	86,390		86,390		
			Total:	786,727	0	786,727	22,270	66,500
Technical Assistance	Egypt	Water Use & Mgmt Eval.	1-02-066-85		41,268	41,268		
	EL SALVADOR	PID PREPARATION	1-02-059-85		22,500	22,500		
	HONDURAS	IRRIG. DEVEL. PROJECT	1-02-060-85	8,955	5,354	12,309		
	INDIA	HYDRAULIC CONDUCTIVITY	1-02-024-85		31,750	31,750	500	
		RESERVIOR OPERATION STUDIES	1-02-025-85		36,990	36,990	500	
		UNIV. CURRICULA	1-02-013-85		26,472	26,472		
		PRIORITY RESEARCH	1-02-014-85		113,877	113,877		
		RAPID APPRAISAL	1-02-016-85		75,853	75,853	1,500	
	INDONESIA	ASSESSMENT TEAM	1-02-009-85B					
		ASSESSMENT TEAM	1-02-009-85C					
		SSI WORKSHOP & TECH. ASSIST.	1-02-009-85A	145,658	55,000	200,658		
	JAMAICA	PLANNING ACTIVITIES	1-02-007-85	11,970		11,970	5,100	
		SYSTEMS STUDY	1-02-008-85	24,822		24,822	12,092	
	JORDAN	JORDAN ADVISORY SERVICES	1-02-028-85	10,338		10,338	9,200	
	MAURITANIA	PEACE CORPS ASSISTANCE	1-02-061-85	4,930		4,930		
	MOROCCO	PID DEVELOPMENT	1-02-002-85	47,629		47,629	2,000	
	SRI LANKA	CENTRAL SUPPORT	1-02-003-85		73,695	73,695		
		SOCIOECONOMIC STUDIES FOR REHAB.	1-02-004-85	82,672		82,672	15,000	
		MODEL CALIBRATION	1-02-005-85	37,600		37,600	500	
	SWAZILAND	IRRIGATION ASSISTANCE	1-02-029-85	12,207		12,207	500	
	WORLDWIDE	MEETING RECURRENT COSTS OF IS	1-02-062-85		51,345	51,345		
			Total:	386,781	534,104	918,885	46,892	0
TRAINING & TECH. TRANS.	BOLIVIA	COURSE SSI - DESIGN & OPERATION	2-14-010-85	41,333		41,333	12,575	
		ON-FARM WATER MANAGEMENT	2-01-011-85	55,813	25,555	81,368	21,870	
	DOMINICAN REPUBLIC	ON-FARM WATER MGMT. COURSE	2-14-030-85		9,909	9,909	200	
	INDIA	DEM/WORKSHOP OF COMPUTER ISM	2-14-040-85	40,731	16,740	57,471		
		WATER BALANCE	2-14-023-85		40,333	40,333	500	
		DEVELOPMENT OF HANDBOOKS	2-13-027-85	79,956		79,956		

TABLE 9. ACTIVITY FUNDING SUMMARY FY85 (02/15/85)

Activity Type	Country	Activity	Code #	FY85 Core	Activity Buy-in	Funding Total	Mission Cont.	Carry over
		INNOVATIVE TEACHING	2-03-012-85		138,090	138,090	2,000	
		MAIN SYSTEMS TRAINING	2-14-015-85		65,372	65,372	1,000	
		FARMER ORGANIZATION WORKSHOP	2-14-017-85		81,141	81,141		
		TRAINING OF TRAINERS	2-14-019-85		37,594	37,594		
		TRAINING MATERIALS	2-13-020-85		435,210	435,210		
		TECHNOLOGY TRANSFER	2-06-022-85		164,971	164,971		
	NEPAL	NEPAL DA OF IRRG. SYS.	2-02-031-85	126,479		126,479		
	PAKISTAN	EXTENSION TRAINING - RECON.	2-06-063-85					
		MANAGEMENT TRAINING - PLANNING	2-01-065-85		99,881	99,881		
	WORLDWIDE	FRENCH LANGUAGE TRAINING	2-11-041-85	10,650		10,650		4,000
		REHABILITATION, GAME SIMULATION	2-13-048-85	33,444		33,444		
		WORKSHOP LESSONS LEARNED: PDA	2-14-049-85	41,790		41,790		
		JOINT SEMINAR CURRENT RESEARCH	2-14-050-85	94,372		94,372		
		MICRO COMPUTER WORKSHOP	2-14-032-85	44,594	15,378	59,972		
		SEMINAR ON IRRG SYS REHAB #1	2-05-033-85	53,030		53,030		
		LESSONS LEARNED ISM	2-14-039-85	103,209		103,209		
			Total:	725,401	1,130,174	1,855,575	38,145	4,000
			Total:	2,762,418	1,664,278	4,424,696	107,307	70,500

PART II -- ACTIVITY PLANS WITH BUDGETS

TECHNICAL ASSISTANCE DATE: January 29, 1985

EGYPT

Activity Title: Egypt Water Use and Management Project Evaluation Code #1-02-066-85

Description: To provide an evaluation and report for the Egypt Water Use and Management Project. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineer					.75	.25							1.0
Agronomist					.75	.25							1.0

TOTAL 2.0

Project Costs:

Item:		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel			
Professional Personnel			
Host Country Clerical Support		$ 750	
Other: Communications		350	
Reproduction		600	
Supplies		250	
Consultants:			
Fee (2 consultants)	30 days each at $ 253	15,180	
Travel	2 @ 1 trip at $2,500	5,000	
Per Diem	70 days at $ 90	6,300	
Miscellaneous (visas, shots, taxis, etc.)		400	
TOTAL DIRECT COSTS		$ 28,830	
Indirect Costs:			
University Overhead		$ 9,226	
CID - DBA		358	
- G&A		2,854	
TOTAL INDIRECT COSTS		$ 12,438	
TOTAL COST OF ACTIVITY		$ 41,268	

Mission Buy-In Funding . . . . . $ 41,268 *

WMS II Core Funding . . . . . $ -0-

* In addition to the above budget, an administrative fee of $4,325 shall be charged the Mission by AID/Washington.

TECHNICAL ASSISTANCE

DATE: 12/17/84

COUNTRY: EL SALVADOR

Code #: 1-02-059-85

Activity Title: PID PREPARATION

Description: A Social Scientist and an Agricultural Engineer will assist the USAID mission in preparation of a Project Implementation Document.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: LATTIMORE

Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer		0.75											0.75
Civil Engineer													0.00
Economist													0.00
Agronomist													0.00
Social Scientist													0.00
Consultant		0.50											0.50
Support		0.50											0.50
													1.75

Project Costs: Item				WHS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	0.50 PPM (ts)	at	5,131.00	2,566.00	
Professional	0.25 PPM (nts)	at	3,247.00	812.00	
Support	0.50 PPM (nts)	at	1,944.00	972.00	
Travel -USA to El Salvador	1.00 trips	at	1,000.00	1,000.00	
	trips	at			
Per Diem	16.00 days	at	66.00	1,056.00	
	1.00 days	at	100.00	100.00	
Other Direct Costs					
Consultants					
Fee	14.00 days	at	391.00	5,474.00	
	3.00 days	at	250.00	750.00	
Travel	1.00 trips	at	1,000.00	1,000.00	
Per Diem	16.00 days	at	66.00	1,056.00	
	1.00 days	at	100.00	100.00	
Other: (Itemize, if large)				1,268.00	
TOTAL DIRECT COSTS				$ 16,154.00	
Indirect Costs					
University Overhead				4,643.00	
CID - DBA				104.00	
- G & A				1,599.00	
TOTAL INDIRECT COSTS				$ 6,346.00	
TOTAL COST OF ACTIVITY				$ 22,500.00	
Mission Buy-in Funding				$ 22,500.00	

TECHNICAL ASSISTANCE

1/7/85

HONDURAS

Activity Title: Irrigation Development Project

Code #1-02-0LO-85

Description: Review present status of irrigated agriculture by meeting with Mission, GOH, and other donor officials and review documentation in USAID files; consult with selected USAID and GOH officers concerning overall approach for a bilateral irrigation development project; and assist USAID in generating a project development calendar for the proposed project, including specification of TA requirements for completing the project development process. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers			0.75										0.75

TOTAL 0.75

Project Costs:

Item:		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	0.75 PPM (ts) at $7,000	$ 5,250	
Travel - USA to Honduras	1 trip at $1,000	1,000	
- In-country	2 trips at $ 100	200	
Per Diem	21 days at $96	2,016	
Other Direct Costs		100	
TOTAL DIRECT COSTS		$ 8,566	
Indirect Costs:			
University Overhead		$ 2,741	
CID - DBA		154	
- G&A		848	
TOTAL INDIRECT COSTS		$ 3,743	
TOTAL COST OF ACTIVITY		$ 12,309	

Mission Buy-In Funding . . . . . $ 8,955

WMS II Core Funding . . . . . $ 5,354

TECHNICAL ASSISTANCE REVISED 12/20/84 1/7/85

INDIA

Activity Title: University Curricula Code #1-02-013-85

Description: Develop curricula for the training courses to be conducted in the State Training Institutes (STIs) of Tamil Nadu, Rajasthan and Madhya Pradesh and carry out a careful evaluation of the existing curricula of the training courses in the STIs in Maharashtra and Gujarat and make suitable modifications/additions as necessary to make them more field-oriented and suitable for the needs of the action agencies in the field. Review plans for irrigation management programs in two agricultural and two engineering universities and develop curricula for undergraduate and post-graduate courses. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Jack Keller Phone: (801) 750-2785

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers				0.5	1.0								1.5

TOTAL 1.5

Project Costs:

Item:	WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel PPM (ts) at		
Professional Personnel PPM (nts) at		
Consultants:		
Fee 38 days at $300	$ 11,400	
Travel: Colombo-Delhi-Karachi 1 trip at $750	750	
Travel: In-Country	2,612	
Per Diem: International and In-Country	3,612	
Miscellaneous	100	
TOTAL DIRECT COSTS	$ 18,474	
Indirect Costs:		
University Overhead	$ 5,912	
CID - DBA	257	
- G&A	1,829	
TOTAL INDIRECT COSTS	$ 7,998	
TOTAL COST OF ACTIVITY	$ 26,472	

Mission Buy-In Funding . . . . . $ 26,472 *

WMS II Core Funding . . . . . $ -0-

* In addition to the above budget, an administrative fee of $2,771 shall be charged the Mission by AID/Washington.

TECHNICAL ASSISTANCE

DATE: 01/15/85

COUNTRY: INDIA

Code #: 1-02-014-85

Activity Title: PRIORITY RESEARCH

Description: Assist in development of a process for identifying high priority research topics related to irrigation management and training. Sixth day pay requested.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: MOHAN REDDY Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer							0.25	1.00	0.50				1.75
Civil Engineer													0.00
Economist							0.25	1.00	0.50				1.75
Agronomist							0.25	1.00	0.50				1.75
Social Scientist							0.25	1.00	0.50				1.75
Extension Spec.							0.25	1.00	0.50				1.75
Technical Editor									0.50				0.50
													9.25

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	5.00 PPM (ts)	at	5,530.00	27,650.00	
Professional	4.25 PPM (nts)	at	4,147.00	17,625.00	
Travel - USA to India	5.00 trips	at	3,000.00	15,000.00	
In-country	5.00 trips	at	500.00	2,500.00	
Per Diem	150.00 days	at	86.00	12,900.00	
	days	at			
Other Direct Costs					
Other: (workshop materials/facilities)				5,000.00	
Other: (printing,materials,misc.)				3,000.00	
TOTAL DIRECT COSTS				$ 83,675.00	
Indirect Costs					
University Overhead				21,296.00	
CID - DBA				622.00	
- G & A				8,284.00	
TOTAL INDIRECT COSTS				$ 30,202.00	
TOTAL COST OF ACTIVITY				$ 113,877.00	
Mission Buy-in Funding				$ 113,877.00	
WMS II Core Funding				$ 0.00	
Administration Fees (15%)				$ 12,551.00	

TECHNICAL ASSISTANCE 1/15/85

INDIA

Activity Title: Water Balance Code #1-02-023-85

Description: To give training and direction in conducting water balance studies and in developing strategies for using groundwater conjunctively with surface irrigation water. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: L. Willardson Phone: (801) 750-2789

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Civil Engineer		1.0					1.0	0.5					2.50
												TOTAL	2.50

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	2.00 PPM (ts) at $7,000	$ 14,000	
Professional Personnel	0.50 PPM (nts) at $5,000	2,500	
Travel - USA to India	2 trips at 3,000	6,000	
- In-Country			$ 500
Per Diem -	60 days at 86	5,160	
Other Direct Costs:			
Equipment		1,000	
Other (report)		1,000	
TOTAL DIRECT COSTS		$ 29,660	
Indirect Costs:			
University Overhead		9,491	
CID - DBA		242	
- G&A		940	
TOTAL INDIRECT COSTS		$ 10,673	
TOTAL COST OF ACTIVITY		$ 40,333	$ 500

* Mission Buy-In Funding . . . . . $ 40,333

WMS II Core Funding . . . . . $ -0-

* An administratiave fee of $4,449 is also being requested of the Mission.

TECHNICAL ASSISTANCE

1/15/85

INDIA

Activity Title: Hydraulic Conductivity Studies

Code #1-02-024-85

Description: Develop and direct studies to establish correlation of hydraulic conductivity to actual seepage loss rates in order to estimate seepage loss rates in subproject canals. Efforts will be made to correlate seepage loss rates with the Unified Soil Classification System for Engineering. Studies will lead to recommendations and guidelines for canal design. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Al Bishop Phone: (801) 750-2799

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers		0.5	0.5				1.0						2.0

TOTAL 2.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	1.5 PPM (ts) at $7,000	$ 10,500	
Professional Personnel	0.5 PPM (nts) at $5,000	2,500	
Travel - USA to India	2 trips at 3,000	6,000 *	
- In-Country			$ 500
Per Diem -	44 days at 100	4,400	
Other Direct Costs		200	
TOTAL DIRECT COSTS		$ 23,600	
Indirect Costs:			
University Overhead		5,632	
CID - DBA		182	
- G&A		2,336	
TOTAL INDIRECT COSTS		$ 8,150	
TOTAL COST OF ACTIVITY		$ 31,750	$ 500

** Mission Buy-In Funding . . . . . $ 31,750

WMS II Core Funding . . . . . $ -0-

* No overhead; tickets provided through AID/W.

** An administrative fee of $3,540 is also being requested of the Mission.

TECHNICAL ASSISTANCE

1/15/85

INDIA

Activity Title: Reservoir Operation Studies

Code #1-02-025-85

Description: To give direction and guidance to the preparation of monthly reservoir operation studies which are to be based on at least 20 years of historical climatological and hydrological information. Results will be used for determining reliability of seasonal irrigation water supplies, sizing of canals to meet peak irrigation demands, etc. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinators: Bob Hill/Wynn Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers				0.25	1.0			1.0					2.25

TOTAL 2.25

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	2.00 PPM (ts) at $7,000	$ 14,000	
Professional Personnel	0.25 PPM (nts) at $5,000	1,250	
Travel - USA to India	2 trips at 3,000	6,000 *	
- In-Country			$ 500
Per Diem -	58 days at 100	5,800	
Other Direct Costs		200	
TOTAL DIRECT COSTS		$ 27,250	
Indirect Costs:			
University Overhead		6,800	
CID - DBA		242	
- G&A		2,698	
TOTAL INDIRECT COSTS		$ 9,740	
TOTAL COST OF ACTIVITY		$ 36,990	$ 500

** Mission Buy-In Funding . . . . . $ 36,990

WMS II Core Funding . . . . . $ -0-

* No overhead; tickets provided through AID/W.

** An administrative fee of $4,088 is also being requested of the Mission.

Activity Title: Small-scale irrigation workshop and other technical assistance Code #1-02-009-85

Description: A series of activities in support of irrigation development in Indonesia includes technical assistance in analysis of irrigation regulation and water disputes, engineering assistance to various small-scale irrigation projects, and conducting a workshop for selected Indonesian government officials from West Java, NTB, and NTT.

Institutions: Managing: CORNELL Cooperating: Participating: CSU, USU

Activity Coordinator: E. Walter Coward, Jr. Phone: (607) 256-5495

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Anthropologist	1.0												1.0
Water law specialist	---	---	0.5								0.5		1.0
Irri. Engineer	1.0	2.0		1.0			1.0	---	---				5.0
Rural Sociologist				0.5			1.0	---	---				1.5
Soc.Sci./Crop Specialist							1.0	---	---				1.0
Grad Student				2.0	---	---	---	---	---				2.0
												TOTAL	11.5

Project costs

Item			WMS-II FUNDING	01/07/85 MISSION CONTRIBUTION
Direct Costs				
Salaries & Benefits				
Professional Personnel	9.5 PPM @	$6,000	57,000	
Graduate Students	2 months @	$1,500	3,000	
Travel				
USA to Indonesia	10 trips @	$3,500	35,000	
Internal travel			4,000	
Colombo to Indonesia			1,500	
Per Diem				
	230 days @	$ 112	25,760	
	55 days @	42	2,310	
Other Direct Costs			3,000	
TOTAL DIRECT COSTS			$131,570	
Indirect Costs				
Cornell Indirect (Statutory on-campus)			26,294	
CSU Indirect (35%)			14,886	
USU Indirect (32%)			14,883	
CID G&A			13,025	
TOTAL INDIRECT COSTS			$ 69,088	
TOTAL COST OF ACTIVITY			$200,658	
WMS-II Core Funds			$145,658	
Anticipated Carryover Funds			0	
Mission Buy-in Funds			$ 55,000	

TECHNICAL ASSISTANCE

1/7/85

JAMAICA

Activity Title: Planning Activities

Code #1-02-007-85

Description: Provide assistance to new public body responsible for overall water management in planning activities. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: G. Skogerboe Phone: (801) 750-2801

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers									1.0	0.25			1.25

TOTAL 1.25

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	1.00 PPM (ts) at $7,000	$ 7,000	
Professional Personnel	0.25 PPM (nts) at $5,000	1,250	
Travel - USA to Jamaica	1 trip at 1,000		$ 1,000
- In-Country travel			500
Per Diem -	30 days at 120		3,600
Other Direct Costs		100	
TOTAL DIRECT COSTS		$ 8,350	$ 5,100
Indirect Costs:			
University Overhead		2,672	
CID - DBA		121	
- G&A		827	
TOTAL INDIRECT COSTS		$ 3,620	
TOTAL COST OF ACTIVITY		$ 11,970	$ 5,100

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 11,970

TECHNICAL ASSISTANCE 1/7/85

JAMAICA

Activity Title: Systems Study Code #1-02-008-85

Description: Conduct two short-term special studies of two irrigation systems in southern part of Jamaica. Assess what should be done to improve them. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Bryant D. Smith Phone: (801) 750-2787

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers		1.00											1.00
Hydrologist		0.75											0.75
Social Scientist		0.75											0.75
												TOTAL	2.50

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	2.25 PPM (ts) at $7,000	$ 15,750	
Professional Personnel	0.25 PPM (nts) at $5,000	1,250	
Travel - USA to Jamaica	3 trips at 1,000		$ 3,000
- In-Country Travel			1,000
Per Diem -	68 days at 119		8,092
Other Direct Costs		300	
TOTAL DIRECT COSTS		$ 17,300	$12,092
Indirect Costs:			
University Overhead		5,536	
CID - DBA		273	
- G&A		1,713	
TOTAL INDIRECT COSTS		$ 7,522	
TOTAL COST OF ACTIVITY		$ 24,822	$12,092

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 24,822

TECHNICAL ASSISTANCE

JORDAN

1/7/85

Activity Title: Jordan Advisory Services

Code #1-02-028-85

Description: Continue advisory role twice yearly to the Jordan Valley Authority and the Soils and Irrigation Department of the University of Jordan. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Jack Keller Phone: (801) 750-2785

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers					0.5					0.5			1.0

TOTAL 1.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	1.0 PPM (ts) at $7,000	$ 7,000	
Travel - USA to Jordan	2 trips at $3,000		$ 6,000
- In-Country			500
Per Diem -	30 days at 90		2,700
Other Direct Costs		200	
TOTAL DIRECT COSTS		$ 7,200	$ 9,200
Indirect Costs:			
University Overhead		2,304	
CID - DBA		121	
- G&A		713	
TOTAL INDIRECT COSTS		$ 3,138	
TOTAL COST OF ACTIVITY		$ 10,338	$ 9,200

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 10,338

Technical Assistance

January 7, 1985

MAURITANIA

Activity Title: Peace Corps Assistance

Code #1-02-061-85

Description: Travel to Mauritania to review Peace Corps irrigation program associated with irrigated rice production and to provide training design on pump maintenance.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: W. Ray Norman Phone:

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineer	0.5	---	---										0.5
											TOTAL		0.5

Project costs

01/07/85

Item	WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs		
Salaries & Benefits .5 gpm @ $800	$ 400	
Travel Niamey-Nouakchott	1,000	
Per Diem 15 days @ $93	1,395	
Other Direct Costs Photocopies, publications etc.	1,000	
TOTAL DIRECT COSTS	$ 3,795	
Indirect Costs		
Cornell Indirect (Statutory off-campus)	759	
CID G&A	376	
TOTAL INDIRECT COSTS	$ 1,135	
TOTAL COST OF ACTIVITY	$ 4,930	
New WMS II Core Funds	$ 4,930	
Anticipated Carryover Funds	0	
Mission Buy-in Funds	0	

TECHNICAL ASSISTANCE

MOROCCO 1/7/85

Activity Title: PID Development Code #1-02-002-85

Description: Assist in project design for enhanced water management of public irrigation office (ORMVA) and in coping with drought which is seriously affecting water use and distribution. Develop a project identification document. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers		0.75											0.75
Economists		0.75											0.75
Agronomists		0.50											0.50
Instit. Specialist		0.75											0.75
Sociologist (local)		0.75											0.75

TOTAL 3.5

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	2.75 PPM (ts) at $7,000	$ 19,250	
Travel - USA to Morocco	4 trips at 1,650	6,600	
- In-Country Travel			$ 2,000
Per Diem -	81 days at 55	4,455	
Other Direct Costs		400	
Consulting Fees	21 days at $125/day	2,625	
TOTAL DIRECT COSTS		$ 33,330	$ 2,000
Indirect Costs:			
University Overhead		10,666	
CID - DBA		333	
- G&A		3,300	
TOTAL INDIRECT COSTS		$ 14,299	
TOTAL COST OF ACTIVITY		$ 47,629	$ 2,000

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 47,629

TECHNICAL ASSISTANCE

DATE: 01/15/85

COUNTRY: SRI LANKA

Code #: 1-02-003-85

Activity Title: CENTRAL SUPPORT

Description: Assist in feasibilty studies prior to irrigation rehabilitation work. Scopes of work will be developed for each specialist, who will be expected to support services being provided by long-term advisor (Larry Nelson). Each specialist will provide a report of his fieldwork with recommendations for additional work (if necessary) prior to carrying out rehabilitation. Sixth day pay requested.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: DAN LATTIMORE

Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer						1.00							1.00
On-farm Engineer						1.00							1.00
Hydrologist					1.00								1.00
Soil Specialist				1.00									1.00
Social Scientist				1.00									1.00
													0.00
													0.00
													5.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	5.00 PPM (+ts)	at	5,530.00	27,650.00	
Professional	0.00 PPM (nts)	at	4,147.00	0.00	
Travel - USA to Sri Lanka	5.00 trips	at	3,000.00	15,000.00	
	trips	at			
Per Diem	150.00 days	at	85.00	12,750.00	
	days	at			
Other Direct Costs					
Other: (materials,videotapes)				0.00	
TOTAL DIRECT COSTS				$ 55,400.00	
Indirect Costs					
University Overhead				12,188.00	
CID - DBA				622.00	
- G & A				5,485.00	
TOTAL INDIRECT COSTS				$ 18,295.00	
TOTAL COST OF ACTIVITY				$ 73,695.00	
Mission Buy-in Funding				$ 73,695.00	
WMS II Core Funding				$ 0.00	

January 7, 1985

Technical Assistance

SRI LANKA

Code #1-02-004-85

Activity Title: Socioeconomic studies for rehabilitation

Description: Improve the capability of ARTI to conduct socioeconomic studies of schemes undergoing rehabilitation and those planned for rehabilitation. This activity supports the Water Management Project and the planned Irrigation Systems Management Project.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: Norman Uphoff Phone: (607) 256-6370

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri.Economist	---	---	---	0.5	---	---	---	---	---	0.5	---	---	1.0
Agri.Engineer	---	---	---	0.5	---	---	---	---	---	0.5	---	---	1.0
Political Scientist	---	---	---	0.5	---	---	---	---	---	0.5	---	---	1.0
												TOTAL	3.0

Project costs

01/07/85

Item		WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Professional Personnel	3 ppm @ $5,600	$16,800	$15,000
Travel			
USA to Colombo	6 trips @ $3,200	$19,200	
In Sri Lanka		2,000	
Per diem			
Colombo	80- days @ $85	$ 6,800	
Other Sri Lanka	10 days @ $63	630	
Other Direct Costs		$ 2,000	
TOTAL DIRECT COSTS		$47,430	
Indirect Costs			
Cornell (Endowed) (MTDC = $5,500)		3.333	
Cornell (Statutory On-Campus (68.6)		27,214	
CID G&A		4,696	
TOTAL INDIRECT COSTS		$35,242	
TOTAL COST OF ACTIVITY		$82,672	$15,000
WMS-II Core Funds		$82,672	
Anticipated Carryover Funds		0	
Mission Buy-in Funds		0	

TECHNICAL ASSISTANCE

SRI LANKA

1/7/85

Activity Title: Model Calibration

Code #1-02-005-85

Description: Work with the computer model that was developed in 1984. The purpose of the model is to predict and account for irrigation deliveries down to the distributory channel level. This study will involve project personnel to improve the data base and various parameters used in the model. The study will result in a report of the finds and recommendations on improving the computer model. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers								1.0					1.00
Graduate Students								1.0	1.0	1.0			3.00
												TOTAL	4.00

Project Costs:

Item			WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	1.00 PPM (ts)	at $7,000	$ 7,000	
Graduate Students	3.00 PPM (ts)	at $1,320	3,960	
Travel - USA to Sri Lanka	2 trips	at 2,500	5,000	
- In-Country				$ 500
Per Diem -	120 days	at 85	10,200	
Other Direct Costs			200	
TOTAL DIRECT COSTS			$ 26,360	$ 500
Indirect Costs:				
University Overhead			8,435	
CID - DBA			195	
- G&A			2,610	
TOTAL INDIRECT COSTS			$ 11,240	
TOTAL COST OF ACTIVITY			$ 37,600	$ 500

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 37,600

1/7/85

TECHNICAL ASSISTANCE

SWAZILAND

Activity Title: Irrigation Assistance Code #1-02-029-8

Description: Provide USAID/Swaziland with advice regarding the best technical approach on t irrigation/water management component of the agriculture production and marketing project a possibly the cropping systems research project. Approval for six-day work week and holiday pay requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Jack Keller Phone: (801) 750-2785

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers						0.5							0.50
												TOTAL	0.50

Project Costs:

Item				WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	0.50	PPM (ts)	at $7,000	$ 3,500	
Travel - USA to Swaziland		1 trip	at 3,600	3,600	
- In-Country					$ 500
Per Diem -		16 days	at 85	1,360	
Other Direct Costs				100	
TOTAL DIRECT COSTS				$ 8,560	$ 500
Indirect Costs:					
University Overhead				2,739	
CID - DBA				61	
- G&A				847	
TOTAL INDIRECT COSTS				$ 3,647	
TOTAL COST OF ACTIVITY				$ 12,207	$ 500

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 12,207

Technical Assistance

January 7, 1985

WORLDWIDE

Activity Title: Meeting recurrent costs of irrigation systems—a systematic assembly and synthesis of what is known.

Code #1-02-062-85

Description: Subcontract to the University of Minnesota to support the research of K.W. Easter and graduate research assistant on financing recurrent costs of irrigation programs in developing countries. Study will include literature review, four or five case studies, and analysis and synthesis of findings. In addition, a Cornell team will prepare a complementary paper for the Manila ARD Conference to be held May, 1985. The report will summarize literature and experiences to suggest ways in which AID can reduce recurrent costs in its projects.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: Randolph Barker Phone: (607) 256-2105

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Economist	2.5	---	---	---	---	---	---	---	---	---	---	---	2.5
Graduate Student	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0					9.0
Administrator	.25												0.25
Soc.Scientist				1.0	---	---	---	---					1.0
												TOTAL	12.75

Project costs

01/07/85

Item		WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Professional Personnel	1 month @ $6,400	6,400	
Administrator	.25 months @ 3,000	750	
Travel			
Ithaca-Manila-Ithaca	1 trip @ $3,000	3,000	
Per Diem			
Manila: 5 days @ $68		340	
International: 2 days @ $100		200	
Other Direct Costs			
CID Subcontract to University of Minnesota		27,720	
Paper preparation		1,000	
Communications		500	
TOTAL DIRECT COSTS		$39,910	
Indirect Costs			
Cornell Indirect (Statutory On-Campus)		7,484	
CID G&A		3,951	
TOTAL INDIRECT COSTS		$11,435	
TOTAL COST OF ACTIVITY		$51,345	

TRAINING AND TECHNOLOGY TRANSFER 1/7/85

BOLIVIA

Activity Title: Course -- Small-Scale Irrigation Design and Operation Code #2-14-010-85

Description: Organize and put on a course on small scale irrigation design and operation, in which the following tasks are carried out: (1) develop the course outline in collaboration with Bolivian personnel; (2) develop training materials in Spanish to be used in the course, including field exercises; (3) present the course to 25 to 30 participants; and (4) provide a written final report and evaluation of the course. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: R. Kern Stutler Phone: (801) 750-2790

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers	0.5	2.0	0.5										3.0
Social Sci. (local)	0.5	1.0											1.5
												TOTAL	4.5

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel *	1.5 PPM (ts) at $7,000	$ 10,500	
Professional Personnel	1.5 PPM (nts) at $5,000	7,500	
Travel - USA to Bolivia	2 trips at 2,000		$ 4,000
- In-Country			500
Per Diem -	75 days at 51		3,825
Consulting Fee	34 days at $125/day		4,250
Other Direct Costs		11,000	
TOTAL DIRECT COSTS		$ 29,000	$12,575
Indirect Costs:			
University Overhead		9,280	
CID - DBA		182	
- G&A		2,871	
TOTAL INDIRECT COSTS		$ 12,333	
TOTAL COST OF ACTIVITY		$ 41,333	$12,575

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 41,333

* Assumes all local and participant costs are not included in this budget.

TRAINING AND TECHNOLOGY TRANSFER 1/7/85

BOLIVIA

Activity Title: Course -- On-Farm Water Management Code #2-01-011-85

Description: Design and conduct a course in on-farm water management, including the following tasks: (1) develop the course outline in collaboration with Bolivian personnel; (2) develop training materials in Spanish to be used in the course, including field exercises; (3) present the course to 25 to 30 participants; and (4) provide a written final report and evaluation of the course. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: R. Kern Stutler Phone: (801) 750-2790

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers								1.0	2.0	2.0	2.0		7.0
Social Scientist									1.0	1.0			2.0

TOTAL 9.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	4.0 PPM (ts) at $7,000	$ 28,000	
Professional Personnel	3.0 PPM (nts) at $5,000	15,000	
Travel - USA to Bolivia	5 trips at 2,000		$10,000
- In-Country			500
Per Diem -	128 days at 40		5,120
Consultant	50 days at $125/day		6,250
Other Direct Costs		14,000	
TOTAL DIRECT COSTS		$ 57,000	$21,870
Indirect Costs:			
University Overhead		18,240	
CID - DBA		485	
- G&A		5,643	
TOTAL INDIRECT COSTS		$ 24,368	
TOTAL COST OF ACTIVITY		$ 81,368	$21,870

Mission Buy-In Funding . . . . . $ 25,555

WMS II Core Funding . . . . . $ 55,813

* Assumes all local and participant costs are not included in this budget.

TRAINING AND TECHNOLOGY TRANSFER 1/15/85

DOMINICAN REPUBLIC

Activity Title: On-Farm Water Management Course Code #2-14-030-85

Description: Assist USAID/Dominican Republic and the National Institute of Hydraulic Resources (INDRHI) in preparing materials in Spanish and carrying out a two-day workshop in the areas of on-farm water management policies, water fees related to crop profitability, and water user associations. Approval for a six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Humberto Yap-Salinas Phone: (801) 750-2800

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers	.33												0.33
Economists	.33												0.33

TOTAL 0.66

Project Costs:

Item	WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel 0.5 PPM (ts) at $7,000	$ 3,500	
Professional Personnel 0.2 PPM (nts) at $5,000	1,000	
Travel - USA to Dominican Republic 2 trips at 850	1,700	
- In-Country travel		$ 200
Per Diem - 10 days at 64	640	
Other Direct Costs	100	
TOTAL DIRECT COSTS	$ 6,940	$ 200
Indirect Costs:		
University Overhead	2,221	
CID - DBA	61	
- G&A	687	
TOTAL INDIRECT COSTS	$ 2,969	
TOTAL COST OF ACTIVITY	$ 9,909	$ 200

* Mission Buy-In Funding . . . . . $ 9,909

WMS II Core Funding . . . . . $ -0-

* An administrative fee of $1,041 is also being requested of the Mission.

TRAINING AND TECHNOLOGY TRANSFER

1/15/85

INDIA

Activity Title: Innovative Teaching

Code #2-03-012-85

Description: Assist in development and use of modern and innovative teaching techniques includin audio-visual technology, computer technology, multidisciplinary approaches and field laboratories fo use in teaching irrigation management in Indian universities. Approval for six-day work week an holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Tom Cronkite Phone: (801) 750-3137

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers											0.5	0.5	1.0
Economists											0.5	0.5	1.0
Agronomists											0.5	0.5	1.0
Social Scientists											0.5	0.5	1.0
Comm. Arts/Aud.Vis.										1.0	1.0	1.0	3.0

TOTAL 7.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	7.00 PPM (ts) at $7,000	$ 49,000	
Professional Personnel	1.25 PPM (nts) at $5,000	6,250	
Travel - USA to India	5 trips at 3,000	15,000 *	
- In-Country			$ 2,000
Per Diem -	210 days at 85	17,850	
Other Direct Costs: Audio-visual equipment lease, etc.		12,000	
TOTAL DIRECT COSTS		$ 100,100	$ 2,000
Indirect Costs:			
University Overhead		27,232	
CID - DBA		848	
- G&A		9,910	
TOTAL INDIRECT COSTS		$ 37,990	
TOTAL COST OF ACTIVITY		$ 138,090	$ 2,000

** Mission Buy-In Funding . . . . . $ 138,090

WMS II Core Funding . . . . . $ -0-

* No overhead; provided through AID.

** An administrative fee of $15,015 is also being requested of the Mission.

TRAINING AND TECHNOLOGY TRANSFER 1/15/85

INDIA

Activity Title: Main Systems Training Code #2-14-015-85

Description: Arrange and implement training program on the main systems, irrigation scheduling, operation monitoring and corrective action based on experience of South and South East Asia countries. Use available technical materials to convert into training materials. Train in measurement of discharge and calibration of gauges. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers				0.5	1.0	0.5		1.0	1.0				4.0

TOTAL 4.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	4.0 PPM (ts) at $7,000	$ 28,000	
Travel - USA to India	2 trips at $3,000	6,000 *	
- In-Country Travel			$ 1,000
Per Diem -	120 days at 84	10,080	
Other Direct Costs		3,000	
TOTAL DIRECT COSTS		$ 47,080	$ 1,000
Indirect Costs:			
University Overhead		13,146	
CID - DBA		485	
- G&A		4,661	
TOTAL INDIRECT COSTS		$ 18,292	
TOTAL COST OF ACTIVITY		$ 65,372	$ 1,000

** Mission Buy-In Funding . . . . . $ 65,372

WMS II Core Funding . . . . . $ -0-

* No overhead; tickets provided by AID.

** An administrative fee of $7,062 is also being requested of the Mission.

TRAINING AND TECHNOLOGY TRANSFER

1/15/85

INDIA

Activity Title: Rapid Appraisal

Code #2-14-016-85

Description: Arrange rapid appraisal and carry out field exercises on one project from headworks to farmers' fields for present status, improvements suggested on priority, for cost effective items in all multidisciplinary items of irrigation management, for improved production. Approval for a six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Jack Keller Phone: (801) 750-2785

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Engineers				2.0									2.0
Economists				1.0									1.0
Ag. Ext/Sociologist				1.0									1.0

TOTAL 4.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	4.0 PPM (ts) at $7,000	$ 28,000	
Professional Personnel	1.0 PPM (nts) at $5,000	5,000	
Travel - USA to India	4 trips at 3,000	12,000 *	
- In-Country			$ 1,500
Per Diem -	120 days at 86	10,320	
Other Direct Costs		500	
TOTAL DIRECT COSTS		$ 55,820	
Indirect Costs:			
University Overhead		14,022	
CID - DBA		485	
- G&A		5,526	
TOTAL INDIRECT COSTS		$ 20,033	
TOTAL COST OF ACTIVITY		$ 75,853	$ 1,500

** Mission Buy-In Funding . . . . . $ 75,853

WMS II Core Funding . . . . . $ -0-

* No overhead; tickets provided through AID/W.

** An administrative fee of $8,373 is also being requested of the Mission.

Training and Technology Transfer

January 7, 1985

INDIA

Activity Title: Farmer Organization Workshop

Code #2-14-017-85

Description: Help in planning, organizing, and implementing a workshop on procedures and methodologies in farmer organization and in experiments in farmer organization. Develop contacts and identify individuals in India with experience in organizing farmers for irrigation management, and to plan the development of a module for training purposes.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: Norman Uphoff Phone: (607) 256-6370

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Social Scientist	2.0	---	---	---	---	---	---	---	---	---	---	---	2.0
Pol.Scientist	1.0	---	---	---	---	---	---	---	---	---	---	---	1.0
												TOTAL	3.0

Project costs

01/07/85

Item				WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Wages					
Professional Personnel	1 month @ $5,000			5,000	
International Travel					
1 trip Ithaca to Delhi @ $3,000				3,000	
2 trips Colombo to Delhi @ $800				1,600	
2 trips Manila to Delhi @ $1,500				3,000	
Travel in India				1,500	
Travel for Indian workshop participants - 15 trips				15,000	
Per diem					
New Delhi: 30 days @ $86				2,580	
Other Direct Costs					
Consultant					
Fees	50 days	@	$ 250	12,500	
Travel	2 trips	@	$3,000	6,000	
Per diem: Ithaca	30 days	@	$ 55	1,650	
Delhi	41 days	@	$ 86	3,526	
Internal	4 days	@	$ 100	400	
Conference Costs					
Honoraria				2,000	
Other				2,000	
TOTAL DIRECT COSTS				$59,756	
Indirect Costs					
Cornell Indirect (Endowed On-Campus)				3,030	
Cornell Indirect (Statutory On-Campus)				1,818	
Cornell Indirect (Statutory Off-Campus)				10,621	
CID G&A				5,916	
TOTAL INDIRECT COSTS				$21,385	
TOTAL COST OF ACTIVITY				$81,141	
New WMS II Core Funds				$81,141	
Anticipated Carryover Funds					
Mission Buy-in Funds					

TRAINING & TECHNOLOGY TRANSFER

DATE: 01/15/85

COUNTRY: INDIA

Code #: 2-14-019-85

Activity Title: TRAINING OF TRAINERS

Description: To help in organization of workshop of STI for farmer involvement. Develop contacts with such individuals who would be participants in the workshop and to design the contents of the workshop. Sixth day pay requested.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: ROBBY LAITOS

Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Agr. Economist													0.00
Agronomist													0.00
Social Scientist									1.00	1.00	1.00		3.00
Ag. Extension													0.00
													0.00
													3.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	2.00 PPM (ts)	at	5,530.00	11,060.00	
Professional	1.00 PPM (nts)	at	4,147.00	4,147.00	
Travel - USA to India	2.00 trips	at	3,000.00	6,000.00	
In-country	2.00 trips	at	200.00	400.00	
Per Diem	60.00 days	at	86.00	5,160.00	
	days	at			
Other Direct Costs					
Other: (materials)				1,000.00	
TOTAL DIRECT COSTS				$ 27,767.00	
Indirect Costs					
University Overhead				6,829.00	
CID - DBA				249.00	
- G & A				2,749.00	
TOTAL INDIRECT COSTS				$ 9,827.00	
TOTAL COST OF ACTIVITY				$ 37,594.00	
Mission Buy-in Funding				$ 37,594.00	
WMS II Core Funding				$ 0.00	
Administration Fees (15%)				$ 4,165.00	

TRAINING & TECHNOLGY TRANSFER

DATE: 01/15/85

COUNTRY: INDIA

Code #: 2-13-020-85

Activity Title: TRAINING MATERIALS

Description: Work with State Curricula Committees to develop curricula and training materials needed urgently by five states participating in the Irrigation Management and Training Project. Will provide one-on-one training to Indian professionals in developing curricula, lesson plans, training materials and field exercises. Will use available technical materials to convert into training materials. Sixth day pay requested.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: AL MADSEN

Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Civil Engineer						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Agr. Economist						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Agronomist						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Social Scientist						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Communications						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
													0.00
													42.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	18.00 PPM (ts)	at	5,530.00	99,540.00	
Professional	24.00 PPM (nts)	at	4,147.00	99,528.00	
Travel - USA to India	12.00 trips	at	3,000.00	36,000.00	
In-country	12.00 trips	at	250.00	3,000.00	
Per Diem	540.00 days	at	86.00	46,440.00	
	days	at			
Other Direct Costs					
Other: (materials,videotapes)				30,000.00	
TOTAL DIRECT COSTS				$ 314,508.00	
Indirect Costs					
University Overhead				87,326.00	
CID - DBA				2,240.00	
- G & A				31,136.00	
TOTAL INDIRECT COSTS				$ 120,702.00	
TOTAL COST OF ACTIVITY				$ 435,210.00	

Mission Buy-in Funding	$ 435,210.00
WMS II Core Funding	$ 0.00
Administration Fees (10%)	$ 31,451.00

TRAINING & TECHNOLGY TRANSFER

DATE: 01/08/85

COUNTRY: INDIA

Code #: 2-06-022-85

Activity Title: TECHNOLOGY TRANSFER

Description: Design and establishment of technology transfer for IM in the Irrigation Research Management Improvement Cell of CWC linked to international center and to institutions and activities in the Indian States. Plans for linking apex unit with State units. Sixth day pay requested.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: DAN LATTIMORE Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Agr. Economist													0.00
Agronomist													0.00
Social Scientist													0.00
Communic. Spec.						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Educational Spec.						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
													14.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	14.00 PPM (ts)	at	5,530.00	77,420.00	
Professional	0.00 PPM (nts)	at	4,147.00	0.00	
Travel - USA to India	2.00 trips	at	3,000.00	6,000.00	
In-country	2.00 trips	at	1,000.00	2,000.00	
Per Diem	420.00 days	at	86.00	36,120.00	
	days	at			
Other Direct Costs					
Other: (materials,videotapes)				2,000.00	
TOTAL DIRECT COSTS				$ 123,540.00	
Indirect Costs					
University Overhead				27,459.00	
CID - DBA				1,742.00	
- G & A				12,230.00	
TOTAL INDIRECT COSTS				$ 41,431.00	
TOTAL COST OF ACTIVITY				$ 164,971.00	
Mission Buy-in Funding				$ 164,971.00	
WMS II Core Funding				$ 0.00	
Administration Fee (15%)				$ 18,531.00	

Training and Technology Transfer

DATE: 01/15/85

COUNTRY: INDIA

Code #: 2-13-027-85

Activity Title: Development of Handbooks

Description: Identify priorty subjects, and develop outlines, and write handbooks for use by field irrigation water management staff in India. Host country professionals will assist in planning and writing the handbooks. Sixth day pay requested.

Institutions: Managing: CSU Cooperating Participating

Activity Coordinator: Dan Lattimore

Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer			0.50	0.50	0.50	0.50	1.00	1.00	0.50				4.50
Civil Engineer				0.50		0.50	1.00						2.00
Economist													0.00
Agronomist													0.00
Social Scientist													0.00
Coordinator													0.00
Editor			0.50		0.50		0.50						1.50
													8.00

Project Costs:

Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	3 PPM (ts)	at	6,567	19,701	
Professional	5 PPM (nts)	at	4,923	24,615	
Travel - USA to India	1 trips	at	2,950	2,950	
Per Diem	90 days	at	90	8,100	
Other Direct (Printing)				3,750	
TOTAL DIRECT COSTS				$ 59,116	$ 0
Indirect Costs					
University Overhead				14,545	
CID - DBA				443	
- G & A				5,852	
TOTAL INDIRECT COSTS				$ 20,840	$ 0
TOTAL COST OF ACTIVITY				$ 79,956	$ 0

Mission Buy-in Funding $ 0
WMS II Core Funding $ 79,956

TRAINING AND TECHNOLOGY TRANSFER

1/15/85

INDIA

Code #2-14-040-85

Activity Title: Demonstration/Workshop of Computer Assisted Irrigation System Management

Description: This demonstration/seminar is designed to utilize the computer assisted irrigation management program which is being developed by the special study, "Main System Design, Management and Rehabilitation." The purpose of this specific activity will be to demonstrate the capabilities of computer assisted irrigation system management and to begin training mid and upper level operational officials in the sensitivity of systems to various system configurations, operating controls, rainfall hydrographs and cropping patterns, etc., and the possibilities for improved system management. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers				1.0	1.0								2.00
Graduate Students				1.0	2.0								3.00

TOTAL 5.00

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	1.00 PPM (nts) at $5,000	5,000	
	1.00 PPM (ts) at 7,000	7,000	
Graduate Student	1.00 GPM (nts) at $1,200	1,200	
	2.00 GPM (ts) at $1,200	2,400	
Travel - USA to India	3 trips at $3,000	9,000 *	
Per Diem	90 days at $ 86	7,740	
Other Direct Costs:			
Shipment, insurance and lease of computer		6,000	
Miscellaneous supplies, handbooks, etc.		4,000	
TOTAL DIRECT COSTS		$ 42,340	
Indirect Costs:			
University Overhead		10,669	
CID - DBA		270	
- G&A		4,192	
TOTAL INDIRECT COSTS		$ 15,131	
TOTAL COST OF ACTIVITY		$ 57,471	

New WMS II Core Funds . . . . . $ 40,731
Anticipated Carryover Funds -0-
Mission Buy-In Funds . . . . . $ 16,740

* No overhead; tickets provided through AID/Washington.

** An administrative fee of $6,351 also being requested of Mission.

TRAINING & TECHNOLOGY TRANSFER

DATE: 9/21/84

COUNTRY: NEPAL

Code #: 2-02-031-85

Activity Title: Diagnostic Analysis of Irrigation Systems

Description: A diagnostic analysis study of an irrigation system in Nepal will be jointly conducted with Nepali team counterparts. A 3-day senior official's workshop will be held at the end of the study to discuss the study's findings and recommendations. Trainer team will be a joint effort between Cornell and CSU. Sixth day pay requested.

Institutions: Managing CSU Cooperating CORNELL Participating_____

Activity Coordinator: ROBBY LAITOS

Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer				1.00	1.00								2.00
Civil Engineer				1.00	1.00								2.00
Agr. Economist				1.00	1.00								2.00
Agronomist				1.00	1.00								2.00
Social Scientist				1.00	1.00	1.00							3.00
													0.00
													0.00
													11.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	7.50 PPM (ts)	at	5,530.00	41,475.00	
Professional	3.50 PPM (nts)	at	4,147.00	14,515.00	
Travel - USA to Nepal	6.00 trips	at	2,175.00	13,050.00	
New York	2.00 trips	at	500.00	1,000.00	
Per Diem	225.00 days	at	63.00	14,175.00	
	days	at			
Other Direct Costs					
Equipment				5,000.00	
Other: (materials,report)				5,000.00	
TOTAL DIRECT COSTS				$ 94,215.00	
Indirect Costs					
University Overhead				22,499.00	
CID - DBA				933.00	
- G & A				8,832.00	
TOTAL INDIRECT COSTS				$ 32,264.00	
TOTAL COST OF ACTIVITY				$ 126,479.00	
Mission Buy-in Funding				$ 0.00	
WMS II Core Funding				$ 126,479.00	

TRAINING & TECHNOLOGY TRANSFER

DATE: 01/07/85

COUNTRY: Pakistan

Code #: 2-01-065-85

Activity Title: Management Officials Training - Planning

Description: Subproject Management personnel will be trained in the concepts, principles and procedures for Command Water Management. The planning phase includes a workshop in the U.S. to assist in the synthesis of knowledge on irrigation system management relevant for Pakistan. A trip to Pakistan to make organizational arrangementes, identify personnel, and prepare a plan and budget for the training program is also included. Sixth day pay will be paid.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Economist			0.50										0.50
Agronomist			0.50										0.50
Social Scientist			0.75	1.00									1.75
Engineer			0.75	1.00									1.75
Secretarial				0.50									0.50
													5.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	2.00 PPM (ts)	at	6,567.00	13,134.00	
Professional	2.50 PPM (nts)	at	4,924.00	12,310.00	
Technicians	PPM (ts)	at			
Support	0.50 PPM (nts)	at	1,500.00	750.00	
Travel - USA to Pakistan	2.00 trips	at	2,300.00	4,600.00	
Within USA	10.00 trips	at	400.00	4,000.00	
Per Diem Pakistan	60.00 days	at	68.00	4,080.00	
within USA	60.00 days	at	100.00	6,000.00	
Other Direct Costs					
Consultants Fee	60.00 days	at	250.00	15,000.00	
Other: (Itemize, if large)				0.00	
SUBTOTAL DIRECT COSTS				$ 59,874.00	
Contingency (15%)				8,382.00	
TOTAL DIRECT COSTS				$ 68,256.00	
Indirect Costs					
University Overhead				24,572.00	
CID - DBA				296.00	
- G & A				6,757.00	
TOTAL INDIRECT COSTS				$ 31,625.00	
TOTAL COST OF ACTIVITY				$ 99,881.00	
Mission Buy-in Funding				$ 99,881.00	

TRAINING & TECHNOLOGY TRANSFER

DATE: 01/15/85

PAKISTAN

Code #: INFORMATION

Activity Title: MANAGEMENT OFFICIALS TRAINING

Description: Subproject Management personnel will be trained in the concepts, principles and procedures for Command Water Management. Development of the program at CSU and implementation of the training in Pakistan are the principle outputs of this component. Both an interdisciplinary training team and an organization experienced in management training are included. Sixth day pay will be paid.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: WAYNE CLYMA, DAN LATTIMORE Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Economist					1.00	1.00	1.00	0.50					3.50
Agronomist					1.00	1.00	1.00	0.50					3.50
Social Scientist					1.00	1.00	1.00	0.50					3.50
Engineer					1.00	1.00	1.00	0.50					3.50
Secretarial						0.50	0.50	0.50					1.50
													15.50

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	8.00	PPM (ts)	at 6,567.00	52,536.00	
Professional	6.00	PPM (nts)	at 4,924.00	29,544.00	
Technicians		PPM (ts)	at		
Support	1.50	PPM (nts)	at 1,500.00	2,250.00	
Travel - USA to Pakistan	4.00	trips	at 2,300.00	9,200.00	
within USA	0.00	trips	at 0.00	0.00	
Per Diem Pakistan	240.00	days	at 68.00	16,320.00	
		days	at		
Other Direct Costs					
Consultants				100,000.00	
Other: (materials, supplies)				5,000.00	
SUBTOTAL DIRECT COSTS				$ 214,850.00	
Contingency (15%)				32,228.00	
TOTAL DIRECT COSTS				$ 247,078.00	
Indirect Costs					
University Overhead				64,020.00	
CID - DBA				1,182.00	
- G & A				24,461.00	
TOTAL INDIRECT COSTS				$ 89,663.00	
TOTAL COST OF ACTIVITY				$ 336,741.00	$ 32,774.00 *
Mission Buy-in Funding				$ 336,741.00	
WMS II Core Funding				$ 0.00	

TRAINING & TECHNOLOGY TRANSFER

DATE: 01/15/85

COUNTRY: Pakistan

Code #: INFORMATION

Activity Title: Monitoring & Evaluation

Description: Technical assistance will be provided to the Subproject Management Staff to plan and initiate a systematic program of monitoring and evaluation for management and improvement of irrigated agriculture in the area. A team will travel to Pakistan to provide assistance in the planning and implementation of a monitoring and evaluation program. Sixth day pay will be paid.

Institutions: Managing_____ Cooperating_____ Participating_____

Activity Coordinator: Phone: ( )

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Economist											1.00	1.00	2.00
Agronomist											1.00	1.00	2.00
Social Scientist											1.00	1.00	2.00
Engineer											1.00	1.00	2.00
Secretarial													0.00
													8.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	6.00 PPM (ts)	at	6,567.00	39,402.00	
Professional	2.00 PPM (nts)	at	4,924.00	9,848.00	
Technicians	0.00 PPM (ts)	at	0.00	0.00	
Support	0.00 PPM (nts)	at	0.00	0.00	
Travel - USA to Pakistan	4.00 trips	at	2,300.00	9,200.00	
Within USA	0.00 trips	at	0.00	0.00	
Per Diem Pakistan	180.00 days	at	68.00	12,240.00	
within USA	0.00 days	at	0.00	0.00	
Other Direct Costs					
Other: (Itemize, if large)				1,000.00	
SUBTOTAL DIRECT COSTS				$ 71,690.00	
Contingency (15%)				10,037.00	
TOTAL DIRECT COSTS				$ 81,727.00	
Indirect Costs					
University Overhead				20,904.00	
CID - DBA				887.00	
- G & A				8,091.00	
TOTAL INDIRECT COSTS				$ 29,882.00	
TOTAL COST OF ACTIVITY				$ 111,609.00	
Mission Buy-in Funding				$ 111,609.00	
WMS II Core Funding				$ 0.00	

TRAINING & TECHNOLOGY TRANSFER

DATE: 01/15/85

COUNTRY: Pakistan

Code #: INFORMATION

Activity Title: Baseline Data Collection

Description: Technical assistance will be provided for an organization in Pakistan to plan and implement baseline data collection as an interdisciplinary team preportory to, and periodically during, the implementation of the Command Water Management Program. The assistance will be provided over a period of time in-country by an interdisciplinary team. Sixth day pay will be paid.

Institutions: Managing_____ Cooperating_____ Participating_____

Activity Coordinator: Phone: ( )

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Economist								1.00	1.00	1.00			3.00
Agronomist								1.00	1.00	1.00			3.00
Social Scientist								1.00	1.00	1.00			3.00
Engineer								1.00	1.00	1.00			3.00
Secretarial													0.00
													12.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	8.00 PPM (ts)	at	6,567.00	52,536.00	
Professional	4.00 PPM (nts)	at	4,924.00	19,696.00	
Technicians	0.00 PPM (ts)	at	0.00	0.00	
Support	0.00 PPM (nts)	at	0.00	0.00	
Travel - USA to Pakistan	8.00 trips	at	2,300.00	18,400.00	
Within USA	0.00 trips	at	0.00	0.00	
Per Diem Pakistan	240.00 days	at	68.00	16,320.00	
within USA	0.00 days	at	0.00	0.00	
Other Direct Costs					
Other: (Itemize, if large)				1,000.00	
SUBTOTAL DIRECT COSTS				$ 107,952.00	
Contingency (15%)				15,113.00	
TOTAL DIRECT COSTS				$ 123,065.00	
Indirect Costs					
University Overhead				44,303.00	
CID - DBA				1,182.00	
- G & A				12,183.00	
TOTAL INDIRECT COSTS				$ 57,668.00	
TOTAL COST OF ACTIVITY				$ 180,733.00	
Mission Buy-in Funding				$ 180,733.00	
WMS II Core Funding				$ 0.00	

TRAINING & TECHNOLOGY TRANSFER

DATE: 01/15/85

COUNTRY: WORLDWIDE

Code #: 2-14-032-85

Activity Title: Micro Computer Workshop

Description: To develop and conduct a workshop on application of microcomputers in water management to increase the capability of WMS II to serve project needs in training, technical assistance, and technology transfer. Sixth day pay is requested.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Tom Sheng

Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer				1.00									1.00
Civil Engineer			1.00	1.00									2.00
Economist			0.50	1.00									1.50
Agronomist													0.00
Social Scientist													0.00
Technician			1.00										1.00
													0.00
													5.50

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	3.00 PPM (ts)	at	5,530.00	16,590.00	
Professional	1.50 PPM (nts)	at	4,147.00	6,221.00	
Technicians	PPM (ts)	at			
Technicians	1.00 PPM (nts)	at	900.00	900.00	
Travel - USA to Indonesia	3.00 trips	at	2,675.00	8,025.00	
	trips	at			
Per Diem	90.00 days	at	112.00	10,080.00	
	days	at			
Other Direct Costs					
Other: (supplies & equipment)				2,362.00	
TOTAL DIRECT COSTS				$ 44,178.00	
Indirect Costs					
University Overhead				11,047.00	
CID - DBA				373.00	
- G & A				4,374.00	
TOTAL INDIRECT COSTS				$ 15,794.00	
TOTAL COST OF ACTIVITY				$ 59,972.00	
Carryover				$ 0.00	
New Core Funds				$ 44,594.00	
Mission Buy-in Funds				$ 15,378.00	

TRAINING & TECHNOLOGY TRANSFER

COUNTRY: WORLDWIDE

DATE: 2/14/85

Code #: 2-05-33-85

Activity Title: Seminar on Irrigation System Rehabilitation. PHASE #1

Description: Conduct literature search and prepare state-of-art paper on Irrigation System Rehabilitation. An international group of experts will be invited to contribute to the state-of-the-art paper and participate in the seminar. World Bank, Asian Development Bank, and International Irrigation Management Institute will be contacted for co-sponsorship and participation. The seminar will be conducted in FY86.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Haider Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985									FY 1986			
	1985									1985			
Discipline	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Agri. Engineer				0.25	0.25	0.25	0.25	0.25					1.25
Agri. Engineer													0.00
Economist				0.25	0.25	0.25	1.00	0.25					2.00
Agronomist													0.00
Social Scientist				0.25	0.25	0.25	0.25	0.25					1.25
Editor								0.50					0.50
													0.00
													5.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	1.00 PPM (+ts)	at	5,530.00	5,530.00	
Professional	4.00 PPM (nts)	at	4,924.00	19,696.00	
Travel - USA to	0.00 trips	at	3,500.00	0.00	
within USA	3.00 trips	at	500.00	1,500.00	
Per Diem	0.00 days (+ts)	at	85.00	0.00	
	21.00 days	at	75.00	1,575.00	
Other Direct Costs					
Consultant Fees	30.00 days	at	250.00	7,500.00	
Other: (editing,publishing,misc.)				1,500.00	
TOTAL LIRECT COSTS				$ 37,301.00	
Indirect Costs					
University Overhead				12,655.00	
CID - DBA				124.00	
- G & A				2,950.00	
TOTAL INDIRECT COSTS				$ 15,729.00	
TOTAL COST OF ACTIVITY				$ 53,030.00	
Mission Buy-in Funding				$ 0.00	
WMS II Core Funding				$ 53,030.00	

TRAINING & TECHNOLOGY TRANSFER

DATE: 01/15/85

COUNTRY: WORLDWIDE

Code #: INFORMATION

Activity Title: Seminar on Irrigation System Rehabilitation. PHASE #2

Description: For budgeting purposes Sri Lanka is identified as the location for the seminar. The budget allows for travel and participation of 10 experts from the U.S. and 10 from other Asian countries to Sri Lanka. The staff time accounts for participation in the seminar, and the preparation and publishing of the proceedings of the seminar. Part of this activity cost may be covered by the contribution of the co-sponsors.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Haider Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1986												
	1985			1986									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer				0.25									0.25
Civil Engineer													0.00
Economist	0.25	0.25	0.25	1.00									1.75
Agronomist													0.00
Social Scientist				0.25									0.25
Editor				0.50	0.50								1.00
													0.00
													3.25

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	1.00 PPM (+ts)	at	5,530.00	5,530.00	
Professional	0.50 PPM (ts)	at	5,530.00	2,765.00	
Professional	1.75 PPM (nts)	at	4,147.00	7,257.00	
Travel - USA to	10.00 trips	at	2,800.00	28,000.00	
	10.00 trips	at	800.00	8,000.00	
Per Diem	30.00 days	at	85.00	2,550.00	
	130.00 days	at	70.00	9,100.00	
Other Direct Costs					
Other: (editing,publishing,misc.)				1,500.00	
TOTAL DIRECT COSTS				$ 64,702.00	
Indirect Costs					
University Overhead				22,519.00	
CID - DBA				187.00	
- G & A				6,405.00	
TOTAL INDIRECT COSTS				$ 29,111.00	
TOTAL COST OF ACTIVITY				$ 93,813.00	
Mission Buy-in Funding				$ 0.00	
WMS II Core Funding				$ 93,813.00	

TRAINING AND TECHNOLOGY TRANSFER

2/11/85

WORLDWIDE

Activity Title: Lessons Learned: Irrigation System Management

Code #2-14-039-85

Description: The purpose of this activity is to synthesize lessons which have already been learned in the area of irrigation system management and organize these lessons into a training program for relevant professionals. In the first year, primary concentration will be placed on the surveying of sources of information from which lessons will be extracted, establishing a program of interviewing WMS II TA teams for lessons learned, and organizing the materials into an analytic framework. Approval for six-day work week and holiday pay is requested for all short-term TDY under this 'ivity.

Institutions: Managing USU Cooperating CSU, CU Participating _____

Activity Coordinator: Allen LeBaron Phone: (801) 750-2322

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agronomists							1.00	1.00	0.50				2.50
Social Scientists							0.50	0.50	0.50				1.50
Institutional Exp.							1.00	1.00	0.50				2.50
Information Spec.	<-	-	-	-	-	-	-	1.50	-	-	-	->	1.50
Indian Consultant							1.67	1.67	1.66				5.00
Ford Foundation							0.40	0.30	0.30				1.00
Graduate Students	<-	-	-	-	-	-	-	8.00	-	-	-	->	8.00

TOTAL 13.00 PPM
1.00 donated
8.00 GPM

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	0.5 PPM (ts) at $7,000	$ 3,500	
Professional Personnel	8.0 PPM (nts) at $5,000	40,000	
Ford Foundation Personnel	1.0 PPM donated time	-0-	
Graduate Students	8.0 GPM (nts) at $1,200	9,600	
Travel - to USU: (Cornell/CSU)	4 trips at $ 500	2,000	
- to USA	5 trips at $ 500	2,500	
- within India	2 trips at $ 500	1,000	
Per Diem - USA	95 days at $ 75	7,125	
- India	14 days at $ 100	1,400	
Other Direct Costs		1,358	
Consultants:			
Fee (Indians) 5 ppm @ $300/month		1,500	
Travel (in-country)	5 trips at $ 200	1,000	
Per Diem (in-country)	35 days at $ 50	1,750	
TOTAL DIRECT COSTS		$ 72,733	
Indirect Costs:			
University Overhead		$ 23,275	
CID - DBA		-0-	
- G&A		7,201	
TOTAL INDIRECT COSTS		$ 30,476	
TOTAL COST OF ACTIVITY		$103,209	

New WMS II Core Funds. $103,209

Mission Buy-In Funds . . . . . $ -0-

TRAINING AND TECHNOLOGY TRANSFER 2/11/85

Code #2-11-041-85

Activity Title: French Language Training

Description: In order to enhance the French language capacity of USU's WMS-II core staff, language training will be given through a French speaking graduate student to Jon Moris, Wynn Walker and Bryant Smith. This is a continuation of USU's efforts to increase its capacity to service Mission requests, especially those involving French speaking Africa.

Institutions: Managing USU Cooperating _____ Participating _____

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
French Teacher	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.0

TOTAL 6.0

Project Costs:	WMS II FUNDING	MISSION CONTRIBUTION
Item		
Graduate Student Personnel P. Zgheib 6.00 GPM (nts) at $1,200	7,200	
Other Direct Costs	300	
TOTAL DIRECT COSTS	$ 7,500	
Indirect Costs:		
University Overhead	2,400	
CID - DBA	-0-	
- G&A	750	
TOTAL INDIRECT COSTS	$ 3,150	
TOTAL COST OF ACTIVITY	$ 10,650	

Mission Buy-In Funding . . . . . $ 6,650

WMS II FY85 Core Funding . . . . . $ 4,000

Carryover

Training and Technology Transfe

January 7, 1985

WORLDWIDE

Activity Title: "Rehabilitation", A Game Simulation of Participation in Irrigation Development.
Code # 2-13-048-85

Description: A draft of a game simulation has been prepared to help prepare technical staff at Gal Oya to work on system rehabilitation in a more participatory manner. The purpose of this activity is to generalize and refine this game for use in a variety of irrigation contexts and to develop a computer graphics component for the game.

Institutions: Managing CORNELL Cooperating USU Participating _____

Activity Coordinator: Norman Uphoff Phone: (607) 256-6370

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Geographer	1.25	---	---	---	---	---	---	---	---	---	---	---	1.25
Political Scientist	1.0	---	---	---	---	---	---	---	---	---	---	---	1.0
Agr. Engineer				0.5	---	---	---	---	---	---	---	---	0.5
											TOTAL		2.75

Project costs

01/07/85

Item	WMS-II Funding	MISSION CONTRIBUTION
Direct Costs		
Salaries & Benefits		
Professional personnel		
1 months @ $5,114	5,114	
.5 months @ $4,747	2,374	
Other Direct Costs		
Consultants		
Fees -- 30 days @ $235	7,050	
Travel -- Detroit-Ithaca	500	
Per Diem -- 40 days @ $55	2,200	
Computer rental	1,000	
Software, supplies, duplicating	1,000	
TOTAL DIRECT COSTS	$19,238	
Indirect Costs		
Cornell Indirect (Statutory On-Campus)	7,991	
Cornell Indirect (Endowed On-Campus)	4,311	
CID G&A	1,905	
TOTAL INDIRECT COSTS	$14,207	
TOTAL COST OF ACTIVITY	$33,444	
WMS-II Core Funding	$33,444	
Anticipated Carryover Funds	$ 0	
Mission buy-in funding	$ 0	

WORLDWIDE

Activity Title: Workshop on Lessons Learned: Project Design Activities Code # 2-14-049-85

Description: Two day workshop to systematically review past experiences of technical assistance teams in developing strategy statements and project design papers. Output will be a set of recommendations for future work of this kind. Participants will include WMS-II staff with experience in these types of technical assistance, selected AID staff, private consultants, and several representatives of Third World irrigation agencies involved in similar efforts.

Institutions: Managing: CORNELL Cooperating: USU Participating:

Activity Coordinator: Phone:

PERSONNEL BY DISCIPLINE	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Social Scientist						1	---	---	---				1
Graduate Student						2	---	---	---				2
												TOTAL	3

Project costs

01/07/85

Item				WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional Personnel	1 PPM	@	$6,000	6,000	
Graduate Student	2 GSM	@	1,000	2,000	
Travel					
US to Ithaca	16 trips	@	750	12,000	
Per Diem					
Ithaca	48 days	@	55	2,640	
Other Direct Costs:					
Conference costs				2,500	
Duplication, communications, etc.				2,000	
TOTAL DIRECT COSTS				$27,140	
Indirect Costs					
Cornell Indirect (Statutory On-Campus)				9,563	
Cornell Indirect (Statutory Off-Campus)				2,400	
CID G&A				2,687	
TOTAL INDIRECT COSTS				$14,650	
TOTAL COST OF ACTIVITY				$41,790	
WMS-II Core Funds				$41,790	
Anticipated Carryover Funds				0	
Mission Buy-in Funds				0	

Training and Technology Transfer

January 7, 1985

WORLDWIDE

Activity Title: Joint Seminar on Current Research in Irrigation Code #2-14-050-85

Description: This seminar would consist of (1) short field trips to large-scale irrigation projects in Pakistan and in Sri Lanka and to small-scale tank projects in Tamil Nadu, India, and (2) a gathering of the full group of about 25 scientists at IMMI headquarters in Sri Lanka to discuss issues and problems related to the management of large government irrigation schemes and to small-scale irrigation development. Outputs will include summary and assessment of ongoing research on these topics, identification of future research needs, and assessment of how WMS-II and IMMI can best complement each other in meeting future research demands.

Institutions: Managing CORNELL Cooperating IIMI Participating _____

Activity Coordinator: Randolph Barker Phone: (607) 256-2105

PERSONNEL BY DISCIPLINE	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Economist	.75	---	---	---	---	---	---	---	---	---	---	---	.75
											TOTAL		.75

Project costs

01/07/85

Item			WMS-II Funding	MISSION CONTRIBUTION
Direct Costs				
Salaries and benefits				
Professional personnel	.75 ppm	@ $6,375	4,781	
Travel				
USA to Sri Lanka	12 trips	@ $3,500	42,000	
Asia to Sri Lanka	6 trips	@ 1,000	6,000	
Asia to Sri Lanka via TN	3 trips	@ $1,000	3,000	
Asia to Sri Lanka via Pakis.	3 trips	@ $1,500	4,500	
Internal Travel			2,500	
Per Diem**				
India	42 days	@ $ 64	2,688	
Pakistan	42 days	@ $ 62	2,604	
Other Direct Costs			1,325	
Total Direct Costs			$69,398	
Indirect Costs				
Cornell Indirect (Statutory On-Campus)			6,232	
Cornell Indirect (Statutory Off-Campus)			11,872	
CID G&A			6,870	
Total Indirect Costs			$24,974	
TOTAL COST OF ACTIVITY			$ 94,372	
WMS II Core Funds			$ 94,372	
Anticipated Carryover Funds			0	
Mission Buy-in Funds			0	

**IMMI to provide conference costs in Sri Lanka, including per diem and internal travel.

SPECIAL STUDIES

INDIA

1/7/85

Activity Title: India Main Systems Case Study

Code #3-04-043-85 d

Description: To develop an irrigation system case study representing irrigated conditions in Southwestern India. Case study data is to be developed from existing sources and experience of investigators. Results are intended for use in demonstration of modeling rather than for verification and calibration. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers					0.50	0.50	0.50	0.50	0.50	0.50			3.0
Institutional Spec.					0.50								0.5
Students					0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	4.0

TOTAL 7.5

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel:			
Dean F. Peterson	3.00 PPM (nts) at $5,000	15,000	
Bryant Smith	0.50 PPM (nts) at $5,000	2,500	
Graduate Student Personnel			
M. Sawart	2.00 GPM (nts) at $1,000	2,000	
B. Mulik	2.00 GPM (nts) at 1,000	2,000	
Other Direct Costs			
Reproductions, drafting, mailing, etc.		1,000	
TOTAL DIRECT COSTS		$ 22,500	
Indirect Costs:			
University Overhead		7,200	
CID - DBA		-0-	
- G&A		2,228	
TOTAL INDIRECT COSTS		$ 9,428	
TOTAL COST OF ACTIVITY		$ 31,928	

New WMS II Core Funds . . . . . $ 31,928
Anticipated Carryover Funds . . . . . $ -0-
Mission Buy-In Funding . . . . . $ -0-

SPECIAL STUDIES

MOROCCO

1/7/85

Activity Title: Moroccan Case Studies

Code #3-04-043-85 c

Description: To initiate an irrigation system case study in Morocco to verify and calibrate the modeling package under conditions of large-scale automation. Case study is specifically intended to investigate the functions of project level management and institutions. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers						0.50	0.25						0.75
Ag. Economist						0.50	0.25						0.75
Institut.						0.50	0.25						0.75

TOTAL 2.25

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel:			
W. R. Walker	0.75 PPM (ts) at $7,000	5,250	
Ag. Economist	0.75 PPM (ts) at 7,000	5,250	
Institutional Specialist	.75 PPM (ts) at 7,000	5,250	
Travel - USA to Morocco	3 trips at 1,500	4,500	
Per Diem -	63 days at 90		$ 5,670
Other Direct Costs			
Report Preparation		300	
TOTAL DIRECT COSTS		$ 20,550	$ 5,670
Indirect Costs:			
University Overhead		6,576	
CID - DBA		273	
- G&A		2,034	
TOTAL INDIRECT COSTS		$ 8,883	
TOTAL COST OF ACTIVITY		$ 29,433	$ 5,670

New WMS II Core Funds . . . . . $ 29,433
Anticipated Carryover Funds . . . . . $ -0-
Mission Buy-In Funding . . . . . $ -0-

SPECIAL STUDIES

Revised 01/15/85

NIGER

Activity Title: Traditional & Developed Small-Scale Irrigation Study Continuation*
Code # 3-04-052-85

Description: Monitoring and evaluation of both agency developed and traditional small-scale irrigation systems in Niger in order to examine the transition from traditional to agency system, to see how the traditional irrigation experience may best be utilized in agency small-scale programs, to assess the optimal mixtures between traditional and introduced elements in irrigation projects, and to identify appropriate levels of intervention for future irrigation development in the Sahel.

Institutions: Managing: CORNELL Cooperating _____ Participating _____

Activity Coordinator: Michael Walter Phone: (607) 256-2173

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Ag. Engineer				1.0									1
Grad Student Ag Engineering	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1,0	1.0	1.0	12
											TOTAL		13

Project costs

Revised 01/15/85

Item				WMS-II Funding	Mission Contribution
Direct Costs					
Salaries & Benefits					
Professional personnel	1 PPM	at	$4,659	4,659	
Graduate student	12 GSM	at	$ 750	9,000	
Travel					
Delhi-Niger-Delhi	1 trip	at	$3,000	3,000	
Per Diem & Living Allowance					
Niamey	20 days	at	$ 70	1,400	
Other Niger	20 days	at	$ 20	400	
Paris	2 days	at	$ 95	190	
Living Allowance Supplement	12 mths.	at	$ 150	1,800	
Other Direct Costs					
Vehicle fuel and maintenance				4,000	
Supplies & equipment rental				3,000	
Labor				5,400	
TOTAL DIRECT COSTS				$32,849	
Indirect Costs					
Cornell Indirect (Statutory off-campus)				6,383	
CID G&A				3,252	
TOTAL INDIRECT COSTS				$ 9,635	
ACTIVITY TOTAL				$42,484	
FY-85 Core Funding				35,484	
Anticipated Carryover from FY-84*				7,000	
Mission buy-in				0	

*Code #3-04-111-84

This budget includes carryover from the FY84 budget which has been reduced by an offsetting amount.

COUNTRY: SRI LANKA

Code #: 3-04-036605

Activity Title: Sri Lanka Interfacing On-Farm Water Management

Description: This activity provides in-country action-research for Sri Lanka. It includes interdisciplinary activities integrating agricultural economics, agronomy, engineering, and sociology components for a study of existing tanks to identify constraints to improvement and evaluate alternative improvements.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Freeman Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer										1.00	1.00		2.00
Economist										1.00			1.00
Social Scientist										1.00	1.00		2.00
Agronomist													0.00
Res. Assoc. Eng.						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Res. Assoc. Econ.						1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.00
Res. Assoc. Soc.						1.50	1.50	1.50	1.50	1.50	1.50	1.50	10.50
													29.50

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	3.00 PPM (+ts)	at	6,567.00	19,701.00	
Professional	2.00 PPM (+ts)	at	5,530.00	11,060.00	
Research Associate	24.50 PPM (+ts)	at	1,300.00	31,850.00	
Travel - USA to Sri Lanka	6.00 trips	at	2,700.00	16,200.00	
	trips	at			
Per Diem	90.00 days	at	85.00	7,650.00	
	120.00 days	at	70.00	8,400.00	
Other Direct Costs					
Other: (In country support)				3,000.00	
TOTAL DIRECT COSTS				$ 97,861.00	
Indirect Costs					
University Overhead				21,949.00	
CID - DBA				1,409.00	
- G & A				9,688.00	
TOTAL INDIRECT COSTS				$ 33,046.00	
TOTAL COST OF ACTIVITY				$ 130,907.00	
WMS II Core Funds				$ 130,907.00	
Mission Buy-in Funds				$	

SPECIAL STUDIES

DATE: 01/15/85

COUNTRY: Sri Lanka

Code #: 3-04-038-85

Activity Title: Landsat85 - Remote Sensing Rapid Reconnaisance for Project Appraisal Using Landsat Photo Data

Description: Program to incorporate the use of Landsat Data in Irrigation System Rehabilitation. Initial emphasis is proposed for Sri Lanka in cooperation with Larry Nelson who will supervise the field work and training. Sixth day pay requested.

Institutions: Managing CSU Cooperating Participating

Activity Coordinator: Dan Lattimore Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Economist													0.00
Agronomist			0.50	1.00								0.50	2.00
Social Scientist													0.00
Research Assoc.			0.50	1.00	0.50	0.50	0.50	0.50	1.00	1.00	1.00	0.50	7.00
													0.00
													9.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	1.00 PPM (ts)	at	5,530.00	5,530.00	
Professional	1.00 PPM (nts)	at	4,924.00	4,924.00	
Research Associates	4.00 GPM (ts)	at	1,300.00	0.00	5,200.00
Research Associates	3.00 GPM (nts)	at	1,300.00	3,900.00	
Travel - USA to Sri Lanka	3.00 trips	at	2,130.00	6,390.00	
	0.00 trips	at	0.00	0.00	
Per Diem	120.00 days	at	95.00	$	11,400.00
	0.00 days	at	0.00	0.00	
Other Direct Costs (tuition,computer time)				3,250.00	
Other: (Photos and data tapes)				2,500.00	
TOTAL DIRECT COSTS				$ 26,494.00	16,600.00
Indirect Costs					
University Overhead				5,449.00	
CID - DBA				124.00	
- G & A				2,375.00	
TOTAL INDIRECT COSTS				$ 7,948.00	
TOTAL COST OF ACTIVITY				$ 34,442.00	16,600.00
Mission Buy-in Funding				$ 0.00	
WMS II Core Funding				$ 34,442.00	

SPECIAL STUDIES

DATE: 01/15/85

COUNTRY: Sri Lanka

Code #: INFORMATION

Activity Title: Landsat86 - Remote Sensing Rapid Reconnaisance for Project Appraisal Using Landsat Photo Data.

Description: Program to incorporate the use of Landsat Data in Irrigation System Rehabilitation. Initial emphasis is proposed for Sri Lanka in cooperation with Larry Nelson who will supervise the field work and training. Sixth day pay requested.

Institutions: Managing CSU Cooperating USU Participating_____

Activity Coordinator: Dan Lattimore Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1986												
	1985			1986									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Economist													0.00
Agronomist			0.50	1.00								0.50	2.00
Social Scientist													0.00
Research Assoc.	0.50	0.50	1.00	1.00	0.50	0.50	0.50	0.50	1.00	1.00	1.00	0.50	8.50
													0.00
													10.50

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	1.00 PPM (ts)	at	6,567.00	6,567.00	
Professional	1.00 PPM (nts)	at	4,924.00	4,924.00	
Research Assoc.	5.00 GPM (ts)	at	1,300.00		6,500.00
Research Assoc.	3.50 GPM (nts)	at	1,300.00	4,550.00	
Travel - USA to	2.00 trips	at	2,130.00	4,260.00	
	0.00 trips	at	0.00	0.00	
Per Diem	120.00 days	at	95.00	0.00	11,400.00
	0.00 days	at	0.00	0.00	
Other Direct Costs (tuition,computer time)				4,750.00	
Other: (Photos and data tapes)				2,500.00	
TOTAL DIRECT COSTS				$ 27,551.00	$ 17,900.00
Indirect Costs					
University Overhead				6,362.00	
CID - DBA				148.00	
- G & A				2,480.00	
TOTAL INDIRECT COSTS				$ 8,990.00	
TOTAL COST OF ACTIVITY				$ 36,541.00	17,900.00
Mission Buy-in Funding				$ 0.00	
WMS II Core Funding				$ 36,541.00	

SPECIAL STUDIES

THAILAND 1/7/85

Activity Title: Thailand Case Study Code #3-04-043-85 b

Description: To develop case study data from two small irrigation projects in Northeast Thailand for verification and calibration of the irrigation system analyses models Funds cover M.S. training of two RID irrigation engineers, and one B.S. RID irrigation engineer. Approval for six-day work week and holiday pay is requested on all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Irrig. Engineers	0.25	0.25	0.25	0.25	0.25				0.25	0.25	0.25		2.00
Institutional Spec.			0.75										0.75
Students	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	16.00

TOTAL 18.75

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel:			
W. R. Walker	1.00 PPM (nts) at $5,000	5,000	
G. V. Skogerboe	1.00 PPM (nts) at 5,000	5,000	
B. D. Smith	0.75 PPM (nts) at 5,000	3,750	
Graduate Student Personnel			
Mr. Somkiat		1,305	
Mr. Charoon		8,000	
Mr. Kanching		8,000	
Other Direct Costs			
TOTAL DIRECT COSTS		$ 31,055	
Indirect Costs:			
University Overhead		9,938	
CID - DBA		-0-	
- G&A		3,074	
TOTAL INDIRECT COSTS		$ 13,012	
TOTAL COST OF ACTIVITY		$ 44,067	

New WMS II Core Funds . . . . . $ 44,067
Anticipated Carryover Funds . . . . . -0-
Mission Buy-In Funding . . . . . $ -0-

SPECIAL STUDIES

DATE: 02/14/85

COUNTRY: WORLDWIDE

Code #: 3-04-036A85

Activity Title: Interfacing On-Farm Water Management - Backstopping

Description: Preparation for field studies of the interface between on-farm and main system for irrigation management and support for field team once it is in place. Development of an interdisciplinary research team.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Freeman Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer				0.50		0.50	0.25	0.25	0.25	0.25	0.25	0.25	2.50
Economist						0.50	0.25	0.25	0.25	0.25	0.25	0.25	2.00
Social Scientist						0.50	0.25	0.25	0.25	0.25	0.25	0.25	2.00
Agronomist						0.50	0.25	0.25	0.25	0.25	0.25	0.25	2.00
Res. Assoc. Eng.													0.00
Res. Assoc. Soc.													0.00
Graduate Student	1.50	1.50	1.50	1.50	1.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	11.00
													19.50

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	6.00 PPM (nts)	at	4,924.00	29,544.00	
Professional	2.50 PPM (nts)	at	4,147.00	10,368.00	
Research Associate	11.00 PPM (nts)	at	1,300.00	14,300.00	
Travel - USA to Sri Lanka	0.00 trips	at	2,130.00	0.00	
	trips	at			
Per Diem	0.00 days	at	95.00	0.00	
	0.00 days	at	70.00	0.00	
Other Direct Costs					
Other: (In country support)				5,000.00	
TOTAL DIRECT COSTS				$ 59,212.00	
Indirect Costs					
University Overhead				21,316.00	
CID - DBA				0.00	
- G & A				5,862.00	
TOTAL INDIRECT COSTS				$ 27,178.00	
TOTAL COST OF ACTIVITY				$ 86,390.00	
New WMS II Core Funds				$ 86,390.00	
Mission Buy-in Funds				$	

SPECIAL STUDIES

1/7/85

WORLDWIDE

Code # 3-04-042-85

Activity Title: Rapid Irrigation Project Appraisal Using Remote Sensing Systems

Description: The principal objective is to test the use of remote sensing systems as methods for rapid appraisal of irrigation systems. The specific objectives for this funding period would be as follows: (1) to determine the specific factors related to irrigation project appraisal which can be identified from the aerial photographs and LANDSAT data and that are useful indicators for the evaluation of irrigation projects; (2) to identify the interpretations of the data which can be made to characterize the status and long-term dynamics of irrigation projects; (3) to determine the nature and extent of required ground truth and the consequences of the timing of such measurements or observations on the adequacy of the remote sensing application; and (4) to apply the remote sensing techniques to support the CSU irrigation rehavilitation activities in Sri Lanka and to serve as a case study in training activities. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers	0.25		0.25										0.5
Economists		0.25		0.25									0.5
Students	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	8.0

TOTAL 9.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel:	1.00 PPM (nts) at $5,000	5,000	
Graduate Student Personnel	8.0 GPM (nts) at $1,000	8,000	
Travel - Within USA	3 trips at $1,000	3,000	
Per Diem	12 days at $ 100	1,200	
Other Direct Costs		2,000	
Subcontracts: IRIS International		35,000	
TOTAL DIRECT COSTS		$ 54,200	
Indirect Costs:			
University Overhead		14,144	
CIO - DBA		-0-	
- G&A		5,366	
TOTAL INDIRECT COSTS		$ 19,510	
TOTAL COST OF ACTIVITY		$ 73,710	

New WMS II Core Funds . . . . . $ 73,710
Anticipated Carryover Funds -0-
Mission Buy-In Funds . . . . . $ -0-

WORLDWIDE

Code #3-04-043A85

Activity Title: Irrigation System Model Development

Description: Development and testing of an irrigation systems analysis package to assist in the design and management of irrigation projects, as well as train technical staff and evaluate alternative design and management options. Models of the unit command area, main delivery system, reservoir, and catchment subsystem will be formulated. Computer codes will be developed for both micro- and main-frame computer systems. Training materials and user guides will be included along with demonstrations based on case studies in Thailand, Morocco and India. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers	0.25	0.25	0.50	0.50	0.50	0.50	0.25	0.25	0.25	0.25	0.25	0.25	4.00
Civil Engineers									0.25	0.25	0.25	0.25	1.00
Institutional Spec.								0.50	0.25				0.75
Students	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	3.00	3.00	3.00	3.00	24.00

TOTAL 29.75

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel:			
W. R. Walker	3.00 PPM (nts) at $5,000	15,000	
R. W. Hill	1.00 PPM (nts) at 5,000	5,000	
T. C. Hughes	1.00 PPM (nts) at 5,000	5,000	
B. O. Smith	0.75 PPM (nts) at 5,000	3,750	
Graduate Student Personnel			
A. Keller	8.00 GPM (nts) at $1,000	8,000	
R. Diven	8.00 GPM (nts) at 1,000	8,000	
R. Eisle	8.00 GPM (nts) at 1,000	8,000	
Other Direct Costs			
Computer		8,000	
Drafting, Reproduction, etc.		1,000	
TOTAL DIRECT COSTS		$ 61,750	
Indirect Costs:			
University Overhead		19,760	
CID - DBA		-0-	
- G&A		6,113	
TOTAL INDIRECT COSTS		$ 25,873	
TOTAL COST OF ACTIVITY		$ 87,623	

WMS Core FY85 Funds $37,623

Mission Buy-In Funds . . . . . $ -0-

Carryover 50,000

SPECIAL STUDIES

WORLDWIDE 1/7/85

Activity Title: Interdisciplinary Main Systems Workshop Code #3-04-043-85 e

Description: To assess the USU irrigation systems analysis program via a select group if internationally experienced and interdisciplinary experts. Workshop will review modeling strategy and applicability. Participants will gain actual experience of models with detailed analysis of Thai and Indian case studies. Approval for six-day work week and holiday pay is requested for all short-term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Wynn R. Walker Phone: (801) 750-2788

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers				0.25	0.25	0.25	0.25						1.0
Students					0.50	0.50							1.0

TOTAL 2.0

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	1.00 PPM (nts) at $5,000	5,000	
Graduate Student	1.00 GPM (nts) at $1,000	1,000	
Travel - Within USA	15 trips at $ 675	9,375	
Per Diem	75 days at $ 50	3,750	
Other Direct Costs: Conference room, materials, etc.		500	
TOTAL DIRECT COSTS		$ 19,625	
Indirect Costs:			
University Overhead		6,280	
[illegible]		-0-	
[illegible]		1,943	
T[illegible] INDIRECT COSTS		$ 8,223	
TOTAL COST OF ACTIVITY		$ 27,848	

New WMS II Core Funds . . . . . $ 27,848
Anticipated Carryover Funds . . . . . $ -0-
Mission Buy-In Funding . . . . . $ -0-

January 7, 1985

Special Studies

WORLDWIDE

Activity Title: Phase I - Comparative Analysis of Indirect Investment Strategies for Development of Small-scale Irrigation Works.
Code #3-04-053-85

Description: During Phase I of this research activity special attention will be given to a literature review of U.S. experiences with indirect irrigation investment strategies. A draft paper summarizing these findings will be prepared. There will also be a start of identifying relevant literature from LDC experiences.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: E.W. Coward, Jr. Phone: (607) 256-5495

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Rural Sociologist	.25	---	---	---									.25
Agri. Economist	.25	---	---	---									.25
Graduate Student Agr. Engineering	1.0	1.0	1.0	1.0									4.0
Graduate Student Rural Sociology	1.0	1.0	1.0	1.0									4.0
												TOTAL	8.5

Project costs

01/07/85

Item				WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Faculty	.5 months	@	$6,000	$ 3,000	
Graduate Student	4 months	@	$ 532	2,128	
Graduate Student	4 months	@	$1,000	4,000	
Other Direct Costs				$ 750	
TOTAL DIRECT COSTS				$ 9,878	
Indirect Costs					
Cornell Indirect (Statutory On-Campus)				$ 4,175	
CID G&A				978	
TOTAL INDIRECT COSTS				$ 5,153	
TOTAL COST OF ACTIVITY				$15,031	
WMS-II Core Funds				$15,031	
Anticipated Carryover Funds				0	
Mission Buy-in Funds				0	

Special Studies

WORLDWIDE

January 7, 1985

Activity Title: Phase II - Comparative Analysis of Indirect Investment Strategies for Development of Small-scale Irrigation Works.

Code #3-04-054-85

Description: Comparative study of investment strategies based primarily on field studies conducted in Nepal and Indonesia and secondarily on a review of the literature on investment in small-scale irrigation systems. Data will be collected and analyzed to determine (1) how subprojects are initiated and what inputs are provided by governments as part of the indirect investment strategy; (2) what resources are mobilized by communities and what processes of local resource mobilization are used as part of this strategy; and (3) what are the irrigation specific consequences of this strategy.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: E.W. Coward, Jr. Phone: (607) 256-5495

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Rural Sociologist							.75						.75
Agri. Economist							.75						.75
Research Assoc.							1	1	1	1	1	1	6.0
Graduate Student Agr. Engineering					1	1	1	1	1	1	1	1	8.0
Graduate Student Rural Sociology					1	1	1	1	1	1	1	1	8.0
												TOTAL	23.5

Project costs 01/07/85

Item				WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Faculty	.75 months	@	$6,000	$ 4,500	
Research Associate	6 months	@	$3,637	21,822	
Graduate Student	5 months	@	$ 532	2.660	
Graduate Student	11 months	@	$1,000	11,000	
Travel					
Ithaca-Jakarta-Kathmandu				3,500	
Jakarta-Ithaca				3,200	
Kathmandu-Ithaca				3,200	
Internal Travel: Indonesia, Nepal				1,000	
Per Diem					
Ithaca	28 days	@	$ 65	1,820	
Jakarta	15 days	@	$ 112	1,680	
Kathmandu	15 days	@	$ 63	945	
Other Direct Costs:				700	
TOTAL DIRECT COSTS				$56,027	
Indirect Costs					
Cornell Indirect (Statutory on-campus 68.6%)				23,314	
Cornell Indirect (Statutory on-campus 69.5%)				10,932	
Cornell Indirect (Statutory off-campus)				1,280	
CID G&A				5,546	
TOTAL INDIRECT COSTS				$41,072	
TOTAL COST OF ACTIVITY				$97,099	
WMS-II Core Funds				$97,099	
Anticipated Carryover Funds				0	
Mission Buy-in Funds				0	

WORLDWIDE

Code No.: Information

Activity Title: Comparative Analysis of Indirect Investment Strategies for Development of Small-Scale Irrigation Works.

Description: Comparative study of investment strategies based primarily on field studies conducted in Nepal and Indonesia and secondarily on a review of the literature on investment in small-scale irrigation systems. Data will be collected and analyzed to determine (1) how subprojects are initiated and what inputs are provided by governments as part of the indirect investment strategy; (2) what resources are mobilized by communities and what processes of local resource mobilization are used as part of this strategy; and (3) what are the irrigation specific consequences of this strategy.

Institutions: Managing: CORNELL Cooperating: Participating:

Activity Coordinator: E. W. Coward, Jr. Phone: (607) 256-5495

PERSONNEL BY DISCIPLINE	FY-1986												
	1985			1986									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Rural Socio.	1.5	---	---	---	---	---	---	---	---	---	---	---	1.5
Agr. Econ.	1.5	---	---	---	---	---	---	---	---	---	---	---	1.5
Research Ass.	1	1	1	1	1	1	1	1	1		1	1	11
											TOTAL		14.0

Project costs

Item			WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs*				
Salaries & Benefits				
Faculty	3 months	@ $6,600	19,800	
Research Associate	11 months	@ 4,000	44,000	
Travel				
Ithaca-Jakarta-Kathmandu 3 trips @ $3,500			10,500	
Kathmandu-Jakarta			1,500	
Jakarta-kathmandu			1,500	
Internal Travel			4,000	
Per Diem				
Ithaca - 28 days @ $65			1,820	
Jakarta - 28 days @ $112			3,136	
Other Indonesia - 21 days @ $42			882	
Kathmandu - 28 days @ $63			1,764	
Other Indonesia - 21 days @ $20			420	
Other Direct Costs:				
Subcontracts with Indonesian, Nepali consultants			45,000	
Reporting, data analysis, documents			1,000	
Other			500	
TOTAL DIRECT COSTS			$135,822	
Indirect Costs				
CU Indirect (On-Campus: 69.5%)			57,412	
CU Indirect (Off-campus: 20%)			851	
CID G&A (9.9%)			15,822	
TOTAL INDIRECT COSTS			$ 74,085	
TOTAL COST OF ACTIVITY			$209,907	
WMS-Core Funds			$209,907	
Anticipated Carryover Funds			0	
Mission Buy-In Funds			0	

*For planning purposes, costs estimated for Nepal & Indonesia.

Special Studies

WORLDWIDE

Code No.: Information

Activity Title: Comparative Analysis of Indirect Investment Strategies for Development of Small-Scale Irrigation Works.

Description: Comparative study of investment strategies based primarily on field studies conducted in Nepal and Indonesia and secondarily on a review of the literature on investment in small-scale irrigation systems. Data will be collected and analyzed to determine (1) how subprojects are initiated and what inputs are provided by governments as part of the indirect investment strategy; (2) what resources are mobilized by communities and what processes of local resource mobilization are used as part of this strategy; and (3) what are the irrigation specific consequences of this strategy.

Institutions: Managing: CORNELL Cooperating: Participating:

Activity Coordinator: E. W. Coward, Jr. Phone: (607) 256-5495

PERSONNEL BY DISCIPLINE	FY-1987												
	1986			1987									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agr.Economist	1	1	1	1.25	1	1							6.25
Rur.Sociologist				.25									.25
Pol.Scientist				.25									.25
											TOTAL		6.75

Project costs

Item				WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs*					
Salaries & Benefits					
Professional personnel	.75 PPM	@	$6,750	5,063	
Research Associate	6 PPM	@	$4,400	26,400	
Travel					
Ithaca-Kathmandu-Jakarta	1 trip	@	$3,700	3,700	
Kathmandu-Ithaca	1 trip	@	3,000	3,000	
Jakarta-Ithaca	1 trip	@	3,500	3,500	
Per Diem					
Ithaca - 28 days @ $65					
Jakarta - 7 days @ $112				1,820	
Other Indonesia - 14 days @ $42				784	
Kathmandu - 7 days @ $63				588	
Other Nepal - 14 days @ $20				441	
				280	
Other Direct Costs:					
Subcontracts with Indonesian, Nepali consultants				15,000	
Report publication and preparation				3,500	
Other				1,000	
TOTAL DIRECT COSTS				$ 65,076	
Indirect Costs					
CU Indirect (On-Campus: 72.5%)				31,743	
CID G&A (9.9%)				6,443	
TOTAL INDIRECT COSTS				$ 38,186	
TOTAL COST OF ACTIVITY				$103,262	
WMS-Core Funds				103,262	
Anticipated Carryover Funds				0	
Mission Buy-In				0	

*For planning purposes, costs estimated for Nepal & Indonesia.

Activity Title: Rural Employment and Irrigation System Performance

Code #3-04-055-85

Description: Exploratory study of relationship between irrigation development and employment opportunities will include (1) review of existing literature, (2) examination of irrigation project and evaluation documents to determine their implied and/or actual employment outcomes, (3) contact with other individuals and agencies concerned with this relationship, and (4) examination of the association between irrigation and employment in conjunction with WMS-II and other international activities.

Institutions: Managing: CORNELL Cooperating: Participating:

Activity Coordinator: Phone:

PERSONNEL BY DISCIPLINE	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Grad. Student	1	1	1	1	1	1	1	1	1				9.0
Agr. Econ.	.25												.25
Rur.Socio.	.25												.25
												TOTAL	9.5

Project costs

01/07/85

Item				WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional Personnel	.5PPM	@	$6,000	3,000	
Graduate Student	9GSM	@	550	4,950	
International travel & per diem (supplemental)				2,000	
Other Direct Costs:				1,000	
TOTAL DIRECT COSTS				$10,950	
Indirect Costs					
Cornell Indirect (Statutory On-Campus)				4,116	
CID G&A				1,084	
TOTAL INDIRECT COSTS				$ 5,200	
TOTAL COST OF ACTIVITY				$16,150	
WMS-II Core Funds				$16,150	
Anticipated Carryover Funds				0	
Mission Buy-in Funds				0	

Special Studies

Revised 01/15/85

WORLDWIDE

Activity Title: Irrigation Systems Performance as Affected by Intensities of Management
Code # 3-04-056-85

Description: The purpose of this activity is to gain a better understanding of the appropriate intensity of management needed in specific irrigation systems and to develop procedures for determining levels of management appropriate to different system objectives and to a variety of environmental conditions. Intensity of management includes the following variables: extension of canal distribution system into the farming areas, allocation procedures, and water user organization. See attached proposal for detailed description. Continuation from FY-84.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: Randolph Barker Phone: (607) 256-2105

PERSONNEL BY DISCIPLINE	1984			1985									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agr. Economists	1	---	---	---	---	---	---	---	---	---	---	---	1
Agri. Engineers.	1	---	---	---	---	---	---	---	---	---	---	---	1
Grad.Student Ag. Economics	2	2	2	2	2	2	1	1	1	1	1	1	18
Grad.Student Ag. Engineering	1	1	1	1	1	1							6
											TOTAL		26

Project costs

Revised 01/15/85

Item		WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Professional Personnel	2 mos. @ $5,300	10,600	
Graduate Student	24 mos. @ $1,000	24,000	
Other Direct Costs:			
Computer rental		3,100	
Supplies & software		1,000	
Report production		2,500	
TOTAL DIRECT COSTS		$41,200	
Indirect Costs			
Cornell Indirect (Statutory on-campus 68.6%)		22,405	
Cornell Indirect (Statutory on-campus 69.5%)		1,931	
CID G&A		4,079	
TOTAL INDIRECT COSTS		$28,415	
TOTAL COST OF ACTIVITY		$69,615	
WMS-II Core Funds		$69,615	
FY-85 Core funding		$60,115	
Anticipated Carryover from FY-84*		9,500	
Mission Buy-In Funding		0	

*Code #3-04-096-84

This budget includes carryover from the FY84 budget which has been reduced by an offsetting amount.

ADMINISTRATION

January 7, 1985

CORNELL UNIVERSITY

Direct Costs	
Salaries and benefits	
Faculty salaries (1.75 months)	9,604
Support Staff	
Associate Coordinator (10 months)	30,225
Secretarial	28,600
Accountant	13,200
Editorial assistance	7,300
Travel	
Travel to JPMT and CPMT meetings	$ 6,200
Other administrative, program support travel	3,600
Per Diem	
JPMT and CPMT meetings	$ 2,000
Other administrative	1,125
Equipment	0
DBA Insurance	1,000
Other Direct Costs	19,565
TOTAL DIRECT COSTS	**$122,419**
Indirect Costs	
Cornell Indirect (Endowed on-campus) MTDC = $5,500	3,333
Cornell Indirect (Statutory on-campus 68.6%) before July 1, 1985 (MTDC = $70,687)	45,840
Cornell Indirect (Statutory on-campus 69.5%) after July 1 (MTDC = $35,643)	23,221
CID G&A	12,119
TOTAL INDIRECT COSTS	**$ 84,513**
TOTAL COST OF ACTIVITY	**$206,932**

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FY 85 USU ADMINISTRATIVE BUDGET

Code #0-02-997-85

ITEM	Overall Univ Admin.	Intellectual Mgt/Networking	SERVICES TO SUBACTIVITIES Short-term & SS	Long-term field per.	Total Time	Expense
Professional Staff						
Jack Keller	1.50 PPM	1.50 PPM	0.50 PPM	0.50 PPM	4.0 PPM	
Bryant Smith	2.25 PPM	0.75 PPM	4.50 PPM	2.00 PPM	9.5 PPM	
Gaylord Skogerboe	0.50 PPM	----	0.50 PPM	----	1.0 PPM	
	4.25 PPM	2.25 PPM	5.50 PPM	2.50 PPM	14.5 PPM	$ 72,138
Support Staff						
Secretary	4.00 SPM	----	7.00 SPM	1.00 SPM	12.0 SPM	
Production Typist	----	----	11.75 SPM	0.25 SPM	12.0 SPM	
Staff Accounting	6.00 SPM	----	0.50 SPM	1.50 SPM	8.0 SPM	
	10.00 SPM	----	19.25 SPM	2.75 SPM	32.0 SPM	$ 48,000
Reserve Students	3.00 SPM	----	2.00 SPM	1.00 SPM	6.0 SPM	$ 7,200
Domestic Travel	80%	20%				$ 13,000
6 trips/Wash. DC						
4 trips/Ithaca, NY						
6 trips/Ft. Collins						
Office Expenses						
Word Processor Maintenance Contract						$ 3,051
Supplies, phones, etc						$ 20,900
TOTAL DIRECT COSTS						$164,289
USU Overhead						$ 52,572
CID G&A						$ 16,265
TOTAL INDIRECT COST						$ 68,837
TOTAL BUDGET						$233,126

New WMS II Core Funds . . . . . $ 233,126

DATE: 01/15/85

Code #: 0-02-998-85

Activity Title: CSU ADMINISTRATION

Description: Administrative support to carry out project activities.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Wayne Clyma, Dan Lattimore Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	1.00
Civil Engineer	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	1.00
Economist	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	1.00
Agronomist	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	1.00
Social Scientist	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	1.00
Tech. Journ.	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.32	4.50
Agri. Eng. - UPD	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	3.00
Adm. Officer	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.00
Accountant	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.00
Secretary	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	5.40
Sr. Typist	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.00
Typist	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00
													47.90

Project Costs:

Item			WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs				
Salaries (includes benefits)				
Professional-UPD	3.00 PPM	at 5,065.00	15,195.00	
Professional-AUPD	4.50 PPM	at 3,770.00	16,965.00	
Professional-AIMS	5.00 PPM	at 4,123.00	20,615.00	
Support-Adm. Officer	6.00 PPM	at 3,063.00	18,378.00	
Support-Accountant	6.00 PPM	at 1,885.00	11,310.00	
Support-Secretary	5.40 PPM	at 1,767.00	9,542.00	
Sr. Typist	6.00 PPM	at 1,885.00	11,310.00	
Typist	12.00 PPM	at 1,296.00	15,552.00	
Travel - Within USA	17.00 trips	at 500.00	8,500.00	
Per Diem - Within USA	34.00 days	at 100.00	3,400.00	
Other Direct Costs				
Materials & Supplies			6,000.00	
Communications			10,000.00	
Computer Time (Word Processors & Main Frame Computer)			5,250.00	
Printing & Copying			5,000.00	
Misc.			1,750.00	
TOTAL DIRECT COSTS			$ 158,767.00	
Indirect Costs				
University Overhead 36% of Direct Costs			57,156.00	
CID - G & A - 9.9% of Direct Costs			15,718.00	
TOTAL INDIRECT COSTS			$ 72,874.00	
TOTAL COST OF ACTIVITY			$ 231,641.00	

ADMINISTRATION

DATE: 01/15/85

Code #: 0-01-999-85

Activity Title: EPD

Description:

Institutions: Managing_____ Cooperating_____ Participating_____

Activity Coordinator: Phone: ( )

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
EPD	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00
Assistant	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.00
Secretary	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00
													0.00
													0.00
													0.00
													0.00
													0.00
													0.00
													30.00

Project Costs: Item			WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs				
Salaries (includes benefits)				
Professional-EPD	12.00 PPM	at 5,750.00	69,000.00	
Support-Assistant	6.00 PPM	at 4,000.00	24,000.00	
Support-Secretary	12.00 PPM	at 2,200.00	26,400.00	
Travel			10,000.00	
Other Direct Costs				
Rent			15,000.00	
Utilities			3,000.00	
Computer Support			4,000.00	
Misc. Office Support/postage/comm.			4,000.00	
TOTAL DIRECT COSTS			$ 155,400.00	
Indirect Costs				
University Overhead			18,975.00	
CID - G & A			17,435.00	
TOTAL INDIRECT COSTS			$ 36,410.00	
TOTAL COST OF ACTIVITY			$ 191,810.00	

WMS II Core funds	$ 191,810.00
Funded by Admin. Fee	$
Mission Buy-in Funds	$

PART III -- PLANS FOR WORLDWIDE ACTIVITIES

UNIVERSITY INITIATED ACTIVITIES

Microcomputer Workshop - 2-14-032-85

Colorado State University

January 16, 1985

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DEVELOPMENT OF MICROCOMPUTER WORKSHOP

For the past few years, the Third World countries have been quite interested in utilizing microcomputer technology whenever it is appropriate. In late 1981, an international survey of microcomputer use in developing country institutions was conducted by Noel Berge et al. The survey yielded a total of 34 countries where individuals, programs or projects have found a use for microcomputers in development projects. Some of the specific applications of microcomputers in the Third World countries can be found in the works of Berge, 1982; Bertoli et al., 1981; Edoo, 1982; Mann, 1982; Pinckney et al., 1982; Radnor, 1982; Sadowsky, 1982; Steele, 1982; Kettering, 1982; and others.

The purpose of this activity is to develop an integrated program of application of microcomputer software to improve water management capability of host country institutions and professionals. The specific objectives are provided below. Specifics of the workshop will be developed for a particular country depending upon its needs.

Work Objectives

- To develop a short training course in Indonesia or India on application of microcomputer software in water management to enhance the capacity of the host country in evaluating irrigation systems performance and to provide rapid data analysis for more responsive results.

- To integrate the above materials into the project's other training programs overseas.

- To utilize the training materials as building blocks for the computer component of technical assistance activities such as the Long-Term Irrigation Systems Studies in Sri Lanka and the Command Water Management Planning Project in Pakistan.

Proposed Tasks

To develop a workshop on application of microcomputer software in water management in a developing country. Specific topics will include the following:

- General overview of microcomputer software development as applied to water management.

- Summary of microcomputer software available on the market.

- Selecting the proper software and hardware (microcomputer and its peripherals) to meet particular research needs in water management.

- Demonstration of specific software developed and selected by WMS II for water management applications in engineering, agronomy and the socio-economic disciplines.

- Suggestions for developing or selecting an integrated data-base management system to meet data processing, analysis, and storage needs for the host country's water management projects such as the

needs for the host country's water management projects such as the High Performance Sederhana Irrigation System Project and the Small-Scale Irrigation Project in Indonesia, the Long-Term Irrigation Systems Studies in Sri Lanka, and the Command Water Management Planning Project in Pakistan.

A tentative schedule for conducting this workshop is May-June 1985. As for selecting the participants, we will work with the USAID Mission and the host country institutions to identify and to invite the individuals who have expressed interest in using microcomputer software in water management to attend the workshop. The workshop will be free-of-charge to the invited participants, but travel and per diem will be up to the host country institutions or the USAID mission. This workshop activity is subject to a mission approval before it is executed.

All four disciplines (engineering, agronomy, sociology and economics) at CSU will develop training materials for the workshop so that they can be used for other workshops, project evaluations, sector reviews, and other project activities focusing largely on "How to process and analyze your data with a microcomputer to determine the performance of irrigation systems."

By having a microcomputer with appropriate software in the recent India DA workshop, the training team found the quality of collected data was improved compared to previous workshops. The trainers and trainees were able to analyze the collected data on a continuous basis during the field study period. The analyzed results, from the data collected from the day before, served as feedback for the trainees to improve performance of their data collection on the subsequent days. This corrective activity would not have been possible for the participants to accomplish on a day-by-day basis without the microcomputer. The tasks of data processing and analyses were greatly simplified. In fact, the trainers and co-trainers were able to complete the data processing and preliminary analyses by the end of the six-week workshop for the first time. Based on these facts and the fast growing use of microcomputers in developing countries, we feel it is very important to include this subject as a part of the regular training.

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UNIVERSITY INITIATED ACTIVITIES

Rehabilitation Seminar Planning

2-05-033-85

Colorado State University

February 1985

A Seminar on Improving Irrigation Water Management Through System Rehabilitation

Background and Statement of the Problem

The recognition of need for increasing food production by increasing the irrigated land area has led to massive investment in irrigation infrastructures over the past 35 years. From a large number of post project assessments in the 1970s, it became apparent that the performance of these irrigation systems had generally averaged less than 50 percent of the anticipated outcomes. Part of this discrepancy between the potential and actual performance of these irrigation systems was attributed to poor delivery, distribution, utilization, and removal of the irrigation water, and inadequate provisions for interacting social, economic, and biological factors. As a result, from the late 1970's onward, a shift in emphasis toward improving existing irrigation systems instead of establishing new facilities occurred. Further, the potential for improving the efficiency of an irrigation system through better management is recognized.

A great deal of effort by various developing countries with the cooperation of international agencies has been made in the past 15 years to identify irrigation water management related problems and viable solutions to those problems. The efforts made and knowledge acquired in this area has, however, remained fragmented. The concepts and objectives of irrigation water management, the priority areas of focus where substantial improvement can be made (main system versus farm system), and the methods of dealing with the problem (structural versus software improvement) proposed by various experts in irrigation water management are based mostly on individual experiences of the projects and activities.

The process of learning and generalization from field experiments have been slow in the face of growing urgency to deal with the problem. The need to speed up the process of diagnosing the irrigation water management problems of an irrigation system and prescribing practical solutions instead of long-term experimentation needs to be addressed. While there is a good opportunity to make progress in this area, we must also be cognizant of the complexity and differences between irrigation systems and hence, the difficulty of arriving at a universal list of irrigation water management problems and solutions to prescribe. The Development Model utilized by the Water Management Synthesis Project has considerable potential for contributing to this area of endeavor. This approach is currently being employed in Egypt, India, Sri Lanka, and Pakistan.

The state of the science of irrigation water management was appropriately described by Wickham and Vallera in ADC-SEARCA-IRRI water management seminar in 1976:

> "While it is generally agreed that better water management is needed, it is not clear what is required to achieve it. What do we really mean by improving water management, and how can it be achieved?" (IRRI, 1976)

While a number of management solutions to common maldistribution problems have been reported (Early, 1980). The degree to which these socio-technical solutions are generally applicable remains open to question. In the mid-1980's, after a large number of studies and field experiments, considerable opportunity for furthering understanding of concepts, theories, and methods of irrigation water management has remained.

A recent discussion paper by David Seckler titled, "The Management of Padi Irrigation System: A Laissez-Faire, Supply Side Theory," questions the state of knowledge even in theory for identifying the objectives, tasks and results of alternative management system in padi irrigation. He pointed out the strong propensity that exists for applying theories of irrigation management developed for other irrigated crops (OICs)--like maize, wheat, etc.--to paddy as though the two were the same. The points raised by Seckler in this paper are primarily thought-provoking and have generated response by a number of water management experts (Frances Korten, letter, January 3, 1984; David Robinson, memorandum, January 13, 1984; Mark Svendsen, memorandum, January 30, 1984).

Roberto Lenton's paper, "Management Tools for Improving Irrigation Performance" has stressed the need for developing tools which can take the guesswork out of irrigation management, and make the management of the irrigation systems less of an art and more of a science. With this acknowledgment, Lenton proceeds with his contribution to developing a field of irrigation water management.

Throughout the years the investigators in irrigation water management have documented their interpretation of what is meant by improving irrigation water management, how the irrigation water management problems can be dealt with, how the improvements from water management can be measured, and areas in need of further research in various project reports and journals. Such a scattered documentation of findings of various experiments and proposed strategies have, however, not been sorted and synthesized in a manner that can speed up the science of irrigation water management through its paradigm stage (existence of examples of actual scientific practices--examples which include theory, application, and instrumentation together--provide models from which spring particular coherent traditions of scientific research)

There is a strong need for identifying major program areas in need of development and information gaps that exist currently in irrigation water management and for identifying the appropriate programs and irrigation water management experts that have the opportunity to further the knowhow in those specific areas. A number of areas where attention needs to be focused include:

1. Determining the optimal combination of improvement in hardware (structural) and software (management) technologies for improving the performance of an irrigation system.

2. Establishing an effective organizational structure and communication pattern between irrigation system management and farmers.

3. Identifying the problems and issues involved in rehabilitating the irrigation system.

4. Assessing the need and devising methods for improving the data base in irrigation water management upon which irrigation water management projects can be formulated and the subsequent improvements achieved measured.

5. Improving the technique for identifying the specific outcomes of an irrigation water management project and the appropriate parameters which can be measured to assess the degree to which the proposed objectives were achieved.

6. Identifying the training needs for the irrigation system designers, system managers, and field staff and an assessment of the adequacy of the existing training programs.

7. Assessing the degree of difficulties encountered in conducting irrigation water management programs due to the involvement of several different institutions in water management and identifying the appropriate means for bridging the institutional divisions which have been established.

8. Assessing the nature of difficulties encountered in promoting irrigation water management programs due to the type of role assumed by the assisting international organizations as opposed to developing countries counterpart agencies.

9. Identifying the opportunity that exists for improving the coordination of efforts by various international organizations involved in irrigation water management programs and the potential it will have in minimizing the replication of errors in planning and conducting water management projects. Accumulation and synthesis of experiences and knowledge gained across countries and international organizations can greatly boast the art of water management.

10. Assessing the success of strategies proposed and implemented in reorganizing, training and equiping the appropriate government agencies to more effectively pursue the irrigation water management program.

The on-going and planned activities of the Water Management Synthesis Project should contribute toward meeting a number of the priority research and training needs. However, a systematic approach for synthesizing and expanding the body of water management knowledge that would ultimately enhance the success of the irrigation water management programs needs to be identified and pursued.

The need for this activity is correctly identified in the scope of work of the technology transfer component of the Water Management Synthesis Project. Systematic gathering and dissimination of lessons learned is emphasized as an important task of the project. Specifically, it is stated that,

"...there is a need for:

- Systematically building into all projects a memory mechanism to identify technologies and procedures with likely transfer potential across the regions.

- Developing a means to meet the water management knowledge transfer needs in the LDCs.

- Establishing regional on-going water management improvement seminars/workshops that would meet regularly, in an asian country, with the specific objective of transferring water management knowledge."

As part of the WMSII contribution to this overall effort, Colorado State University will conduct a workshop on Improving Water Management Through System Rehabilitation. System rehabilitation is one area where the developing countries have placed a great deal of emphasis for improving water management and increasing productivity. The international development organizations are responding to this need by the provision of grants and loans. The state of knowledge in this area has, however, fallen behind the planned implementation activities.

Seminar Objectives

In view of the above stated needs this seminar will bring together leading experts in an attempt to state, elaborate and synthesize the existing body of knowledge on system rehabilitation. This would aim at providing guidance for the upcoming rehabilitation projects and identification of critical research areas.

First, a thorough literature search will be conducted and a state-of-the-art paper on rehabilitation of the irrigation system prepared. The insight gained from this process will lead to the identification of the specific topics to be addressed in the seminar. A number of specific topics on system rehabilitation that can be addressed by this seminar are listed below.

A. Types of studies required for identifying problem areas faced during the rehabilitation process. This may include:

1. Redesign of the major system based on soil and topographical surveys, crop water requirements, suitable farm stream size, and community needs.

2. Evaluation of the organizational structure to provide for the proper management of the main system in an equitable manner. Include farmer involvement.

3. Identification of basic repairs needed in the main system and provide appropriate control and measuring structures.

4. Identification of alternative methods for initiating farmer participation in irrigation system organizations where none has previously functioned.

5. Farmer involvement in on-farm improvements such as design and construction of field channels, land leveling and use of appropriate surface irrigation methods.

B. Topics that should be addressed regarding the development of data base and the monitoring and evaluation of rehabilitation projects may include:

1. Baseline studies that should be made prior to rehabilitation.

2. The advisability of introducing a farm record keeping system to obtain data for enterprise budgets and benefit cost analysis.

3. Determination of production results before and after renovation.

C. The seminar should address the combination of management and structural improvements that should be made and whether improvement in the system management should

proceed, be carried out concurrently, or follow the structural improvements.

D. The role for extension and training agents that should be considered when conducting a rehabilitation program.

Planning Phase of the Irrigation System Rehabilitation Seminar

The planning phase of the seminar will commence in March 1985. An appropriate date for conducting the seminar will be selected, but it will not happen before FY86. The planning phase is designed to conduct a thorough literature search on the rehabilitation of irrigation systems and to prepare a state-of-the-art paper. Subsequently, the specific topics addressed at the seminar and the participants who have relevant experience and expertise will be identified. In the meantime, the World Bank and the Asian Development Bank, which are heavily involved in financing rehabilitation projects around the world, will be contacted to see if they would co-sponsor or otherwise participate in the seminar. The new International Irrigation Management Institute has expressed interest in participating in such a seminar.

The literature search and state-of-the-art paper on irrigation system rehabilitation will be the result of coordinated effort of several individuals from various disciplines. This task will be assigned to the individuals on the basis of their discipline and country expertise and their association with institutions that can provide the information required. Progress and consistency will be assessed during team meetings throughout the information-gathering and report-writing phase. This report should compile and synthesize information on what has transpired in the past several years regarding the need for rehabilitating irrigation systems, the projects undertaken, difficulties encountered, rehabilitation strategies tested, lessons learned, and the future prospects for rehabilitation of irrigation systems. The focus of this report will be further defined following an assessment of the availability of information and value of the information to institutions and individuals concerned with system rehabilitation.

Appropriate individuals in the World Bank and Asian Development Bank who fund and assess rehabilitation projects will be contacted to locate relevant documents and reports for the state-of-the-art paper. IMMI is currently hiring a group of experienced water management specialists who could contribute to the seminar objective. Another valuable source of information and expertise in this area are researchers and project implementors attached to government organizations and universities in the developing countries where extensive work in the rehabilitation of the irrigation system is carried out and/or being planned.

The planning phase will proceed as follows:

1. Identify three to four individuals from the WMSII Project who have expertise and interest in system rehabilitation to plan and actively participate in the literature search and prepare the state-of-the-art paper.

2. Contact appropriate individuals at World Bank and Asian Development Bank and explore their interest in co-sponsoring the seminar.

3. Meet to identify the appropriate areas to include in the state-of-the-art paper and sources of information. Also, define the details for carrying out this activity and the responsibilities of the team members.

4. Identify and contact five to ten individuals with expertise and experience in system rehabilitation from various international donor and research organizations, and governments of the developing countries where irrigation systems are being rehabilitated. Active participation of these individuals in pooling together relevant information will be sought. Analysis and interpretation of the information gathered by some of these experts may lead to the papers which they will present in the seminar.

5. Commence the literature search. This will be done primarily by mail correspondence and phone communications.

6. Prepare a state-of-the art paper.

7. Present findings to CPMT and AID/Washington and discuss what was learned from the literature search and the state-of-the-art paper. Then identify the participants and the topics to be addressed in the seminar.

8. Revise and submit proposal for the Irrigation System Rehabilitation Seminar for FY 86, if needed to readjust funding.

This comprehensive first phase which allows for a thorough literature search in irrigation system rehabilitation and preparation of the state-of-the-art paper will result in a systematic identification of priority topics and water management experts for the subsequent seminar. The state-of-the-art paper can be a valuable source of information for the organizations and individuals concerned with the rehabilitation of irrigation systems.

Conducting the Seminar

The four-day seminar will bring together about 20 participants from the United States, developing countries, and international organizations involved in system rehabilitation projects. The seminar will be held in FY 86. The specific date for the seminar, location, and co-sponsors will be identified in the planning phase.

The World Bank and Asian Development Bank, which are heavily involved in funding rehabilitation projects, will be contacted for possible co-sponsorship or participation in the seminar.

The proceedings of the seminar will be published as a report. This publication will consist of three segments. The first segment will present a synthesis of the experiences and views expressed on specific topics. A listing of areas that require further investigation will be presented in the second section and the papers presented in the seminar will be placed in the final section of the report.

Funding

Phase One of this activity, which entails a thorough literature search, preparation of a state-of-the-art paper on rehabilitation of the irrigation systems, and planning for the seminar will be funded by the WMSII. The state-of-the-art paper will in itself be an invaluable output of this phase.

The funding allows for partial involvement of three WMSII professionals. Allowance is also made for hiring international consultants who have considerable experience in planning and implementation of rehabilitation projects. Editorial and secretarial support is needed for the preparation of the state-of-the-art paper.

The budget for conducting the seminar in FY86 includes major cost items that can be anticipated at this time. Due to possible contribution of other sponsoring agencies, the actual cost incurred by the WMSII Project for conducting the seminar may be considerably smaller. Following the commitment of co-sponsors for this activity, a revised budget projecting the activity cost for WMSII will be prepared and submitted for FY86 funding.

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01/08/85

Code # 2-13-048-85

WORLDWIDE: "REHABILITATION": A GAME SIMULATION FOR PARTICIPATION IN IRRIGATION DEVELOPMENT

Cornell University

In 1981, Cornell University consultants with the Agrarian Research and Training Institute (ARTI) in Sri Lanka, prepared a game simulation at the request of the Sri Lankan Ministry of Lands and Land Development. The purpose of this game was to help prepare technical staff to work with farmers in a participatory mode on rehabilitation of the Gal Oya irrigation system. Those involved with the initial development of the game were Douglas Merrey, Piyasena Ganewatte, D. Hammond Murray-Rust, Norman Uphoff, Edward Vander Velde, and Lakshman Wickramsinge.

About 32 persons, including engineers, administrators, and others, participated in the initial version of the game and found it both engaging and instructive. At that time, possibilities for elaborating and generalizing the game were discussed, but there was no immediate followup. Subsequently, AID/Delhi, has shown interest in having this or a similar training device developed for use in India. In April, 1984, Dr. Vander Velde prepared a draft for the game simulation for review and comment (see Appendix).

Elaboration of a final and more generally applicable version of this game will require approximately one and one-half months of Dr. Vander Velde's time and one month of Dr. Uphoff's time. This would be used responding to comments by the games initiators and others, developing a flow chart of the "play of the game", collecting more examples of farmer questions for a variety of contexts, and to make map data available to game participants through the use of a computer graphics program or other device. In addition to Vander Velde's and Uphoff's time, completion of this game will require access to a micro computer with good graphics capabilities and to typing and duplicating services. It is anticipated that the revised and generalized game would have wide utility in training and orientation programs for program planners and implementation staff.

Since Colorado State University proposes to organize a workshop to examine lessons learned in planning and implementing rehabilitation programs, it is proposed that the revised rehabilitation game be "played" and discussed as one of the activities of that workshop. This game can also be tested in conjunction with USU's International Irrigation Center courses.

The draft of the simulation follows in an appendix.

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APPENDIX: PARTICIPATION IN IRRIATION DEVELOPMENT: "REHABILITATION" A GAME SIMULATION (DRAFT)

by

Piyasena Ganewatte
D. Hammond Murray-Rust
Norman T. Uphoff
Edward J. Vander Velde
Lakshman Wickramasinghe

Introduction

Irrigation system rehabilitation usually is not a primary rural development objective in itself. Rather it is typically a means for creating a better foundation for improving system and farmer management of the scarce and valuable water resource, so often a prerequisite to sustained increases in overall agricultural production. No less than any other rural development activity, a successful irrigation rehabilitation project means meeting real rural problems and issues with technically appropriate and socially desirable solutions. If irrigation system rehabilitation is planned and implemented in such a way as, for example, to reduce farmer cooperation and participation in rehabilitation, or to diminish farmers' willingness to accept responsibility for improving operation and maintenance of the rehabilitated system at field and field channel level, major rural development objectives are less likely to be realized, and the return to the major financial investment in system rehabilitation will be substantially diminished. To the extent that project knowledge needs can be accurately and satisfactorily identified, that the information necessary is obtained and incorporated into project planning, and that a process is developed whereby the resulting project design is implemented in an effective, flexible and participatory manner, actual irrigation rehabilitation will proceed more smoothly. Moreover, the result is likely to be an irrigation system that can be managed more efficiently and equitably, and then can assist farmers in achieving important increases in agricultural output. Irrigation system rehabilitation thus becomes a <u>means</u> to the end of improved water management and increased agricultural production, as well as enhanced human well-being.

The game of "Rehabilitation" has been designed to simulate many of the conditions and problems likely to be encountered in planning for and implementing the rehabilitation of an existing irrigation system. Its purpose is to assist those involved in irrigation development to increase their awareness and understanding of both the knowledge needs and the process variables which are likely to affect the successful implementation of irrigation system rehabilitation projects. Game participants are challenged to anticipate and to try to resolve (or provide a basis for resolving) as many problems as possible that typically may emerge in designing an irrigation rehabilitation project; in so doing, they will improve their skills in identifying knowledge needs, formulating good plans and designs, and developing appropriate strategies for solving problems. Thus, there are likely to be (1) fewer problems in project implementation, (2) more favorable prospects for securing farmer cooperation and participation in the project, and (3) increased opportunities for farmer acceptance of responsibility for efficiently operating and maintaining their part of the system after project completion.

"Rehabilitation" incorporates many—but by no means all—of the real conditions and problems likely to be encountered in the rehabilitation of an existing irrigation system. The system used by the authors in designing the game is Gal Oya in Sri Lanka, specifically the Left Bank system of the Gal Oya Irrigation Scheme. However, the Distributary channel system and command area used in the game is hypothetical, and we have named it Any Branch (AB)-99. The characteristics we have given it are a composit of real conditions that have been found in a variety of locations throughout the Gal Oya Left Bank system and which we know from extensive field experience also exist to a greater or lesser degree in many large and small gravity flow irrigation systems throughout Southern Asia.

To be sure, it is unlikely that the full complexity of conditions created for AB-99 would be found in any single distribution channel system. However, they have been combined here in order to give participants exposure to the range of field conditions that may be encountered in any irrigation rehabilitation project. In doing so, we have attempted to generalize "Rehabilitation" so that it can be useful as a training activity for various groups of irrigation engineers (from both the design and field operation sides), government officers (at both district and central ministry levels), and other professionals (consultants, development assistance project officers, researchers, etc.) who typically are involved in both planning and implementing irrigation rehabilitation projects.

The Game

There are four distinct sequential phases to the game of "Rehabilitation". Briefly summarized, they are as follows:

1. The first phase is called Pre-Design. At this time, an initial assessment of conditions and problems within the command area of a specific distribution channel system to be rehabilitated is carried out. Information needs are identified and strategies for obtaining the needed information (surveys, meetings with farmers, etc.) are determined.

2. At the Design stage in the game, participants are engaged in drawing up a design or plan for the system to be rehabilitated. This plan may include a new configuration of channels, control structures, and/or elements of system infrastructure (canal roads, bridges, etc.) as determined to be necessary for improved irrigation and water management in the command area. Once the design has been completed it is presented to farmers in the next phase.

3. In the Communication phase of the game, farmers' acceptance of the rehabilitation plan for the distribution channel system is sought. This is simulated as occurring at a meeting between all farmers served by the system and irrigation engineers who are assisted by other involved government officials. Following a "presentation" of the rehabilitation plan, farmers will have the opportunity to seek further information about the plan or to raise problems and issues in the irrigation service area that may or may not have been anticipated in developing the plan. Clearly, the results of this phase may indicate the need for some design changes, and these can be made in the final phase of the game.

4. Rehabilitation is the last phase of the game. If the problems or issues raised by the majority of farmers in the area are not resolved satisfactorily, it is unlikely that farmers will cooperate and participate in improving water management, or in better system operation and maintenance once rehabilitation has been completed. Thus, the objective here is to determine how many of the potential problems in the system to be rehabilitated have been anticipated by the project design as well as to ascertain the way(s) game participants propose to resolve these problems.

Of course "Irrigation Rehabilitation" is not a game in the traditional sense of competition between players among whom one or a few will "win" while the others "lose". Rather, it is a non-competitive simulation of part of the rural development process—in this case focused upon irrigation development—in which all participants will "win". By increasing their understanding of the ways in which the initial phases of a development project are interrelated, by learning to develop the means to incorporate local knowledge and experience into the project planning process, and by heightening their sensitivity to issues and problems that are likely to be crucial to securing community participation and cooperation in the implementation and operational stages of development projects, all players become winners.

Playing the Game

The game is best played in groups of 5 to 7 persons, and for effective de-briefing and inter-group comparison of results achieved, it is generally desirable to limit the number of groups playing at any one time to 4 or 5. Group composition should be a mix of persons involved in rural development—in rural development—particularly irrigation rehabilitation—programming, representing a diverse set of skills (both technical and non-technical) and responsibilities (e.g. planning, design, administration, operations). The inclusion of a variety of backgrounds, roles and statuses in each group contributes to both more effective problem-solving and learning, while more nearly replicating the actual conditions or irrigation rehabiltiation project development and implementation.

The first phase of the game, Pre-Design, is initiated by a Discussion Leader who provides detailed instructions for the game and possesses all the available information regarding the system to be rehabilitated. However, after the completion of the Pre-Design phase, responsibility for leading group discussion and problem-solving in subsequent phases passes to other members of the group. They are usually the more technically-trained players, and the assumption of a leadership role at this stage rather accurately simulates the key position that engineers or other technical professionals have in irrigation project formulation and implementation. The Discussion Leader assumes the supporting role of a resource person and also functions as a sort of "referee", helping the activity to move along on a planned schedule and interpreting game instructions.

It is important for teams to proceed through the play of the game with a sense of realism, acknowledging that there are practical constraints such as budget, personnel and schedule, as they develop their rehabilitation project design, and recognizing that not all problems will be solved in the process. It is realistic to expect that some problems cannot be anticipated and others will remain unsolved, perhaps because of these constraints. Improving

understanding of how constraints affect problem-solving and the achievement of project goals is as much an objective of the learning process intended for the game as is increasing sensitivity to issues and problems that are critical to community cooperation and participation in the rehabilitation project.

Because the game has been designed to facilitate a learning process for all of those involved, it is "open-ended", i.e. there is no single, pre-conceived "right" or correct solution for rehabilitating our hypothetical irrigation system. Just as in real life, we can not know in advance which solution is going to give the most satisfactory results. Instead, we have to utilize the best judgement of our most knowledgeable and experienced personnel to anticipate and assess the likely consequences of our actions. Thus, each group will evolve its own approach and solutions to irrigation rehabilitation, based upon the information it seeks and has, as determined by its members. There may be several appropriate answers or solutions to the different rehabilitation problems that will be encountered, and multiple approaches to problem-solving are quite possible. The variety of outcomes or proposed solutions will, itself, further facilitate group learning.

Pre-Design Stage

The key event of the Communication phase is a meeting with the farmers served by the AB-99 system. At this time, the rehabilitation plan and design will be presented to them, and their ideas about and agreement with the project will be sought. Communication begins with each team choosing another one of its members—again most likely, but not necessarily, a technically-trained person—to assume leadership in developing a strategy for sucessfully communicating the rehabilitation plan to the farmers. All members of the team should actively contribute to formulating this communication strategy; what should be said, and how it should be said will need to be discussed in some detail before the group can reach agreement on this important subject. Once a communication strategy with farmers has been determined, an element of 'chance' which simulates reality is introduced into the game.

In the "real world", of course, we can never know in advance how many questions will be raised or suggestions made by farmers in response to a proposed rural development project. We do not know how many farmers will come to a meeting where a project is to be explained and discussed. We do not know which farmers will speak out, nor can we be sure that those who do will represent the range of problems, issues and suggestions that actually exist within the rural community concerning the proposed project. We do know, however, that it is highly unlikely that all problems and issues will be raised in such a farmers' meeting. We also know that we probably have anticipated some of the farmers' problems and satisfactorily dealt with them by getting enough information at the Pre-Design phase to incorporate appropriate solutions into the project design. Finally, we know that problems and issues that have not been identified and considered in the various phases of project development are almost certain to emerge during project implementation with consequences that more often are undesirable than not. Therefore, a process which helps to identify as many of these problems and issues as possible before plans and designs are finalized and project implementation initiated is essential; communication and dialogue with farmers is one important element of that process.

We simulate the reality of communication and dialogue at a farmers' meeting with a roll of a pair of dice. The number rolled will be the number of questions that will be drawn from a prepared set of "Farmers' Questions". Each question will be considered by the team, as though it had been asked by a farmer in a public meeting, and the team members should determine whether or not the problem or issue has been satisfactorily resolved in the first three stages of project development. If not, then the team should decide if the problem can be resolved by some agreed upon project redesign, or if it remains unresolved because either insufficient information was available, agreement upon a solution could not be reached within the group, or no solution appears to be available. The team's discussion leader should then summarize the group response to each farmer's question that was "asked".

The final phase, Rehabilitation, is affected by the planning and communication activities that have preceeded it. At this stage, all teams convene together, each with its rehabilitation plan and design, a stated communication strategy for presentation of the project to farmers, and a summary of responses to each of the questions "asked" by farmers. With the Discussion Leader serving as coordinator, teams will share their experiences in rehabilitation project development and problem solving. The objective here is to better understand, through a comparison and joint discussion of team results, how events in the Pre-Design, Design and Communication phases may interact to affect actual system rehabilitation as well as future operation and maintenance of the irrigation system. We are particularly interested in determining how many of the potential problems and issues that could emerge in this irrigation development project have been anticipated by our teams, and in clarifying a process whereby project implementation is likely to be more participatory, flexible and effective.

Phase 1: Pre Design

After groups or teams have been organized, the Discussion Leader will provide the group several copies of a sketch map showing the layout of the irrigation system, AB-99. The sketch map replicates information commonly available in many irrigation departments.

Each team member will then have about 5 minutes to write down the information that he or she thinks the group should have available to it before beginning Phase 2, Design of a rehabilitation project for AB-99.

Teams next should discuss, as a group, each member's information, suggestions and formulate a team list of information to be obtained in this Pre-Design phase. No more than 20 minutes should be taken for this step.

Once the team list of information has been decided upon, the Discussion Leader will give specific information about AB-99 as requested. This will provide the basis for team activity in the next phase, Design. (Note: if certain information desired by the team is not available from the Discussion Leader, the team should develop a strategy for obtaining it; alternatively, the Discussion Leader may make an ad hoc determination of the information and inform the team accordingly.) Up to 20 minutes may be necessary for this step.

Teams now proceed to Phase 2.

Materials: pencils, colored felt-tip markers or pens, and paper; layout maps/plans for AB-99.
Time: 45 minutes maximum.

Phase 2: Design

Each group now must identify a member who will function as the team leader; a member with engineering or other technical skills may be particularly useful in this role, however, this is not an essential requirement. The Discussion Leader now functions as a resource person to clarify any points of confusion that may arise and to keep the game moving along.

Using information obtained in the just completed Pre-Design phase, each group should proceed to develop a plan for rehabilitating AB-99. In order for the rehabilitation project to meet the primary goals of improving water management in the irrigation system and increasing capacity for greater agricultural production, the project design should meet several criteria which are summarized in the following paragraphs.

It is important that water be distributed more equitably throughout the command area of AB-99, particularly to get sufficient quantities of water to the tail-end of the system. To facilitate this objective and also to increase system water control, the new design will eliminate any direct irrigation of fields from either the main or distributary channels. Instead, all fields will be served from field channels and each farmer will have a single outlet for irrigating his farm; this probably will require laying out and constructing some new field channels. Whether or not all field channels should service a similar size area is a design decision to be made by the team.

To ensure improved water distribution throughout the system, attention also must be given to drainage areas and drainage channels. Land irrigated by drainage water should be considered part of the irrigation system.

It has been decided that the Irrigation Department will be responsible for rehabilitating the Distribution channel (AB-99), using machinery and hired labor as necessary; it also will construct any new field channels that may be required. As part of the rehabilitation project, however, farmers will be expected to participate in doing the desilting and other reshaping work required for rehabilitating existing field channels. Although they have not been told this as yet, they do know that they were officially responsible for field channel maintenance in the past.

Each group should agree upon its own design and plan for the rehabilitation of AB-99 through discussion and evaluation of the information available to it, drawing upon the skills, knowledge and experience of all team members. Once agreement has been reached, a rough sketch of the design should be prepared.

Teams now proceed to Phase 3.

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Materials: Large sheets of paper for drafting a rehabilitation design.
Time: 60 minutes maximum.

Phase 3: Communication

This phase of Irrigation Rehabilitation has two distinct parts to it. However, both are primarily concerned with the problem(s) of communicating with farmers about our rural development project. Now that a rehabilitation plan and design has been developed, teams must consider how it will be communicated to the farmers involved, both to obtain their ideas about the project design and to secure their agreement on it, as well as to make any adjustments in the plan that may seem appropriate or necessary. The group will need to choose another member to serve as the discussion leader for this phase.

First, each team should consider how it will present the rehabilitation project plan to farmers served by AB-99. Examples of topics that groups may want to evaluate at this stage include: what will be told to the farmers about the project plan? who will do this and how will it be presented? who should attend the meeting with farmers? should farmers be encouraged to give their ideas and suggestions? how best can this be done? what should be the response to farmer criticisms and objections? All members of the group should contribute to this discussion, and the team's discussion leader will try to obtain general agreement on the various points that are considered.

Once general agreement has been obtained within the group on an appropriate plan of action for communication with farmers, the discussion leader (with assistance from group members) should prepare a concise statement and summary of the group's communication plan. Up to 30 minutes will be needed for this part of Communication.

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The second part of Communication is a consideration and discussion of questions that farmers on AB-99 are likely to raise at their meeting with project officials. We will assume that our technical discussion leader has now made the kind of presentation to farmers that was planned in part one of Communication; we also will assume that all members of the team are present at this meeting to help him to respond to farmer questions.

Part two begins with one member of the group rolling dice and obtaining a number between 2 and 12. This number determines the number of farmer questions that will be raised at the meeting with the farmers on AB-99. The fewer the questions raised at the meeting, the simpler it will be for the team at this stage of Phase 3; however, the situation encountered in Phase 4 may be more complicated. Conversely, the more questions asked at the meeting at this stage, the less complicated will be the team's situation in Phase 4. (Note: each team is likely to get a different number of questions, and the set of questions each group must consider is likely to be different as well.)

Once the number of questions has been determined, members of each team will draw cards from a "Farmers' Questions" deck until that number has been reached. Each question will be read to the group who will then discuss what

the appropriate response can and should be. Once all of the questions have been discussed and evaluated, the team should determine which of the farmers' questions have been (a) anticipated and effectively resolved by prior information gathering (the Pre-Design phase), (b) solved by the rehabilitation plan and design (the Design phase), or (c) satisfactorily handled by the team's communication strategy (the Communication phase). It is entirely possible that some of the problems presented by the farmers can be resolved only by (d) re-design of the rehabilitation plan, or that (e) they will remain as difficult issues (during the Rehabilitation phase). Each team should classify the questions they were presented by farmers into one of these five categories as appropriate. This second part of Communication is likely to require 30 to 45 minutes.

Teams now proceed to Phase 4.

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Materials: Pack of "Farmers' Questions"
Time: 60 to 75 minutes.

Phase 4: Rehabilitation

Each team has now completed its formulation of a rehabilitation design and plan for the AB-99 system. Moreover, strategies for presenting the plans to farmers in the system have been developed, and groups have had the opportunity to respond to some of the questions and problems that farmers are likely to raise regarding this development project. It is now time for each team to report its rehabilitation plan to members of other teams for general review and discussion. This summary report should include the team's design for the AB-99 system, its strategy for presenting it to farmers, and its responses to questions and problems raised by farmers; it should be presented by the team's discussion leader.

The game Discussion Leader will moderate this last phase of Rehabilitation Simulation. Ample opportunity should be given all participants to ask questions of other teams, comparing and contrasting rehabilitation designs, and approaches to and responses from farmers. The Discussion Leader also will present any "unused" farmers questions remaining from Phase 3 for consideration by all of the groups.

The purpose here is <u>not</u> to determine a winning team. Rather, we are interested in learning how different teams perceived and handled various of the hypothetical problems that might be encountered in rehabilitating AB-99 both, as a result of specific features of that system—e.g. topography, field layout, tenure relations, settlement pattern—and the need to secure farmer cooperation with and participation in the project. Thus our focus is on understanding how the different phases of irrigation rehabilitation fit together, and how effectively these phases can be used to anticipate and resolve problems that could complicate and/or delay the implementation of such a rural development project, or that could increase the difficulties of achieving the objective of improved farmer water management.

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Time: 60 to 90 minutes

01/08/85

Code # 2-14-049-85

WORLDWIDE: WORKSHOP ON LESSONS LEARNED: PROJECT DESIGN ACTIVITIES
Cornell University

During the initial phase of the WMS-II project a number of technical assistance teams have been organized to assist AID Missions in the development of project papers for a variety of irrigation projects. In general these efforts appear to have been successful and, in some instances, to have resulted in innovative project concepts and designs. Also as a result of these assignments a number of WMS-II staff members and colleagues, have gained important experiences and insights regarding irrigation project design. While some of these insights are reflected in the written documents prepared by the design teams—other insights remain to be extracted, debated and systematized. The seminar proposed herein will be the vehicle for reviewing these experiences and identifying ways to improve future design efforts.

It is proposed that in the Spring, 1985 a two-day workshop be organized with the objective of systematically reviewing the experiences of several design teams in assisting AID Missions in project conceptualization and design. Participants will be limited to about 16 persons and will consist of persons who have actually participated in WMS-II design team efforts and a few selected persons who have irrigation project design experience outside of WMS-II (perhaps from one or more private consulting firms). In addition, a small number of AID participants from both Washington and the field would be invited.

Workshop discussion will be focused on the actual experiences of several of the design teams (perhaps 2-3 WMS-II teams and 1 private firm effort). Each design team will present an overview of the design process it followed and make available for review and discussion a copy of the design team report or project paper.

Based on the seminar discussions a set of guidelines for implementing WMS-II design team activities will be developed. These guidelines will deal with a range of pertinent topics such as team composition, phasing of the design team efforts, development of scopes of work for the overall team and individual team members, and substantive design issues such as the contribution of institutional analysis, the function of action research, the utility of working groups for project implementation and other matters as identified by the seminar participants. These guidelines will be made available to future WMS-II design teams, to AID missions who may be requesting such teams, and to private agencies who engage in irrigation project design activities for their consideration and use. Such guidelines will also be useful for discussion in AID staff training programs such as that organized for RDO's this past summer.

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1/7/85

2-14-039-85

Proposed Work Plan

for

LESSONS LEARNED IN IRRIGATION SYSTEM MANAGEMENT

Training and Technology Transfer

October 1, 1984 - September 30, 1985

Principal Investigators:

A. LeBaron	Irrigation Economics
D.W. James	Irrigated Crop Production
B. Smith/D. Daines	Water Law and Institutions
K. Stutler	Irrigation Engineering
Cornell University	Irrigation Sociology
D. Lattimore	Information and Training

This proposal is part of the Work Plan under the Water Management Synthesis II Project, which is a USAID project being conducted by Utah State University, Cornell University and Colorado State University.

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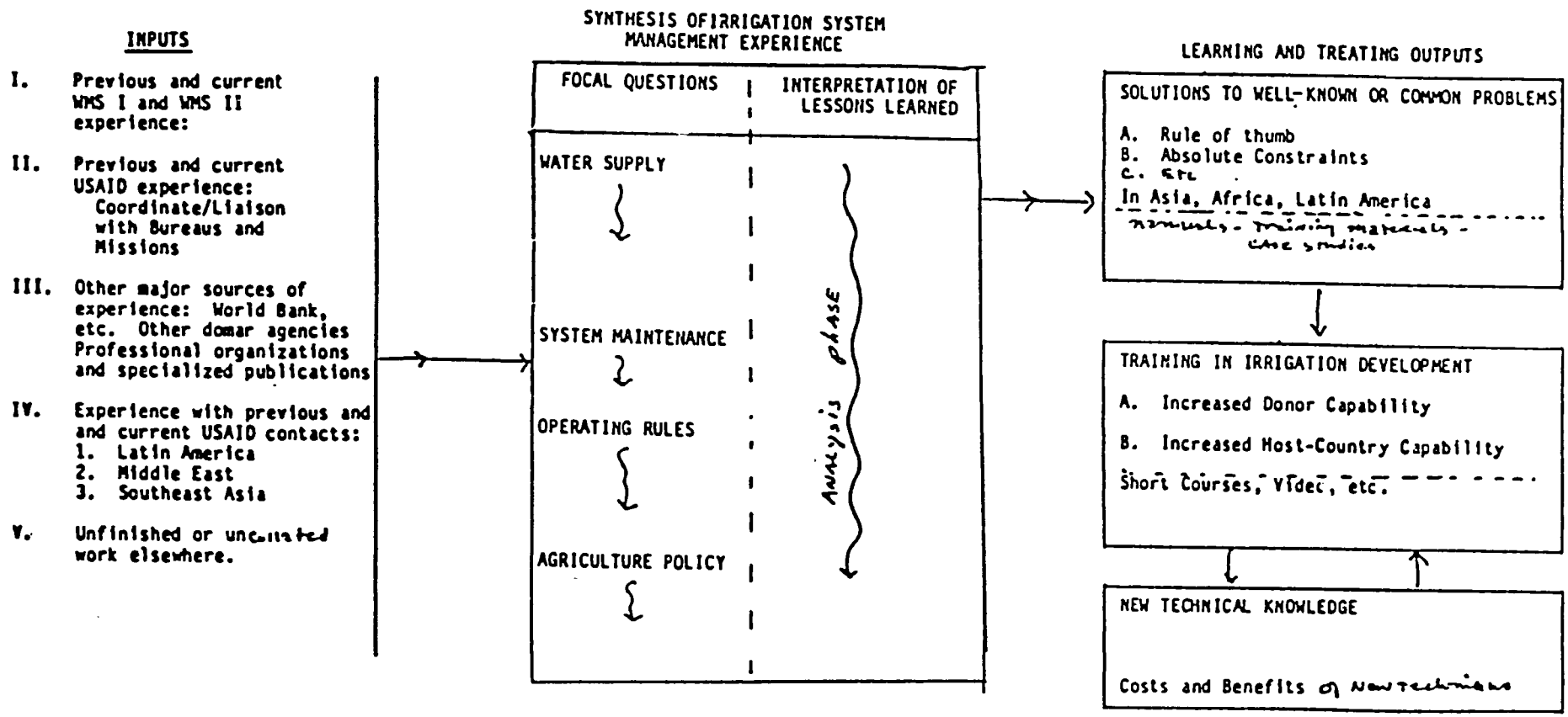
Overview of Sub-project Activities

LESSONS LEARNED IN IRRIGATION SYSTEM MANAGEMENT



GOAL, SCOPE, JUSTIFICATION

The aim of the WMS Program is to improve irrigation planning and management in less developed areas of the world by bringing to bear as much existing interdisciplinary information as is available to solve problems at all levels from design to operation. This can be accomplished to some degree by well organized expert teams with considerable background in irrigation experience (see WMS project reports 6, 9, 11, 12, 14, 23, 24 and 26 in attached Selected Bibliography.) However, the need for knowledge normally acquired by personal experience and the need for greater interdisciplinary ability in analysis and recommendations outrun the supply. What is needed is a way to transfer such ability to others in a through and effective manner.

The general objective is to synthesize worldwide irrigation experience and to transfer what has been learned to others via project outputs: how-to materials (such as expanded lessons learned, case studies, training aids, etc.) and specific training in interdisciplinary analysis of irrigation development and management problems for persons with mainly single specialty backgrounds.

The output of this project will be a tested, interdisciplinary procedure for rapid reconnaissance surveys (and other technical assistance activities in the irrigation sector) and a trained group of people who can apply it. The training materials and manuals will enrich the learning process for any person interested in participating in irrigation development, planning and project execution. Individuals with diverse backgrounds will be able to understand and apply key questions and insights from various disciplines. The primary (but not exclusive) beneficiaries will be engineers who, in the final analysis, must design, execute and manage irrigation works and water delivery systems.

ACHIEVING THE OBJECTIVE

A. Defining What is to be Transferred and to Whom

A Lessons Learned conference was held as part of the windup of WMS-I. It was designed to (1) delineate lessons learned from WMS-I; and (2) develop a way to extract, organize and disseminate the expected flow of information from WMS-II.

The discussion first centered on the audience for lessons learned. The conclusion was that the lessons, initially, would be for those who were to be the "experts" on WMS or similar teams. Next, the audience would be expanded to include other international agency representatives, host-country planners and finally out to the operational network of technicians and farmers.

The words "technology transfer" may conjure up mental visions that involve a wide range of technical assistance activity even in a realm as defined as irrigation development. It was apparent, however, that the chief interest of conference participants was in irrigation sector (project) evaluation or programming and in how analysis can be carried out accurately as part of rapid reconnaissance surveys. In the first instance what is to be transferred is not some particular technology, but a methodology or procedure of how to site or categorize an existing or proposed irrigation system in terms of its shortcomings and potentials while avoiding unexpected pitfalls in future performance.

B. Questions to be Asked

As a first step in synthesizing irrigated agriculture experience into a form useful for planning, evaluation and management, project activities will be confined to the integrating theme of IRRIGATION SYSTEM MANAGEMENT. Various questions may then be explored in terms of their effects upon typical system performance and management response.

The following list of questions will guide the analytical focus of this subproject. Topics are arranged so that less and less engineering discipline is emphasized. However, it should be noted that all questions have non-engineering dimensions. For example, an alteration in waste-water management might have significant third party effects upon water users in other areas, or farmer organizations may not be able to interface with the main system as planned and still maintain group harmony.

Some Key Parameters in Irrigation System Management Water Supply

1(a). System size and potential disaggregation

- Terrain slope of command area
- Distribution and control structures

1(b). Intensive/extensive design

- Consumptive use requirements
- Relative cost per family or other measure

2. Interface with main system

- Mgt. through command area versus irrigation only approach
- Operating capabilities of collective

3. Use of intermediate storage?

4. River run versus storage projects

5. Reliable/timely

- Communication of expected system performance to users

- Effects of levels and divesity of trainging on bureauracy single other discipline level/multidiscipline level

Maintenance Procedures

a. Deferred or continuous
b. Other

Operating Rules

a. Managability in relation to complexity
b. Water delivery method

- Continuous, rotation, demand, intermittent, 12/24 hr
- Requires night irrigation, etc?

c. Equity under the rules

d. Other

Agricultural Policy

a. Water user

- Taxes, subsidies, protection,
- Comparative advantage in domestic and foreign markets

b. Bureauracracy Incentives

- Basis for job eval/promotion (linkages to irrigators and system managers)
- Legal constraints to water use and allocation

A number of the above questions emphasize areas of special interest to WMS staff at Cornell and Colorado State or, possibly, to USAID personnel. A high degree of their participation in subproject activities will be important to successful accomplishment of the proposed work plan.

C. Analysis

One of the principal objectives of analyzing lessons learned is to identify key junctures in each problem category where input of other disciplines can significantly influence conclusions. An example of this would be in the development of an on-farm water management program. When analyzing the crop selection for an extension program, economic/marketing considerations of price and marketing restrictions or barriers would be examined. If it were found, such as it was in Peru, that domestic laws prohibited the storage of potatoes, then recommendations would be influenced by the fact that the profitability of potato production is constrained and the recommendations and design of such a program would take a different direction.

D. Data Input (see "Sources" bibliography)

A large body of experience and literature in irrigation development assistance has accrued over the last thirty years. However, a methodology for synthesizing the lessons learned has not been developed. Therefore, one of the major activities of this proposed subproject is to close this gap.[1]

To answer the questions listed above, collection and review of the written materials of various regional and worldwide sources as well as oral interviews, written correspondence and analysis of trip reports will be undertaken. Initially, the following sources will be utilized and/or invited to participate:

Regional sources include the following:

1. FOR LATIN AMERICA: On-Farm Water Management Project, the Plan MERIS Project and the Interamerican Development Bank.

2. FOR ASIA: The scheduled USAID Mission Irrigation evaluation including the Ford Foundation in India, Colorado State University experience in Pakistan and Sri Lanka, and Cornell University experience in Sri Lanka and the Philippines.

3. FOR THE NEAR EAST: Colorado State University experience in Egypt.

4. FOR AFRICA: Bibliography developed by Jon Moris, literature review in progress by Jon Moris and team, proposed African workshop by Utah State University.

Worldwide sources include the following:

1. WMS I and II.

2. USAID -- the Policy and Planning Coordination Bureau.

3. The World Bank.

4. The Food and Agricultural Organization of the United Nations.

5. USAID S&T Project and water pricing (Sutter/Minnesota, Colorado State).

6. Asia -- Near East Irrigation Seminars, with Dean F. Peterson and A. Alvin Bishop as contact persons.

7. Overseas Development Institute network, Committee for Economic Development.

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[1]A somewhat analogous activity in recent years is found in the thinking that has gone into "farming systems" analysis.

8. Technical Advisory Committee reviews for International Irrigation and Management Institute (IIMI).

9. USAID sponsored Water Pricing Project (Minnesota/CSU).

10. Rehabilitation study to be conducted in FY 85 by CSU under the WMS II Project.

11. CSU workshop held in FY 84 under the WMS II Project in farmer participation.

Ways to extract and preserve the lessons learned by WMS II teams will be explored. As the methodology develops the questions to be asked of returning team members will become clearer. The responses will feed back into the refinement of the methodology. This, in turn, will enhance the quality of the training activity. Various techniques including telephone interviews and questionnaires will be utilized.

PLAN OF WORK

Development of the training materials and conducting workshops will be based on the data assimilation described. Once the analysis process has been completed, draft manuals will be prepared and a preliminary workshop held in order to test, critique, and refine the materials and teaching approach.

The core group of this activity will be drawn from the three participating universities of the WMS II Project. They will represent an interdisciplinary team which will work in close collaboration and act as a catalyst to achieve a synthesis of water management knowledge in the project. The group will be Allen LeBaron as activity leader and irrigation economist, David James as agronomist, Bryant Smith and David Daines as water law and institutional specialists, Kern Stutler as irrigation engineer, Dan Lattimore as information and training specialist, and a sociologist from Cornell.

The activity will draw upon the expertise of several developing country institutions and the Ford Foundation. The Mahatma Phule Agricultural University and the Ford Foundation Office in India will assist in drawing out lessons from the India experience. In addition, the Centro Inter-Americano para Desarollo Integral de Aguas y Tierras (CIDIAT) will be called upon to help draw out lessons from Latin America, and particularly the On-Farm Water Management Project which involved 35 man years of work in seven countries. Many lessons are available from the On-Farm Water Management project in Pakistan. If a current National Science Foundation proposal is approved, David James, who would work on this project, will make arrangements for the involvement of an Egyptian institution through USAID/Egypt funding.

Specific phases of the procedure will be as follows:

First Year

1. Contact will be made with developing country institutions to arrange their participation in terms of scope or work and funding sources. Because of USU's long association with CIDIAT, it is anticipated that its program with CIDIAT can be established by phone and written correspondence. It is anticipated that CIDIAT will cover the salaries of its participants.

In the case of India, it is anticipated that a larger level of effort will be involved and core funds will be used to support the activities of the Mahatma Phule Agricultural University located in Rahuri in the State of Maharashtra. USU participants in either the Mission irrigation evaluation activity or the Madyha Pradesh Socio-Technical Feasibility Study group will make the arrangements with the university and set up its program. Five professors in Mahatma Phule University will be involved in related interdisciplinary fields. It is hoped that they will be drawn from those participating in the Mission Irrigation Evaluation so the maximum benefit can be gained through this cross-fertilization.

2. A preliminary analytic framework will be designed by the core group to serve as the basis for the analysis of the sources of materials. This framework will build on the prior work done by the lessons learned activities of the WMS I project workshop and the prior activities of the special study in interdisciplinary selection of irrigation technologies. Annex I discusses past experience and current thoughts on this approach. Graduate students who participated in both these activities will be involved. The important background experience at Cornell, Colorado State and Utah State outside WMS I and II will also be employed and utilized.

3. At the same time, analysis of information in other written sources will begin. This will include the AID/PPC irrigation evaluations, prior evaluations of the Inter-American Development Bank, Ford Foundation, World Bank, CIDIAT, USAID Missions, WMS I and II published reports and trip reports. This will be performed by graduate students according to defined prodedures.

4. Dan Lattimore will develop an interviewing format and carry out experimental telephone interviews with WMS II teams coming out of the field to capture fresh lessons learned from them. He will write up his preliminary notes so the entire core group can incorporate them in the final training materials. These notes will also serve as the basis for comparing the value of information generated from such interviews relative to written reports and interviews which are further removed in time from the period of involvement of the interviewee.

5. In the spring of 1985 the core group will undertake a further analysis of the survey of sources from written materials have been collected. Then interviews with former and current water management specialists will be carried out through telephone interviews, correspondence, and a trip to U.S. sources by some of the core group.

6. On the basis of the materials gathered, the analytic framework will undergo substantial revision with special attention being given to the identification of interdisciplinary intersect points. This work will be carried out principally by the core group.

Second Year

1. In the spring of 1986 materials will be drafted (on the basis of the analytic framework) for a preliminary training course. The materials will be organized on the case study method of presentation. The case studies will include summaries of real problems extracted from the survey of sources and will be organized in a way so that trainees deduce conclusions about lessons learned and intersect point issues.

2. Once the materials are organized in a preliminary form, a pilot training workshop will be held which includes two separate groups. The first will be experienced water management experts, including the CPMT, and the second will be mid-career professionals with international experience, but not water management backgrounds. The case study method will be used and an internal evaluation system will be set up to appraise the content and organization of the training materials and the teaching method employed. This workshop is designed to be a "quick and dirty" training session, with limited financial resources to serve as the basis for a "mid-course" adjustment to the work.

3. On the basis of the preliminary training session, the final training materials will be drafted and the teaching format established. A manual which includes the analytic framework and the case studies will be completed in a polished form.

4. A training session will then be held at USU to begin training of U.S. professionals in order to enlarge the pool of individuals who can be reasonably involved in the WMS II project and USAID water management activities. All three universities will be involved in the training.

Third Year

1. A training workshop will be held in an LDC site, preferably India, to train LDC professionals in better interdisciplinary analysis of water mangement problems.

2. A second training workshop will be held at USU to train additional U.S. professionals.

CHRONOGRAM AND BUDGET

	1984			1985									
	October	November	December	January	February	March	April	May	June	July	August	September	Total
Establish Network & Develop Preliminary Analytic Framework													
Conduct Survey of Sources													
Engineering (Stutler)							0.5	0.5	0.5				1.5
Economics (LeBaron)							1.0	1.0	0.5				2.5
Sociology (Cornell)							1.0	1.0	0.5				2.5
Agronomy (D. James)							1.0	0.5					1.5
Law/Instit. (BDS,DD)							1.0	1.0	0.5				2.5
Info/Tr. (D. Lattimore)	----------	----------	----------	----------	----------	----------	----------	1.5	----------	----------	----------	----------	1.5
Ford Foundation expert							-----1.0---------						1.0*
Indian Consultants (MPAU)							-----5.0---------						5.0
Graduate Students	----------	----------	----------	----------	----------	----------	----------	8.0	----------	----------	----------	----------	8.0
Revision of Analytic Framework													
Core Group											2.5		2.5

Total PPM 17.0
*donated 1.0
GMP 8.0

	1985			1986									
	October	November	December	January	February	March	April	May	June	July	August	September	Total
Draft Training Materials Core Group							3.0						3.0
Conduct Preliminary Training workshop Core Group								3.0					3.0
Completion of Final Training Materials Core Group								3.0	1.5				4.5
Training Workshop--U.S. Professionals Core Group											3.0		1.0
												Total	13.5

	1986			1987									
	October	November	December	January	February	March	April	May	June	July	August	September	Total
Training Workshop--U.S. Professionals Core Group							2.25						2.25
Training Workshop--LDC Professionals Core Group										2.25			2.25
												Total	4.5

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ANNEX 1

For our purposes, irrigation project shortcomings can be treated as failure to live up to expectations. Sometimes such failure can be traced to faulty engineering design or construction. And, in a few instances, engineers and big thinkers get carried away with the challenges of tunnel boring and concrete pouring. Most generally, however, it will be discovered that initial expectations were unrealistic for a host of other legal, political, social, economic or institutional reasons.

Promotional expectations for success are framed on information bases too narrow to be realistic. All sorts of obvious and not so obvious potentials for unexpected side-effects -- communal resistance, incorrect interpretation of market signals, endangered power structures, etc. -- which are ignored, overlooked, or to greater or lesser degree, hidden from scrutiny during planning, or are misread even when systems are in operation. Such oversights are exposed by genuine interdisciplinary evaluation of results. Impartial investigation reveals the range of what realistic expectations should have been in the first place.

While no one would argue that interdisciplinary planning and scrutiny would guarantee error-free project design or follow-up analysis, recognition of the need to take into account unsuspected pitfalls is at the heart of the current structure of USAID's WMS Project. The reasons for the percentage of project personnel associated with satellite disciplines orbiting what at heart must be basically engineering questions, are made obvious by this discussion.

Having reached this conclusion, it must be recognized that a way to bring order into interdisciplinary problem solving is a bottom line project requirement. The basic element of an ordering procedure is the assumption that the "solutions" or "interpretations" applied to any irrigation problem from individual discipline perspective come together to form the boundary conditions within which the final engineering solutions must be found. In other words, all the inputs from various disciplines must be in place before part of the agronomy and the final engineering alternatives can be recommended or recognized.

How can important lessons extracted from WMS II and other irrigation activities be turned into meaningful operational procedures? What will satisfy the requirement to synthesize irrigation management experience?

The clue is contained in the conference experiences cited.

It was noted by the group that each individual member of a study team thinks in terms of their own private hierachy of important questions, and what analysis of lessons learned will do is allow such individuals to expand and/or reorganize individual classification systems. At the same time, these systems imply a great deal of technique and insight that are the basis of lessons learned. Experienced team members carry with them a

mental view of the "irrigation world" against which new experiences and situations are tried and tested. For such individuals important lessons seem to arise from unique questions or insights which in turn are related to a topical area. Information about each topic can be orgainzed in a meaninful way and can be developed into a theory. The theories allow predictions of results or responses and the eventual development of strategies for successfully impacting given domains.

Can all the special theory of team members be put into a systematic (interdisciplinary) format? Probably the answer is yes, since what seems to be required is a logical order for a series of selected questions suitable for team guidance or review in a rapid reconnaissance situation.

A first step is to arrange problem areas into "great categories," such as the following purely illustrative example:

Example of Important Questions Defined by Lessons Learned

Constraints on physical success at farm level (at this level physical success = financial success):

I. Never success if water supply not assured.

A. Headend/tailend -- water theft.
B. Main system management requires night irrigation?
C. Designed supplies less than consumptive use requirements?

II. Inadequate demand for increased output due to higher yields?

A. What happens if project is replicated?
B. Other.

Physical and financial success of irrigation investment at society level:

I. No comparative advantage versus rainfed ag. development.

A. Is project a welfare scheme?
B. Can farmers afford higher operating costs plus interest/capital costs?
C. Relative benefits of public versus private system develop.

II. Nation self-sufficient in basic foods or can afford imports.

A. Is domestic irrigation the best way to meet future increases in demand?
B. Is the project cost competitive measured by international standards?
C. Can increased product be exported?

It will be noted that the Roman Numeral statements can be associated with absolute barriers to irrigation project success. Analysis cannot be executed beyond them. Inside such absolute bounds are many gray areas involving a range of questions. Answers to the example questions involve the special theories already mentioned, along with logical statements about policy consequences.

The lessons learned manuscript prepared from the conference illustrates overlap of discipline interest among categories and specific lessons learned questions. This cannot be made apparent in the examples above, but removal of such overlaps suggests the possibility of reaching interdisciplinary agreement over a basic set of questions or lessons and agreement of expert views on policy repercussions of program solutions.

1/7/85

2-14-040-85

Training and Technology Transfer

Proposed Work Plan for WMS-II Subproject:

DEMONSTRATION/SEMINAR OF COMPUTER ASSISTED IRRIGATION SYSTEM MANAGEMENT

November 1984 - March 1985

by

Wynn R. Walker and Jack Keller
Agricultural and Irrigation Engineering
Utah State University
Logan, Utah

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DEMONSTRATION/SEMINAR OF COMPUTER ASSISTED IRRIGATION SYSTEM MANAGEMENT

This demonstration/seminar is designed to utilize the computer assisted irrigation management program which is being developed by the special study, "Main System Design, Management and Rehabilitation." The development of a general computer assisted management program for use in more optimally scheduling and routing irrigation water deliveries throughout various sizes of irrigation systems will be completed by November/December 1984.

Plans are under way to tailor the program to be specifically applicable to typical medium irrigation projects. Data from a "typical medium irrigation system" in Maharashtra (see Annex, "Synthabad Medium Irrigation Project) will be utilized in the development of the final test program. The purpose of this specific activity will be to demonstrate the capabilities of computer assisted irrigation system management and to begin training mid and upper level operational officials in the sensitivity of systems to various system configurations, operating controls, rainfall hydrographs and cropping patterns, etc, and the possibilities for improved system management.

Timing and Participants

It is anticipated that preparations will be made to hold the three week demonstration/seminar some time between November 1984 and March 1985. By this time, in addition to acompleting the necessary computer programs under the special stuoy, an experts workshop for testing the programs and further refinement of the programs should also be completed.

The demonstration/seminar will be geared for approximately 20 to 30 participants who are involved in operating Maharashtra medium irrigation projects. The participants will include a mixture of Superintending, Executive and Chief Engineers from the Irrigation Department. It is anticipated that it would be held in Aurangabad, India, at the Water Management Institute there (WALMI).

Demonstration/Seminar

A mini computer capable of operating the program will be transported to India in preparation for the demonstration/workshop. As mentioned earlier, a "typical Maharashtra Minor irrigation system" will be programmed into the computer for the demonstration. The demonstration/seminar will begin with discussions of current practices for managing irrigation systems, visits to nearby systems and an introduction of the benefits to be derived from a computer assisted management. The computer assisted management program will be demonstrated to the group and

the participants will be allowed to decide on alterations of the program to test the following:

1. Various configurations of project size and layout, including different canal and control structures;

2. Alternate operating rules; for example, warabundi or demand systems, daytime operation only, or 24-hour operation, etc;

3. Various cropping patterns;

4. Effects of various rainfall hydrographs;

5. Coping with various levels of water shortage due to supply problems or poor maintenance, causing reduced capacity of the main delivery networks;

6. Effects of various farmer activities such as water reallocation and unauthorized system interventions; and

7. Failure of Irrigation Department personnel to operate control structures as specified.

As part of the exercise, the participants will become aware of the data requirements necessary for computerizing the management of a given system. The data requirements will become apparent as the computer program is manipulated to demonstrate the above-listed items.

As part of this assignment, the instruction team will investigate mechanisms for transferring the technology to India. Decisions will be made as to the possibility for transferring the programs to Indian computers and/or the advisability of procuring special computers for managing irrigation systems. What would actually be needed is a computer complete with necessary programs at the management headquarters for each irrigation project system.

It is anticipated that a follow-up workshop will be requested in the 1986 FY work plan for presentation in October or November. The idea of this workshop will be to put the program in place on a given project and train necessary engineering talent to input and adjust their program and manage their projects with it. This later workshop will include going to the field and procuring necessary data for inputting to the program and the actual adjustment of a generalized program for a specific system. To accomplish this task in the most expeditious manner, the project selected for study and implementation will be an irrigation system which has been studied by virtue of one of the following: the remote sensing special study which will take place during FY 85 (see special study on remote sensing); the rapid appraisal activity which has recently been requested by AID/India; or a previous Diagnostic Analysis Workshop.

ANNEX

to

Demonstration/Seminar of Computer Assisted
Irrigation System Management

SYNTHABAD MEDIUM IRRIGATION PROJECT*

A hypothetical project synthesized for demonstration
and testing of Main Systems Model developed under
Water Management Synthesis-II Project supported by
U.S. Agency for International Development

*Data set developed by Dean F. Peterson

GLOSSARY

Cropped Area - Annual area sowed to crops. If the same area grows two or three successive seasonal crops, it is counted twice or thrice. Conversely, areas growing perennial or two seasonal crops are counted only once.

Culturable Command Area (CCA) - Geographical area of culturable land to be served by an irrigation system.

Gross Command Area(GCA) - Geographical area under the system command including villages, farmsteads, roads, ponds, wastelands, etc.

Irrigation Command Area (ICA) - Cropped area provided irrigation.

Irrigation Intensity - Irrigated cropped area divided by cultural command area.

Hot Weather or Zaid Season - Very hot, dry spring season, February-June.

Kharif - Growing season during the summer monsoon, June-October.

Medium Irrigation Project (MIP) - A project (normally served by a surface reservoir and canals) with CCA ranging from 2,000 to 10,000 ha.

Minor Irrigation Scheme (MIS) - A project serving less than 2,000 ha CCA either by a reservoir and canals, wells or lift pump.

Rabi - Winter growing season, October-February.

Trap - Hard rock formation characteristic of Indian Deccan consisting of layered basalt with weathered zones between layers.

SYMBOLS

- Metric units are used throughout.
- Symbols are those commonly used or as defined in the text. Some of the latter are:

A	Area, m^2, km^2, ha
f	A function, here used as a multiplier
h	Height of water surface in reservoir above streambed
P	Annual precipitation, mm/ann. P_i = P for the ith year
P_m	Monthly precipitation P_{mi} = P_m for the ith month
Q	Stream discharge m^3/s, l/s, ft^3/s
S	Unit seepage loss m/s
WB	World Bank, including its associated organizations, IBRD, IDA

REPORT

SYNTHABAD MEDIUM IRRIGATION PROJECT

I. Purpose

Synthabad is a hypothetical project synthesized to simulate a medium-sized project in west central Maharashtra planned and designed using methods in force circa 1970-80. Synthabad will be used in developing and demonstrating the WMSP-II Main Systems model. The simulation is based on secondary and limited primary data available in Logan and the writer's and others' experience. Only summary material based on more extensive trial calculations (Notes[1]) is included here.

II. Location

Central Maharashtra plateau

A. Zones Considered

1. Scarcity zone (500-750 mm)
2. Assured zone (700-900 mm)
3. Moderate zone (900-1200 mm)
4. High zone (1200-1700 mm)

Cropping patterns differ in each zone. As rainfall increases, these generally become more diversified with limited dry season and perennials in the wetter zones (Figure 1).

Because of the possibility of obtaining daily weather records for Pune (ave. rainfall 708 mm), Synthabad is a scarcity zone project. A project in the moderate or high rainfall areas would be rather different, possibly even more interesting. For example, paddy and hot season crops would be added. We may wish to try a wetter site later.

B. Meteorology

The meteorological record will be used to calculate irrigation requirements and estimate concurrent reservoir evaporation and available water supply on a daily or monthly basis as required.

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[1] "Notes" refers to detailed handwritten notes and computations supporting this report - DFP files.

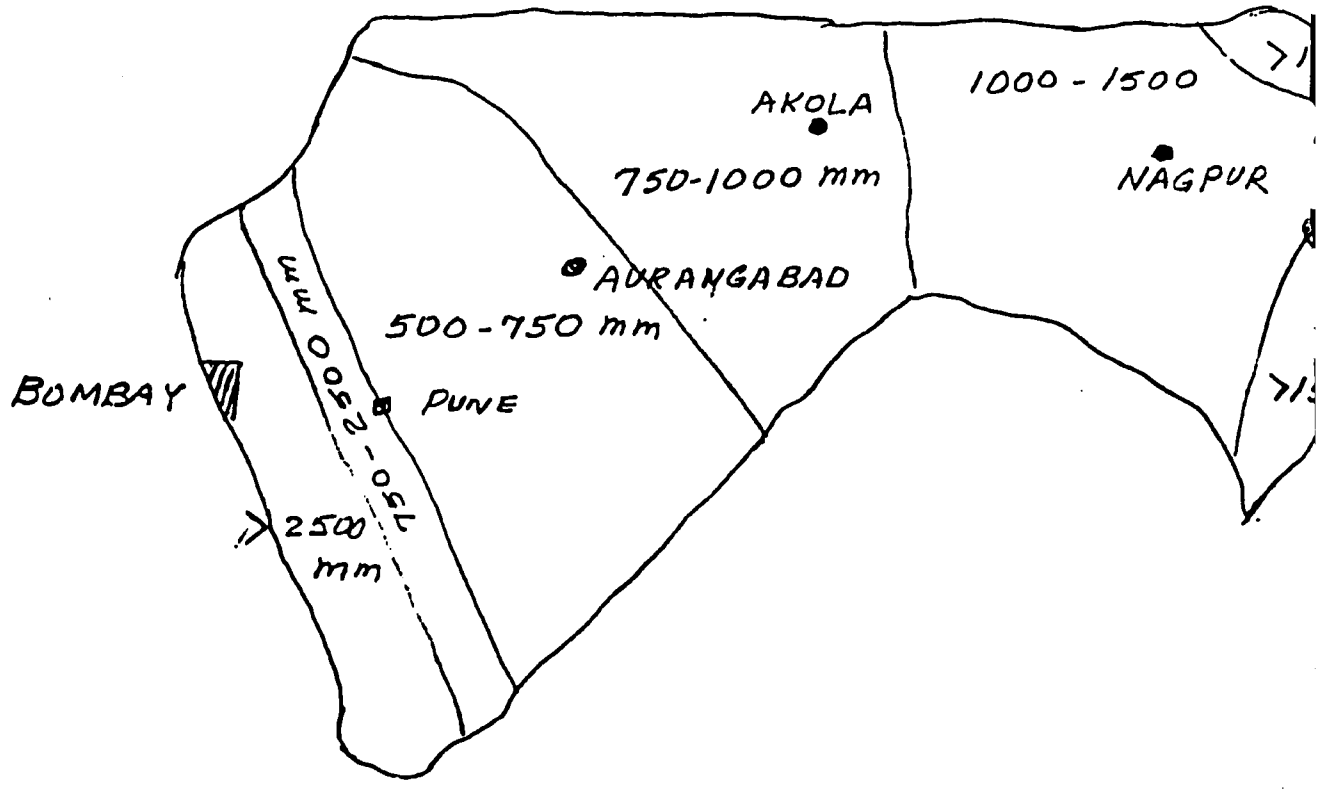

FIG 1. CLIMATIC ZONES IN MAHARASHTRA

III. General Characteristics

A. CCA (Culturable Command Area): 5,000 ha

GCA (Gross Command Area: 5,750 ha

These are arbitrary choices in the medium project range, somewhat larger than average.

B. Irrigation Intensity: 88%, 36% kharif, 52% rabi

Based on similar projects. See Project Paper, Maharashtra Irrigation Technology and Management, Vol. II (USAID, 1982). (Conventionally multiple season crops are only counted once in figuring intensities, e.g., if on 100 ha there are kharif: 20 ha sorghum, 16 ha two season cotton; rabi: 12 ha pulses, 40 ha wheat, this counts as 36 percent and 52 percent, even though 68 percent of the area would be irrigated during rabi.)

C. ICA Irrigation Command Area: 4,400 ha

D. Water Supply (W.S.)

1. Overall: 30.78 Mm^3/ann.

(Conventionally overall water supply allowance is 1.0 M ft^3 for 10 acres ICA. This allowance includes all losses including reservoir evaporation, and effects of multiple cropping. Several MIPs examined using data in USAID (1982) verify. See p. 17 of Notes.

W.S. = (4400 x 2.47)/10 = 1,087 M ft^3/Ann = 30.78 Mm^3/Ann

2. Linkage to Precipitation

For scarcity zone annual W.S. is taken as the amount available in 50 percent of the years. In this zone annual W.S. is computed from precipitation using an empirical method (Strange's Tables -- see USAID, 1984).

a. Correlation

Walker (USAID, 1984) gives precipitation, watershed area and estimated water supply for five minor irrigation schemes (MIS), from which runoff coefficients can be computed.

Project	50% Probable Ann. Precip. mm	Yield Coeff. $m^3/km^2/mm$ Co	Method of Estimating
Changewadi	3,656,7	778.6	Inglis
Sarabadi (Nagpur)	1,105.25	321.8	Strange
Ratnapur	619.25	157.4	?*
Otchir	1,841.6	681.4	?*
Dhule	651.75	223.35	?*

*The last four are on the plateau and presumably, for the last three, water supply was estimated using Strange's Tables. These four data points correlate very well by:

$$Co = -81.6 + 0.4053P \qquad r = 0.9878 \qquad 202 \leq P \leq 1850 \qquad \text{(Eq. 1)}$$

For Pune, P_{50} = 687 mm

$C_o = 278.4 - 81.6 = 196.8 \qquad Y = (196.8)(687) = 135.202\ m^3/km^2$

3. Watershed Area

$A = 30.78/0.1352 = 227.7\ km^2$

4. Annual Runoff

$$V_i = (227.7)(0.4053\ P_i^2 - 81.6\ P_i)$$

where V_i is the runoff in year i and P_i the annual precipitation in year i.

5. Monthly Distribution

Seasonal runoff needs to be distributed by months. Studies of runoff into Paithan Reservoir, a large reservoir serving a major project near Aurangabad (World Bank, 1977). (Notes, p. 23) shows that annual distribution is variable, peaking in August or September somewhat randomly distributed around the peak. The following is suggested where P_m is the precipitation during the month and V_m is the estimated runoff during that month.

$$V_m = [(P_m - 40.5)/(P_i - 202.5)]\ (0.94\ V_i) \qquad \text{(Eq. 2)}$$

(Solving Eq. 1 for $C_0 = 0$ gives $P_0 = 202.5$. P_0 is the seasonal threshold. Assume monthly threshold is 1/5 seasonal because, except for very high years, virtually all precipitation [±94%] occurs during June-Oct.)

Remainder: Distribute: December: 40%; May: 60%

(Review of Paithan Dam data shows the residue is sporadically scattered, but December, April and May are highest [see Notes p. 38]. Operationally there is no need to try to refine further.)

E. Reservoir

1. Live Storage: $V_R = 20.71$ Mm^3 live storage

At planning stage, no distinction, conventionally, is made between duty for rabi and for kharif, thus:

kharif requirement = 36/88 (30.78) = 12.59 Mm^3
rabi = 18.19

Conventionally, storage is provided for 20 percent of kharif needs and 100 percent for rabi:

$$V_R = 18.19 + 0.2\ (12.59) = 20.71\ \text{Mm}^3$$

where V_R is the live reservoir storage capacity.

2. Dead Storage

Silt yield = (166.7)m^3 km^{-2} yr^{-1} (227.5)km^2 (50) yrs = 1,896,000 m^3

5% of reservoir = 0.05 (20.7 Mm^3) = 1.05 Mm^3 - Use 1.142 Mm^3

3. Reservoir Tables, Table 1

Height of sill above streambed - 8 m
Height of dam above streambed - 21.05 m
Dead storage - 1.142 Mm^3

4. Reservoir Evaporation

Can be estimated using ET_0 computed from meteorological data synchronously with irrigation requirements and runoff. After live storage is exhausted, this should be applied to dead storage, but this component cannot exceed the dead storage.

TABLE 1[1]

AREA AND CAPABILITY FOR SYNTHABAD RESERVOIR

Water Level Above Sill m	Surface Area Mm^2	Live Storage Mm^3	Dead Storage Mm^3
-8	0		
-7	0.011		0.006
-6	0.025		0.023
-5	0.050		0.061
-4	0.095		0.134
-3	0.161		0.262
-2	0.216		0.501
-1	0.314		0.766
0	0.437		1.142
1	0.575	0.506	
2	0.724	1.256	
3	0.845	2.040	
4	0.792	2.948	
5	1.150	4.010	
6	1.361	5.266	
7	1.583	6.738	
8	1.824	8.447	
9	2.045	10.512	
10	2.240	12.655	
11	2.480	15.016	
12	2.798	17.655	
13	3.045	20.577	
13.05	3.060	20.710	

[1]Reservoir landscape generated by $\Delta A/\Delta h = (f)\cdot(h)$, where h is the height above the streambed and $f = A+BR$, where A and B are constants, R is a random number such that $0<R<1.0$, and A is the surface area of the reservoir. For Synthabad Reservoir A = 4,000, B = 12,000 was chosen. Also, R was restrained such that $|R_{i+1}-R_i| \leq 1/3$. A and B may be estimated using $f = V_R/6h_R^3$ when R = 0.5 and V_R is the reservoir volume at full depth, h_R. A positive value of a A smoothes out landscape profiles. The constant $|R_{i+1}-R_i| \leq m$ smoothes out slopes. (Notes, pp.37,38.)
constraint

F. Canals

1. Configuration

Assume only one main canal. Supply canal 8 Km from command area. Main canals required run 2-3 m/ha (World Bank, 1977 and other sources). Distributaries and minors about 8m/ha. See Sketch, Figure 2. Table 2 is a schedule of main canals and distributaries and minors.

2. Channel Design

Capacity. Use 0.7 l/s/ha seasonal irrigated area. See World Bank, 1977. Also checked for capability to deliver 10 cm on 14 day rotation.

$\bar{Q} \simeq$ approx (0.7)(Irrig Intens)A, Q in l/s; A in ha
Cross-section and slope by Manning's formula
Slope range 1/500 - 1/2500 (USAID, 1984)

Table 3 is a schedule giving design elements for the various channels. Walker, (USAID 1984) reports design standard velocity, $v \sim 0.3$ m/s in clay. This is low compared to other literature (Hanson, Israelsen and Stringham, 1979; for example), within the above slopes, channels would have to be unreasonably wide and shallow to achieve this low velocity.

This standard, 0.7 l/s/ha, is a tight design. Some references (USAID, 1982, for example) suggest 1.0 l/s/ha. World Bank (1977) studies based on climatic calculation of irrigation requirement did not exceed 0.6 l/s/ha in Maharashtra Irrigation Project II appraisal area. Model studies will reveal adequacy of this criterion. If needed, canal sections will be enlarged. This could be the case also if irrigation intensity were increased.

3. Losses in Channels - Actual (not design) seepage loss rates are estimated as follows:

Murum: $S = 5 \times 10^{-6}$ m/s
Clay loam = 3.6×10^{-6} m/s
B.C. clay = 2.5×10^{-6} m/s
Hard rock = 1.2×10^{-6}

Operational losses are determined to be 15 percent of the flow over the main sill.

Soils in the upper part of the project, Div B, are clay loam 2 to 5 m thick underlain by murum 4.5 m and hard rock below.

Soils in the lower part, Div. C, D, E, are black cotton ranging from 2 to 3 m thick to 5 to 8 thick underlain by 4 to 6 m murum.

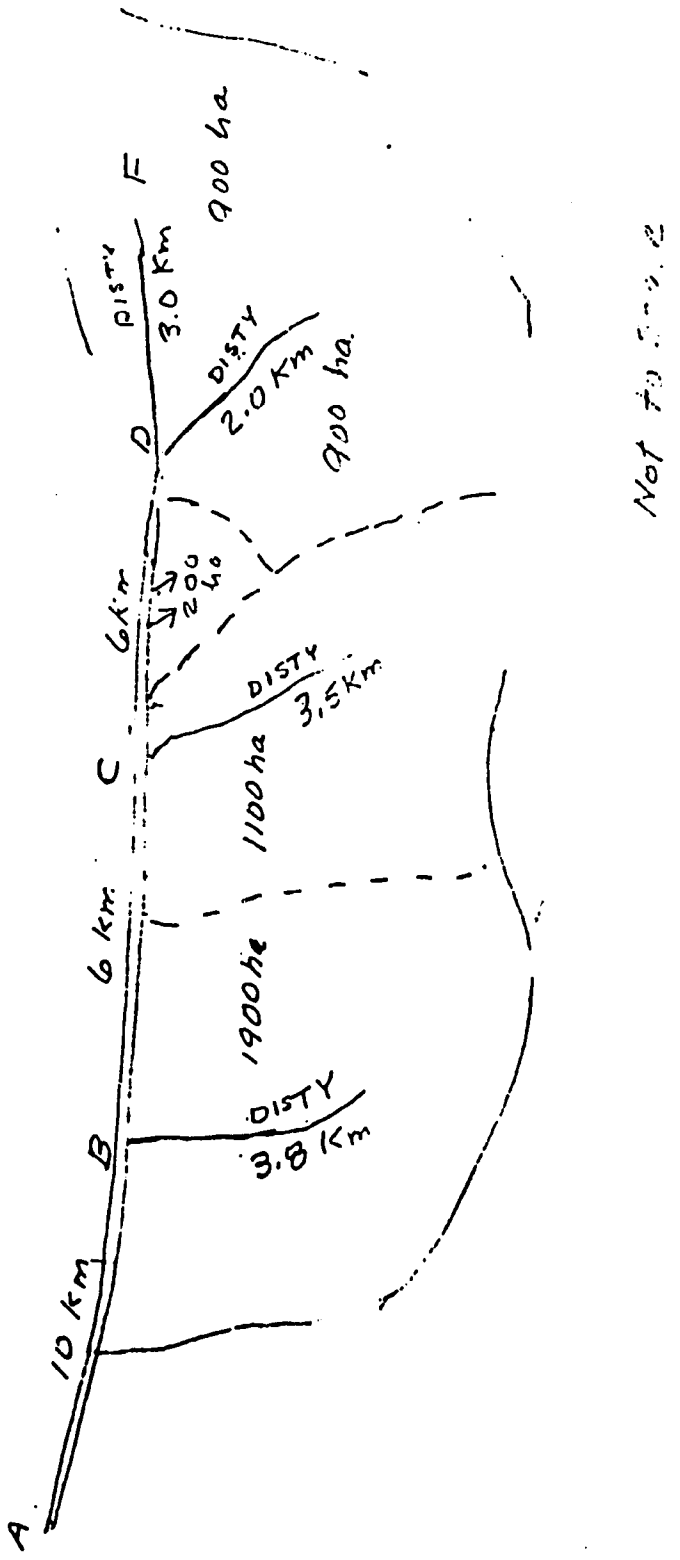

FIG 2. SCHEMATIC OF SYNTHABAD PROJECT

TABLE 2

CANAL SCHEDULE

Section	Length km	Capacity m^3/s	CCA Area Served ha	No. of Outlets
AB	10	1.8	5000	0
BC	6	1.1	3100	0
Distry B	3.8	0.75	1900	0
Minor B-1	1.7	0.15	300	8
" B-2	1.0	0.15	210	6
" B-3	2.2	0.21	460	14
" B-3	2.1	0.15	350	10
" B-4	1.3	0.15	237	6
" B-5	2.3	0.15	343	8
Disty C	3.5	0.45	1100	0
Minor C-1	3.5	0.3	583	19
" C-2	1.3	0.15	197	6
" C-3	0.9	0.15	110	6
" C-4	1.7	0.15	210	7
CD	6.2	0.75	2000	6 serving 200 ha
Disty DE	2.8	0.45	900	0
Disty DF	2.0	0.45	900	0
Minor DE-1	2.3	0.21	411	13
" DE-2	1.4	0.15	219	6
" DE-3	1.6	0.15	270	8
" DE-1	1.8	0.15	310	7
" DF-2	1.5	0.15	187	5
" DF-3	2.2	0.21	403	12

TABLE 3
CHANNEL DESIGN SCHEDULE

Channel	Material	Q (m^3/s)	b (m)	d (m)	Side-slope	Manning's n	R (ft) (m)	W.P. (ft) (m)	v (m/s)	A (ft^2) m^2	s
AB 0-1.7km	Hard Rock	1.8	1.5	1.04	1/2:1	0.035	(1.80) 0.549	(12.54) 3.82	0.85	2.10	0.002
AB 1.7.5.1km	Murum	1.8	1.5	1.07	1:1	0.035	(1.97) 0.601	(14.9) 4.54	0.66	2.75	0.001
AB 5.1-10	Clay Loam	1.8	3.0	0.73	1.5:1	0.025	(1.74) 0.530	(18.5) 5.64	0.59	(32.24) 2.99	0.0005
BC	" "	1.1	2.0	0.67	1.5:1	0.025	(1.50) 0.457	(14.48) 4.41	0.54	(21.69) 2.01	0.0005
CD Dist B	Clay	0.75	1.0	0.72	1.5:1	0.025	(1.36) 0.415	(11.74) 3.58	0.50	(15.99) 1.50	0.0005
Dist C DE DF	Clay	0.45	1.0	0.55	1.5:1	0.025	(1.10) 0.335	(9.76) 2.98	0.44	(10.76) 1.004	0.0005
Minor C1	Clay	0.30	1.0	0.46	1.5:1	0.025	(0.96) 0.293	(8.68) 2.65	0.39	(8.29) 0.777	0.0005
Minor B3 DE1 DF3	Clay	0.21	0.5	0.47	1.5:1	0.025	(0.85) 0.259	(7.22) 2.20	0.36	(6.14) 0.57	0.0005
Minor B1 B2 B4, B5, C2, C3, C4, C2 DE2, DE3, DF1, DF2	Clay	0.15	0.5	0.40	1.5:1	0.025	(0.74) 0.226	(6.32) 1.93	0.34	(4.66 0.43	0.0005

IV. Cropping Pattern

A. Planned With/Project

Seasons:	kharif	122 days	6/15-10/15
	rabi	123 days	10/16- 2/16
	H.W.	122 days	2/16- 6/14

Table 4 gives proposed W/P planned cropping pattern.

B. Actual Cropping Pattern

Based on history (see USAID, 1982), irrigation targets are not met. In kharif utilization (actual area/planned area) ranged from 8 to 32 percent for four projects analyzed by USAID. For rabi the range was 68 to 120 percent.

Why kharif targets fall so short has not been documented, although there are several fairly good hypothetical reasons not discussed here.

The records show that for rabi, the farmers will push planted area as far as they can. Inability of the system to deliver the planned supply to the field gates (underestimation of losses) can be inferred with confidence from examination of project historical cropping and water delivery records, and this is probably the principal reason for shortfalls in meeting planned areas. Instead of an overall delivery efficiency of 50 to 55 percent, actual efficiency turns out to be 30 to 35 percent.

Actual crop distribution patterns do not appear to be significantly different than planned.

1. Actual Utilization for Synthabad Project

kharif: 25% of planned, or .09 (CCA)
rabi: 95% of planned, or 0.494 (CCA)

Relative cropping distribution turns out as planned, Col. 2, Table 4, with the reduction going to fallow.

a. Rabi assumptions (Notes, p. 46)

(i) In years when adequate seasonal runoff occurs, reservoir will be full on Oct. 15, i.e., the kharif reserves are, in effect, transferred to rabi.

(ii) Farmers will shift back on water production function to optimize marginal returns on irrigation water at 75 percent of full irrigation supply.

TABLE 4

W/P PLANNED CROPPING PATTERN

(1) Crop	(2) Percent of Irrigated Area	(3) Percent of CCA	(4) Season
Kharif		36	
HYV Sorghum	60	21.6	6/15-10/15
Maize	15	5.4	7/01-12/31
Pearl Millet	15	5.4	6/15-10/15
Chillies	5	1.8	6/15-10/15
Pulses	5	1.8	6/15-10/15
Rabi		52	
Wheat HYV	60	31.2	11/01-02/31
Sorghum HYV	15	7.8	10/15-02/28
Gram	10	5.2	11/01-02/28
Oil Seed	15	7.8	10/15-02/28
Unirrigated kharif		64	
Local Sorghum		10	
Pearl Millet		5	
Fallow		49	
Candidate Crops where G.W. is Available			
Cotton			05/15-12/31
Sugarcane			Year round
Bananas			Year round
Lucerne			Year round
Groundnuts			02/15-06/30
Fodder			02/02-06/30
Fruits - Mango, Grape			Year round

(iii) Residual soil moisture at beginning of rabi is 100 mm. This implies fallow during kharif on those fields planted to rabi.

(iv) Winter inflow will offset reservoir evaporation during rabi.

Project was based on 50 percent probability of water supply (30.78 Mm^3). This strategy will reduce required water supply by 10 to 15 percent. Probability of meeting reduced supply will increase, but not significantly; possibly 5 to 10 percentage points.

Actually, matching of water supply delivered to farm with cropping pattern will be an output of the model, so the above is a first iteration.

V. Groundwater

Typically, the disintegrated basalt trap, "murum," underlying the topsoil and overlying the hard rock, serves as a limited free aquifer annually replenished by monsoon rain and, where it exists, irrigation. It is exploited using dug wells about 2 to 6 m in diameter and 8 to 15 m deep. Volumes, 50 to 100 m^3, are pumped daily, emptying the well, which recovers overnight and may be emptied again the next day (Peterson, 1978; USAID, 1982).

A. Project Aquifer

Annual recharge from rain: 150 mm on GCA (5750 ha)

Annual recharge from irrigation: One-third of all losses of the volume delivered over the main gate sill are potentially recoverable as groundwater. (These choices were made considering MGWD statistics, World Bank procedures, rough water balance assessments, etc. Optinion about the proper coefficient varies. These are mid range. [Notes, pp. 40-41].)

B. Project Wells

1. Well Strategy

Wells are used only sporadically during kharif. This use would not signficiantly alter the water table level at beginning of rabi when recharge would be at its peak, declining slowly thereafter. Data available shows that production capability during H.W. season is about 60 percent of winter production capability.

H.W. production when ET is highest limits area of perennial crops. In winter, perennial requirements are less, leaving water

available for rabi seasonals. One cannot save the latter water to increase his perennial area because of the natural recession of the water table and use by others.

a. Standard (Average) Well

	Before Irrigation Project	After Irrigation Project
Annual Water Production, m^3	18,000	22,500
Hot Weather	7,000	8,500
Rabi	11,000	14,000
Cropping, ha		
Perennial	0.67	0.8
Rabi sesonals	0.95	1.25
Spacing	¨ 325 m 1 well/10 ha GCA	

*Perennial is based on sugarcane ET_c; Rabi is based on wheat. Alternative or additional perennials are: fruits (mango, grape); bananas, lucerne. Rabi crops would doubtless include vegetables. Sorghum would use less water than wheat. Hot weather seasonals include groundnuts, fodder, vegetables. Cotton is two-seasonal, planted in kharif but extending into rabi.

Above should be adequate for hydrological modeling. If economic modeling is desired, more detailed cropping patterns would be needed.

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1/7/85

2-11-010-85

Training and Technology Transfer

Proposed Work Plan for WMS II Subproject:

FRENCH LANGUAGE TRAINING

October 1, 1984 - September 30, 1985

by

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This proposal is part of the Work Plan under the Water Management Synthesis II Project, which is a USAID project being conducted by Utah State University, Cornell University and Colorado State University.

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FRENCH LANGUAGE TRAINING

The WMS II Project has seen an increasing demand for its involvement in Africa and the possibility of a buy-in by the Africa Bureau of AID. While there is a large number of consultants and professionals from the university community with Africa experience, there are a lack of expertise who concurrently have experience in water management who can respond to this demand. Part of the forward planning of the WMS II Project has been to try and build capacity in core people from Utah State University who can work with other experienced professionals to enlarge the pool and expand the quality of water management technical assistance and training services which could be made available for Africa work.

One of the important requirements in expanding the expertise of core water management specialists is to increase their French language capability so that they can be more functional in French speaking African countries. To this end, USU undertook in FY 84 a French language program in which four core professionals took tutoring in French for one hour per day each, without remuneration from the project. Three of the four individuals have reached a 1+ French capability and need to continue their training for another year to increase their facility to a level which would be useful for field work. Thus, USU proposes a continuation of the current program in the same format as followed the previous year. Teaching will be carried out by a French speaking graduate student, using the Foreign Service Institute manual and method of French language training. The sole cost of the activity is the stipend to the graduate student.

Not only is funding for this activity necessary for the reasons cited above, but also because the benefit of the program for the first year will be lost without its continuation. The time period of the activity (two years) is similar to the period of time used by AID for its own personnel who take foreign languages on a limited one hour per day basis in Washington. The level of competence already achieved is roughly equivalent to that reached in the Foreign Service Institute program for students studying French for an equivalent period of time. The use of a graduate student on a tutorial basis is most effective because it allows each professional the maximum progress on the basis of his own ability and does not hinder other students when one or more of them must leave town on WMS II or other business.

UNIVERSITY INITIATED ACTIVITIES

Special Studies--Interfacing On-Farm Water Management

3-04-036-85

Colorado State University

January 17, 1985

INTERFACING FARM WATER MANAGEMENT WITH MAIN SYSTEMS MANAGEMENT THROUGH LOCAL COMMAND AREA MANAGEMENT

General Objectives

It is the purpose of this statement to establish a plan of work which will:

1. develop an integrated program of special studies to increase the capacity of WMS II to serve project needs in training, technical assistance, and technology transfer; and

2. promote constructive collaboration with special studies and other activities undertaken by colleagues at Cornell and Utah State Universities; and

3. advance state of the art knowledge regarding means to build and manage local command area irrigation units as interfaces between farm and main system operations.

The Problem

Water control on farm, the capacity to apply the proper quantity and quality of water at the optimum time to the crop root zone to meet crop needs and soil leaching requirements, is a most fundamental yardstick against which to measure effectiveness of irrigation systems.(1) Irrigation water management, in large scale surface systems at least, involves the capture and control of water in central irrigation works, passing it on to local command area units which divide and control it further and, in turn, pass it on to the farmer who must control it on farm and in particular fields to place it in crop root zones. Failure to secure adequate farmer control over irrigation water is associated with poor water productivity and signficant public health problems.

The extent to which water supply on-farm can be applied in accordance with biological requirements of crops is a function of the socio-technical operations at the three levels--main system, unit command area, and on-farm. Farmers in irrigation systems around the world are faced with the common task of hitting a changing target--a crop root zone moisture deficit--in a technically dynamic and socially tumultuous environment within an irrigation system. This system often has been designed by remote engineers, administrators, and politicians whose professional responsibilities were to do little more than aim a quantity of water in the general direction of farms within local unit commands. In most large scale systems, especially in Asia where the preponderance of global irrigation occurs, the upstream main systems were designed with little regard to problems faced by farmers in securing local water control for effective water management.(2) Furthermore, the original design criteria have become, in many instances, inappropriate to new crop technologies and new irrigation management objectives.

The major focus of irrigation policy during the last century, quantitative expansion of irrigation works, has been rapidly shifting to a focus on qualitative improvement as a means of increasing agricultural production.(3) Hopes rest heavily on the knowledge that existing large scale surface gravity flow irrigation systems tend to operate at low efficiencies because of

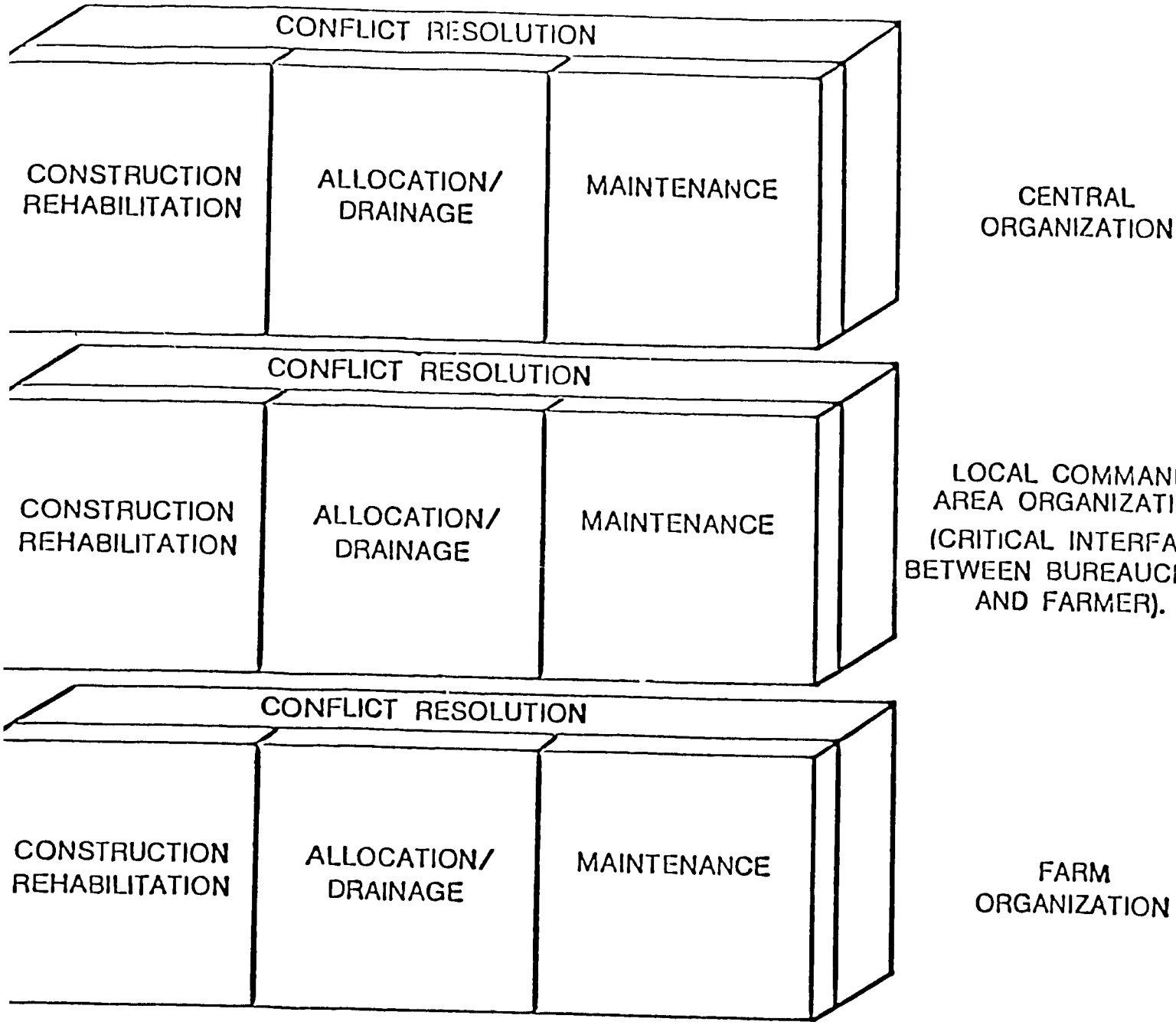

FIGURE 1. OVERVIEW OF IRRIGATION ORGANIZATION

widespread failure to productively organize to yield the highest possible precision water control to the farmer. Such control makes improved farm management possible.

Focus on qualitative improvement of inefficient irrigation systems must require analysis of both physical "hardware" [tools] and social organizational "software" [rules] aspects in an interdisciplinary fashion. The proposed special studies work is rooted in the twin premises that: a] design of the middle level social-technical interfaces is a most strategic determinant of farmer water control, and thereby, productivity of irrigation systems; and b] that local command area interface organizations with appropriate rules and tools are most problematic in irrigation systems around the world, and most specifically in many South and Southeast Asian nations.(4) The proposed work, therefore, pursues three kinds of analyses:

1) investigation below the unit command area interface which establishes farm irrigation requirements which the middle level command area organizational interface must serve;

2) investigation above the unit command area interface which establishes main system constraints upon interface arrangements;

3) investigation in the unit command area interface to determine which kinds of "rules" and "tools" can best serve on-farm water control requirements under conditions obtaining in the main and on-farm systems.

The WMS II Project has defined a special studies theme of irrigation systems management. This theme focuses on the improvement of the performance of irrigation projects by focusing on the improved management. To provide complimentary use of resources, and a field and institutional building focus, special studies at CSU will try to initiate an effort to improve system management of tanks in Sri Lanka as a complimentary effort to the Mission-funded Technical Assistance (TA) effort. CSU is also seeking other areas in Asia to provide comparative data.

Defining The Units

An initial set of concepts employed to distinguish main, command area, and on-farm systems are presented in Figure 1. Interests of people at different levels of the irrigation system are typically not the same:

At the central main system level, good water management must focus heavily on keeping the flow of water in large volumes within key parameters such that the main system functions effectively. The emphasis is on aggregating many requirements of diverse unit command systems and dealing with them as aggregates by dealing with average needs and behaviors. This level is characterized by the following attributes:

1. Central main system water managers are not rewarded or punished according to the on-farm productivity of the water.

2. Main system water managers depend heavily upon the processed disciplinary knowledge of engineering, public

administration, sociology, economics, and the like without knowing specific local details of unit command area and on-farm operations.

3. Main system water managers have operational smoothness as a fundamental objective.

At the farm level, good water management must focus heavily on placing relatively small volumes of water in particular crop root zones in a manner which fulfills crop requirements. The farmer cannot focus on average behavior in the over-all main system or command area, but must focus on the unique condition of particular fields and crops. Farm units are characterized by the following attrributes:

1. Farmers are rewarded and punished according to farm productivity of water.

2. Farmers cannot depend heavily upon general tendencies yielded by the several disciplines except as they are adjusted to his or her particular situation.

3. Farmers have as a fundamental objective of rapid adaptation to changing field conditions which vary widely from time to time, within fields, among fields, among farms, and among unit commands.

Farmers adaptive field needs must be linked to main system operational requirements. This linkage is provided by farmer associations comprising the interface between farms and main systems. These associational interfaces must possess the rules and tools necessary to break down large main system water volumes into amounts appropriate to farm application under terms such that the farmer can employ it productively by virtue of his or her capacity to control it and thereby be willing to pay for it. Farmers cannot be expected to pay costs of main system and command area management, or to enthusiastically participate in unit command area organizational affairs unless these systems provide to farmers at least minimally acceptable control over water. Farmers are understandably reluctant to pay for water which comes too soon, too late, too much, too little, or in unacceptable quality. Middle level organizational designs for operating in the interface between farm and main systems must address many specific issues having to do with the following general problems:

1. Management at the unit command level can be primarily responsive to higher main system authority and be rewarded and punished on the main system format or management can be importantly responsive downward to local farmer representatives who exercise at least some control over the

unit command area operation.

2. Unit command area management must disaggregate central supply tendencies of the main system into specific requirements of multiple and diverse farm systems within the command.

3. Unit command area management must develop some combination of rules and tools which will allow divergent objectives of main system management and local farmers to productively and equitably mesh.

4. Unit command area management must deliver water to farmers with sufficient control that farmers will be willing to to mobilize their resources in sustained support for the local organization.

It is the objective, then, to conduct a program of integrated special studies which will produce greater capacity to interface farm systems with main systems through improved unit command area organization and management. This is an inherently interdisciplinary task and the specific components discussed below each possess that interdisciplinary orientation.

To implement the research investigation into the interface of on-farm and main system irrigation system management, CSU has initiated a proposal for an interdisciplinary analysis of the organizational and technical requirements of serving main system management needs and irrigator water demands through water user associations in Sri Lanka. A copy is attached.

In addition efforts are underway to initiate studies that will provide complimentary data in India, Thailand and/or Pakistan. Therefore, this special study is divided into two phases. Phase I is the preparatory and development phase for the field work. Phase II is the actual field investigation and will not be initiated until mission and country approval has been received in one of the Asian countries noted. Budgets are divided into the two phases.

Proposed Program of Special Studies--Development, Phase I

Phase I will include preparation of proposals for the site specific research, will provide for development of potential researchers through on-campus seminars in water management, and will provide an interdisciplinary team to define the areas of research and assessment necessary to work with the team when it is in the field. The planning phase will proceed as follows:

1. Identify graduate students, research associates and professors from WMS II who have expertise and interest in field research that will investigate the interfacing problems.

2. Contact appropriate individuals in the missions, host countries, and development institutions to explore their interests in participating and, perhaps, contributing to the study.

3. Develop site specific proposals for Sri Lanka, India, Thailand, and Pakistan.

4. Provide intellectual direction to the studies and especially to the graduate students carrying out the studies.

5. Evaluate specific analytical tools for investigating the interface between farm and main systems.

Outputs from this phase will include the following:

1. Proposals for Sri Lanka, Pakistan, India, and Thailand

2. FY 85 special studies progress report

3. Trained personnel that contribute significantly to both the host country and U.S. capability in water management

Proposed Program Of Special Studies--Interfacing Main System Management With Farm System Management--Phase II

The problem of designing and implementing middle level farmer associations to productively link main system requirements to farmer water use needs is of high priority to potential host country governments in the region. Severe budget and irrigation productivity problems are forcing a reassessment of traditional relationships between central bureaucracies and farmers. There is recognition of the importance of involving farmers in management of the lower reaches in the respective systems. Most specifically there is concern to mobilize farmer contributions of labor, materials, knowledge, management, and money. Examination of the means by which local middle level organizations can be constructed so as to effectively mobilize such resources is something in which host country governments are most seriously interested. It is expected that irrigation bureaucracies and USAID missions in several host countries will enthusiastically collaborate with the proposed WMS II special studies research efforts.

Proposed Sites

In Sri Lanka, discussions suggest that WMSII/CSU special studies activity would be welcomed at four sites in Polonnaruwa District--Parakrama Samudra, Giritalle, Minneriva, and Kaudula. Each site consists of irrigated acerage [4,380--19,600 acres] served by tanks and a network of canals administered by the Department of Irrigation. Each site is scheduled for a least some rehabilitation work and the issues of interfacing main systems with farm systems are paramount. Work will be closely linked to, and build upon, the diagnostic analyses which have already been conducted. The USAID mission is involved in rehabilitation work at these sites and special studies analyses can be expected to contribute to mission objectives as well as to the worldwide objectives of WMSII.

In Thailand, small scale irrigation development has proceeded in the Northeastern region for more than twenty years as the Royal Irrigation Department has constructed about 200 small reservoir impoundment projects. Unfortunately, these schemes have not reached their potential in substantial part because satisfactory arrangements have not been worked out between main

system management and local farmers who are to exercise considerable responsibility for controlling water, facilities maintenance and conflict resolution, in the lower reaches of the systems. USAID Thailand has undertaken a loan agreement to develop and demonstrate methods of rehabilitation at seven sites. Unfortunately, due to rapid increases in physical rehabilitation costs, decisions have been made to concentrate effort at three of the original seven sites. Design of the local interface organizations, although recognized to be crucial, has been a subject largely neglected. The special studies work will be focused on the problem of organizational design to serve effective interfacing of farms and main system operations at selected sites within the original seven chosen for rehabilitation.

In India, opportunities for advancing our knowledge with regard to the special studies theme exist at many sites, but discussions indicate that work can be initiated at Dahod Tank near Bhopal in Madhya Pradesh. Dahod Tank was the site at which a WMSII Diagnostic Analysis was undertaken during the winter of 1984. This site has been selected by USAID/India and the GOI as one which will be the object of significant rehabilitation work. Work on problems of interfacing farm and main systems will, therefore, be integrated into a larger program of irrigation systems development.

Specific Special Studies Objectives

First, investigation will document and analyze the structure and dynamics of existing arrangements established between farmers and main system operators. This will involve investigation of farmer water control problems in the context of main system management constraints.

Second, interface designs will be proposed and evaluated within which appropriate sharing of responsibilities might be undertaken by irrigation authorities in collaboration with farmers.

Third, information will be provided to host country and USAID personnel about the uses and limits of interface design alternatives;

Fourth, activities within each country will be conducted within a comparative design for investigation such that experiences gained and documented can be productively shared among the relevant audiences within targeted countries, the wider region, and interested parties around the world.

Mode Of Operation

Special studies efforts will:

1. Be interdisciplinary. Neither social science, nor the technical sciences, in isolation, can adequately capture realities of the field situation. Physical analyses of crops, soils, and water will be integrated with social analyses of human behavior. Consideration of the social "rules" for allocation, maintenance, communication and conflict resolution will be closely associated with physical "tools" relevant to these activities.

2. Be comparative. Site specific experiences will be placed within a comparative conceptual framework within which lessons learned can be distilled and transmitted to others who face problems of interfacing farm and main systems in other areas of the world.

3. Rely heavily upon graduate student personnel backstopped in the field by WMSII Senior TDY personnel, by direct hire USAID mission personnel, by indigenous personnel in local institutions, and by USAID contract hire personnel. Budget constraints preclude the establishment of teams of WMSII faculty stationed full-time at project sites.

4. Be undertaken in collaboration with indigenous host country institutions for the mutual benefit of all parties. In Sri Lanka work will be closely articulated to that of the Water Management Cell and it is expected that collaboration will evolve with the Agrarian Research And Training Institute. In Thailand, collaborative arrangements are being established with the Royal Irrigation Department and Kaesesart University. Arrangements are yet to be made in Madhya Pradesh, but there is reason to believe that satisfactory collaborative effort will be forthcoming.

5. Be closely articulated to on-going rehabilitation efforts funded by USAID loan/grant programs. Close cooperative ties to such programs insure the relevance of special studies work and provide an extra dimension to the local in-country mission work which would otherwise be unavailable.

6. Connect farmer participation in system allocation, maintenance, and conflict resolution to efforts at local command area organizational design. Participatory approaches involving farmers in irrigation management are essential to successful system management, but they are, by themselves, insufficient. Participation must result in effective and specific joint agreements among farmers, and between farmers and main system management, which serves both farmers and main system requirements. These joint agreements about the use of tools and the application of rules compose local organizations. The design of the organizational joint agreements must be connected to farmer participatory processes. Work in each country will reveal the uses and limits of alternative organizational designs; analysis of these experiences can be expected to be of significance for main system management agencies in host countries, and for other main system management agencies in the region and beyond.

Methods

Interdisciplinary and comparative analysis requires that the physical and social data be gathered in a carefully coordinated manner. At the farm level, data will be collected to determine farmer requirements and problems to which the middle level command area organization must respond if it is to elicit strong farmer support. Data will be gathered at this level regarding cropping, soil types, and water distribution. Furthermore, data will be collected about farmer irrigation behavior individually and as it occurs in coordinated informal joint actions of small farmer groups. Social data at the farm level will include those regarding demographic characteristics, and farmer perceptions and rankings of problems and obligations including revenue assessment arrangments. At the level of local command area organization, physical data will be gathered with respect to water deliveries, channel performance, turnout operations and the like. Social data will focus on examining extant organizational arrangements employed for water allocation and assessment, maintenance, and conflict resolution. Careful attention will be paid to both *dejure* and *defacto* conditions. At the main system level, data will be collected regarding interactions between main system managers and command area personnel; physical data will be compiled indexing main system

operating characteristics.

A combination of data gathering approaches will be employed including:

1. The variety of engineering and soil science techniques for making physical measurements in the systems;

2. Sample survey methods employing questionnaires--useful to obtain distributions of events and behaviors across the system;

3. In-depth interviewing of key informants--especially appropriate for investigating rules, roles, and relationships among actors;

4. Participant observation--especially useful for learning about unspoken meanings of events and behaviors.

Expected Outputs

The special studies program will produce results for use by host country personnel, by USAID missions, by other agencies in the region, and by the Water Management Synthesis Project in assessing and integrating concepts and analytical approaches. They are:

1. Country specific case studies of the uses and limits of existing interface arrangements for linking main to farm systems. Data will be generated which will increase our insight into the problems currently faced.

2. A summary analysis for agency administrators extracting and presenting lessons learned for construction of middle level organizational interfaces between farm and main systems.

3. Dissertations and theses which will yield scholarly in-depth analyses of selected aspects of the problems associated with organizing middle level interface units.

4. Evaluation and production of specific analytical tools (economic, engineering, agronomic, and sociological) for examining interactions between organizational rules and tools with specific applicability to the problems of interfacing main and farm systems.

5. A series of workshops to infuse knowledge gained into WMSII training and technical assistance efforts such that such efforts become increasingly responsive to the problems of linking main to farm systems.

6. Concepts, procedures, and data, which can be incorporated in host country and WMSII training materials.

7. Articles submitted to host country and international journals transmitting important findings to professional audiences in the region and beyond.

8. Synthesis of lessons learned in support of increased project capacity to respond the urgent problems of integrating main and farm system managment--something which paysoff not only for increased agricultural production and incomes, but also for reduced negative health and environmental effects associated with improved irrigation water management.

Schedule

1. FY 1984-85 preparation for, and initiation of specific country programs in Sri Lanka, Thailand, and/or India (Madhya Pradesh).

2. FY 1985-86, conduct of in-country investigations, analyses of results, and integration of lessons learned into related project activities--training, technology transfer, and technical assistance.

3. FY 1987, conclusion of in-country work, preparation of publications, and conduct of final workshops for dissemination of special studies results to relevant audiences.

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WATER MANAGEMENT SYNTHESIS II SPECIAL STUDIES PROJECT IN SRI LANKA

Introduction

The proposed research will examine means to more productively link farm water management with main system management (tank-diversion level). Interdisciplinary research will be conducted on main system and farmer irrigation water control problems, factors affecting farmer participation in local level water management activities, problems and potentials of current local farmer organizations, and culturally appropriate and replicable organizational forms.

This proposal has been written specifically to address USAID and WMS II project needs and interests. An alternative form of the proposal, written in ARTI format, is included. It indicates research activities of each proposed CSU/WMS II research associate.

The major focus of irrigation development throughout the world over the past century has been on developing and expanding new lands and water supplies. Improved management and institution building has received less attention (1). The Government of Sri Lanka has recognized the importance of improved water management and the potentials for strengthening institutional linkages between the central irrigation administration and individual farmers (2). Improvement of the irrigation organization requires interdisciplinary analysis of both physical "hardware" [tools] and social "software" [rules].

The proposed research is rooted in the premises that: a] design of local farmer organizations as interfaces between farmers and main system management is a strategic determinant of farmer water control and, thereby, water productivity; b] water control and productivity are key determinants of willingness of farmers to deliver sustained support of local organizational rules and tools; and c] the design of local farmer water user organizations is strategic to both improvement of main system management and farm water management. For purposes of this proposal, "interface" is taken to mean an organizational entity which operates to improve management linkages between Irrigation Department personnel and farmers.

General Objective

The general objective is to advance a plan of research which will contribute data, information, and options to policy discussion regarding means to advance farmer participation in local water user associations, while adapting forms of farmer participation to main system management requirements. An important element of this effort is the building upon current farmer participation activities, conducted by Cornell University and the Agricultural Research and Training Institute (ARTI), in irrigation management and maintenance.

The plan of research work is intended to:

1. Provide direct assistance to the Government of Sri Lanka and USAID/Sri Lanka in facilitating the structural and management improvement of four tanks and one diversion

system by the newly initiated Irrigation Systems Management Project (ISMP) in the Polonnaruwa District, under the Ministry of Lands and Land Development (MLLD).

2. Assist the Government of Sri Lanka in collecting interdisciplinary benchmark data, which, when analyzed and interpreted in the local cultural context, will contribute to practical implementation strategies for improving operation, maintenance, and the involvement of water users in managing appropriate components of the irrigation system. Work is to be conducted by both Sri Lankan researchers and CSU/WMS II researchers. Developing a cooperative working relationship with personnel of the Agrarian Research and Training Institute in this endeavor, given their experience and expertise in the field, is most important.(3)

3. Support current efforts in building upon host country knowledge regarding the potentials for eventual formation of appropriate water user associations or equivalent institutions. Such knowledge, based upon local precedents, experiences, and cultural values, is of great importance. This will support future efforts of the relevant government agencies to advance productivity of irrigated agriculture through development of improved means to integrate farm and main system water management (4).

4. Assist the Water Management Project (WMP), and through it the Irrigation Management Division (IMD), in conducting diagnostic analyses on the four irrigation schemes scheduled for improvement. This assistance will focus on aiding ISMP to fulfill its objectives.

5. Contribute to a developing program of special studies designed to increase the capacity of WMS II in serving USAID project needs in training, technical assistance, and technology transfer in Sri Lanka and the wider region.

6. Promote constructive collaboration with special studies and other activities undertaken by colleagues at Cornell and Utah State Universities.

Background, Perspective, and Potential Significance

In large scale surface irrigation systems, water management may be viewed as the capture and control of water in central irrigation works, the process of passing it on to local farmer associations which further divide and control it, while then delivering it to farmers who must distribute it to their fields. Farmers in large gravity flow irrigation systems around the world commonly face the difficult task of rapidly adapting water flows to dynamic land and crop consumptive demands. As new crop technologies are developed and crop diversification occurs, new management objectives and water demands must be

met. It is not uncommon to find system designs and operating procedures that are ineffective in providing farmers the local water control they desperately need (5).

One way to define water control at the farm level is to view it as the capacity to apply the proper quantity and quality of water at the optimum time to the crop root zone to meet crop needs and soil leaching requirements. Such water control is felt to be an important yardstick in measuring the effectiveness of irrigation systems (6). In Sri Lanka, where much irrigation is focused on rice in flooded basins, there are significant problems of securing sufficient control to achieve hoped for increases in crop yields (7). Furthermore, as agricultural policy places greater emphasis on employing nitrogen-fixing crops in rotation with paddy, requirements for water control will increase (8).

In the Sri Lankan context, the domain of the central irrigation administration is organized to extend down to the F-channel turnout. The decision domain of the individual farmer is generally defined as limited to the farm itself. This proposal is written from the perspective that the extent to which water can be applied on the farm in accordance with land and crop requirements is a function of socio-technical operations at four distinct levels: the main system level (tank diversion), the distributary channel level, the field channel level, and the field level. (Figure 1, p.6). The focus of the proposal is to investigate ways in which the current organizational interfaces between farmers and main system operators can be improved at D and F channel levels (9).

It is suggested that the failure of farmers in some areas to secure adoquate control over irrigation water and to achieve potential yields is often directly associated with the absence of an effective organization between the main system management and the farm. Again, this is a major theme underlying the proposed research work. The research is intended to directly address the priorities brought forward in the ISMP design report, the Water Management Project Paper (10), and those suggested by the Integrated Management Program forMajor Irrigation Schemes (INMAS):

> "Institutional building and setting up of farmer organizations is given high priority under this program. This would enable them (farmers) to participate meaningfully in management decisions and activities that affect them and acquire a degree of management capability that will enable the state to withdraw from certain operational activities at a later date" (11).

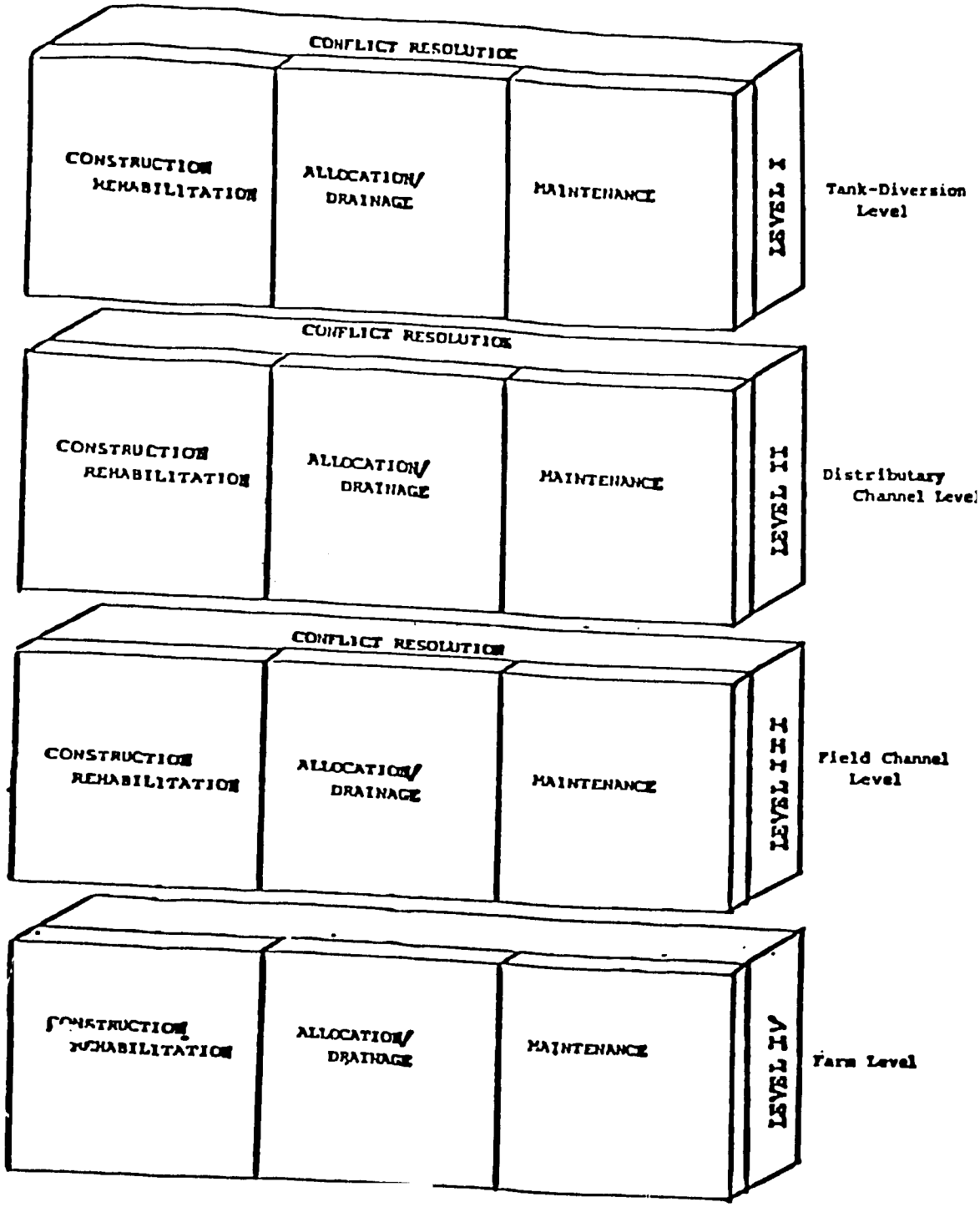

FIGURE 1 .OVERVIEW OF IRRIGATION ORGANIZATION

Research Premises and Areas of Analysis

In cross-cultural studies it has been suggested that efficiency, productivity, equity and self-determination of water users are viewed as keys to long-term stability of irrigation systems (12). The premises on which the proposed workplan is based are that:

1. Essential to long-term productivity and stability are water management operations of local farmer associations which serve as interfaces between main system and farm managements.

2. The organization between main system management and farmers can be provided with both technical and social features which lead to better water control, accountability, and reciprocal rights and obligations between main system managers and water users.

3. While local farmer associations may be at times perceived as problematic to irrigation agencies, farmer associations represent a significant resource as a means toward achieving greater performance from existing irrigation systems (13). Main system managements are fully aware that their resources will be quickly dissipated if they are expended in countless local interventions. Information is too scarce, and energy of main system management is too limited. Viable farmer associations, functioning within main system parameters, which can organize local water allocation, perform local maintenance, and resolve local conflict constitute a critical counterpart of main system operations.

The proposed work will pursue the following areas of analysis in collaboration with Irrigation Department (ID) personnel, Sri Lankan researchers associated with ARTI, CSU/WMS II researchers, and farmers:

1. Interdisciplinary investigation at the farm level to establish the downstream irrigation requirements to which an improved interface association will need to respond.

2. Interdisciplinary investigation at the main system management level to establish the upstream operational requirements to which an improved interface organization will need to respond.

3. Interdisciplinary investigation to examine the current and potentially feasible "rules" and "tools" of existing farmer organizations, with the purpose of contributing toward a further understanding of the operational requirements and linkages between main system management and the farm water management levels.

As part of this effort, further understanding will be developed regarding ways in which the nature of the relationship between main system and farmer operations affects local community relationships and agricultural practices.

Research Sites and Special Studies Project Organization

The Consortium for International Development, in conjunction with the Water Management Synthesis II project, is providing the services of a long-term Water Management Specialist, Dr. Larry Nelson, who is working to provide technical assistance to the Irrigation Department of the Ministry of Lands and Land Development. Among other duties, the water management specialist is responsible for strengthening the institutional capability of the Irrigation Department to perform multi-disciplinary studies of irrigation schemes scheduled for structural and management improvement at four sites in Polonnaruwa District--Parakrama Samudra, Giritale, Minneriya, and Kaudulla. The proposed special studies research will contribute significantly to the conduct of the required studies.

Each site designated for structural and management improvement consists of irrigated acreage [6,000--19,600 acres] served by tanks and a network of canals administered by the Irrigation Department. The problem of coordinating main system water supplies with farm water demand through institutional strengthening is considered a major priority by the Water Management Project, the Irrigation Management Division, and the Ministry of Lands and Land Development (14).

The special studies project will be closely linked to, and build upon, the work specified under Water Management Project (contract # 383-0057) currently providing technical assistance to the Irrigation Department. Four WMSII/CSU research associates--two sociologists, one economist, and one engineer, will carry out the special studies project workplan, while also providing assistance to the long-term water management specialist, Dr. Larry Nelson (15; see Figure 2, p.11). In addition, it is expected that a fifth individual, an agronomist funded by the related Landsat proposal, will become part of the research team.

It is expected that the four WMSII/CSU special studies research associates will provide approximately fifty percent of their time in support of the Water Management Project work, in return for which they will: 1) receive counsel, collaboration and support from Dr. Nelson and host country counterparts associated with the Water Management Project; 2) receive vehicular support from the Water Management Project on an "as available" basis; and 3) receive housing in the project area. Two CSU sociology research associates have been selected. The economic and engineering research associates have been identified and will be appointed upon approval of this proposed research. The agronomist, supported by the Landsat activity, has also been identified.

It is expected that experienced counterpart Sri Lankan researchers, associated with the Agrarian Research and Training Institute, and committed to the long-term Water Management Project activity under the leadership of Dr. Nelson, will serve as senior host country counterparts. They will be supported by funds available under the long term Water Management Contract #383-0057 as will a number of Sri Lankan field research assistants who will be responsible for day-to-day data collection. We understand that these counterparts are already in the process of being selected. Our goal is to assist them in their

endeavor while accomplishing the goals stated in this proposal.

The international travel and salaries of CSU research associates will be provided by CSU/WMS II core funding. It is expected that these research associates will be allowed privileges granted to WMS II project staff under contract # DAN-4127-6-00-2086-00.

Research Activities

Research activities will involve data collection to serve three distinct but interrelated needs: baseline data to support WMP and ISMP efforts at the work sites; organizational data for WMP/ISM and special studies needs; and case study information to insure local relevance of institutional analysis as suggested in the ISMP design report (16).

A. Workplan Development.

Soon after arrival, a planning meeting between WMS II special studies research associates and WMP/ISM personnel would be conducted under the direction of Dr. Larry Nelson. This meeting will provide an opportunity for special studies research associates to be informed of WMP/ISM activities. Attention will be given to choice of compatable research sampling units, scheduling of team activities, sharing of data between special studies and WMP/ISM personnel, establishing deadlines for data collection, analysis, and report writing.

It is expected that Landsat data will be provided to ISMP and CSU/WMS II special studies under a separately funded activity. The proposal for the landsat activity will be soon forthcoming. Data gathered by special studies researchers will help contribute to ground truth verification for Landsat imagery, and the Landsat activity will provide an important resource for the special studies endeavors as well as those of the WMP and ISMP.

ORGANIZATIONAL CHART

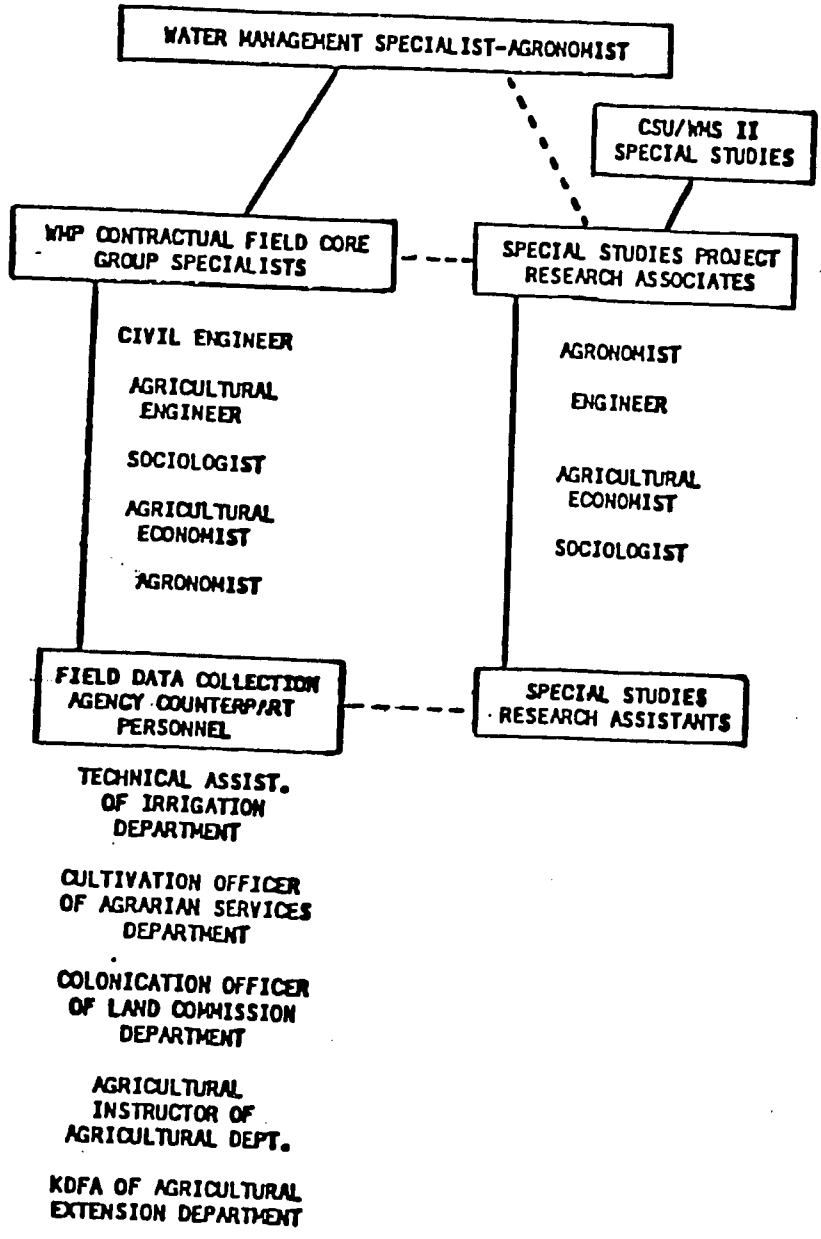

FIGURE 2 ANTICIPATED COOPERATIVE RELATIONSHIPS

B. Mode of Operation.

Workshops will be held to:

1. Familiarize and gain support from farmers and the community for conduct of the research.

2. Establish a functioning interdisciplinary team in order to facilitate the collection of physical, economic, and social data.

3. Determine ways to minimize the impact of field data collection and sample farmer interviews on farm household time and privacy.

4. Provide a monitoring and evaluation mechanism of field research and changing community views of the research.

CSU research associates will become as proficient in Sinhala as possible prior to their arrival in Sri Lanka. Sri Lankan field research assistants, supported by WMP, will be relied upon for assistance in the collection of data. It is assumed that the special study data collection requirements are compatable with, and contributory to, WMP project objectives.

C. Baseline Data

Specific baseline data measurements are discussed in the ARTI proposal which accompanies this statement. Using well accepted sampling procedures, the objectives are to:

1. describe and document current procedures for water allocation, system maintenance, and conflict management in the target schemes. This information ill be gathered by the appropriate reprsentatives of the several disciplines.

2. make water measurements necessary to construct main system water supply hydrographs and the farm water demand hydrographs. This investigation would also involve examination of farmer water distribution problems in the context of management constraints at the tank level. Conveyance losses and field application efficiencies will be measured.

3. collect detailed quantitative information on farmer attitudes and expectations surrounding the structural and management improvement effort. This will be supplemented by quantitative assessments of community conflict patterns, power distributions, and innovation-adoption patterns.

4. collect detailed information to document the water use practices and irrigation requirements of farms in the

irrigation schemes to ascertain potential discrepancies between current distribution practices and observed farm needs. Timing of deliveries will be measured against agronomic data on crop consumption patterns, growth stages, soil conditions and crop requirements.

Collection of the above kinds of data will provide important benchmark information for the Irrigation Systems Management Project, which is to begin in 1986, as well as contributing to the establishment of a monitoring, evaluation, and feedback system for the same project.

D. Organizational Data

Future government efforts toward achieving a productive link between main and farm systems will likely depend upon a good data base which includes detailed information on the current arrangements between farmers and main system operators, and farmer views about water user associations.

Further, it will be necessary to conduct in-depth interviews of key administrators and farmer informants with specific reference to the feasibility of, and potentials for, development of local organizational arrangements to improve relationships between main and farm systems based upon historical precedent and current practices.

Employing a measurement instrument especially designed for the purpose, various alternative situations will be introduced to farmers and to main system personnel during interviews, in order to elicit their views about the following:

1. culturally meaningful and operationally appropriate property rights and responsibilities of water users, for the purpose of improving operations, maintenance, and assessment collection;

2. locally defined water distribution procedures relevant to the hydrology of the system in question, to improve the equity of distribution and the timing of deliveries;

3. accountability, responsibility, and reward patterns of Irrigation Department personnel, and those of farmer representatives;

4. staff recruitment patterns of main system personnel and farmer organizations for the purpose of assessing effects of different personnel backgrounds upon problems in the interface between farm and main system management;

5. operational goals for, and constraints upon, water control of main system managers compared with goals and constraints for farm irrigators;

6. possible ways in which to promote the formation of, and participation in, farmer organizations to distribute water in areas where investigation reveals opportunities for improved arrangements.

7. potential new functions of D and F channel farmer organizations, including allocation, maintenance, and conflict management.

8. locally relevant structural attributes of existing farmer organizations, including decision-making authority, sanctioning powers, selection of leadership, maintenance mobilization, and grievance procedures;

In summary, one could visualize this effort in the following way:

Independent Factor	Intervening factor	Dependent Factor
share type staff recruitment staff accountability mobilization for maintenance conflict resolution	degree of water control at the several levels	willingness to support organization

This type of research would include the design, testing, and application of an organizational options measurement instrument. The instrument would scale, simulate, and elicit responses to various combinations of the above points. This would address the need for modeling and testing of alternative appropriate farmer irrigation organizations as referenced in the USAID Project Paper (17), but will utilize proposed alternative options and participant experiences to avoid the imposition of untested models on farmers.

E. Case Studies

In order to provide a full contextual basis for the baseline and organizational data outlined above, and specifically for the qualitative description of current and historical irrigation practices, a case study approach is viewed as an integral part of the research activities. Work will be directed toward collection of information concerning settlement history, cultural values surrounding agricultural activities, existing patterns of social interaction, and experience with irrigation rules and tools.

This information, in combination with the baseline and organizational data, will support the general goal of assessing feasibilities of various organizational options in a manner which is sensitive to local conditions. The data will be collected through the usual sociological/anthropological field methods of participant observation, key informant interviews, and collection of selected life histories.

This effort should not be considered as a separate activity from the baseline and organizational data activities, but rather as the documentation of some of the relevant aspects of the social/historical/technical context within which the other two data bases occur. As such, it is not perceived as competing with the other activities. It is generally possible to collect two or three forms of data in a single situation, such as a key informant interview in a farm field or home.

Benefits of the Special Studies Project

Strengthening farmer organizations that link mair system requirements to water user needs is important to the Government of Sri Lanka. Budget and irrigation productivity problems, as well as the recognition of the importance of involving farmers in the management of the lower reaches of the main system, are important reasons for research which addresses institutional strengthening. Strong farmer organizations will be needed to mobilize water user contributions of labor, materials, knowledge, management, and money (18).

Information collected during a recent Diagnostic Analysis Workshop at Polonnaruwa (July 23-Aug 17, 1984) seems to suggest that current irrigation and operation and maintenance fee collections are below the desired level at the proposed work sites. Special studies research will address the problem of irrigation fee collection through an investigation of the extent to which extant organizations serve farmer water control requirements and thereby elicit farmer support and investment. Farmers cannot be expected to enthusiastically support organizations, by fee payment or other means, which do not provide them appropriate forms of water control necessary to make water deliveries reliable and productive.

The learning process model being employed at the Gal Oya project has shown potential, and the proposed research will attempt to draw upon the work of ARTI, Dr. Norman Uphoff, and associated researchers knowledgable about the institutional organizing efforts employed there (19).

The special studies project directly addresses problems identified during the Diagnostic Analysis Workshop. The apparent confusion over spheres of water control and maintenance responsibilities below the tank, and local problems with the new water management program for major irrigation schemes in Sri Lanka are issues central to achievement of reasonable investment returns from structural and management improvement efforts. Farmers' apparent willingness to pay higher irrigation fees in return for greater budget accountability, improved sanctioning of distributary and field channel violations, more use of hired labor, and improved timing of deliveries, clearly demonstrate a desire for greater local responsibility, initiative, and control (20).

Outputs

The special studies project will produce results for use by host country personnel, by USAID missions, by other agencies in the region, and by the Water Management Synthesis Project in assessing and integrating concepts and analytical approaches. They are:

1. A summary report for the Sri Lankan USAID mission and interested GSL agencies. The report will present data gathered by the research associates, and will draw out implications for strategies regarding establishment of sustainable D-channel and F-channel water user associations.

2. Comparative case studies of all four tanks being considered for improvement. Data will be generated on the uses and limits of existing organizational interface arrangements for linking main to farm systems. Potential alternative designs intended to strengthen farmer participation and management will also be presented.

3. A workshop to desiminate knowledge gained to associates in Sri Lanka, the region, and the U.S.

4. Concepts, procedures, and data, which can be incorporated in host country and WMSII training materials.

5. Two doctoral dissertations which will yield scholarly in-depth analyses of social, economic, and technical aspects of the problems associated with organizing better operating arrangements between main and farm systems.

6. Articles submitted to host country and international journals transmitting important findings to professional audiences in the region and beyond.

7. WMS II technical reports.

Schedule

1. February 1 - April 15, 1985.
Begin work. Preparation of field data collection in Yala season. Key informant interviewing of farmers and officials. Maps and materials research. Pre-testing of engineering, economic, and sociological measurement instruments. Training of data collectors selected by the Water Management Project for the long term structural and management improvement effort.

2. April 15 - September 1, 1985.
Yala season field data collection. Initiation of technical measures necessary for constructing main system supply and farm system demand hydrographs in sample areas. Initiation of sociological fieldwork on identifying constraints at the farm, F-channel, D-channel, and tank-diversion level. Blocking out case studies and collection of life histories during agricultural mid-season.

3. September 1 - October 1, 1985.
Preparation for field data collection in Maha season. Pre-testing of option instrument to evaluate farmer support for water user associations, based on selected organizational features. Reliability and validity checks of technical, economic, and social measurements taken during the Yala season.

4. October 1 - February 1, 1986.
Collection of technical, economic, and social data in Maha season. Continued testing of option instrument to evaluate farmer support for water user associations.

5. February 1 - April 15, 1986.
Preliminary analysis of data collected over two seasons at all four tanks. Summary report to USAID/Sri Lanka for the structural and management improvement effort.

6. April 15 - August 1, 1986.
Field data collection of option instrument to evaluate farmer support for water user associations during Yala season. Continued collection

of technical data to evaluate against previous Yala season. Continued work on completing case studies.

7. August 1 - September 15, 1986.
Preparation of case studies. Presentation to WMS II in the Fall. Preparation of workshop to be given in the Spring of 1987.

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WORLDWIDE: PHASE I - COMPARATIVE ANALYSIS OF INDIRECT INVESTMENT STRATEGIES FOR DEVELOPMENT OF SMALL-SCALE IRRIGATION WORKS
Cornell University

This is Phase I of a larger, multi-year study comparing the use of indirect and direct strategies of investment in small-scale irrigation in two developing countries. This work will procede under the direction of Professors Barker and Coward and will involve two part-time graduate assistants.

In this phase (October, 1984 - January, 1985) preliminary activities will begin with a focus on relevant literature searches. Primary attention will be directed to collecting information regarding the US experience with indirect irrigation investments as implemented through the Soil Conservation Service (SCS) or other agencies. Some attention will be given to review of materials regarding investment approaches in the LDC's, with perhaps special attention to Peru.

By the end of January a report on the American experience will be prepared and the materials identified to that point assembled in a preliminary bibliography.

01/08/85

Code # 3-04-054-85

WORLDWIDE: PHASE II - COMPARATIVE ANALYSIS OF INDIRECT INVESTMENT STRATEGIES FOR DEVELOPMENT OF SMALL-SCALE IRRIGATION WORKS

Cornell University

Introduction

A major theme of the Water Management Synthesis II Project (WMS-II) is improving programs and policies for the development of small-scale irrigation systems. Many national governments, often with assistance from international agencies such as AID, are engaged in small-scale irrigation activities.

In the initial two years of WMS-II, a number of activities have been targeted on small-scale irrigation programs: Cornell University conducted a special study to review various program experiences and held a workshop to review the preliminary findings; Colorado State University carried out a training program in support of small-scale facility development in Madya Pradesh; and both Utah State and Cornell have assisted AID Missions with project planning for small-scale irrigation in Ecuador, Peru, Senegal, Tanzania, and in the states of Himachal Pradesh and Maharastra in India.

While a number of lessons have been learned through these experiences, one that appears to be of critical importance has to do with achieving the appropriate mix of state and local involvement in these irrigation development activities. In recent years many irrigation development programs have been based on a large and dominant role by the state's technical agencies and an increasingly marginalized role for local groups. To sharpen our understanding of this phenomenon we have begun using the terms direct and indirect investment (described in more detail below). The research proposed herein seeks to build on this distinction, which emerges from several of the WMS-II activities noted above, and to further analyze and understand several irrigation development cases in which an indirect investment strategy has been applied.

Direct and Indirect Investment Strategies

During the last two decades, the dominant mode of government investment in irrigation works has taken the form of what is called herein—direct investment. That is, the government through one or more of its technical agencies acts directly, using its own budget and staff, to design, construct, and operate irrigation facilities which are government owned.[1]

However, parallel investments have continued in the local sector —investments made by water users through a variety of local institutions such as water user associations, village government units, cooperatives, etc. In some parts of Asia, local sector irrigation is a major component of the overall irrigated area. For example, in Indonesia, approximately 40 percent of the irrigated rice is commanded by village (desa) systems. In South Asia, minor irrigation is an important element of the irrigated agriculture of India, Bangladesh, Sri Lanka, and parts of Pakistan. In Nepal, it is estimated that nearly 80 percent of the irrigated area is served by small non-government systems.

[1]For a fuller discussion of this point see Coward (1983a) and Coward (1983b).

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In recent years, the state has been extending assistance to these small-scale works. In some instances, it does so using the direct investment approach. In this strategy, assistance with the improvement of an existing small system or the construction of a new one is very much a state-controlled process. Often, the works that are built, or improved, are then part of the government sector which owns the facilities and is responsible for their upkeep and improvement. For example, this approach to small-scale irrigation has been used by Indonesia in its sederhana irrigation program (USAID, 1982) and by the State of Himachal Pradesh in northern India (Coward, 1983c).

But, there also are examples of the state providing indirect assistance to local groups for small-scale irrigation—aid in the form of technical assistance, small grants of cash or materials, or subsidized loans. When an indirect strategy is used, often there is more local control of the process—the pace of development and the priority actions to be taken, for example, are determined to some extent by the local group. Also, a very important consequence is that ownership of the hydraulic property remains with the local group. Government actions do not serve to alienate local people from the irrigation facilities. An indirect, or community-based, investment strategy has been used in programs such as the Philippines' communals program and in Indonesia's village subsidy program. In India and Nepal, indirect investments appear to be made through panchayat organizations with resources being provided, as in Nepal, through the Ministry of Panchayats and Local Development.

As is discussed in detail below, there have been some studies of indirect investment strategies. Nonetheless, it is accurate to say that we lack comprehensive studies of this approach that would assist one to understand the conditions under which such an approach might be appropriate and the critical components needed to successfully implement this strategy.

Finally, it should be noted that a better understanding of the indirect approach is especially relevant at this time for the following reasons. First, while many governments in Asia continue to give high priority to irrigation development these governments also are strained with regard to the resources, financial and human, required to implement and sustain direct irrigation investments. One manifestation of this problem is the present concern with recurrent costs as discussed by Carruthers (1981). The argument is not simply to shift all responsibilities and costs from the government to the locality, but rather to seek a mix of agency and local group functions built on a realistic understanding of the high opportunity costs of many of the state's resources and the possibility of creating environments that induce greater local mobilization of resources.

A second reason for concern is that the direct investment strategy has frequently resulted in irrigation systems whose performance is far below that expected at the time of project planning. While the causes of poor performance are varied, common difficulties include inappropriate agency procedures and actions as well as ineffective actions on the part of the water users (sometimes in reaction to what the agency is doing). The direct investment strategy, characterized by heavy state control of the investment process, seems to create an inappropriate mix of state and community rights and responsibilities. The indirect approach, in which the agency attempts to support community-based actions, has the potential for structuring a more suitable balance of state and community functions.

Past Research on the Indirect Approach

Relatively little research has been done on the indirect investment strategy. As Kikuchi, Dozina, and Hayami (1978:211) recently noted,

> . . . few empirical explorations have been made to identify the economic and social conditions by which labor and other local resources can be effectively mobilized by village communities.

Akino (1979), reviewing the development of irrigation infrastructure in Japan in the twentieth century, emphasizes the role that government subsidies and loans have played in inducing the mobilization of community resources and preserving local control of irrigation facilities.

The most detailed analysis of the indirect investment approach has been done by Hayami and his colleagues in their examination of assistance to the communal irrigation sector of the Philippines and the subsidi desa program in Indonesia.

The Philippine case is concerned with the Cavite Communal Irrigation System in Zambales Province (Kikuchi et al., 1981; Dozina et al., 1979). This is a 90 hectare system owned and managed by the local village council. Following significant flood damage, the village council arranged to obtain resources from several outside agencies—technical assistance, materials such as cement and steel rods and foodstuffs for those providing labor for the project. The primary locally mobilized resources were labor (more than 1,000 man-days) and the local administrative skills to plan and implement the project.

The conclusions of the authors are striking (Kikuchi et al., 1978:225):

> It was found that government assistance facilitated the mobilization of local resources, [illegible] labor, on the order of 50%-80% of outside assistance. In terms of social benefit and cost criteria, the irrigation project proved to be highly profitable.

In commenting on the implications of this case study, the authors draw attention to two important points: (1) in this location, investments in the irrigation system have high payoffs in terms of agricultural productivity and (2) the nature of the social organization in this location allowed for a relatively good distribution of project benefits across various social classes.

The Indonesian study is based on the analysis of two small community (desa) irrigation systems which were assisted through the national program called subsidi desa (Hafid and Hayami, 1979). Each of the systems received a subsidy of US $250 which was then matched by locally mobilized resources including construction materials, direct labor, and some payment for hiring skilled craftsmen. The authors calculate an investment inducement coefficient of 4.4 and 5.4 for the respective systems—based on the ratio of total investment divided by the government subsidy.

Hafid and Hayami (1979) conclude that these two projects were successful for the following reasons: (1) the benefits were apparent to the community, (2) the projects do not involve the dislocation of people, and (3) the projects do not involve construction of the complete system. What the authors

do not highlight is that the projects received assistance from the government in a form that allowed the local group to manage the improvements and continue to own and control the facilities.

These case studies of the indirect investment strategy are very suggestive of what might be accomplished using this approach. However, they are less than what is needed for identifying clear and persuasive policy options for two reasons: (1) they emphasize the mobilization of local labor to the exclusion of other important community inputs such as knowledge and experience with the apparatus of the system and local administrative capacity and (2) they do not elaborate the nature of the interaction between the state agencies and the community in the investment process. To come closer to that goal two things are required:

- there is need to move the analysis from a focus on several irrigation system subprojects to analysis of an entire indirect investment program such as the subsidi desa program of Indonesia, and

- there is need to broaden the analysis to focus on a wider range of locally-managed resources and to consider the nature of the state-community interactions in implementing the indirect strategy.

In sum, it is possible to build on these important prior studies, expanding and broadening the research strategy, as noted above, for the purpose of developing a stronger research base from which to propose alternative investment policies.

Research Strategy

The basic research strategy is comparative: the research will be based on a comparison of indirect and direct strategies of irrigation investment in each of two, or more, countries. Thus, countries will be selected in which both indirect and direct investment strategies have been used for purposes of small-scale irrigation development. This research design will allow for both in-country comparisons and cross-country comparisons. The strategies used in each of these countries will be examined with as much historical depth as possible.

Included in this rersearch will be an examination of the American experience as implemented through agencies such as the Soil Conservation Service in providing assistance for irrigation development in the western states. In addition, [illegible] studies will be conducted in two countries to examine the direct and indirect investment program(s) for small-scale irrigation development that have been used therein. In selecting these two countries we will be looking for the following broad conditions:

1. Small-scale irrigation works are an important part of the irrigation sector in the country.

2. One or more indirect investment strategies have been used in the country for development of small-scale irrigation works, and

3. In combination, the countries selected represent important

ecological variations and their associated differences in irrigation facilities and agronomic practices.

While final identification of the two countries to be studied will not be made at this time we suggest that the two would come from a pool of countries such as the following: Bangladesh, Indonesia, Nepal, or Ecuador. Each of these countries appear to have the conditions identified above as relevant for the research design.

The approach will be to plan the detailed research design and implement the field studies in collaboration with research colleagues and institutions in each of these countries. Thus, an additional criterion for selecting these locations is the availability of research colleagues experienced in irrigation research and likely to be interested in this topic.

While the details of the research methodology will be fashioned in the context of a research planning workshop, it is expected that each country analysis will include secondary data assembled to provide a program-wide view of the activities as well as primary data collected at the field level. Field studies might include detailed studies in a few locations supplemented by a survey of a larger number of locations.

Data will be collected to provide information on the following three broad questions:

1. How are subprojects initiated and what are the inputs provided by the government as part of the direct and indirect investment strategies?

2. What are the resources mobilized by the local community and what processes of resource mobilization are used as part of the direct and indirect investment strategies?

3. What are the irrigation-specific consequences of the direct and indirect investment strategies?

As noted, each of these are broad questions and to deal with them satisfactorily a large set of smaller questions will need to be posed and answered.

The chronology of Phase II of the research process is outlined below and is proposed to extend from February, 1985 through March, 1987—a total of 26 months. The flow of activities will be as follows:

FY 85	2nd Quarter	Continued background preparation.
	3rd Quarter	Preliminary field trips to consult with potential collaborators.
	4th Quarter	First planning meeting and start of fieldwork.
FY 86	1st Quarter	Fieldwork underway.
	2nd Quarter	Fieldwork continues.
	3rd Quarter	Second planning meeting to review fieldwork progress and discuss analysis plans. Fieldwork completed.
	4th Quarter	Analysis begins.

FY 87	1st Quarter	Consultations in field. Draft reports
	2nd Quarter	Final meeting held and reports completed.

Research Staff

The research staff will be composed of a small group on-campus at Cornell and collaborators (and their field teams) in two other countries.

On campus, overall guidance to the research efforts will be provided by Professors Barker, Coward, and Uphoff. Day-to-day responsibility for the project supervision will rest with a research associate (a post-doc with specific irrigation research experience). Graduate student support also will be provided.

In each of the countries where field research will be conducted, a social scientist experienced in irrigation-related research will be identified and associated with the project. These national associates will have primary responsibility for the field studies in their respective countries and the analysis of the data which they collect. They may require field assistants for data collection.

Funding

Total funding for this project in FY-85 is being divided into two phases. Phase I to run from October, 1984 through January, 1985 is budgeted at $15,037. Phase II scheduled from February through September, 1985 has a budget of $92,996. A final decision on the budget for Phase II will be delayed until a better determination of possible Mission support for the work can be determined.

Projected budgets for FY-86 ($209,907) and FY-87 ($103,262) are provided in the Appendix of this volume.

Research Results and Outputs

It is planned that the project produce the following research reports:

1. A country report for Country A describing the indirect investment programs that have been implemented and analyzing the results of such. Implications of the findings for further use of the indirect strategy in that country will be identified.

2. A similar country report for Country B.

3. A conceptual report attempting to establish a theory of irrigation investment in small-scale irrigation works. It will draw on the data from field studies as well as the additional cases available in the literature that identify the strengths and weaknesses of the indirect approach and the factors related to successful implementation of this strategy, and draw implications for AID programming in irrigation development.

In addition to the specific reports noted above, it is anticipated that several papers for professional meetings and journal articles/book chapters will be produced in conjunction with the research project.

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WORLDWIDE: RURAL EMPLOYMENT AND IRRIGATION SYSTEM PERFORMANCE
Cornell University

Introduction

The Water Management Synthesis II Project (WMS-II) is concerned with a variety of issues related to the performance of irrigation systems—both large-and small-scale. These include both matters of production and equity outcomes. A broad objective of the project is the identification of means for improving the operation and maintenance of irrigation systems so that agricultural production can be enhanced. However, in most rural sectors employment is an equally important objective. Without employment, rural (and urban) people are unable to acquire the additional marketed food supplies that irrigated agriculture may generate. Thus, there is considerable policy relevance to understanding the impacts that improved irrigation system performance may have on employment opportunities within regions, among different farmer groups, and within households.

Thus far, most work on the relationship between irrigation and employment has been at the unrefined level of comparing the labor inputs involved in irrigated and nonirrigated agriculture. What has not been empirically analyzed is the impact that improved irrigation system performance has on employment. This is of critical importance given the large expenditures that are being made to rehabilitate, modernize, and more effectively manage irrigation systems. While the production outcomes to be associated with these developments are usually projected, there is less conjecture about the employment outcomes that might arise.*

What is required is a better understanding of the co-variation of these two variables—system performance and employment. Based on such an understanding it may be possible to select from various alternatives for improving irrigation system performance those with the more desirable employment consequences.

The Research Strategy

It is proposed that a modest effort on this topic be initiated in FY-85. Based on the results of this initial period of exploration, a further proposal for work on the topic would be formulated, if warranted. This initial effort would include the following activities: (1) a careful review of the existing research literature, (2) examination of various irrigation project evaluation documents to determine implied and/or actual employment outcomes, (3) contacts with other individuals and agencies concerned with these issues (ILO, for example, has been giving some attention to this matter), and (4) explorations of the topic in conjunction with other international assignments (WMS-II related or otherwise).

Research Staff

It is proposed that in FY-85 the literature review would be carried out by a graduate student research assistant.

Professors Barker and Coward would direct this effort.

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Research Outputs

The major output of this modest research effort will be a brief concepts paper further exploring the relationship between irrigation system performance and rural employment. Relevant research and project literature will be cited and reviewed. Particular attention will be given to the experiences of the ILO with this topic. Research and policy gaps will be identified and suggestions made regarding possible additional work to be done on this topic.

*Robert Wade has prepared an essay for the ILO suggesting these possible relationships. See: Robert Wade, Employment, Water Control and Water Supply Institutions: South India and South Korea. Bangkok: Asian Development Programme Working Paper, ILO.

UNIVERSITY INITIATED ACTIVITIES

Rapid Reconnaissance

3-04-038-85

Colorado State University

January 23, 1985

Rapid Appraisal

3-04-042-85

Utah State University

January 23, 1985

INTRODUCTION

LANDSAT data can provide valuable information for the evaluation, rehabilitation, and management of irrigation systems in developing countries. This data is available in two general formats: datatape and computer generated composite photographs. LANDSAT data tapes require computer analysis and printing where LANDSAT composite photographs can be manually analyzed. An advantage of photo interpretation and manual inventory of computer generated composite photographs, particularly for developing countries, is that the methods require less training and less expensive equipment. Should digital techniques be utilized, the manual methods can serve as valuable correlation criteria for analysis of datatapes.

This proposal presents activities to more fully develop the use of LANDSAT data in irrigation rehabilitation activities of the Water Management Synthesis Project.

1. The USU activity will concentrate on developing techniques to generate special purpose pattern recognition and interpretation methods from the digital information contained on LANDSAT datatapes.

2. CSU activities will provide immediate information on command areas for the Sri Lanka DA project using available LANDSAT photographs and ground truth investigations. Also provided will be detection and measurement of soil and water management problem areas, identification of some of the irrigation system infrastructure, identification of specific cropping patterns and mapping of major soil types throughout each system.

BACKGROUND

STATEMENT OF PROBLEM AND ISSUES

All donor agencies, USAID included, rely heavily on interdisciplinary teams to evaluate the status of irrigation systems, to determine the feasibility of investing funds for rehabilitation, and to assess the potential for implementing new irrigation projects. While the level of competence of the teams is generally high and the experience that is brought to bear is extensive, there are several significant constraints on the effectiveness of such teams. In order to illustrate the problem that this proposal would address, three of these constraints or issues will be described.

Consider first that WMS teams (and, in fact, USAID staff as well) rarely participate in the full spectrum of activities involved in implementing irrigation projects. Most consultants would be involved in a single phase of the project implementation and may be involved for as little as a month of in-country effort. It is not uncommon for an appraisal team to

develop a project paper on the basis of one visit of a few hours to a possible site. One must logically question the capability of even the most experienced international experts in this regard. It may not be entirely possible in a short time to develop a firm understanding of the essential geography of potential project sites. The size, shape, slope and other characteristics of a particular site configuration as well as the host of cultural and economic influences must be identified by relatively superficial visual observation, verbal communication and/or reading of published documents. Since most team members are unlikely to have visited the site previously, they must attempt to correlate the associations they observe with the experience they have had elsewhere in order to produce the evaluation. The essential problem is that little if any preview of the problem is possible and therefore the team cannot begin its work with some "feel" for the task. New and useful ideas generated in behalf of the evaluation are reluctantly formed in the fear of suggesting unworkable concepts. There is a tendency to promote time tested remedies which may not address the needs of the particular irrigation project. The first issue is, therefore, whether or not it is feasible to conduct, off-site, rapid preliminary appraisals of the area to increase the effectiveness of consultants and USAID personnel.

A second problem emerges when the team is in the field and is considering how the potential project would respond to technical and financial assistance. For example, USAID teams rely on local sources of data to determine the magnitude and variability in cropping patterns and yields, water use, and the host of other data needed to determine the most likely system response. As a general rule, data that are available are likely to be, at best, crude estimates and may be substantially in error. It is not difficult to find, for example, information critically important to the feasibility and effectiveness of a project which is completely without basis in measurement or investigation. Often data indicate what a local individual wishes to be seen. In some respects the past performance of an irrigation project reflects the capabilities of people working within it. The second issue, therefore, is whether or not the historical and current performance of irrigation projects can be accurately evaluated in the absence of reliable local data.

An individual irrigation system is very complex and highly dynamic. Some of the processes that most significantly affect the performance of the system proceed at such small rates that they are only observable if studied over a series of years. Processes which might be classified as long-term include waterlogging and salinity, soil erosion, and the evolution of farming practices. These long-term processes are distinguishable from short-term dynamics such as crop water use and individual irrigation events which can be more precisely measured during a short site visit. The problem of how to evaluate the long-term dynamics of irrigated agriculture during a short visit or even during a three to six week diagnostic analysis, needs to be addressed. One might observe an obvious waterlogging and salinity problem and think to suggest causes and remedies. An observed high water table, for example, may be the result of poor irrigation efficiency on the farms, conveyance channels with high seepage losses, expansion of irrigated systems upstream (in the natural drainage flow system) of the problem area and thus result in the emergence of a regional drainage inadequacy. The cause of the

drainage problem may be something so subtle that it is easily overlooked. For example, the basic chemical balance of the system may be neglected. Proper measurements and observations at the time of the evaluation may identify contributions to the problem presently occurring, but these may only be maintaining it and not be the underlying cause. The fundamental causes may no longer be active and any treatments of existing problems may leave the problem unresolved in the future. The third issue is whether or not alternative field evaluation procedures are available to define long-term, slowly evolving conditions within irrigated agriculture.

There are, of course, problems and issues that might be noted regarding the effectiveness of evaluating irrigated agriculture in the international setting. It is certain that the array of evaluation methods being used today are not all that could be applied and thus the techniques being used fall short of the capabilities that exist. One such opportunity is the use of the data retrieved from the earth resource observation satellites such as the LANDSAT series. Setting aside for a moment the limitations of this information and the capability to evaluate it accurately, the space platform for conducting surface measurements offers some real advantages to the WMS and USAID community. First, the data are available for nearly every irrigation project or potential project that might come under investigation. Further, it has a largely uninterrupted history of 14 years. In fact, subject to some omissions, every irrigation project has been observed every 18 days for these 14 years. The data are readily available. Thus, assuming other things to be optimal, the remote sensing systems should provide WMS teams with the capability to review the history of projects they will evaluate. These data are collected independently of human intervention and should be important inputs to project analyses. In other words, remote sensing data provide an excellent source of corroborative evidence. Additionally, the long period of record from a fixed reference should reveal the long-term dynamics of the irrigated system.

The following indicators should be possible from analysis of remote sensing data: (1) measurement of gross irrigated area and selective identification of specific cropping patterns; (2) detection of crop health and growth stage; (3) detection and measurement of areas with soil and water management problems such as soil salinity, high water table or poor drainage, or areas with inadequate irrigation distribution; (4) data base and support criteria for mapping of major soil types; and (5) some of the irrigation system infrastructure such as large canals and reservoirs. This information should be obtainable through photo interpretation and manual inventory methods with adequate ground truth and could also serve as correlation criteria for analysis of information directly from datatapes.

The extrapolations that can be made from this information range from definition of the farmer response to changes in crop price or governmental commodity policies to analysis of the system inequity between head and tail water users. Determination of the growth of waterlogging and salinity problems over several years or the emergence of cropped areas using return flows and groundwater should be possible. The list of possibilities is likely to grow substantially as the new high resolution sensors begin to operate in the next year or so.

A question arises as to why the sudden feasibility of this technology since it has been available for so long. One answer is the relatively recent development of the statistical procedures and computers needed to evaluate the massive body of data generated by one observation. This proposal suggests that WMS evaluate remote sensing applicability to irrigation project evaluation as a means of making possible, rapid, more reliable and more extensive appraisals.

SRI LANKA CASE STUDY

A current problem facing irrigation rehabilitation in Sri Lanka is that the irrigated area in many systems has been expanded beyond the original design size by additional land being cultivated on the perimeter of the original command areas. Due to political considerations, the Government cannot remove the new people from the areas that been added, nor is it possible to deny them the continued use of the water that they have appropriated from the system. The current plans are that those people currently using the water in the expanded areas will be incorporated into a new, expanded command area. Regulations will be enacted to place limitations on this practice so that the command area will not be expanded in this way in the future. Other problems inherent to most irrigated areas and present in Sri Lanka include are areas with soil, topographic and irrigation management deficiencies. Soil deficiencies (soil salinity, textural extremes, shallow depth to barrier, etc.) topographic deficiencies (unlevel surface, slope extremes, natural surface depressions, etc.) and irrigation management deficiencies (inadequate water supply, over saturation, scheduling errors, etc.) contribute to poor crop performance and inefficient water management. These problem areas have not been sufficiently identified, measured or characterized in Sri Lanka. Also, the classification of major soil types in the Sri Lankan irrigation systems has not been completed at a level sufficient for systems planning.

In order to plan for the rehabilitation of the delivery works and to make plans for an improvement in the management of the system, an accurate measure of the total area currently irrigated is needed. Areas of poor crop health due to soil, topographic and management deficiencies need to be identified and measured. These areas could then be specifically addressed as to their problem sources with subsequent mitigation measures recommended, where appropriate. Also, a knowledge of the character and extent of the major soil types is fundamental to understanding the irrigation systems and is therefore basic to implementing successful rehabilitation. Obtaining this information can be facilitated by use of LANDSAT photos along with ground investigations. In addition, the historical base of LANDSAT information should allow investigation into the changes in land use that have occurred over the past few years and provide information about the onset or buildup of land and management problems. LANDSAT information should also serve as a data base and as correlation criteria for mapping of major soil types throughout each system.

The primary need at this time is to determine the current command areas of the tanks on which the Diagnostic Analysis and the following Improvement Program will be concentrated. The additional information that

can be developed will be of significant value and these techniques will be incorporated into the training activities. This will provide valuable information for system redesign and the additional uses, such as crop surveys, and will be useful in future system management.

OBJECTIVES

The principal objective is to test the use of remote sensing systems as methods for rapid appraisal of irrigation systems. The specific objectives for this funding period (FY 85) would be as follows:

1. To determine the specific factors related to irrigation project appraisal which can be identified from the LANDSAT type sensor and that are useful indicators for the evaluation of irrigation projects;

2. To identify the interpretations of the data which can be made to characterize the status and long-term dynamics of irrigation projects;

3. To determine the nature and extent of required ground truth and the consequences of the timing of such measurements or observations on the adequacy of the remote sensing application; and

4. To apply the remote sensing techniques to support the CSU irrigation rehabilitation activities in Sri Lanka and to serve as a case study in training activities.

CSU ACTIVITIES

Some of the techniques required to use LANDSAT photos for the purpose of analyzing the Sri Lanka irrigated areas have been worked out in prior applications (measurement of land areas). Other specific applications such as measurement of soil and water management problem areas, crop surveys and identification of major soil types will require new interpretive techniques coupled with ground level investigations to develop data correlation criteria for Sri Lankan soils, crops and conditions and irrigation systems efficiency. One anticipated problem will be with the size of the cultivated plots and the resolution levels of the photos. Most likely, this data will have overall or large area usage, but may not have the detail to make measurements on individual plots. The exact order of resolution is not clear at this point as so much will depend on the quality of the photos and the repetitive coverage that is available. The expected resolution levels are in the five acre range, but with repetitive photo coverage and a wide divergence of crop types, a smaller resolution level may be possible.

In order to initiate this study, a request for funding to support a half-time research assistant is being requested. It is anticipated that WMS will need to cover costs at CSU and the international travel involved. Local costs and support will be provided by the new long-term project in Sri Lanka.

The required period of time to complete this activity will be two years with two summers in Sri Lanka for field work. (An outline schedule is provided on a following page). The activity will formally start in January of 1985.

USU ACTIVITIES

The USU study activity will deal with the comparative analysis between the relative merits of LANDSAT photo and digital sensor analysis techniques based on the ground truth obtained above. At present USU does not have the capability to conduct this analysis but does have the expertise to guide an organization that does have the technological development in how to interpret the data in the agricultural setting and in determining what evidence to search for. Further, USU personnel are periodically visiting a number of irrigation projects where case studies could be undertaken. Consequently, it is proposed that USU subcontract with IRIS International to perform the primary data acquisition and analysis phases of the subproject.

The subcontractor would be asked to examine the archival data base and determine the quality of the data for candidate irrigation projects where WMS personnel have had personal experience or are anticipating a field assignment and where ground truth data could be extracted. Then, an assessment would be made in collaboration with USAID and other WMS personnel to identify specific times within the year when the highest probability exists to isolate and measure particular characteristics of the irrigation project. From this assessment it is proposed that the subcontractor obtain the data for four or five years within the period of record, perform the reductions and statistical analyses needed to interpret the observations to a form that can be studied in the context of this subproject, and then work in conjunction with USU to interpret the information and prepare the necessary demonstration packages and documentation.

Because the specific analysis required by the subcontractor are not known at the time of this writing, it is proposed that a detailed outline of the activities be developed and submitted for approval prior to initiation of the work. Thus, the request of this proposal is for approval of the concept of the subproject and its level of funding.

ACTIVITY OUTLINE SCHEDULE

1.	Obtain LANDSAT data for each tank area.	Jan. - Feb. 1985
2.	Use of available tank maps for initial interpretation with LANDSAT data.	Feb. - March 1985
3.	Blending LANDSAT and maps. Tank command areas delineated. Develop initial training program.	Feb. - May 1985
4.	Ground correlation studies. Participation in 1985 DA training program.	June - Aug. 1985
5.	Blending ground correlation studies with interpretation of LANDSAT data.	Sept. - Dec. 1985
6.	Design of new field interpretive techniques. Final design of training methods. Preparation of written materials for field staff reference.	Jan. - May 1986
7.	Final ground correlation studies. Participation in 1986 DA training and special training for field staff in new methods, interpretations and uses.	June - Aug. 1986
8.	Final design of field interpretive techniques. Preparation of final reports and materials.	Sept. - Dec. 1986

PROPOSALS FOR MISSION REQUESTED ACTIVITIES
FOR FY 85

DEVELOPMENT OF HANDBOOKS

INDIA: 2-13-027-85

Introduction

Although there are a considerable number of technical publications and materials on irrigation subjects available in India, the need for additional and new information is great. There is a particular need for manuals and pamphlets prepared for the junior and assistant field engineers and also for technicians who may have only on-the-job training. The manuals, reference books and pamphlets now in use may be available at the higher levels of responsibility but are not usually found at the field design, construction and operational level. There is a problem also that materials prepared in one Ministry may not be available or known in another Ministry or Department, i.e. Agriculture and Irrigation. The number of copies of particularly useful publications seem to have been severely limited and reprinting or copying is not a common practice because of low priority and financial constraints.

Much of the reference material now in use was prepared 10 to 15 years ago and although usable, needs revision to reflect the more recent developments of principles, techniques, materials and methods. World literature in the irrigation field has proliferated in the form of several reference books and manuals and these need to be widely distributed, particularly to the suvervisory and executive engineer, and hopefully to the lower level staff who have design, construction and operational responsibilities.

Basic Need and Present Status

Adequate information available in the field offices for design, development, operation and maintenance of acceptable irrigation systems is the primary need to be addressed in this report. The manuals and pamphlets for these phases need to be clearly written with step-by-step procedures outlined for the junior and assistant level staff and occasionally for the technician. Most desirable are publications with a single narrow subject field, i.e. land leveling, water measurement, surface irrigation, irrigation network design. These narrow subjects are desirable since those involved with field projects will have adequate reference material in a single easily carried publication. Workshops and symposiums are excellent vehicles for developing the content of these publications and testing their educational value. The manuals then can be used as study and reference materials for future training workshops and be revised.

New and/or updated reference materials are also needed at higher levels of responsibility in the Irrigation Departments. Because of time demands, the Chief Engineer needs executive summaries and planning guides for concise summarized information. These may also be useful at the Supervisory Engineer level but he also needs more technical information like engineering manuals and handbooks. The Executive Engineer needs access to both manuals and handbooks and also the pamphlets and booklets prepared particularly with the junior and assistant level staff in mind.

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Another need that should be addressed by USAID is the availability of adequate reference materials for the agricultural universities, colleges and research stations/centers. These needs require more of textbook type training material but the same aforementioned manuals, handbooks etc. should be available for college/research station reference purposes.

Some of the most used reference materials in India on water management and soil conservation are handbooks prepared in the early 1970s by USAID/SCS and the Government of India, Ministry of Agriculture. Of particular note were:

- Handbook of Hydrology - Handbook of Sedimentation - Handbook on Water Management

Other publications of the same technical series were:

- Cylinder Infiltrometer Method for Determining Intake Rate - A Guide for Estimating Irrigation Water Requirements - Lining of Small Irrigation Channels - Measerement of Irrigation Water

Much of the above material is still in use and have been valuable aids for the Water Management Division, Ministry of Agriculture (new Ministry of Irrigation), but were apparently generally unknown and not used by GOI and State irrigation personnel. However, these publications have been out of print and unavailable for a long period.

Various publications have been issued by different States in India for use in the particular area. These have usually been typewritten with limited duplication. Two notable examples of much-used manuals are:

- Design Manual for On-Farm Development Works (Government of Rajasthan) Office of the Additional Chief Engineer Command Area Development, Chambal, Kota (Raj), Feb. 1977.

- Manual of Design for On-Farm Development Works (Government of Maharashtra) Irrigation Department, Bombay, 1982.

The use of these publications in other States is not known, but they were probably not widely distributed.

Another excellent publication prepared by GOI, Ministry of Agriculture is entitled:

- Manual on Irrigation Water Management (Government of India) Ministry of Agriculture and Irrigation Department of Agriculture, Krishi Bhawan, New Delhi, March 1979.

This manual was developed partly through a compilation of symposium papers and should be used as a pattern for preparation of future manuals.

An excellent text and reference book on irrigation and water management has been published in India. This is:

- Irrigation Theory and Practice, by A. M. Michael, Project Director, Water Technology Center Vikas Publishing House, New Delhi, 1978.

The reference provides information regarding the design and layout of irrigation systems and practices in the field, including step-by-step procedures, and the necessary equipment for implementation.

In addition to these very useful manuals prepared in India, there are many publications prepared in other countries that contain design, construction and operational information for irrigation systems useful for Indian conditions. Two of these manuals are:

- SCS National Engineering Handbook
  U.S. Department of Agriculture
  Section 15, Irrigation, Chapters 1-15

This manual contains separate, removable chapters on irrigation subjects ranging from soil-plant-water relationships, planning systems, irrigation methods, land leveling, pumping, sprinklers and water measurement. From these materials and supplemented with other information, many of the States in the USA have developed their own SCS State handbooks.

- On-Farm Water Management Field Manual
  (Water Management Wing)
  Ministry of Food, Agriculture ad Cooperatives
  Government of Pakistan, 1980

Vol. I - Reference (sections on soils, inventory, planning, soil-water-plant relationships, agronomy, engineering, equipment, economics, management, glossary)
II - Precision land leveling
III - Watercourse improvement
IV - Irrigation water mangement
V - National standards for irrigation - practices and materials and irrigation structures designs

This manual was developed jointly by GOP/USAID/SCS.

Currently active research projects in the USA supported by USAID are producing a multitude of manuals and training aids that are appropriate and can be used for Indian conditions. Some of these are:

1. Water Course Improvement Manual, Management Technical Report No. 58 Water Management Research Project, 1980.

2. Circular Concrete Irrigation Turnout: Design and Construction, Handbook No. 1, 1982.

3. Farm Irrigation Structures, Handbook No. 2, 1983.

All of the above reports were produced under the Water Management Synthesis Project, Colorado State University and Utah State University, USA, under contracts with USAID.

Effort Needed

Current and new information in the form of books, manuals, pamphlets and leaflets are needed in India on irrigation subjects. This need can be answered in the following ways:

a. Direct purchase and distribution of materials - This requires a survey of need at the engineering levels of locations and projects in order to determine numbers of copies and distribution routing of appropriate material. A careful selection of the references is necessary, keeping in mind Indian conditions and needs, and also insuring a minimum of duplication.

b. Reprinting and/or copying of existing, appropriate manuals- Because of long periods of time involved in getting publications published and revised, reprinting and copying of manuals that are still useful should be considered. The previously mentioned GOI/USAID/SCS handbook on water management is a good example for copying since it contains much usable material but has been out of print for a long period. A survey would determine an adequate number of reprints.

c. Revision of manuals, pamphlets, etc. - Revisions are desired for several of the manuals and pamphlets now in use to reflect new information and techniques and to make this material available. The GOI/USAID/SCS manual should be revised and updated. A procedure for doing this will be outlined in the following section together with a listing of other publications needing revisions. Consultants and/or contractors may be necessary to make the revisions since permanent technical staff have responsibilities that preclude preparation of manuals.

d. New Manuals - The preparation of manuals and pamphlets on irrigation subjects, where material exists but not in concise published form, is a most pressing and important need. The usual situation is cited as a very productive, busy engineer and/or scientist who has developed the ideas and materials sometimes through workshops, but does not have the time to write and assemble the material for the manual. Assistance needs to be given to this person in the form of additional staff and/or TDY consultant to prepare the publication under his general direction and guidance.

It must be emphasized that the effort of dissemination of information should not end with distribution of materials. Adequate technology transfer requires that there be sessions, seminars and workshops for training in use of the material for design, construction and operation of irrigation systems. The seminars and workshops are also source of new materials for additions for the manuals. The manuals, handbooks, pamphlets, etc. should also be available at all agricultural colleges and training centers for instructional purposes.

Scope of Work

For FY 85 we propose to have one person, A. R. Robinson, go to India to work with host country professionals in the state training institutes to prepare a few top priority publications. In addition, a number of existing publications will be selected for reprinting and distribution to the institutes.

INDONESIA 1-02-009-85

Small-Scale Irrigation Workshop and Other Technical Assistance

A number of activities are planned in support of the Mission's development of a new program of small-scale irrigation assistance. The activities discussed below have been identified by the Missions in collaboration with WMS-II staff.

To collect further and more detailed information regarding the existing physical and socioeconomic conditions in the proposed project locations and to gain further detail about the engineering designs and plans already developed by the irrigation agency a three person team will be sent to Indonesia for approximately one month beginning in mid-November. Persons identified for this activity include Dr. Jeff Brewer (anthropologist), Dr. Ramchand Oad (agricultural engineer) and Mr. Andrew Keller (agricultural engineer). Dr. Oad and Mr. Keller were part of the original design team that visited Indonesia in July-August.

A second activity will be the organization of a workshop for selected GOI officials from the three provinces planned to participate in the project. This activity is planned to be a bridging activity in preparation for actual project implementation at a later stage. While detailed planning needs to be done in collaboration with GOI counterparts it is anticipated that the workshop will provide an opportunity to discuss in detail the three major components of the proposed project strategy augmentation, de-coupling and capacitation. Appropriate field trips may be planned and relevant Indonesian researchers asked to report the results of their irrigation studies. Cornell University will be responsible to plan and implement this activity in collaboration with GOI counterparts. To that end, it is proposed that one staff member from Cornell visit Indonesia for approximately 2 weeks in January to develop further plans. The team to assist in implementation of the workshop will be in-country for approximately one month at a time to be agreed upon. This group would be in Indonesia for a week to 10 days prior to the start of the workshop, for the duration of the workshop and for a brief wrap-up period. It is proposed that the workshop team include an irrigation engineer, a social scientist and an agriculturalist (one of whom might be an advanced graduate student).

In directly related to the above activities, it is proposed that George Radosevich visit Indonesia for one month, split between a December, 1984 visit and an August, 1985 visit. The purpose of these visits is to consult with Indonesia counterparts on a proposal for further analysis of current and needed rules and regulations for water allocation and arbitration of water disputes. These issues are judged as being of increasing importance in Indonesia.

Finally, the Mission has also requested the services of an irrigation engineer for one month (preferably January, 1985) to assist with assessment activities related to the current Sederhana and HPSIS activities. We

believe this to be of less priority than the above requests and would like to procede with this activity only after additional information is obtained regarding the activities to be conducted and the outcomes that are anticipated. Likewise, if funding constraints are experienced, we suggest that this activity be given lower priority than the others.

FARMER ORGANIZATION WORKSHOP 2-14-017-85

This activity proposes to combine two requests received from AID/India for assistance in planning and organizing two separate workshops dealing with methodologies in farmer organization and experiments in farmer organization, respectively. Herein, we propose to combine these into a single activity.

This workshop, to be planned collaboratively with Indian colleagues would focus on important experiments in farmer organization for irrigation development, drawing on cases from both India and elsewhere—including the Philippines and Sri Lanka. On the basis of these case experiences the workshop would begin to identify key elements of methodologies for creating, or strengthening, farmer irrigation organizations.

This activity will be under the direction of Professor Norman Uphoff. We hope to arrange assistance for him in the planning of this activity from a social scientist experienced with irrigation matters in India. The budget also provides for participation in the workshop from colleagues in Sri Lanka and the Philippines.

01/08/85

Code # 2-14-050-85

WORLDWIDE: JOINT SEMINAR ON CURRENT RESEARCH IN IRRIGATION
Cornell University

An increasingly large amount of research currently is being conducted on various aspects of irrigation system management and irrigation development. Given the necessarily long lag-times often involved in the publication of these research findings and the relatively few forums available for the more rapid dissemination of research results, it is proposed that a Seminar on Current Research in Irrigation be organized and held sometime during FY 1985. This seminar would be jointly sponsored by Water Management Synthesis II and the International Irrigation Management Institute (IIMI).

The focus of the seminar will be on research now underway, or recently completed, and representing a spectrum of agroecological settings and disciplinary orientations. Participants would be selected whose research relates to one or more of the following themes: (1) problems and issues in the management of large government irrigation schemes either main system operations or on-farm level activities, or (2) problems and issues of small-scale irrigation development. An international group of approximately 25 scientists will be invited to attend. The seminar will be approximately six days duration and composed of two parts. The main part of the seminar will consist of three days of presentations and discussions at the IIMI headquarters in Kandy, Sri Lanka. This part of the seminar will be proceded by en route field visits in Pakistan, Tamil Nadu, India or the Gal Oya project in eastern Sri Lanka. Each of these field visits will be approximately two days in duration and be limited to small groups of 6-7 persons. Each field site will allow special focus on a topic related to the seminar—in Pakistan, on-farm water management activities; in Tamil Nadu, small-scale irrigation development and in Gal Oya, main-system management issues. It is expected that these field experiences prior to the seminar will enhance discussion and exchange.

In addition to facilitating and accelerating the exchange of research results, the seminar would include opportunities to review and critique the state of research methods being used in irrigation research, thereby assisting researchers and research organizations (including WMS-II and IMMI) in formulating their conceptions of important future irrigation research agendas.

The outputs of the conference would include the following:

1. A summary and assessment of ongoing research in water management with specific reference to main systems management and small-scale irrigation development.

2. Identification of future research needs.

3. Assessment of how WMS-II, IMMI, and other organizations can best complement each other in meeting future research demands.

Lead responsibility for further planning of the Seminar has been assigned to Cornell University under the Water Management Synthesis Project. It is anticipated that WMS-II will cover international travel and costs incurred in conjunction with the seminar outside of Sri Lanka. IMMI has agreed to pick up all local costs in Sri Lanka.

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CONTINUING ACTIVITY PROPOSALS WITH
FY 85 FUNDING

Proposed Activities

for

ECUAVIR AUDIO VISUAL MODULES

NO COST EXTENSION REQUEST

2-03-054-84

October 1, 1984 - September 30, 1985

by

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This proposal is part of the Work Plan under the
Water Management Synthesis II Project

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ECUAVIR AUDIO VISUAL MODULES

This is a No Cost Extension Request for completing the Ecuavir audio visual modules. We expect that the set of 40 separate modules (covering 45 topics) will be completed by the end of December 1984. The previous anticipated completion date was mid-October 1984; thus, this represents a two and one-half month delay in completion.

R. Kern Stutler presented the first 20 modules in Ecuador during the spring of this year. During this presentation a number of changes were requested in addition to the spotting of some technical errors which needed correction. While making these needed and requested changes, we elected to also improve the quality of the first 20 modules. The desire for the quality improvements resulted from the fact that the production group has been on a continuous learning curve and, in looking back on the first modules produced, they felt they could improve them considerably by adding more and better graphics in a number of spots. The requested changes, corrections and improvements have now been made on the first 20 modules. However, doing this took slightly longer than anticipated, and thus delayed the production schedule somewhat.

In addition to the above-mentioned delays, a recent equipment breakdown occurred which caused a further month delay. Moreover, although the production crew is becoming more efficient in producing modules, they also are tending to produce high quality modules. The net effect of improved efficiency on the one hand, and improved quality on the other hand, is requiring slightly more production time than had we remained at the efficiency and production quality levels used in preparing the previous schedule.

The current state of the remaining half of the modules is that the storyboarding, scripting, translations and word descriptions (and skteches) for all graphics have been made for the entire set. Furthermore, the live footage has been taken in the field, and the graphics for the first couple of the remaining modules is complete. The production crew is at full speed, all equipment is up and running and the projected completion date appears quite reasonable.

We, and those who have reviewed the modules, are quite pleased with the quality. We also are confident that these modules will prove very helpful in conveying a better understanding of the visual and conceptual elements of water management technology to a broad array of clients. We are confident that the modules will be received enthusiastically, and are hopeful of attracting additional funding to produce supplemental training materials to be used with them. Furthermore, we also hope to attract funding inorder to prepare presentations for farmer clients from selected portions of the modules.

PROFESSIONAL VISITORS

2-11-068-84

This continuing activity is designed to support irrigation administrators and scholars who visit Cornell on an individual basis rather than in conjunction with formal workshops. It is anticipated that providing these informal opportunities for scholars and professionals to report on research or action projects and to exchange information and views with the Cornell irrigation studies group will contribute both to Cornell's expertise in problems of irrigation development and to the development of interdisciplinary capability for building and managing irrigation programs in host countries.

Visitors will be selected according to the following criteria:

(1) Their field experience with those issues in which Cornell is particularly interested—the design and operation of small-scale irrigation systems, traditional irrigation in a development context, and participation and local organization;

(2) Their experience in countries to which Cornell is or expects to be providing technical assistance—e.g., Burma, Kenya, India (Himachal Pradesh), Indonesia, Sri Lanka, Peru, Bolivia;

(3) Their familiarity with areas about which Cornell needs to know more (e.g. Africa);

(4) The potential for the visitor to gain a broader perspective on irrigation issues and to internalize the WMS II interdisciplinary approach to water management issues; and

(5) The likelihood of the visitor's becoming a collaborator on future WMS II or other AID irrigation activities.

They will have the opportunity to meet extensively with Cornell project participants individually, in small group meetings, and in larger seminars.

The following outputs from the professional visitors activity are anticipated:

Updating Cornell project participants on the results of recent research outside of the WMS II project.

Help in identifying new directions for WMS II activities and for AID irrigation projects in general.

The exposure of other irrigation professionals and scholars to WMS II ideas and approaches to irrigation issues.

The identification of host country professionals and institutions for WMS II collaborative efforts.

Englargement of the pool of irrigation expertise in this country and abroad.

This activity was initiated in FY-84. WMS-II funds were used to support a seminar in which David Elder of the Asia Program Office of the American Friends Service Commission in Philadelphia discussed with the small-scale group and others interested in irrigation his experiences with small-scale irrigation development in Laos.

A second seminar sponsored by WMS-II was given by Joseph Ssennyonga, an anthropologist studying indigenous small-scale irrigation systems in Kenya's rift valley. Ssennyonga also spoke individually with those working on the Farmer Participation and Small-Scale Systems special studies. Finally, some of the costs associated with the visit of Dr. Tom Wickham, Director of IIMI, who spoke to the Irrigation Studies Group at Cornell on new directions for IIMI and possible collaboration with WMS-II, were also funded through this activity.

Because travel costs for seminar speakers were low, the FY-84 budget was underexpended. It is expected that carryover from FY-84 will be available for continuing this activity in FY-85.

01/08/85

Code # 3-04-056-85

WORLDWIDE: IRRIGATION SYSTEMS PERFORMANCE AS AFFECTED BY MANAGEMENT INTENSITY
PROGRESS REPORT FY-84 AND PLANS FOR FY-85
Cornell University

Concern for better management of irrigation systems has increased throughout the developing countries during the past decade. Attention has been focused primarily on the management problems associated with large, government managed systems. However, increasing government involvement with small, farmer-managed or communal irrigation systems through technical assistance makes it important to understand the management problems of small, locally-managed systems as well. The purpose of this ongoing study is to gain a better understanding of what constitutes appropriate management intensity in specific irrigation systems.

Management intensity refers to the time, labor, and effort that is put into organization for irrigation and to the organization's activities as they relate to irrigation tasks. Relevant variables include number and duration of irrigation meetings, number of elected or appointed officials charged with performing irrigation tasks, and the number of irrigation activities planned and carried out by irrigation organizations.

Small-scale, farmer-managed systems in Nepal and large-scale, government systems in the Philippines are the sources of data for the research. Edward Martin (agricultural economics) and Robert Yoder (agricultural engineering) collected primary field data on fourteen farmer-managed irrigation systems in Nepal from November 1981 to August 1983; Alfredo Valera collected data on a large government-managed system in Nueva Ecija in the Philippines from November 1981 to July 1983. Carol Ferguson began data collection in the Philippines in July 1983 and will continue through September 1984.

These data on water supply and demand, yields, and on water management practices are being analyzed to address the issue of appropriate levels of investment in management. Farmer-managed irrigation systems will be analyzed to determine the factors affecting the various levels of management intensity that have evolved and the level of investment the farmer organizations have chosen to make; the performance of both agency-operated and farmer-managed systems representing different management intensities will be evaluated in terms of agricultural productivity, reliability, sustainability, and equity.

In order to better understand irrigation management behavior, the researchers will analyze the decisions made by farmers and agency staff regarding the levels of management intensity. Finally, based on the results of the above analyses, a framework will be outlined for determining what type and degree of management intensity is appropriate relative to key aspects of the physical and economic environment in specific situations.

Progress Report -- FY-1984

Nepal

The major activities were coding and preliminary analysis of data which had been collected over the previous 22 months in Nepal These included interview data concerning farming and irrigation practices of a sample of 125 farmers, crop cut data for three crops on the fields of these sample farmers, daily water balance data for the calculation of relative water supply, irrigation organization records of water allocation and resources mobilized, and the information gathered in rapid assessments of ten irrigation sites (including one or more irrigtion organizations) in addition to four primary research sites. The farmer survey data has all been coded and is now being entered for analysis on the computer. Calculation of relative water supply for these systems has proven to be a complex task. The calculations have been done for one site, and the procedure developed for doing the calculations for the other sites.

A draft of the publication analyzing the importance of the effect of the choice of type of water allocation principle on irrigation system performance was written. This draft does not include the quantitative analysis that will be included in the final version. This draft has been circulated for review and comments. In addition, a seminar given in USAID, Washington, outlined the field research and presented preliminary findings.

Philippines

Analysis of the data collected by Valera is nearly completed and final analysis and writing will be accomplished by the end of the fiscal year. The material used in this analysis is based on detailed field observations and data collected in the Upper Pampanga River Integrated Irrigation System (UPRIIS) in Nueva Ecija, the Philippines. UPRIIS is one of the largest irrigation systems in the Philippines and one of the few reservoir-based systems.

The data collected cover a wide range of hydraulic, agronomic and socio-economic variables. When the project was originally designed it was expected that the National Irrigation Administration would implement a management experiment in the form of different levels of agency activities in selected zones of the command area. For a number of reasons the agency was unable to implement these experimental activities and thus an important component of the original research design was eliminated.

Nevertheless, considerable differences in agency actions, and management activities were observed across the three distributory units that were studied in UPRIIS. In addition to the variation in agency activities there are also important variations in the relative water supply and the extent of farmer-initiated management actions. Thus, the work over the past months has focused on analyzing and understanding the nature of the inter-relationships in these variations. Based on the analysis of these data a number of important questions regarding management intensity and the relationships between agency and farmer management activities will be explored and discussed in the final report.

The second phase of the Philippines part of the project involves an attempt at modeling management alternatives. The major activity thus far has been the collection, documentation, and assessment of the wealth of data existing at IRRI and NIA. This has turned out to be a very difficult and time-consuming task as even IRRI does not have a very efficient system for handling data. Data quality problems are a major concern. Ferguson, who is in the Philippines working on this phase of the project reports, for example, "the data collected on water discharges I plan to completely ignore. It is very incomplete and of terrible quality (somewhere between science fiction and total fantasy.")Plans for FY-85

Nepal

In FY-1985, data analysis and building of the irrigation system model will be completed and the following two documents produced:

1. A publication analyzing the intensity of management in small, farmer-managed systems.
2. A publication analyzing the effect of the choice of type of water allocation principle on irrigation systems performance and its significance.

It is anticipated that this work and the Nepal portion of the special study will be completed by the end of March 1985.

Philippines

A draft study of the large-scale government-managed irrigation system at UPRIIS in Central Luzon will be available at the end of summer 1984. The main activity to be undertaken in FY-85 is interpretation of the analytical results in light of the modifications in the research strategy.

Carol Ferguson will return to Cornell in October, 1984, to begin the analytical phase of her work which will run through FY-85. At the end of FY-85, a publication based on the research in the Philippines analyzing the intensity of management in large, agency-operated systems will be completed.

Following completion of the Philippines part of the study, it is proposed that a workshop be held in the Philippines to discuss the results of the study and the implications for irrigation system management. This would be a separate activity in the FY-86 workplan.

PROPOSED ACTIVITIES
FOR
IRRIGATION SYSTEM MANAGEMENT

3-04-061-84

October 1, 1984 - September 30, 1985

by

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This proposal is part of the work plan under the Water Management Synthesis II Project which is a USAID project being conducted by Utah State University, Cornell University and Colorado State University.

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Proposed Activities for Developing Integrated Strategies for Improving Main Systems Design, Management and Rehabilitation

STATEMENT OF PROBLEM AND ISSUES

Under the theme "irrigation system management," the WMS-II Project is conducting research studies of various components and operational linkages within irrigation systems. As a part of this objective, a subproject is proposed to study the design, operation and maintenance of the irrigation conveyance system which collects and stores water resources in the watershed and conveys them to the farmlands. This system is divided into a "main" system operated by government agencies of structured user groups, and a secondary system serving a "unit command area" which is constructed, operated and maintained by individuals or small non-agency groups.

Analysis of main systems must be prepared to deal with a multitude of important linkages between the main system, the watershed catchment and the individual command areas. These linkages are not generally considered in sufficient detail during the design, operational or rehabilitation phases of an irrigation project. As a consequence, a large variety of operational weaknesses have developed. Very often these problems are attributed to the engineers and administrative agencies responsible for main systems. Poor management is occasionally listed as the outcome of a "single-minded" discipline that is unwilling to recognize the array of social and institutional pressures acting within the system and incapable of system scale coordination of water development.

The irrigation main system is one of the more important constraints on agricultural production. The reliability of deliveries affect crop rotation, fertilization and pest management decisions at the farm level. System losses affect drainage systems but may also enhance groundwater development as a supplemental water resource. The operational regime (rotation, demand, etc.) affects crop yields insofar as irrigation timing enters the phenological development of the crop. The agency personnel responsible for irrigation may not receive adequate training specifically helpful in main system problems. They probably have minimal study of the fundamentals of irrigation at the farm level. Further, the computation and communication tools needed for better system management are not usually available in developing countries, and the translation of social and institutional influences into hydraulics and hydrologic impacts is yet to be made.

As a result many, if not most irrigation systems in the world today are designed and managed according to criteria which simplify and standardize the routine of the operators but constrain irrigation practices at the farm level. It is not a coincidence that irrigation projects which attempt to supply water in response to irrigator demand in a rate and duration set by the irrigator himself are also ones where production as well as irrigation efficiency are highest.

The main system operates in conjunction with the catchment and the command areas and cannot be studied independently of processes occurring in these components, but it does not sense nor does it react to the individual variabilities that occur therein. It tends to see an integrated or sometimes an averaged response of supply at one end and demand at the other. One important requirement of main systems study is the development of methods for analyzing main system design, management and maintenance issues by imposing sufficient catchment and command area linkages to render the predicated outcomes both realistic and informative. Thus, the analyses should incorporate submodels of the subsystems on either end of the main system, but need not consider them in detail.

In addition to the need for more advanced and comprehensive computational tools and training, main system analyses must also begin including institutional issues. These include: how do the institutional linkages in the water law system governing the development and use of water impact on the operation of the irrigation network? What policies which administratively define and extend the legal framework also set in motion procedures for financing, project selection, design and construction, operation, agricultural production supports, etc.? What bureaucratic incentives tend to strengthen or weaken the responsiveness of main system managers to UCA need and requests? What is the nature of alternative organizational arrangements between the public agencies responsible for water development and conveyance and the irrigators? Is the effectiveness of the irrigators in organizing for the construction, operation and maintenance sufficient to provide equitable allocation and use of the irrigation water supplies below the point of main system control?

Given the economic, social, institutional and physical characteristics of main systems, what then are the opportunities for improving both the structural and operational performance? One is the development and testing of a main systems modeling technology. The objectives of the modeling package are four-fold: (1) planning; (2) design; (3) operation; and (4) training. It is toward this objective that the Utah State University (USU) special strategy is focused. We make a number of assertions in support of pursuing this investigation. First, there are no currently available computer software packages with the capability to perform each of the functions listed above. Secondly, there is an established need for this technology that has been communicated in nearly all of the technical literature as well as via irrigation project officials throughout the world. Finally, that the development of such multipurpose software as is feasible, practical and usable.

Technical assistance and training programs assume that main systems can be improved substantially with respect to conveyance efficiency, delivery reliability and management. It is also implied that improved on-farm irrigation practices, and therefore production, depend on better main system operations. Under this project, a conceptual framework will be developed, tested and demonstrated to support the implementation of these programs.

DEFINITIONS AND SCOPE

Three linked subsystems are involved in this project: the unit command area, the catchment and the main system itself. The following paragraphs define these subsystems and discuss some of the issues associated with each that should be factored into this project.

The Unit Command Area

The irrigation conveyance system is a channelized pathway from the water supply to each individual field. Near the downstream end of this system, water distribution changes from allocation between individually irrigated fields. It is also a point where division of flow ceases and division of time begins. This point is assumed to demarcate the main system from what is herein defined as a "unit command area" (abbreviated UCA). This is a physical division point in the system and is generally a turnout or diversion structure which may or may not be the point dividing the public and private sectors of the economy or the governmental and private institutional levels of administration.

The UCA is comprised of individual fields and a network of small ditches. As a system, it has not been investigated extensively. The effects of irrigation timing, frequency, duration and discharge on optimal cropping mixes and higher levels of production are critically dependent upon having water on a timely basis. Conjunctive use of groundwater and surface water resources is often significant within UCAs and may be viewed as the irrigator's response to uncertainty of water availability through the irrigation project. Other issues needing increased attention include: (1) the priority of uses with the UCA; (2) formal and informal arrangements for operation and maintenance of the distribution network; (3) changes in the nature of irrigation from season to season or from year to year; and (4) effects on household subsistence and income, labor and environmental consequences, waterlogging disease vectors, etc.

The size of the unit command area is an important issue in the design of the main system. Small command areas require more main system investment in structures, higher administrative operation and maintenance costs and the likelihood that the main system will be less effective in serving the UCA. But small areas allow more direct participation by the irrigators themselves and thus, in theory at least, an opportunity for better communication between the main system and the UCA. Larger areas cost less to serve, and serve the UCA more reliably, but are more difficult for users to manage. The issue of where the interface occurs often reduces to a question of where public, directly subsidized support such as commonly provided for main systems ends and private (less subsidized) responsibility for unit commands begins. Large UCAs tend, therefore, to reduce public costs while increasing private financial commitments. In most countries, this interface may be set by policy and may be different than the optimal location for best system effectiveness.

Unit command areas seldom have formalized operating rules and the communicating link with the main system is often undefined. One must

presuppose that main system operations would be somewhat reflected in the operation of the UCA and that UCA operations could therefore be influenced by changes in the main system. An important issue, therefore, is how water management in the main system be modified to enhance water use in the UCA.

The organizational effectiveness of the farmers in the UCA for operating and maintaining their portion of the irrigation distribution networks plays a significant role in the effective use of the water supplies for producing crops, both in terms of total production and the equity of this production between farmers at the head and tail of the network. Again, this is a dynamic situation that changes between periods of plentiful and scarce water supplies during any season and from one season to the next. Also, the water losses in the system are significantly affected by the organizational capability for maintaining the water delivery and removal channels.

The primary linkage between the UCA and the main system is the aggregate demand for irrigation water at the UCA inlet. The UCA aggregated demand is cumulative water requirements of the command area over the main system operating horizon and includes internal distribution losses and on-field wastage (deep percolation and surface runoff). The UCA demand represents the water supply which maximizes UCA production and is therefore the optimal main system supply regime in the absence of supply or capacity limitations. Possibly the best index of main system performance is the deviation between the UCA demand for water and the associated main system delivery.

The Catchment Area

For purposes of this study, the catchment area is defined as the area of the watershed supplying water for irrigation to the main system. It would include the upland drainage feeding the stream where main system headworks, reservoirs and control structures are located and operated.

The nature of the catchment has an important bearing on irrigated systems. The size, shape, topography, soil and vegetative characteristics of the drainage area dictates the runoff hydrographs at the main system works. These parameters also effect sediment and debris in the flows which may increase the need for maintenance within the conveyance system.

A few of the issues of concern with regard to the catchment area are: (1) integrated management of storage and control facilities; (2) supplementing direct flow diversions; (3) forecasting and monitoring runoff; (4) treatments of the watershed to control sediment and debris; and (5) flow augmentation.

In many hydrologic systems, the major fraction of runoff from snowmelt or rainfall occurs prior to the peak consumptive use period of agricultural crops. An irrigated area may be so small that even the reduced flows are sufficient to satisfy crop demands during the critical

maturation periods, regardless of the cropping pattern. Under many other systems sufficient water is not generally available and cropping patterns are adjusted toward early maturing crops or drought resistant crops. It is not that the annual water supply is deficient, but that the temporal distribution of the supply is out of phase with crop demands. Reservoirs solve this problem and they make water available for hydroelectric power generation, recreation, fishing, urban and industrial needs, and act to control flooding.

The operation of reservoir systems which supply irrigated agriculture is complex. Reasonably accurate methods have been developed to forecast crop water requirements and to predict crop yields which can be expected under various irrigation regimes. However, few if any reservoir system operators know the cropping pattern being serviced and would never know the moisture status on an individual field, nor the schedules of plantings, cultivations, pest controls, etc., that also affect the scheduling of irrigations. Two general practices have evolved: either water is supplied on a rotation or continuous flow basis, or the reservoir responds to irrigator request. Certainly, one issue of importance is the communication of command area status to the main system headworks.

Agricultural diversions seldom conform to optimal hydroelectric, recreation or urban and industrial water requirements and are usually competitive with flood control objectives. Further, the water diverted into one main system may require coordinated operation of several storage and control facilities in the watershed. In order to manage water resources most effectively, the system of controls, conveyances and users should be operated under an integrated management policy.

Reservoirs are one of the most capital intensive investments that can be made in developing water resources. From an irrigation viewpoint, the question naturally arises as to whether or not a more cost-effective means of shifting the natural runoff distribution toward the agricultural demand distribution could be employed. The catchment area could be modified to substantially retard surface runoff and increase subsurface flow (checks on small channels, infiltration galleries, water spreading, etc.). A groundwater development scheme in the catchment itself might be implemented to augment runoff during low flow periods. Even where possible, water exchanges with neighboring reservoir systems or river basins might provide a better, more reliable water supply for irrigation than reservoir systems. An important consideration at the catchment level is, therefore, the alternatives for stabilizing the water supply.

The communication link between catchment, main system and command area is critically important under direct diversion systems (also called "run-of-the-river" diversion) since the opportunity interval is substantially shorter than under storage systems.

The uncertainty of the supply is of much more concern and thus the tendency to have more limited cropping mixes and less flexible delivery schedules. The effect of stochastic variation in water supplies needs to be included in any evaluation of irrigation system management.

The uncertainty associated with the water supply may be as limiting a factor on agricultural productivity as anyone might conceive, particularly during periods of shortage. Catchment areas respond differently to the magnitude and frequency of precipitation as well as seasonal cycles in temperature, wind and radiation. Improved monitoring of these conditions, coupled with more accurate analysis (forecasting models) would give main system operators and irrigators a significantly better basis for planning and decision making.

Watersheds can be managed in a number of ways to enhance irrigated agriculture. Previously noted were alternatives to regulate runoff patterns. Sediment and debris can also be controlled in the catchment area by managing flow velocities and gradients. Check-drop structures can provide the necessary elevation changes along a waterway while dissipating erosive energy under controlled conditions. Contour plantings, grazing regulations and grassed waterways contribute in essentially the same manner. Programs such as these may be significantly more cost-effective and easier to implement than sediment/debris control within the irrigation system itself.

Several irrigation systems in the world utilize branch canals to reallocate water from one river or canal system to another. This practice has also been applied to the catchment areas, the concept of interbasin transfer of water. Other augmentation alternatives include weather modification, desalination, phreatophyte control and evaporation suppression. While these possibilities are generally inappropriate, they should not be routinely overlooked.

The Main System

The primary conveyance and distribution network, or "main system," is the most deterministic of the irrigation system components, and as a result, a variety of operational strategies have emerged. These can be broadly classified as continuous flow, rotation and demand operation, but it should be noted that many systems will operate as a combination of these strategies. Most of the important issues related to main systems are associated with these operational strategies and their limitations.

Continuous Flow Systems. Some main systems are operated on a continuous diversion, continuous delivery basis. Such systems can be designed to be largely self-operating, and provide each irrigator with his proportionate share of the water supply. The management is simple and the costs associated with construction and operation are minimal. Operating personnel need not be skilled, nor are they in a position to respond to influence in making decisions. On the other hand, continuous flow systems impose a rigid water spreading strategy, and major disadvantages stem from this inflexibility. Small continuous flows are difficult to use efficiently in surface irrigation systems, so irrigators modify delivery by combining and rotating streams within the UCA. Crop demands generally are distributed differently than deliveries. Early irrigations usually enjoy greater supplies than demanded and apply far too much water, while peak

season applications may be so inadequate as to substantially reduce yields. Finally, the burden of seepage and operational losses and fluctuations in the main system are disproportionately borne by the end users.

Rotational Systems. There are also a fairly large number of main systems which rotate deliveries to individual UCAs on relatively fixed schedules and flow rates. This strategy is an extension of water management practices in the UCA and thereby offers substantial advantages over continuous flow regimes. Optimal flow rates necessary for efficient surface irrigation can be supplied, the administrative efficiency of main system operation can be maintained and the system losses tend to be more equitably distributed. However, the systems are more expensive to construct and operate due to larger capacities. The difficulty in serving the temporal variations in crop demands remains a constraint on production, and there is also more opportunity to exert individual influences on administrative decisions.

Demand Systems. In many irrigation projects, the delivery policy is to supply water on request and may be so flexible that irrigators choose the rate and duration of the water deliveries. This scenario assumes implicitly that the requirement of the irrigated sector can to some extent be anticipated one or more days in advance, depending on the lag time in the delivery network. Operating on the basis of irrigator demand, or in response to demand communicated to the system is difficult in both canals and pumps, and therefore capital costs, are higher for such systems. Operation and maintenance costs are also higher due to the need for more skilled managers and increased maintenance due to periodic fluctuations of water levels of the canals. The physical management of main systems is more difficult because the hydraulic conditions are continuously changing. Demand systems present greatly increased opportunities for external influence in decision making since functionaries yield tremendous power at times of high demand in responding to individual requests. Their goodwill is cultivated by most irrigators. This may be the most serious drawback to demand systems.

Summary. It is perhaps paradoxical that with the tremendous capital investments that have been made to construct or rehabilitate irrigation systems, yields in most areas are still well below the attainable. An enumeration of the reasons would be lengthy and site-specific, but in most cases a major contributor would be inadequate irrigation system performance. Newly constructed or rehabilitated main systems should incorporate as much operational flexibility as possible to make the main system more responsive to the needs of irrigators. Farmers are becoming more involved in main system management and in evaluating the performances of their systems. Thus, important issues concern the methods of improving delivery flexibility at reasonable cost, how to modify existing institutional structures to accommodate desirable changes and the development of trained personnel to implement the changes. Some of the primary benefits expected from research in this area are identifying legislative or policy changes that would improve system performance and organizational rearrangements and training programs that would provide the necessary skills for

continually improving the planning, design operation and maintenance of irrigation systems.

CONCEPTUAL STRATEGY

The catchment, main system and unit command area segments of an irrigation system are physically contiguous. These components may be administratively and operationally coordinated at some level, although effective coordination is frequently deficient. Systems themselves may range in size from a few hundred hectares in aerial extent to millions of hectares. They will invariably be complex. The question arises as to how to investigate the main system issues without detailed study of catchment and UCA systems which provide inputs and impose constraints on the main system. There are also a number of logistical questions such as how to incorporate an optimizational capability to evaluate and rank options for improving management and system performance, how to integrate social and economic characteristics with physically based descriptions of the system and how to transfer the results of the study to personnel involved in actual main system operations.

In considering these questions and the nature of the irrigation systems, the strategy for investigating main system issues may be best founded on management science principles which are capable of integrating physical simulation with an optimization capability and including social-institutional considerations as constraints and boundary conditions. Because main systems are themselves networks with discrete control or decision points and flow pathways, it seems logical to base the approach on a network analysis structure. The main system model which emerges from applying hydraulic and administration principles must be linked with catchment and unit command area submodels in order to incorporate their inputs and constraints. This strategy allows the study to investigate main system issues without sacrificing the vital effects of other irrigation system components.

A network analysis of main system functions implies a computer based model. The interactions among the physical variables as well as the management inputs, for example, are too complex for simplified analysis. Further, the information processing requirements on even small irrigation systems justifies a computer. Most irrigation systems operate without computer data base systems, but all of their logistical functions could be substantially improved if they were used. For the purposes of the study, the models need to serve in at least four roles: (1) as a long-term planning tool; (2) as a design aid; 3) as a training medium; and (4) as an operation and maintenance control system.

A modeling framework for problem definition and development of alternative solutions imposes some rather unique restrictions on an investigation. Field data are needed to calibrate and verify the models and are generally more exhaustive than data derived when simply defining problems and remedies. These data need to be indicative of a wide range of physical and operational conditions in order to provide the models with

sufficient generality to be transferable. The calibration and verification data must therefore be collected from multiple sites. The strategy is to formulate the general analysis, configure it for specific case studies and verify the analysis using case study data.

In addition to employing a strategy based primarily on modeling and detailed case study analysis, the results must be applied in a real time situation, i.e., close the loop in the study with an action research program. A significant refinement in most algorithms occurs when their use moves beyond the development and verification stages to their practical application. Methods of collecting and reducing data are often modified to streamline field use of the model, and generally, training others to use the product of a research project is best accomplished under familiar conditions.

PROJECT OBJECTIVES

1. To develop a model describing main conveyance and distribution subsystems within irrigation systems, including the physical and institutional linkages with the catchment and irrigated service areas. The model should simulate main systems generally and provide a means of optimizing objectives within particular system constraints;

2. To test the model using comprehensive field case study data to ensure its applicability to a wide range of systems;

3. To apply the model under an action research program to at least three diversified systems in areas of need in order to substantiate the practicality of the analysis and to provide the framework for transferring technology to other areas; and

4. To formulate guidelines for the selection and development of appropriate technology including software and training materials for users, and hardware for the operation of main systems.

PROPOSED WORKPLAN

The USU main system study was initiated in early 1983. A subproject framework proposal was submitted in August of 1983 and approved in substance by the WMS II project management. In January of 1984, notification was given that some specific research activities were to be described in more detail and approved individually. This was understood to mean the case studies under this project. The work plans for the one such activity was prepared and submitted. The most recent instructions specify that all of this subproject's subactivities will require individual description and approval. In accordance thereof, three tasks are proposed for the main systems subproject. The first is the development and testing of a comprehensive model software package for the analysis of main systems. Secondly, three international case studies are proposed to generate the data needed to verify the model and ensure its broad applicability.

Third, an interdisciplinary workshop is proposed to review both the modeling and case study structures in order to outline the principal issues to be addressed and the components requiring specific emphasis.

Model Development

The main systems modeling activity is guided by what is perceived to be a three-dimensional array of possible configurations. These are the model time frame, the mode of computation, and the type of model use. Computational time increments can range from less than an hour when the hydraulics of the main system are being investigated, to months when issues of water allocation and cropping patterns are considered. For the purposes of this study three time step divisions are proposed. The first is the hourly increment for evaluation of such problems as gate and control structure settings to deliver and manage prearranged flows in the system. The second is the daily increment intended for problems in short-term main system water allocations among the command areas. Finally, is a monthly increment for long-term water allocation problems. Thus, the model would be capable of configuration to analyze problems requiring time steps ranging from seconds to a year.

There are two computational modes the model might be useful for: (1) simulation; and (2) optimization. For the short-time increment, it may be of interest to simply predict the change of water level in the canal if a control structure in the section of interest were obstructed with debris. Similarily, over the span of the following seven days how much water would be needed in the various command areas if the weather should become unusually warm and sunny. And, at the monthly time frame, how much additional water demand might be expected if the irrigators respond quickly to expected increases in the price supports of a particular crop and a major shift in the project cropping pattern occurs. Simulation modeling addresses the question of how the system can be expected to respond to specific changes in either the physical parameters governing the hydraulic and hydrologic processes or the outcome of specific alterations in the method of management of some component of the system.

Optimizational modeling on the other hand seeks the best combination of controllable physical or operational parameters for pre-decided system performance goals. For example, what are the control structure settings that minimize water level fluctuations during changes in the delivery of water to a series of individual areas? What are the daily allocations of water over the next seven days to the UCAs that result in a maximum contribution to productivity with the irrigated areas? Or, what is the cropping pattern within the project area that achieves maximum net revenues for the farmer community given the expected availability of water over the next several months?

The final modeling dimension is the categorization of end users. The users were alluded to earlier as planners, designers, trainers, and operators. Each of these potential users of the main system models may find needs in the six configurations described above, but there is some

tendency for specific uses. The operator, for example, is more hydraulically oriented and would probably find the short time step computations most helpful. Planners are less interested in how irrigation is accomplished hourly or day to day as they are in the long-term effective use of water. Designers focus on capacity and layout while the trainer tries to prepare the others for contingencies.

Thus considering the three time frames, the two computational modes, and the four potential classes of users, there are 24 possible configurations that the proposed main system model should be designed to facilitate. One might observe that some configurations would include analyses that would be of little or no use in others so the model itself might contain substantial redundancy. To minimize the software one would engage for a particular need, it is proposed that the model be subdivided into discrete subprograms which can be organized selectively to yield the model desired. Five such subprograms are envisioned, each with further user selectable options. These primary subprograms accomplish the following tasks: (1) overall model configuration; (2) catchment analysis; (3) main system analysis; (4) unit command area analysis; and (4) output.

Configuration. To relieve the user of the task of assembling the various subprograms needed for the desired analysis and of inputing the necessary control logic, it is suggested that the main systems model include an organizing subprogram. Basically, the user would specify the objective of the analysis, the data available for input, and the form of the output and the organizing subprogram would configure the model to best serve this need.

One aspect of configuration that has already been considered in some detail during the first two years of the project is the need to provide a main systems modeling capability to a number of possible computer systems ranging from personal micros to large main frame systems. There are two principal constraints to be satisfied. First, the characteristics of the programming language changes from system to system. The main system models developed for this activity will be written in both BASIC and FORTRAN 77 code. One subprogram will be a language translator to shift to whatever language the computer requires or the user is most familiar. The second constraint is machine capacity. Personal micro computers may not be capable of running the full range of main systems analyses, particularly the hydraulic calculations. Part of the configuration subprogram will, therefore, be dedictated to sorting the available subprograms on the basis of required memory and execution time.

The development of the configuration subprograms will be a major component of the modeling activity during this proposed funding period. Because this subprogram is viewed as prerequisite to the interdisciplinary workshop, efforts to develop these components of the models would be undertaken first.

Catchment. The purpose of the catchment subprograms is to estimate the water hydrographs for main system diversion. It is not proposed that these models be complex, but employ relatively simple expressions corre-

lating the catchment characteristics with the runoff pattern resulting from rainfall and snowmelt. The analysis should be stochastic in nature and include estimations of sediment and salinity flows in the system. Many of the specific issues that would be proposed for the watershed subprograms were listed above, i.e., management of watershed conditions to enhance runoff characteristics and minimize sediments.

The development of the catchment subprograms would not be undertaken until the end of the year and may not be fully developed until the following year. Simple statistical analyses of the runoff record will be used to provide the hydrographs initially and then expanded as the other modeling efforts are completed.

Main System. The main system itself will be divided into two components for analysis. The first will be the operation of regulating reservoirs, if any, upstream of the canal headworks while the second will be the evaluation of canal flow distributions. As mentioned previously, this area of the modeling activity is intended to be the most intensive.

The primary input to the main systems programs is what will be called the "optimal UCA demand." In the absence on any constraints on the water availability to the command areas, the rate, frequency, and durations of the irrigation water supply would be defined by the individual irrigators based on their assessments of the crop requirements. This "optimal" demand will be formulated as a cumulative hydrograph expected at the UCA control point. The objective of the main system is to deliver water as close as possible to this hydrograph as possible given restrictions on the canal capacity, UCA outlet capacity, water availability, main system operating rules, etc. The objective function will be to maximize the utility of water within the irrigation system. Utility will be defined as an exponential relation dependent on the interval between the "optimal" water use and the actual main system deliveries and can be weighed to account for various institutional and social characteristics of the area. The computational procedures involve traditional network analyses with the addition that the analyses will always be projections into a planning horizon varying from a few hours to several months.

At the beginning of an irrigation season the problem is to evaluate the extent of the water supply's capability to supply the project's expected irrigation demand. When shortages are likely due to either limitations in the delivery capacity of the system or the shortfall in the total supply, decisions must be made as to how water will be allocated between the demands. This preliminary analysis is important to main systems operations because it helps define the operating rules during the irrigation season and can be used to set policies for support of particular cropping patterns. Once the model begins to function within the time frame of the irrigation season, the analysis would maximize the system utility be searching for short-term water allocation strategies that follow the emerging command area demands as closely as allowed by constraints. Then the computations become primarily hydraulic as the system controls are defined which allow implementation of the strategy. From this simplified scenario, the main system submodels that emerge are a

network analysis of water allocation strategies and a hydraulic network analysis of water management practices. In both cases, the program structure allows input of various socio-economic and institutional factors as constraints on the main system's capability to deliver water to the command areas.

The development of this series of submodels has been and would continue to be a major activity. To date, a comprehensive review of the technical literature has been made and a number of similar models have been collected. The tasks proposed for this year are the following: (1) develop the short- and long-term allocation submodels; (2) formulate a routing or kinematic lag and gate stroking submodel for canal systems; (3) develop a network type simulation of linked intermediate regulating reservoirs; and (4) the initial assembly of all of the submodels into specific applications programs.

Unit Command Area. The proposed UCA model involves the integration of two subprograms: (1) estimation of evapotranspiration in response to weather conditions, crop growth stage, irrigation timings, and crop variety; and (2) demand forecasts as functions of UCA size, field size distributions, soil characteristics, and cropping factors such as planting distributions. A more detailed description of the first model is given in Appendix A. The second model is being developed under a project outside of WMS II and consists of a queuing theory model which attempts to statistically relate the characteristics of the command area to the temporal distribution of the water demand. It is th orized that the variances in soils, planting, crops, and sizes of fields, for example, would cause the demand for irrigation water to have a statistical distribution over a period of one to two weeks. The integration of the two submodels allows the water demand to be calculated and then distributed over time to arrive at the "optimal" hydrograph at the UCA inlet.

Work on the UCA submodels is about 50-60 percent complete and will not require the same level of effort during this year as the configuration and main system submodels.

Proposed Time and Funding Levels. The estimated time and funding requirements for this phase of the activity are given in Table 1. Not shown are 24 man-months of time contributed by graduate research assistants who are not funded by the WMS II project but which are working on the main systems activity.

Schedule of Work. It is not possible to place a rigid schedule on the model development subactivity. The work has been divided among a number of individuals who are working on the respective submodels concurrently. The objective is to have the basic model framework in place by about December 1984. This will involve a fairly complete UCA model and the allocation and routing components of the regulating and canal submodel. The configuration submodel will be formulated in an preliminary structure but will necessarily evolve as more and mre of the software package is developed. Work on the catchment submodels will be deferred until spring or summer of 1985.

Case Study Analyses

Three international case studies are proposed. The first involves the NESSI and Lam Nam Oon USAID projects in Thailand. This case study was originated in the fall of 1983 and has been ongoing. The specific proposal for these activities has been submitted previously and will not be expanded upon here. A copy of the proposal is attached to this document in Appendix B except for the proposed budgets which have been revised for this period and are given in Table 2.

The second and third case studies are proposed for Morocco and India. Neither has been initiated beyond general discussions with the respective USAID mission and host-country counterparts. These studies will have substantially different opportunities for calibrating the irrigation system modeling effort and require different organizaiton and WMS support.

Morocco. While Morocco lies outside of the principal WMS II emphasis area, i.e., South and Southeast Asia, it offers several unique features important to the objectives of the main systems investigations. The irrigation development strategy in Morocco is almost opposite to similar strategies in the Asian region but happens to coincide with alternatives being discussed. A case study in the North African region, therefore, should not only extend the scope of the irrigation system models, but provide insights into the workability of similar systems in Asia.

The principal features of irrigation projects in Morocco are: (1) they utilize high capital investments in linings and automatic control structures to relieve the burden of management; (2) the planning, design and implementations of projects extend from the catchment to the individual farms including most of the elements of delivery and distribution throughout the project, land consolidation to make more management irrigation units, and to some extent on-farm design based on national production policies; (3) projects are organized and administered at the local level and coordinated at the national level. Thus, there is an absence of the national irrigation agency at the operational level; and (4) as in other areas, the project implements national agricultural production policy by authorizing and attempting to control cropping patterns.

A Moroccan cases study would provide several important unique inputs for this project. First, it would incorporate a view of the main system which included the upper-end administrative unit. Rather than dealing with individual personnel from a central agency, a case study in Morocco would be able to include the entire project organization because they are discrete at the project level. This would provide an opportunity to examine the institutional linkages more closely to identify how policies are implemented. Further, it would allow some investigation of how the operating agency might be strengthened to improve main system operations. For example, the project administration might benefit from manpower need assessments, training and other management sciences.

The second input would be the individual nature of Moroccan main system hydraulics. Most regulation points are equipped with automated gates to maintain constant upstream or downstream water levels. Projects throughout Asia are considering these devices to improve the hydraulic stability of canal systems. The value to the main systems study from analysis of one of these systems is that the hydraulic and short-term components of the models can be verified using the automatic gate controls as end point comparisons with the hydraulic simulation submodels. A substantial insight should be possible as to how to regulate canal flow and water level fluctuations manually.

The third important input would come from the features of Moroccan unit command areas. Land consolidation has resulted in smaller UCAs than might be found elsewhere. Where greater farmer participation is thought to be important in Asia, systems in Morocco minimize the role of farmer organizations by providing expensive but relatively maintenance free distribution to each block. Few projects worldwide attempt to ensure equitable distribution at the level of the Moroccan projects.

Many UCAs in these projects receive water on a combination demand and rotation basis. Thus, from the main systems viewpoint, such a project provides a simpler more tractable analysis of the unit command area. The field sizes are regular and the cropping patterns relatively well controlled.

There is the obvious disadvantage of a Moroccan case study from the WMS II management level. It would lie outside the Asian Bureau sphere of influence as noted. Morocco is certainly not among the "poorest of the poor", and USAID/Morocco has realigned its portfolio toward rainfed agriculture. On the other hand, there are some compelling advantages. Again, it serves the modeling need of the main systems study. In addition, the strong support from USAID/Morocco for this type of activity as irrigation comes back into focus locally following a series of drought years. There is substantial interest within several irrigation projects as well as from interested French researchers in main systems analysis. Finally, there is a strong local research and training institution in Rabat to provide much of the actual investigation manpower as well as serving the medium for transferring the results of this project not only to Morocco but also to French language countries throughout Africa.

During this funding period it is proposed that WMS support the concept of a Morocco case study and approve funds to develop this case study. As in the Thailand example, a WMS team would visit Morocco to review potential sites and define the objectives and responsibilities of the participating agencies. Support for this activity has already been communicated by USAID/Morocco, a local irrigation project, and the Institut Agronomique et Veterinaire in Rabat. Table 3 includes the estimated WMS costs. It is intended that USAID/Morocco would provide in-country expenses and the host-country agencies would provide limited transportation.

India Case Study. India is one of the largest of investors in irrigated agriculture and probably the largest user of WMS technical assistance. USAID has a number of irrigation projects in the planning or construction phase that offer interesting and unique opportunities to strengthen the technology associated with irrigation system management. The irrigation strategy in India relies heavily on its very large cadre of technical manpower. Emphasis is given more to extension of irrigation to new areas than to improving the operation of existing systems and national food grain sufficiency is a governing factor in cropping patterns and water allocation. The conjunctive use of groundwater is nearly always a high priority issue in India, particularly in the private sector.

Because of the extensive irrigation involvement by USAID and the WMS institutions, India is viewed as a primary opportunity for case study and action research. The heavy emphasis on rotational water deliveries and the tri-seasonal use of water pose a number of unique problems to water managers. Main systems management, especially, must be judged by not only the adequacy of the rotation in meeting crop water requirements but also the reliability of the rotation in servicing individual users along the system. The use of the output of this research should find its highest application in India.

The proposed Indian case study differs somewhat from the Thai and Moroccan studies in that much if not most of the effort is proposed as an on-campus activity rather than in-country. The availability of project data and the experience of WMS personnel is such that most of the information needed for the modeling can be acquired without special site visits. Further, USAID is already scheduling major projects which involve the intensive data collection and participant training which is incorporated in the main systems activity at the other sites. It seems reasonable to conclude that the lessons needed from an India case study can be learned from available information. A shift in the main systems strategy is therefore proposed in which the results are developed independently of particular projects, in other words, generate a generic Indian condition rather than a specific one.

Table 4 presents the proposed breakdown of costs associated with the Indian case study. This activity includes the participation of two Ph.D. candidates from India who have special expertise in irrigation water management in Maharashtra. The completion of this activity can be scheduled for October-November of 1984 if a training exercise can be arranged in india to demonstrate the overall results of the main systems study. If not, the development of the case study would be deferred until the spring and summer of 1985.

Interdisciplinary Workshop

This activity has been part of the main systems work plan since the beginning of the WMS II project, but has been delayed until the modeling had progressed sufficiently to provide the basis of discussion for the participants. The present state of the modeling as well as the slow

development of a main systems school of thought appears opportune for the workshop to be scheduled for this fiscal year. Table 5 shows the budget request for the current fiscal year which should be adequate for the activity and is proposed as a carryover item rather than a new request.

A number of relatively informal discussions have been held regarding the subject of main systems design, management and rehabilitation. It has been obvious that without a concise framework for the workshop, it would be difficult to maintain a concentrated interdisciplinary focus necessary to isolate the most important issues and the means to address them most efficiently. It is, therefore, proposed that the modeling effort and its capabilities be this framework. In addition to discussing main system issues then, the workshop should include the opportunity for the participants to direct their interests to the modeling itself by way of testing the software using one of the case studies or by configuring their own study and evaluating an array of issues defined by the participant.

The timing of the workshop appears to be best in the February-March period.

APPENDIX A

DESCRIPTION OF UCA WATER RESPONSE MODEL

OBJECTIVES

The proposed study will treat the UCA as a modular subsystem of the total irrigation system and will simulate the UCA's response to the inflow hydrograph supplied by the main system. This response will be expressed as an aggregate yield from all UCA farms, the probabilistic distribution of this aggregate yield, the distribution of relative yields (actual yield/potential yield) throughout the UCA and the ratio of actual irrigated area to total cultivatable area. The crop mix for a UCA with multiple cropping patterns will also be predicted by the model. The aggregate yield will be expressed in terms of net income, equivalent grain or some other method of lumping yields from different crops. As mentioned, the output from the UCA model will be in response to a given inflow hydrograph. The term "inflow hydrograph:" is used throughout this proposal to describe the timing, frequency, duration and discharge rate of the water supply.

The UCA model formulated herein will tie into the hydrology of the overall irrigation system with linkages to the main system and catchment area models being developed simultaneously under the WMS-II subproject -- Main System Design, Management and Rehabilitation. The modeling structure, while being physically based, will permit the input of socio-economic variables.

Special emphasis will be directed at analyzing the impact of water reliability on production. Reliability will be viewed as the certainty of having water on a timely basis with sufficient flow to operate the application systems efficiently. It will be assumed that production is influenced directly by the water reliability and indirectly by the farmers' perception of this reliability.

Thus, the specific objectives of this proposed work are to develop, calibrate and verify a model simulating the production response of a UCA to the inflow hydrograph supplied by the main system. The calibrated model will be used to determine how different inflow hydrographs affect the UCA production response and to study the issue of water reliability as it impacts on the UCA production. These results will then be used to specify UCA demands on the main system.

METHOD OF APPROACH

The study proposed involves the following three phases:

1. The conceptualization and development of a model to simulate the response of a UCA to the hydrograph supplied by the main system;

2. The collection of field data from irrigation projects for model calibration and validation if practical within the project funding and timing; and

3. The use of the calibrated UCA model to formulate production functions in terms of water delivery and to investigate the impacts of various main system management practices on UCA production patterns.

Conceptualization of UCA Model

The proposed UCA model involves the integration of a submodel simulating water delivery to individual farms and a submodel for predicting on-farm production for various possible water delivery hydrographs. The relationship between the water delivered to the UCA and the UCA's production is characterized by substantial and unavoidable uncertainty. This is due to the stochastic variability of physical inputs, the impact of socio-economic fctors and the nature of water distribution throughout the UCA. To account for this uncertainty, Bayesian analysis will be used to integrate the UCA water distribution submodel with the on-farm production submodel.

The UCA model developed for the proposed study will have the flexibility to model the UCA's production response to the water supplied by the main system or to express the UCA's demands on the main system. The later case is simpler and requires only a portion of the overall modeling capabilities necessary to simulate the production response for a given hydrograph. However, in order to describe in greater detail the overall UCA model, the description which follows assumes the former and more complicated case of UCA response to the water supplied by the main system.

Before continuing it is necessary to define a few terms. As mentioned earlier, the term "hydrograph" is used to refer to the flow rate of water supplied to the UCA (or to a field within the UCA) over time. Besides describing the rate and timing of the water supply, the hydrograph also describes the frequency, duration and volume of deliveries. For example, the volume of water supplied during a given period is the integral of the hydrograph over that period. An example of a hydrograph is presented in Figure 1.

The term "yield potential" (YP) refers to the maximum potential yield of a given crop when water and other manageable inputs are not limiting. The "maximum yield" (YM) refers to the maximum obtainable yield of a given crop under a given set of water applications when other manageable inputs are not limiting. The "actual yield" (Y) is the yield actually obtained with a given set of inputs. Due to the uncertainty described earlier, Y has a probabilistic distribution rather than a fixed value.

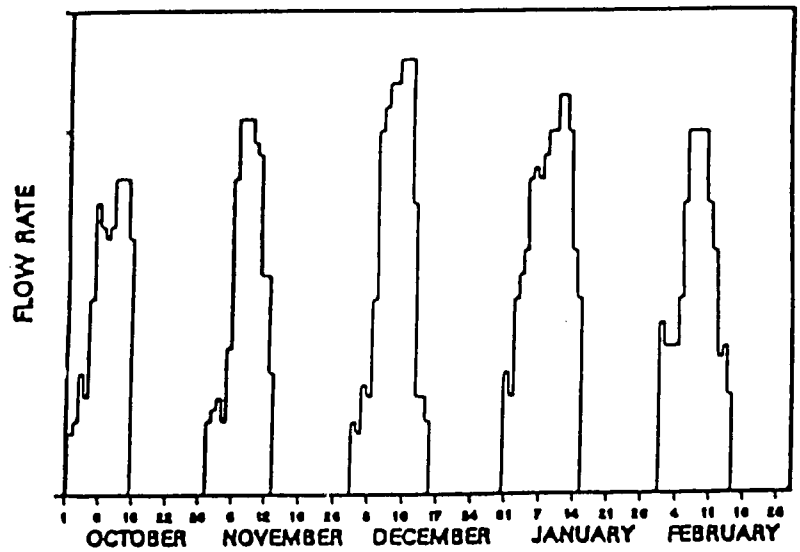

Figure 1. Example of a hydrograph supplied by the main system to a UCA.

The "actual production" (P) is a function of Y less the cost of harvesting (also a function of Y) and the cost of production (a function of YM). Similarly, the "maximum production" (PM) is a function of YM and the "production potential" (PP) is a function of YP. If the crop mix consists of more than one crop, production must be expressed in monetary units or by some other means of lumping the mix; for example, a common measure of utility or units of equivalent grain.

The UCA response to the hydrograph supplied by the main system will be modeled as follows:

1. Route the irrigation water through the UCA;

2. Determine the ratio of YM to YP for each crop in the potential mix;

3. Estimate the crop mix;

4. Determine the average ratio of PM to PP for the UCA; and

5. Determine the distribution of the ratio of P to PM.

The routing of irrigation water through the UCA can be simulated either hydraulically or statistically. A hydraulic model would provide more descriptive hydrographs at the individual field level but would also require more input data than a statistical model. Unless the necessary data for a hydraulic distribution model are already available, a statistical approach will be used. Water allocation will be modeled according to a statistical regression on the geometry of the UCA, the rules of UCA water management and the hydrograph supplied to the UCA by the main system.

The ratio of maximum yield to yield potential (YM/YP) for each crop in the potential crop mix and for each field delivery hydrograph will be determined by the on-farm production submodel. A flow chart of the conceptualized on-farm production submodel is presented in Figure 2. The water delivery input to the on-farm submodel is the output from the UCA water distribution submodel (previous step). When determining YM/YP for each crop, all inputs will be kept at optimum levels except for the water delivery hydrograph.

Statistical decision theory will be employed to estimate the farmer selected crop mixes. This procedure has been well developed and described by English (1,2). Inputs to the decision theory analysis include the distribution of the ratio of actual to maximum yield (Y/YM) for each crop in the potential mix and the utility curves for the farmers. Farmer utility curves will be obtained from the literature (6) while the distribution of Y/YM will be derived from the yield response surface (similar to the production response surface presented in Figure 3) for each YM/YP determined in the last step. Besides estimating the crop mix, the decision theory analysis can also be used to predict the proportions of the UCA that will be irrigated, dry farmed and left fallow for each water supply hydrograph.

Once the crop mix is determined the relative production potential (PM/PP) for representative fields will be estimated by converting the maximum yields derived in the second step to equivalent units of production. Then, based on the distribution of fields in the UCA the average PM/PP for the entire UCA will be determined.

Finally, the distribution of the relative maximum production (P/PM) for the UCA will be generated from the production response surface (Figure 3) by entering the average PM/PP derived in the previous step.

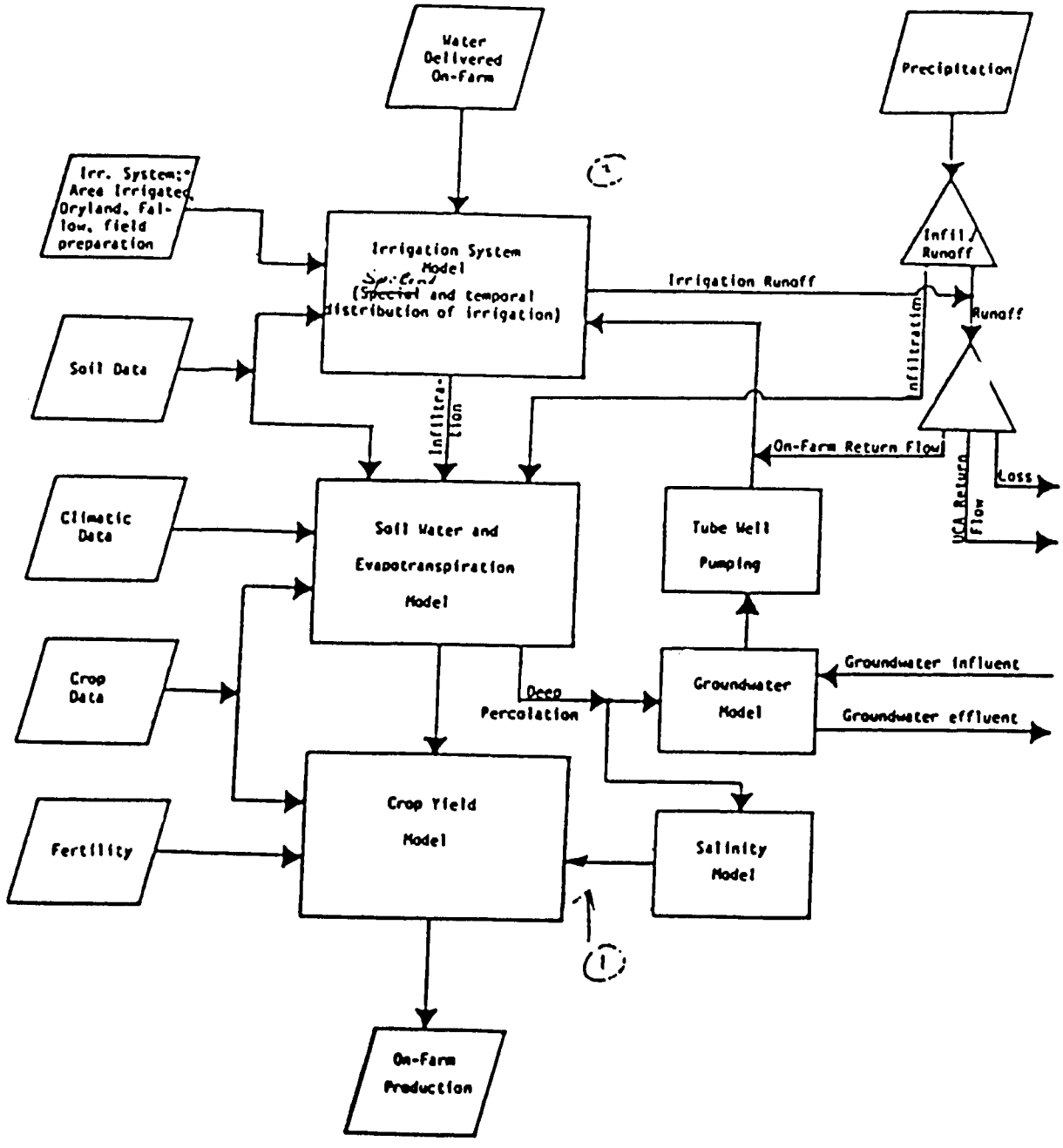

Figure 2. Flow chart of the on-farm submodel. (Those inputs and processes which involve socio-economic interactions are marked with an asterisk.)

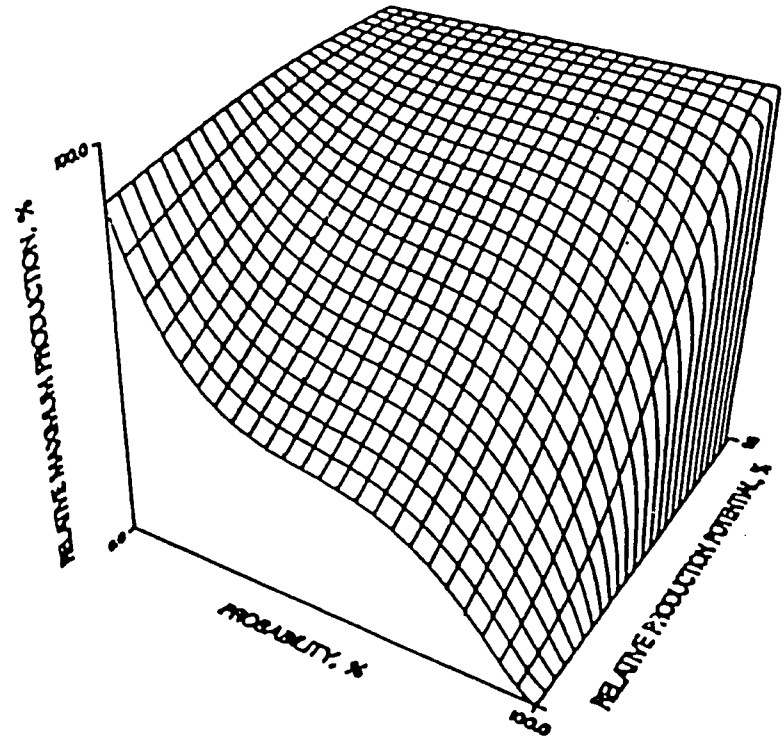

Figure 3. Hypothetical production response surface. (The yield response surface for a given crop and field would have a similar shape.)

It is beyond the scope of this proposed work to fully model all aspects affecting the UCA's production. The intent is to develop a sound physically based modeling framework which will permit the input and modeling socio-economic variables as these become quantifiable and their interactions known. While this modeling approach does not explicitly model socio-economic factors, the impacts of these variables are believed to be implicitly represented by the probabilistic UCA production functions generated by the proposed procedure.

UCA Model Calibration and Validation

Model calibration and validation are necessary steps in model development before a model can be used as a valid analytical or management tool. If practical within the project funding and timing, a study of at least one irrigation project in an LDC is proposed to obtain the following:

1. Model inputs:

    a. Climatic data (daily temperatures, radiation, humidity and wind);

b. Crop parameters (hybrids, availability of hybrids, planting dates, plant densities, crop mixes);

c. Fertility parameters and practices;

d. Irrigation practices and efficiencies;

e. Soil parameters (depth, water holding capacity, saalinity, infiltration characteristics);

f. Rainfall distribution (spatial and temporal);

g. UCA topography and distribution of fields within the UCA;

h. The distribution of UCAs along the main system;

i. The conjunctive use of groundwater;

j. Groundwater data (depth, hydraulic conductivity);

k. Water delivery to individual fields;

l. Water supply and demand relationship (water supply tension) with the overall system;

m. Rules of UCA water management;

n. Irrigation water quality;

o. Distribution of production throughout the UCA; and

p. Farmer utility curves.

2. Outputs for model calibration and validation:

a. UCA production;

b. Ratio of area irrigated to cultivatable area within the UCA; and

c. UCA return flow and runoff.

It is possible that some of this data may be obtained via remote sensing. The use of LANDSAT data and a geographic information system have been proposed for diagnostic analysis of irrigation systems (4). LANDSAT data can be used for determining differences in planting intensity, plant vigor and soil moisture within an irrigation project on a historic basis. If the 57 m x 57 m square resolution of LANDSAT IS NOT A LIMITING FACTOR, LANDSAT data, combined with a geographic information system, can also be used to map UCAs and determine the irrigated area, crop mix and crop quality of fields as a function of the water course distance of the fields from the canal turnout.

Application of the UCA Model

The calibrated and validated UCA model can be used directly to investigate the effect of various main system management scenarios, but an optimization procedure must be employed in order to determine the best inflow hydrograph from the main system to the UCA for maximizing production. Such an optimization procedure could also be used to determine the best planting dates and UCA crop mix for a given hydrograph. At this point the appropriate operations research technique for this situation has not been determined; however, a network of queues and queuing theory or chance-constraint linear programming are possible choices.

As ws mentioned earlier, special emphasis will be directed at analyzing the impact of water reliability on production. This will be accomplished by comparing production from areas of high reliability of irrigation water supply (i.e., head end, tubewell, tail end-reuse) to production from areas of lower reliablity (i.e., tail end).

PROPOSED WORK PLAN

1. Complete UCA model conceptualization;

2. Develop and program UCA model. Models of most of the processes described in Figure 2 have already been developed by prior research (3, 7, 8, 10 and 12). Most of what needs to be done here is to develop the linkages between these submodels and an overall operational flow plan;

3. Develop a work plan for a field visit to an LDC irrigation project to obtain data for model calibration and verification;

4. Make field trip and collect data;

5. Calibrate and validate UCA model;

6. Perform sensitivity analysis of UCA model; and

7. Study the reliability issue of irrigation water supply for the project visited using the UCA model.

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APPENDIX B

Water Management Synthesis II Project

MAIN SYSTEM DESIGN, MANAGEMENT AND REHABILITATION

Thailand Work Plan

STATEMENT OF PROBLEM AND ISSUES

Under the theme "irrigation system management," the WMS-II Project is conducting research studies of various components and operational linkages within irrigation systems. As a part of this work, the Main System Activity is an interdisciplinary, inter-university subproject which is studying the design, operation and maintenance of the irrigation conveyance system which collects water resources at the watershed and conveys them to the farmlands. This system is often dividied into a "main" system operated by government agencies or structured user groups, and a secondary system serving a "unit command area" which is, in theory, constructed, operated and maintained by individuals or small non-agency groups.

At the engineering level, conveyance hydrology is generally understood, although these principles may not be given sufficient emphasis in most civil or agricultural engineering curricula. For example, design procedures are often based on maximum steady state flow rates assuming a standard strategy for operating the system, a strategy which may or may not be valid. The hydraulic transients, introduced in some main system operations, which may be very important factors affecting irrigation practices on individual farms, are seldom taught at the baccalaureate level. Estimating seepage, operational losses and flow measurement errors requires practical experience, particularly since these factors change during the life of the project. Of an even less defined nature are the multitude of important linkages between the main network and the water resource and water use systems at either end. These problems lead to a large variety of operational weaknesses which are often incorrectly attributed to the engineers who may be responsible. Poor managment may not be the result of a "single-minded" discipline that is unwilling to recognize the array of social and institutional pressures acting within the system and incapable of system scale coordination of water delivery and use systems. The truth is that these individuals lack adequate training. The supporting computational tools which would allow a higher level of system management are not readily available, and the translation of social and institutional influences into hydraulic-hydrologic impacts is yet to be developed.

Thus, in addition to the need for more advanced and comprehensive computational tools and training, main system management must also begin including a host of institutional issues. These include: (1) the institutional linkages in the water law system governing the development and use of water and the impact on the operation of the irrigation network; (2) policies which administratively define and extend the legal framework and set in motion procedures for financing, project selection, design and construction, operation, agricultural production supports, etc; (3) the organizational arrangements between the public agencies responsible for water development, water conveyance and sometimes allocation; (4) the interactions between these agencies and the irrigators; (5) the effectiveness of the irrigators in organizing for the construction, operation, maintenance, equitable allocation and use of the irrigation water supplies based on the water demands for optimal crop production below the point of main system control; and (6) the impact of main system operations and maintenance on irrigation water use.

Under the overall WMS-II scope of work, Utah State University (USU) has been assigned the responsibility of evaluating these issues from the top-down perspective, i.e., giving primary emphasis to catchment areas and main systems. Colorado State University will be focusing on the same issues from a bottom-up view by concentrating on the relationships within the commanded areas and the influence on irrigation system performance.

In order to provide a perception of how these two special study groups might support the project's overall objectives, a brief discussion of command area problems affecting the main system will be given. The maximum benefit of irrigation cannot be derived unless the collection, storage, transmission and delivery of water are coordinated with the temporal and spatial characteristics of the water needs at the farm level. A necessary input to the evaluation of the main system, therefore, is the behavior of the area it serves. None of these physical systems should be divorced conceptually from their associated social-institutional systems.

The irrigation conveyance system is a channelized pathway from the water supply to each individual field. Near the downstream end of this system, water distribution changes from allocation between irrigated blocks, or commanded areas, to allocation between individually irrigated fields. This point is assumed to demarcate the main system from what is herein defined as a "unit command area" (abbreviated as UCA). This is a physical division point in the system and is generally a turnout or diversion structure. It may or may not be the point dividing the public and private sectors of the economy or the governmental and private institutional levels of administration.

The UCA is comprised of individual fields and the ditches linking them to the main system. As a system, it has not been investigated extensively. The effects of irrigation timing, frequency, duration and discharge on optimal cropping mixes and crop production need to be quantified since achieving higher levels of production is critically dependent upon having water on a timely basis with sufficient flow to operate the application systems efficiently. Conjunctive use of groundwater and surface

water resources need to address questions regarding the irrigator's response to uncertainty of water availability and production inputs. Other issues needing increased attention include: (1) the priority of uses with the UCA; (2) formal and informal arrangements for operation and maintenance of the distribution network; (3) changes in the nature of irrigation from season-to-season or from year-to-year; and (4) effects on household subsistence and income, labor and environmental consequences, waterlogging, disease vectors, etc.

The organizational effectiveness of the farmers in the UCA for operating and maintaining their portion of the irrigation distribution network plays a significant role in the effective use of the water supplies for producing crops, both in terms of total production and the equity of this production between farmers at the head and tail of the network. Again, this is a dynamic situation that changes between periods of plentiful and scarce water supplies during any season and from one season to the next. Also, the water losses in the system are significantly affected by the organizational capability for maintaining the water delivery and removal channels.

Thus, after indicating the systems local scope of the problem, attention will now be focused on the main systems subproject. A later discussion will address the lower end of the irrigation system.

OBJECTIVES AND SCOPE

The main systems study is expected to encompass several international sites. As Thailand is considered by the project as a primary opportunity, the following objectives are enumerated in terms of the Thai context:

(1) To develop and verify computer simulation programs for application in evaluating design, management and rehabilitation alternatives using operations data from the Lam Nam Oon Project and the Huai Aeng site of the NESSI Project:

(2) To implement the models as system controller aids at the two sites and modify as needed to incorporate local infrastructure and personnel assignments; and

(3) To utilize the programs and operational experience as training systems for the Thai Government's, Royal Irrigation Department, particularly the Operation and Maintenance Division (RID-OM).

PROJECT APPROACH AND SCHEDULE

During September 1982, an interdisciplinary team visited the sites and reviewed the progress as well as discussed upcoming plans. Although the team included outside personnel and the visit to Thailand had a broader view than "main systems," much of this effort was in support to Utah State University's WMS-II subproject entitled "Main System Design,

Management and Rehabilitation." At the end of the field visits, it was concluded that both of the Northeast irrigation projects would be effective case studies for the main systems study.

It is proposed that the following cooperative effort among Water Management Synthesis-II/Utah State University (WMS/USU), United States AID-Thailand, and the Royal Thai Government's Royal Irrigation Department (RID-OM) be made:

(1) December 1983 to November 1984. The structure, timing, responsibilities, and support of an operations analysis at each site, covering both wet and dry seasons, would be organized by the WMS/USU Thailand Coordinator in cooperation with appropriate agency personnel and consultants listed in a following section. Then the field operations studies would be conducted, primarily by two Thai engineers-in-training under direct supervision of project personnel. Data requirements and recording specifications would be developed by the WMS/USU Project Leader, the WMS/USU Thai Coordinator, and In-Country Personnel;

(2) September 1984 to December 1985. The two Thai Engineers-in-training would enter a 15-month degree program in Irrigation Engineering at Utah State University, with one student pursuing an undergraduate degree (B.S.) and the other student a Master of Science degree. They would participate in the main systems modeling program and utilize their data to validate the codes. their study requirements would include description of the field data efforts, analysis and interpretation of the results, and evaluation of hypothetical design and operational conditions pertinent to their case study projects;

(3) January 1986 to November 1986. The Thai Engineers-in-training would return to the project site and again conduct operational studies. Data would be utilized in the models to generate real time suggestions for system management and then evaluate the performance of the main systems. It would be desirable to initiate RID-OM training of not only other junior personnel, but administrative personnel as well, by close coordination and demonstrative effects. During this period, senior level RID staff, consultants, and the WMS/USU Thai Coordinator should develop a framework for formalizing the results of this effort into the institutional training policies of RID. Linkages with academic and research staff at Kasetsart University and the Asian Institute of Technology should be established in order to supplement the training framework.

(4) December 1986 to September 1987. Main systems models should be utlized in conjunction with a special training course covering irrigation systems management. The training course should be viewed as a prototype exercise, evaluated at its conclusion, and modified accordingly. Course content should include about one-third technical review of concepts, one-third familiarization

with computerized main system management (gaming simulation), and one-third field application of the main systems models. It would be important at the end of this effort to hve institutionalized the training program since there are a number of pragmatic uses of the main systems model beyond operation and training. For instance, it could be used to evaluate alternative design strategies, optimize reservoir and tank operations, consider the consequences of water policy or the failure thereof, and address issues raised by farmer groups as to the feasibility of alternative modes of water transfer.

PROPOSED BREAKDOWN OF INSTITUTIONAL COMMITMENTS

(1) WMS-USU

1 Professional man-month/year for in-country technical assistance (TA) and supervision.

19 Engineer-in-training man-months for graduate education at USU plus USU support expenses such as computer charges, printing, typing, drafting, etc.

Airfare for WMS-USU Thai Coordinator and TA personnel.

Support of tuition and fees for undergraduate trainee to attend Kasetsart.

(2) RTG-RID

Assignments of 2 engineer-in-training candidates to work at the project sites and undertake M.S. level training at USU. Support should be provided in the form of individual transportation during field studies.

International travel for the two Thai students.
Additional flow measurement structures should be added to the Lam Nam Oon Project to calibrate and manage main system check structures.

(3) USAID-Thailand

In-Country travel and per diem costs for WMS/USU TA personnel.

Authorization of Radio Communication and miscellaneous monitoring equipment for the Lam Nam Oon Integrated Rural Development Project.

PERSONNEL

(1) Water Management Synthesis II/Utah State University

Project Leader, Dr. Wynn R. Walker, Agricultural and Irrigation Engineering Department, Utah State University

Thailand Coordinator, Professor Gaylord V. Skogerboe, Agricultural and Chemical Engineering Department, Colorado State University

(2) Royal Thai Government/Royal Irrigation Department, Operations and Maintenance Division, Bangkok:
Khun Nukool Thongtawee, Director
Khun Sunthorn Rungrongthanin, Deputy Director

Northeast Small Scale Irrigation Project, Khon Kaen:
Khun Skulwattana Chanthrobol, Project Director
Mr. Joe B. Wadlington, CTF Team Leader, Parsons Overseas Co.
Dr. Pradit Nopmongkol, Team Consultant
Khun Samran Thammultree, O&M Engineer, ROI Et
Khun Kanching Kawsard, Operations Engineer for this study and M.S. candidate at Utah State University (selected for this position because of previous experience on water management studies of small-scale irrigation projects in the Northeast and serving as counterpart to the ADB consultant on operation and maintenance studies at the Nong Wai Pioneer Agricultural Irrigation Projects).
Water Master at Huai Aeng
Zonemen at Huai Aeng

Lam Nam Oon Integrated Rural Development Project:
Khun Vichai Snguanpaiboon, Project Field Director
Khun Banjong Tanagsuangnern, Chief, Operations and Maintenance Division
Khun Virate Vareeratana, O&M Administration
Khun Charoon Possoontorn, O&M Operations
Mr. William C. Bell, Agricultural Engineer, Louis Berger International Inc.
Khun Somkiat Prajamwong, Irrigation Engineer and Computer Specialist. OPerations Engineer for this study and undergraduate candidate at Utah State University (selected for this position because of computer programming capability and previous experience on operations of the LNO Right Main Canal).
Water Masters (3) on Right Main Canal
Zonemen on laterals and sub-laterals served by the Right Main Canal
Special Activities Team member for Lateral R-9L.
Special Activities Team member for Pilot Area 2.

United States Agency for International Development

Mr. Richard Flaspohler, Office of Agriculture and Rural Development, Project Officer for the Northeast Small Scale Irrigation Project and the Lam Nam Oon Integrated Rural Development Project.

Khun Kamol Chantanumate, Office of Agriculture and Rural Development, Assistant Project Officer for the Northeast Small Scale Irrigation Project and the Lam Nam Oon Integrated Rural Development Project.

Khun Vanchai Jaisin, Office of Projects and Engineering Support, Assistant Project Engineer.

Water Management Synthesis II (WMS-II) Project
MAIN SYSTEM DESIGN, MANAGEMENT AND REHABILITATION
Dr. Wynn R. Walker, Sub-Project Leader

Proposed Activities of CSU Personnel

Jim Loftis (1.0 pm nts)

During the 1983-84 academic year, the following activities will be undertaken:

1. Write up literature review performed last summer in cooperation with Leslie Coleman.

2. Assist Gary Merkeley in getting the network model operational on the USU Vax System.

3. Locate study area in Colorado for evaluation of the network model.

4. Acquire microcomputer and evaluate its potential for running the network model.

Edward Sparling (1.0 pm nts)

The primary responsibility will be working jointly with Dr. Walker and Dr. Loftis in developing the economic components of the network model.

R.K. Sampath (0.5 pm nts)

A short report, or position paper, will be prepared by June 1984 on the returns to various levels of operation and maintenance investments as compared with periodic rehabilitation of existing systems. This report will also make recommendations on more specific studies that should be undertaken to further document the alternative investment strategies for irrigation system maintenance and rehabilitation programs. This work will be done in collaboration with Professor Skogerboe.

Gaylord V. Skogerboe (1.00 pm nts and 0.75 pm ts)

During the 1983-84 academic year, the following activities will be undertaken:

1. Serve as Thai Coordinator for the two project sites at Lam Nam Oon and Huai Aeng (Northeast Small Scale Irrigation Project). The field studies will be initiated in December 1983. Present

plans call for a TDY to Thailand from late November to December 20, 1983.

2. During the November-December 1983 TDY, collect available data on rehabilitation and maintenance costs under the NESSI Project and oversites in the Northeast, if readily available.

3. Participate with Dr. Sampath in developing the short report on the returns to various levels of operation and maintenance investiments as compared with periodic rehabilitation of existing irrigation systems.

APPENDIX A: APPROVED FY 84 ACTIVITIES CONTINUING IN FY 85

TECHNICAL ASSISTANCE

AFRICA

Activity Title: African Irrigation Overview — Code #1-02-109-84

Description: To provide Africa Bureau of AID with a state-of-the-art review of African irrigation experience to date, accompanied by a literature search and analytic identification of the major issues which AID should address in formulating its approach to African irrigation. Approval for a six-day work week and holiday pay is requested for all short term TDY (trips for less than four weeks) under this activity.

Institutions: Managing USU — Cooperating _____ — Participating CSU

Activity Coordinator: Jon Moris — Phone: (801) 750-2787

PERSONNEL BY DISCIPLINE	FY 1984									FY 1985			
	1984									1984			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Agri. Engineers							1.0	1.0		1.0			3.0
Economists							1.5	1.5					3.0
Social Scientists							1.0	1.0	1.5	1.5	1.5	0.5	7.0
Graduate Students							2.0	2.0	2.0	2.0	1.0	1.0	10.0

TOTAL 23.0

Project Costs:

Item		WMS-II FUNDING	MISSION CONTRIBUTION
Professional Personnel	1.00 PPM (ts) at $6,000	$ 6,000	
Professional Personnel	8.00 PPM (nts) at $4,500	36,000	
Graduate Students	9.00 PPM (nts) at $1,200	10,800	
Graduate Students	1.00 GPM (ts) at $1,200	1,200	
Travel - USA to Paris	2 trips at $1,500	3,000	
- Within USA	5 trips at $ 700	3,500	
Per Diem - In-Country	100 days at $ 75	7,500	
- International	50 days at $ 95	4,750	
Other Direct Costs		5,000	
Consultants:			
Fee	88 days at $ 227	20,000	
Travel	1 trip at $ 225	225	
Other		100	
TOTAL DIRECT COSTS		$ 98,075	
Indirect Costs:			
University Overhead		31,384	
CID - BBA		132	
- EBA		9,709	
TOTAL INDIRECT COSTS		$ 41,225	
TOTAL COST OF ACTIVITY		$139,300	

Mission Buy-In Funding . . . . . $ 85,000

WMS-II Core Funding . . . . . $ 54,300

Technical Assistance

HAITI

Activity Title: Irrigation Sector Survey Code #1-04-017-84

Description: An evaluation is currently being carried out in Haiti of an integrated Rural Development Project which contains a large irrigation component. On the basis of this evaluation being carried out through the WMS-II Project, the team will determine the potential for irrigation development. If this determination is positive, then a team will be formed under the project to conduct an irrigation sector assessment in FY 84 to provide guidance to the Mission regarding development options and investment opportunities in irrigation in Haiti. Approval for a six-day work week and holiday pay is requested for all short term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers									0.5	1.0			1.5
Economists									0.5	1.0			1.5
Agronomists									0.5	1.0			1.5
Social Scientists									0.5	1.0			1.5
Institutional Exp.				1.0					0.5	1.0			2.5

TOTAL 8.5

Project Costs:				WMS II FUNDING	MISSION CONTRIBUTION
Item					
Professional Personnel	6.00 PPM (ts)	at	$6,000	$ 36,000	
Professional Personnel	2.50 PPM (nts)	at	4,500	11,250	
Travel - USA to Haiti	- 6 trips	at	900		$ 5,400
Per Diem	150 days	at	84		12,600
Other Direct Costs					2,000
Consultants					
TOTAL DIRECT COSTS				$ 47,250	$ 20,000
Indirect Costs:					
University Overhead				15,120	
CID - DBA				977	
- G&A				4,725	
TOTAL INDIRECT COSTS				$ 20,822	
TOTAL COST OF ACTIVITY				$ 68,072	$ 20,000

Mission Buy-In Funding . . . . . $ 47,072

WMS II Core Funding . . . . . $ 21,000

INDIA

Activity Title: TA/Field Stu./TR - Madhya Pr. Minor Irr. Code#1-01-025-84 (Buy-In)

Description: Provide long and short term technical assistance for conduct of training and proposed studies to be carried out under the Madhya Pradesh Minor Irrigation Project. Long term assistance will begin December 1, 1983 and will continue for approximately three years. A full time resident specialist will be provided, shared one-half with the Maharashtra Irrigation Technology and Management Project. Approval for a six-day work week and holiday pay is requested for all short term TDY under this activity, but not for the long term resident specialist.

Institutions: Managing USU Cooperating _____ Participating _____

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Res. Spec. (Ag.Eng.)			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
Tech.Sp.,US Unspec.				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0
Tech.Sp., Indian				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.5
Admin.Asst., Indian				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.5
Clerical, Indian				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0

TOTAL 32.0

Project Costs:				WMS II FUNDING	MISSION CONTRIBUTION
Item					
US Professional Personnel	8.0 PPM (ts)	at	$6,000	$ 48,000	
US Professional Personnel	1.0 PPM (nts)	at	4,500	4,500	
Indian Professional Personnel	9.0 PPM (ts)	at	1,000	9,000	
Indian Clerical	9.0	at	222	2,000	
Travel - International	- 6 trips	at	2,750	16,500	
- In-Country	- 15 trips	at	300	4,500	
Per Diem - International	16 days	at	100	1,600	
- India	380 days	at	75	28,500	
Other Direct Costs				2,000	
Resident Specialist				44,818	
TOTAL DIRECT COSTS				$161,418	
Indirect Costs:					
University Overhead				47,367	
CIU - OBA				1,302	
- G&A				16,142	
TOTAL INDIRECT COSTS				$ 64,811	
TOTAL COST OF ACTIVITY				$226,229	
Mission Buy-In Funding				$226,229	
WMS II Core Funding				$ -0-	

Resident Specialist:

Salary and Fringe, 10 months	$48,370
Housing and Post Differential	12,880
Transport of family, 1 mo. per diem	10,050
Shipment of household goods, car	17,336
Miscellaneous	1,000
	$89,636

Technical Assistance

Activity Title: Madhya Pradesh Minor Irr. Proj: Socio-Tech. Feas. Study Code #1-02-023-84

Description: Carry out an analysis for determining one feasibility of two control pilot projects, each consisting of a minor irrigation scheme to demonstrate the effectiveness of using high technology to develop irrigation systems that will respond to individual farmer demand. If feasible, develop scope of work for design and implementation by modern consulting firms. The feasibility study will be conducted in two phases: a two-person team will develop a scope of work during spring, and feasibility team will carry out study during third quarter, 1984. Approval for a six-day work week and holiday pay is requested for all short term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating CU

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Irrig. Engineer						0.75							0.75
Sociologist						0.75							0.75
Unspec.5 persons,US								5.0	2.5				7.50
Indian Consultants							2.0	2.0	2.0				6.00

* Disciplines to be determined by scope-of-work. TOTAL 15.00

Project Costs:		WMS II FUNDING	MISSION CONTRIBUTION
Item			
US Professional Personnel	9.0 PPM (ts) at $6,000	$ 54,000	
Indian Professional Personnel	6.0 PPM (nts) at 2,000	12,000	
Travel - International	- 7 trips at 2,750	19,250	
- In-Country	15 trips at 300	4,500	
Per Diem - International	21 days at 100	2,100	
- In-Country	315 days at 90	28,350	
Other Direct Costs		2,000	
Consultants			
TOTAL DIRECT COSTS		$122,200	
Indirect Costs:			
University Overhead		39,104	
CID - DBA		1,465	
- G&A		12,220	
TOTAL INDIRECT COSTS		$ 52,789	
TOTAL COST OF ACTIVITY		$174,989	

Mission Buy-In Funding $174,989

WMS II Core Funding . . . . . $ -0-

Technical Assistance

INDIA

Activity Title: TA/Field Stu./TR - Maha Irr. T & M Proj.

Code # 1-01-021-84

Description: Provide long and short term technical assistance for conduct of proposed studies and training under the Maharashtra Irrigation Technology and Management Project. Long term assistance will begin December 1, 1983 and will continue for approximately three years. A full time resident specialist will be provided, shared one-half with the Madhya Pradesh Minor Irrigation Project. Approval for a six-day work week and holiday pay is requested for all short term TDY under this activity, but not for the long term resident specialist.

Institutions: Managing USU Cooperating _____ Participating _____

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Res. Spec. (Ag.Eng.)			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
Tech.Sp.,US Unspec.				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0
Tech.Sp., Indian			–	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.5
Admin.Asst., Indian				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.5
Clerical, Indian				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0

TOTAL 32.0

Project Costs:

Item				WMS II FUNDING	MISSION CONTRIBUTION
US Professional Personnel	8.0 PPM (ts)	at	$6,000	$ 48,000	
US Professional Personnel	1.0 PPM (nts)	at	4,500	4,500	
Indian Professional Personnel	9.0 PPM (ts)	at	1,000	9,000	
Indian Clerical	9.0	at	222	2,000	
Travel - International	- 6 trips	at	2,750	16,500	
- In-Country	- 15 trips	at	300	4,500	
Per Diem - International	16 days	at	100	1,600	
- India	380 days	at	75	28,500	
Other Direct Costs				2,000	
Resident Specialist				44,818	
TOTAL DIRECT COSTS				$161,418	
Indirect Costs:					
University Overhead				47,367	
CIO - OBA				1,302	
G&A				16,142	
TOTAL INDIRECT COSTS				$ 64,811	
TOTAL COST OF ACTIVITY				$226,229	
Mission Buy-In Funding				$226,229	
WMS II Core Funding				$ -0-	

Resident Specialist:

Salary and Fringe, 10 months	$48,370
Housing and Post Differential	12,880
Transport of family, 1 mo. per diem	10,050
Shipment of household goods, car	17,336
Miscellaneous	1,000
	89,636
One-half	$44,818

TECHNICAL ASSISTANCE REVISED 7/17/84

INDIA

Activity Title: Irrigation Sector Evaluation and Strategy Review Code # 1-02-103-84

Description: The objective of this evaluation and strategy review would be to evaluate the current AID irrigation sector program and recommend a mid-term strategy for project and program development. The study will examine the role of irrigation in Indian agriculture, describe irrigation institutions, evaluate the impact of the AID irrigation program on institutional change and technology transfer, outline constraints, review recurrent cost financing of irrigation systems operation and maintenance in Maharashtra, examine socio-technical options, and make recommendations for a future irrigation sector AID program.

Institutions: Managing USU Cooperating _____ Participating CU

Activity Coordinator: Jack Keller Phone: (801) 750-2785

PERSONNEL BY DISCIPLINE	FY 1984												
	1985			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Irrig. Engineers *	1.50	0.70	0.50						0.30	0.20	0.90	0.60	4.70
Inst.&Soc.Sci. **	2.10	1.35	1.35								0.50	1.25	6.55
Agri. Economists	0.50	0.75						0.25	0.75	0.75	0.25	0.75	4.00
												TOTAL	15.25

Other professionals are counted as engineers in this table even though they may be any discipline needed.
Daines' time is divided between Institutional and Agricultural Economics items.

Project Costs:		WMS II FUNDING	MISSION CONTRIBUTION
Item			
Professional Personnel	3.50 PPM (ts) at $6,000	$ 21,000	
Professional Personnel	1.25 PPM (nts) at $4,500	5,625	
Graduate Students	1.00 GPM (nts) at $1,500	1,500	
Travel - USA to India - 3 @ $1,666 & 4 @ 2,760		16,040	
- In-country - 6 @ $400		2,400	
Per Diem - 110 days @ $86 and 70 days @ $64 ***		13,940	
Other Direct Costs USU Document Reproduction & Misc.		2,000	
Consultants:			
Fee	55 days at $242.50	13,338	
	22 days at $150.00	3,300	
Graduate Students (Stanford) 11 days at $65.00		715	
Subcontract: SRD Research Group, Inc.		60,478	
Travel and Per Diem		17,280	
Subcontract (Indian)		5,000	
TOTAL DIRECT COSTS		$ 162,616	
Indirect Costs:			
University Overhead (Modified Direct Costs)		$ 30,022	
CID - OBA		979	
- G&A		16,099	
TOTAL INDIRECT COSTS		$ 47,100	
TOTAL COST OF ACTIVITY		$ 209,716	

Mission Buy-In Funding . . . . . $ 30,000

WMS II Core Funding . . . . . $ 174,716

Special Asia Bureau Funding . . . . . $ 5,000

* Includes consultants' travel.

** These costs will not be charged overheads since they are provided directly by AID.

*** Includes Consultants' per diem.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: WAYNE CLYMA Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985														
	1984					1985									
Discipline	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			12.00
Civil Engineer	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			12.00
Economist	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		12.00
Agronomist	0.50	0.25	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.25		6.00
Social Scientist	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		12.00
Engineer	1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50					6.00
Secretarial			0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.00
Team Leader	0.25	0.25	0.50	1.00	0.50			1.00					1.00		4.50
Graduate Student			2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	30.00
GW Hydrologist	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50							4.00
															104.50

Project Costs: Item					WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs						
Salaries & Benefits						
Professional	31.50	PPM (ts)	at	5,027.00	158,351.00	
Professional	37.00	PPM (nts)	at	3,770.00	139,490.00	
Secretary	6.00	PPM (nts)	at	1,500.00	9,000.00	
Graduate Students	30.00	GPM (nts)	at	1,200.00	36,000.00	
Travel - USA to	22.00	trips	at	2,300.00	50,600.00	
Per Diem	945.00	days	at	68.00	64,260.00	
		days	at			
Other Direct Costs						
Other: (supplies,tuition,computer time,computer)					37,000.00	
Subtotal Direct Costs					$ 494,701.00	
Contingency 15%					74,205.00	
TOTAL DIRECT COSTS					568,906.00	
Indirect Costs						
University Overhead					153,956.00	
CID - DBA					3,563.00	
- G & A					48,480.00	
TOTAL INDIRECT COSTS					$ 205,999.00	
TOTAL COST OF ACTIVITY					$ 774,905.00	$ 315,544.00 *
Mission Buy-in Funding					$ 774,905.00	
WMS II Core Funding					$ 0.00	

* See attached In-country support budget.

TECHNICAL ASSISTANCE

PERU

Activity Title: Plan MERIS

Code #1-01-112-84

Description: Provide long and short term technical services to the Plan MERIS project. An irrigation engineer/chief of party and credit specialist will be provided to assist the GOP in the execution of the work plan for improving small scale irrigation in the highlands of Peru. The irrigation engineer will work with four long term Peruvian counterparts of the Plan MERIS staff who will provide interdisciplinary assistance to the project. The credit specialist will work with the GOP agrarian bank to improve the performance of a credit program to small farmers involved in irrigated agriculture in the project area. In addition, an interdisciplinary short term team will make several visits to plann, design, monitor, and held analyze on-site research in irrigated problems on project systems.

Institutions: Managing USU Cooperating CU Participating _____

Activity Coordinator: Phone: (801) 750-

PERSONNEL BY DISCIPLINE	FY 1984-86			
	1984	1985	1986	
	June - Sept	Oct - September	Oct - Dec	TOTAL
Water Mgmt. Spec.	3.0	12.0	3.0	18.0
Credit Specialist		12.0	3.0	15.0
Research Agronomist	1.0	1.0	1.0	3.0
Extension Agronom.	1.0	1.0	1.0	3.0
Anthrop/Rural Soc.	1.0	1.0	1.0	3.0
Ag. Economist	1.0	1.0	1.0	3.0

TOTAL 45.0

PROFESSIONAL SERVICES			
Water Management Specialist	18 ppm	@ $5,417/mo.	$ 97,500
Credit Specialist	15 ppm	@ 6,500/mo.	97,500
Research Agronomist	3 ppm	@ 7,000/mo.	21,000
Extension Agronomist	3 ppm	@ 7,000/mo.	21,000
Anthropologist/Rural Soc.	3 ppm	@ 7,000/mo.	21,000
Agricultural Economist	3 ppm	@ 7,000/mo.	21,000
PER DIEM			
Lima			$ 10,650
Other in-country			11,550
INTERNATIONAL TRAVEL			
Long-term TA - 2 x 1 RT	@ $4,900		9,800
Short-term TA - 4 x 3 RT	@ $1,400		16,800
POST DIFFERENTIAL			
Lima (10%) - Credit Specialist			9,759
Cajamarca (20%) - Water Management Specialist			19,500
HOUSING			
Lima (Credit Specialist) $1,255/mo.			18,850
Cajamarcca (Water Management Specialist) $4,000/yr.			6,000
EDUCATION			
Water Management Specialist:			
$1,500 x 2 yr. x 2			
Cajamarca: Prov. for two children			6,000
Credit Specialist:			
$4,000/yr plus $3,000 yr			
x 1 yr. x 2			
Lima: Prov. for two children (1 high school/			
1 primary)			14,000
MOBILIZATION COSTS			
Long Term Specialist 2 x 32,560			
Temporary Lodging $126/day x 60 days x 2 = $15,120			
Furniture and appliances (locally procured)			
(14,000 x 2) plus $2,000 transp. = $30,000			
Transportation of HHG (1,000 lbs) plus PVO plus			
storage, $10,000 x 2 = $20,000			65,120
IN-COUNTRY TRAVEL			
Water Management Specialist			
Cajamarca - Lima - Cajarmarca (5 RT x $100)			500
Cajamarcca - Huancayo - Cajamarca (3 RT x $100)			300
Credit Specialist			
Lima - Cajamarca - Lima (4 RT x $100)			400
Lima - Various points in the Sierra - Lima (2 RT x $200)			400
Short-term Specialist			
Lima - Cajamarca - Lima (4 pers. x 3 RT x $100)			1,200
TOTAL DIRECT COSTS			$469,820
INDIRECT COSTS			
University Overhead (245,570 x 32%; 224,250 x 18%)			$ 118,947
CID DBA			6,936
CID G&A			46,512
TOTAL INDIRECT COSTS			$ 172,395
TOTAL			$ 642,215

Activity Title: Long Term Water Management Specialist

1-01-109-84

Description: Long term advisor to identify systems in need of rehabilitation, determine specific needs, and set up and operate a monitoring and evaluation system for achieving improvement. (See attachment A for detailed statement of work.)

JUL 20 1984

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Dan Lattimore Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agonomist						_	1.00	1.00	1.00	1.00	1.00	1.00	6.00

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agronomist	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00

PERSONNEL BY DISCIPLINE	FY 1986												
	1985			1986									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agronomist	1.00	1.00	1.00	1.00	1.00	1.00							6.00

24.00

Project Costs: (See Attachment B for detailed budget) Item			WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs				
Salaries & Benefits				
Professional	24.00 PPM (ts)	at 3,450.00	82,800.00	
Post Differential			16,560.00	
Benefits			15,318.00	
Travel - USA to Sri Lanka	4.00 trips	at 1,700.00	6,800.00	
- R & R	2.00 trips	at 1,500.00	3,000.00	
Transportation			19,000.00	
Other Direct Costs			11,110.00	
Equipment			10,000.00	
TOTAL DIRECT COSTS			$ 164,588.00	
Indirect Costs				
University Overhead			34,009.00	
CID - DBA			2,236.00	
- G & A			15,304.00	
TOTAL INDIRECT COSTS			$ 51,549.00	
TOTAL COST OF ACTIVITY			$ 216,137.00	
Mission Buy-in Funding			$ 216,137.00	
WMS II Core Funding			$ 0.00	

*See next three pages for breakdown into fiscal year. Fiscal Year 1984 expenditures, Fiscal Year 1985 & 1986 expected expenditures.

Technical Assistance

DATE: 2/12/85

COUNTRY: SRI LANKA

Code #: 1-01-109-84-FY84

Activity Title: Long Term Water Management Specialist

Description: Long term advisor to identify systems in need of rehabilitation, determine specific needs, and set up and operate a monitoring and evaluation system for schemes receiving improvement. (See attachment A for detailed statement of work.)

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Dan Lattimore Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agonomist							1.00	1.00	1.00	1.00	1.00	1.00	6.00
Secretary							0.25						0.25
													6.25

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	3.00 PPM (ts)	at	3,951.00	11,853.00	
Professional	3.00 PPM (nts)	at	3,100.00	9,300.00	
Secretarial	0.25 PPM (nts)	at	1,200.00	300.00	
Travel - USA to Sri Lanka	1.00 trips	at	3,006.00	3,006.00	
Per Diem	10.00 days	at	90.00	900.00	
Other Direct Costs				14,582.00	
Equipment				3 [illegible]1.00	
TOTAL DIRECT COSTS				$ 43,662.00	
Indirect Costs					
University Overhead				10,217.00	
CID - DBA				220.00	
- G & A				3,954.00	
TOTAL INDIRECT COSTS				$ 14,391.00	
TOTAL COST OF ACTIVITY				$ 58,053.00	
Mission Buy-in Funding				$ 58,053.00	
WMS II Core Funding				$ 0.00	

Technical Assistance

DATE: 2/12/85

COUNTRY: SRI LANKA

Code #: 1-01-109-84-FY85

Activity Title: Long Term Water Management Specialist

Description: Long term advisor to identify systems in need of rehabilitation, determine specific needs, and set up and operate a monitoring and evaluation system for schemes receiving improvement. (See attachment A for detailed statement of work.)

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Dan Lattimore Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1985												
	1984			1985									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agronomist	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00
Support Staff					1.00					1.00			2.00
													14.00

Project Costs: Item			WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs				
Salaries & Benefits				
Professional	12.00 PPM (+ts)	at 4,248.00	50,976.00	
Support Staff	2.00 PPM (nts)	at 2,394.00	4,788.00	
Travel - USA to Sri Lanka	0.00 trips	at 3,229.00	0.00	
Per Diem	0.00 days	at 65.00	0.00	
Other Direct Costs			10,607.00	
Equipment			6,929.00	
TOTAL DIRECT COSTS			$ 73,300.00	
Indirect Costs				
University Overhead			15,272.00	
CID - OBA			1,147.00	
- G & A			6,571.00	
Washington Admin.				
TOTAL INDIRECT COSTS			$ 22,990.00	
TOTAL COST OF ACTIVITY			$ 96,290.00	
Mission Buy-in Funding			$ 96,290.00	
WMS II Core Funding			$ 0.00	

Technical Assistance

DATE: 2/12/85

COUNTRY: SRI LANKA

Code #: 1-01-109-84-FY86

Activity Title: Long Term Water Management Specialist

Description: Long term advisor to identify systems in need of rehabilitation, determine specific needs, and set up and operate a monitoring and evaluation system for schemes receiving improvement. (See attachment A for detailed statement of work.)

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Dan Lattimore Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1986												
	1985			1986									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agronomist	1.00	1.00	1.00	1.00	1.00	1.00	1.00						7.00
Support Staff		1.00			1.00								2.00
													9.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	6.00 PPM (+ts)	at	4,673.00	28,038.00	
Professional	1.00 PPM (nts)	at	3,400.00	3,400.00	
Support Staff	2.00 PPM (nts)	at	2,600.00	5,200.00	
Travel - USA to Sri Lanka	1.00 trips	at	3,500.00	3,500.00	
Per Diem	10.00 days	at	90.00	900.00	
Other Direct Costs				4,964.00	
TOTAL DIRECT COSTS				$ 46,002.00	
Indirect Costs					
University Overhead				11,324.00	
CID - DBA				631.00	
- G & A				4,554.00	
Washington Admin.				16,459.00	
TOTAL INDIRECT COSTS				$ 32,968.00	
TOTAL COST OF ACTIVITY				$ 78,970.00	
Mission Buy-in Funding				$ 78,970.00	
WMS II Core Funding				$ 0.00	

Technical Assistance

DATE: 9/10/84

SRI LANKA

Code #: 1-02-102-84

Activity Title: Irrigation Systems Management Project Design Team

Description: The primary purpose is to develop the materials that the Mission may use to prepare a Project Paper for institutional development and the rehabilitation of four tanks. Technical assistance will also be provided in construction equipment, development of O & M plans, and financial analysis. Approval for a six-day work week is requested for all short term TDY under this activity.

Institutions: Managing CSU Cooperating_____ Participating_____

Activity Coordinator: Wayne Clyma Phone: (303) 491-6991

PERSONNEL BY DISCIPLINE	FY 1984										FY-85		
	1983			1984							1984		
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Aug	Sep	Oct	Total
WM Spec.										0.50	1.00	1.00	2.50
Economist										0.25	1.00	1.00	2.25
Financial Spec.										0.50	0.50	1.00	2.00
Irr. O & M Spec.										0.50	1.00	1.00	2.50
Social Scientist										0.25	1.00	1.00	2.25
Equip. Spec.										0.50	0.25	1.00	1.75
GRA													0.00
													13.25

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	9.00 PPM (ts)	at	5,968.00	53,712.00	
Professional	1.75 PPM (nts)	at	4,477.00	7,835.00	
Travel - USA to Sri Lanka	5.00 trips	at	2,200.00	11,000.00	
Per Diem	300.00 days	at	85.00	25,500.00	
	days	at			
Other Direct Costs					
Consultants					
Fee (1)	60.00 days	at	250.00	15,000.00	
	15.00 days	at	250.00	3,750.00	
Travel	1.00 trips	at	2,200.00	2,200.00	
Per Diem	60.00 days	at	85.00	5,100.00	
Other: (In country support: typing, transport., etc.)				1,536.00	
TOTAL DIRECT COSTS				$ 125,633.00	
Indirect Costs					
University Overhead				32,383.00	
CID - DBA				1,546.00	
- G & A				12,438.00	
TOTAL INDIRECT COSTS				$ 46,367.00	
TOTAL COST OF ACTIVITY				$ 172,000.00	
Mission Buy-in Funding				$ 172,000.00	
WMS II Core Funding				$ 0.00	

TRAINING AND TECHNOLOGY TRANSFER REVISED 6/13/84

ECUADOR

Activity Title: Finish Original Training Modules Code #2-03-054-84

Description: Under the FY 83 work plan, work was begun on a two-year program to develop conceptual video training modules, in part in response to the request of the Ecuador Mission. The program is developing 45 video modules through the use of computer animation and graphics which will be used as training aids for courses for engineers, agronomists and government officials in Ecuador who are involved in irrigation development. The program represents a pioneering effort in the development and application of computer graphics to irrigation training.

During FY 83 a Mission buy-in financed the direct costs of the activity which should be completed by the end of calendar 1983. This budget is for the completion of the modules as originally agreed with the Mission.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: David Daines Phone: (801) 750-2792

PERSONNEL BY DISCIPLINE	FY 1984													
	1983			1984										
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTAL
Manager	1.00	1.00	0.50	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.37	9.62
ITV Technician	1.00	1.00	0.50	0.25	0.25	0.25	0.25	0.25	0.25					4.00
Engineer	1.00	1.00					0.25	0.25	0.25					2.75
Graphics Supervisor	0.50	0.25	0.25						0.25	0.25	0.25	0.25	0.13	2.13
Coordinator	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	12.50
Graduate Students	5.00	4.00	1.50	2.50	2.50	2.25	2.25	2.50	3.50	2.50	2.00	2.00	1.00	33.50
Support Staff	0.75	0.25	0.25						0.50	0.25				3.00
													TOTAL	67.50

Project Costs:

Item		WMS II FUNDING	MISSION CONTRIBUTION
Professional Personnel	24.87 PPM (nts)	$ 63,522	
Technicians	6.13 PPM (nts)	10,040	
Graduate Students	33.50 GPM (nts)	19,245	
Support Staff	3.00 SPM (nts)	7,870	
Travel - USA to Ecuador		440	
Other Direct Costs		10,015	
TOTAL DIRECT COSTS		$111,132	
Indirect Costs:			
University Overhead		38,896	
CID - OBA		146	
- G&A		11,002	
TOTAL INDIRECT COSTS		$ 50,044	
TOTAL COST OF ACTIVITY		$161,176	

Mission Buy-In Funding . . . . . $ 32,000

WMS II Core Funding $129,176

TRAINING and TECHNOLOGY TRANSFER

Revised 5/23/84

INDIA

Activity Title: Senior Officer's Workshop

Code #2-04-053-84

Description: Six short workshops will be held, one at the Center and one in each of five States. A final roundup will be held at the Center. The purposes of the workshops are to provide orientation of high level government of Indian and State officials in principles of improved water management purposes and implementation of USAID Water Management and Training Project and to explore and discuss policy and operational ways to realize improved irrigation water management as a national objective. Approval for a six-day work week and holiday pay is requested for all short term TDY under this activity.

Institutions: Managing USU Cooperating _____ Participating _____

Activity Coordinator: Dean F. Peterson Phone: (801) 750-1149

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
US Leader (Ag.Eng.)	0.25		0.25	0.50			0.25			0.25			1.50
India Ldr.(Civil E)		0.50	1.00	1.00	1.00	0.50							4.00

TOTAL 5.50

Project Costs: Item		WMS II FUNDING	MISSION CONTRIBUTION***
Consultants:			
Fee (5 days with post diff.)	32 days at $242.50	$ 7,950	
Fee	75 days at RS 750	5,625*	
Fee (Under CID contract)	45 days at $240.00	10,800**	
Travel	2 trips at $3,000	6,000*	
In-Country		4,000*	
Travel fares in U.S.		1,400**	
Misc. travel costs		1,000*	
Per Diem	96 days at $86	8,256*	
	30 days at $75	2,250*	
	23 days at $100	2,300*	
Other:			
Workshop Expenses		14,600*	
Publications purchased and shipped from CSU		3,373	
TOTAL DIRECT COSTS		$ 67,554	
Indirect Costs:			
University Overhead		$ 3,623	
CID - OBA		353	
- G&A		2,807	
TOTAL INDIRECT COSTS		$ 6,783	
TOTAL COST OF ACTIVITY		$ 74,337	

Mission Buy-In Funding . . . . . $ -0-

WMS II Core Funding . . . . . $ 74,337

*local costs, to be disbursed by USAID/India; no USU overhead
**Dollar costs under CID contracts; no USU overhead
*** because of the change in line items, mission contributions is not known

PAKISTAN 301 Code #: 2-04-019-84

Activity Title: Senior Officer's Workshop/Seminar

JAN 20 1984

Description: Workshop for senior officers to enhance appreciation of intergrated approach to improved irrigation system management and command water management. First week will be classroom presentations followed by a one week field study of CADA projects in India and a one week tour of field work in Sri Lanka with farmer organization. A [illegible] week will be spent discussing what was learned on the four, how the classroom work and field observations can be applied in the command water management project, and preparation of a report detailing these observations. Sixth day pay requested.

Institutions: Managing: CSU Cooperating: Participating

Activity Coordinator: Ramchand Cad Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer								0.50					0.50
Civil Engineer													0.00
Economist													0.00
Agronomist							0.25	1.00					1.25
Social Scientist							0.25	1.00					1.25
Coordinator						0.25	1.00	1.00					2.25
Research Assoc.						0.50	0.50	0.50					1.50
													6.75

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	3.50 PPM (ts)	at	6,304	22,064	
Professional	1.75 PPM (nts)	at	4,740	8,296	
Research Assoc.	1.5 PPM (nts)	at	2,000	3,000	
Travel - USA to	0.00 trips	at	0	0	51,777
Per Diem	21.00 days	at	86	4,593	22,848
Participants Costs				29,340	
Other Direct Costs					
Other:				0	
TOTAL DIRECT COSTS				$ 67,293	
Indirect Costs					
University Overhe[illegible]				16,385	
CID - DBA				552	
- G & A				6,662	
TOTAL INDIRECT COSTS				$ 23,599	
TOTAL COST OF ACTIVITY				$ 90,892	$ 74,625

Mission Buy-in Funding	$ 80,828
WMS II Core Funding	$ 10,064

official approval 1-24-84

Training and Technology Transfer

WORLDWIDE

Activity Title: Irrigation System Management Task Force

Code #2-14-060-84

Description: This task force will provide intellectual guidance and administrative coordination of the Irrigation System Management focus of the WMS-II Project. It will review and advise the three lead universities regarding the substantive content of this special studies in irrigation system management to assure their technical work is integrated and properly focused on common issues and approaches. Likewise, it will monitor the studies of the universities to ensure proper coordination and communication. Approval for a six-day work week and holiday pay is requested for all short term TDY under this activity.

Institutions: Managing: None -- Inter-university

Activity Coordinator: Jack Keller Phone: (801) 750-2785

PERSONNEL *Y DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agri. Engineers	- -	- -	- -	- -	2.0	- -	- -	- -	- -	- -	- -	- -	2.0
Social Scientist	- -	- -	- -	- -	2.0	- -	- -	- -	- -	- -	- -	- -	2.0

TOTAL 4.0

Project Costs:				WMS II FUNDING	MISSION CONTRIBUTION
Item					
Professional Personnel	0.00 PPM (ts)	at			
Professional Personnel	2.00 PPM (nts)	at	$5,225	$ 10,449	
Other Direct Costs				4,000	
Consultants:					
Fee	48 days	at	242.50	11,640	
Travel - Overseas to USA	2 trips	at	1,500	3,000	
Per Diem	25 days	at	75	1,875	
TOTAL DIRECT COSTS				$ 30,964	
Indirect Costs:					
University Overhead				9,908	
CID - DBA				316	
- G&A				3,096	
TOTAL INDIRECT COSTS				$ 13,320	
TOTAL COST OF ACTIVITY				$ 44,284	
Mission Buy-In Funding				$ -0-	
WMS II Core Funding				$ 44,284	

Training and Technology Transfer

Code #2-14-065-84

WORLDWIDE

Activity Title: Organization of Task Force for Small-Scale, Community-Managed Irrigation Systems Issues

Description: Task force will include representatives from Cornell, CSU, and USU, as well as other selected participants. The task force will review ongoing and planning Synthesis activities related to this topic and will suggest new directions and activities for consideration. In particular, the task force will recommend activities that might be initiated during the second half of FY 84

Institutions: Managing: CORNELL Cooperating _____ Participating CSU, USU

Activity Coordinator: Walt Coward Phone: (607) 256-5495

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Rural Sociologist	.5	---	---										.5
											TOTAL		.5

Project costs

Item		WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Professional Personnel	.5 PPM at $4,766	2,383	
Travel - to Ithaca	6 trips at $ 900	5,400	
Per Diem	18 days at $ 70	1,260	
Other Direct Costs			
Consultants			
Fee	6 days at $ 200	1,200	
Travel	2 trips at $ 900	1,800	
Per Diem	6 days at $ 70	420	
Other		500	
TOTAL DIRECT COSTS		$12,963	
Indirect Costs			
University Overhead (51.975%)		6,494	
CID G&A		1,284	
TOTAL INDIRECT COSTS		$ 7,778	
TOTAL COST OF ACTIVITY		$20,741	
Mission Buy-In Funding.....		$ 0	
WMS-II Core Funding.....		$20,741	

Training and Technology Transfer

APR 13 1984

WORLDWIDE

Activity Title: Professional Visitors

Code # 2-11-068-84

Description: This activity provides a small amount of resources for inviting to the Cornell campus individual junior and senior professionals to report on recent research or action projects and to exchange information and views with the Cornell group working on irrigation. This intellectual exchange serves to keep Cornell faculty and graduate students informed about current developments, to inform others about present activities and approaches being used in the project and to identify potential participants in technical assistance and other activities of the project.

Institutions: Managing: CORNELL Cooperating _____ Participating _____

Activity Coordinator: Barbara D. Lynch Phone: (607) 256-8463

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
6-8 Professional Visitors	---	---	---	---	---	---	---	---	---	---	---	---	

TOTAL 0

Project costs

Item		MRS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Travel - to Ithaca	5 trips at $ 800	4,000	
Per Diem	15 days at $ 65	975	
Other Direct Costs		1,000	
TOTAL DIRECT COSTS		$ 5,975	
Indirect Costs			
University Overhead (51.975%)		3,106	
CID G&A		592	
TOTAL INDIRECT COSTS		$ 3,698	
TOTAL COST OF ACTIVITY		$ 9,673	
Mission Buy-In Funding.....		$ 0	
MRS-II Core Funding.....		$ 9,673	

Code #: 2-10-051-84

Activity Title: Microcomputer Applications for DA Training

Description: Computer applications developed for simulation and design of irrigation systems to assist trainees in DA workshops to analyze data and simplify report writing, and for linking disciplinary activities.

JUL 20 1984

Institutions: Managing: CSU Cooperating Participating

Activity Coordinator: Dan Sunada Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer	0.50	0.50	0.50	1.00	0.50	0.50	0.50	0.50	0.50	1.00	0.50	0.50	7.00
Economist													0.00
Agronomist													0.00
Social Scientist													0.00
													0.00
Graduate Student	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.00
													13.00

Project Costs: Item			WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs				
Salaries & Benefits				
Professional	7 PPM (nts) at	3,767	26,367	
Graduate Students	6 GPM (nts) at	1,200	7,200	
Other Direct Costs				
Other: Mainframe computer time; leased equipment			12,370	
TOTAL DIRECT COSTS			$ 45,937	
Indirect Costs				
University Overhead			12,084	
CID - DBA			0	
- G & A			4,594	
TOTAL INDIRECT COSTS			$ 16,678	
TOTAL COST OF ACTIVITY			$ 62,615	
Mission Buy-in Funding			$ 0	
WMS II Core Funding			$ 62,615	

Code #: 2 [illegible]-94

Activity Title: Strategy for Training

Description: Create a taskforce on training to develop project training strategies. Present training programs will be considered in regard to project needs of irrigation systems management and small scale irrigation systems. Output will be a training strategies paper.

JUN 20 1984

Institutions: Managing: CSU Cooperating Participating CU & USU

Activity Coordinator: Al Madsen Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer													0.00
Civil Engineer													0.00
Economist							0.33	0.33	0.34	0.33	0.33	0.34	2.00
Agronomist													0.00
Social Scientist													0.00
Coordinator													0.00
Graduate Student	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	1.50
													3.50

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	2 PPM (nts)	at	3,851	7,702	
Graduate Students	1.5 GPM (nts)	at	1,200	1,800	
Travel					
Per Diem	40 days (nts)	at	75	3,000	
Other	10 trips	at	500	5,000	
Materials				1,250	
TOTAL DIRECT COSTS				$ 18,752	
Indirect Costs					
University Overhead				6,751	
CID - DBA				0	
- G & A				1,875	
TOTAL INDIRECT COSTS				$ 8,626	
TOTAL COST OF ACTIVITY				$ 27,378	
Mission Buy-in Funding				$ 0	
WMS II Core Funding				$ 27,378	

Training and Technology Transfer

WORLD WIDE

Code #: 2-12-044-84

Activity Title: Brochures, Newsletters, Publications

Description: Three newsletters will be published per contract. Initial evaluations of present newsletter indicat preferences for expanded version to include more information on water management activities/issues along with proj news items. Project information folder is proposed for FY84. News and magazine articles will be prepared as appropriate. Materials published under WMSI will be supplied/reprinted as necessary.

Institutions: Managing: CSU Cooperating Participating

Activity Coordinator: R. L. McConnen & Dan Lattimore Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer			0.50										0.50
Civil Engineer													0.00
Economist			0.50										0.50
Agronomist			0.50										0.50
Social Scientist			0.50										0.50
Writer/Editor	1.00	0.50			0.50				1.00	0.50			3.50
Graphics Tech.		1.00				0.50			1.00		0.50		3.00
													8.50

Project Costs: Item		WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Professional	8.5 PPM (nts) at 3,170	23,881	
Other Direct Costs			
Other:		3,500	
TOTAL DIRECT COSTS		$ 27,381	
Indirect Costs			
University Overhead		9,857	
CID - DBA		0	
- G & A		2,738	
TOTAL INDIRECT COSTS		$ 12,595	
TOTAL COST OF ACTIVITY		$ 39,976	
Mission Buy-In Funding		$ 0	
WMS II Core Funding		$ 39,976	

Official approval 1-24-84

JUN 20 1984

Training and Technology Transfer

WORLD WIDE

Code #: 2-13-04

Activity Title: Instructors Guide for DA Workshop

Description: A DA workshop teaching manual for coordinators and training staff will be prepared to assist workshop trainers. Manual will provide suggested schedule, lesson plans and objectives, and printed and a visual materials available. See appendices for more detail.

Institutions: Managing: CSU Cooperating Participating

Activity Coordinator: Larry Nelson

Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Tota
Agri. Engineer			0.50										0.
Civil Engineer													0.
Economist			0.50										0.
Agronomist			1.00	1.00									2.
Social Scientist			0.50										0.
Editor			1.00										1.
													0.
													4.

Project Costs:

Item			WMS II FUNDING	MISSION CONTRIBUT
Direct Costs				
Salaries & Benefits				
Professional	4 PPM (nts) at	3,170	14,042	
Other Direct Costs				
Other: (Itemize, if large)			3,000	
TOTAL DIRECT COSTS			$ 17,042	
Indirect Costs				
University Overhead			6,135	
CID - DBA			0	
- G & A			1,704	
TOTAL INDIRECT COSTS			$ 7,839	
TOTAL COST OF ACTIVITY			$ 24,881	
Mission Buy-In Funding			$ 0	
WMS II Core Funding			$ 24,881	

Training and Technology Transfer

WORLD WIDE

Code #: 2-03-040-84

Activity Title: DA Trainers Workshop

Description: Weeklong workshop to train those interested in becoming trainers for future DA workshops. Particip should already be competent in discipline, but workshop will emphasize philosophy of irrigation water management as expressed by WMSII including interdisciplinary team approach, systems approach, and building institutional capacities. See appendices for more detail.

Institutions: Managing: CSU Cooperating Participating

Activity Coordinator: Larry Nelson / Mohammed Haider Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer			0.25	0.50									0.75
Civil Engineer			0.25	0.50									0.75
Economist			0.25	0.50									0.75
Agronomist			0.25	0.50									0.75
Social Scientist			0.25	0.50									0.75
Coordinator			0.50										0.50
													0.00
													4.25

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	4.25 PPM (nts)	at	3,851	16,367	
Travel	6 trips	at	500	3,000	
Other Direct Costs					
Other:				1,000	
TOTAL DIRECT COSTS				$ 20,367	
Indirect Costs					
University Overhead				7,332	
CID - DBA				0	
- G & A				2,037	
TOTAL INDIRECT COSTS				$ 9,369	
TOTAL COST OF ACTIVITY				$ 29,736	
Mission Buy-In Funding				$ 0	
WMS II Core Funding				$ 29,736	

[illegible]

Code #: [illegible]-84

Activity Title: Professional Visitors and Networking

Description: To provide campus resources for inviting host country professionals in water management and key professionals from other universities or agencies to Colorado State for discussions with our staff about Water Management Synthesis Project, our activities, and mutual interests. This communication helps our project staff be aware of various activities and approaches being used worldwide in water management. This exchange helps us identify potential members of technical assistance and training teams, as well as providing a professional networking essential to building water management capability worldwide.

Institutions: Managing: CSU Cooperating Participating

Activity Coordinator: Dan Lattimore Phone: (303) 491 - 6991

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
Discipline	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Agri. Engineer								0.25					0.25
Civil Engineer													0.00
Economist													0.00
Agronomist													0.00
Social Scientist													0.00
Coordinator													0.00
Graduate Students								1.00	0.75				1.75
													2.00

Project Costs: Item				WMS II FUNDING	MISSION CONTRIBUTION
Direct Costs					
Salaries & Benefits					
Professional	.25 PPM (nts)	at	3,851	963	
Graduate Students	1 GPM (ts)	at	1,500	1,500	
Graduate Students	.75 GPM (nts)	at	1,200	900	
Travel - USA to	1 trips	at	2,510	2,510	
	0 trips	at	500	0	
Per Diem	30 days	at	56	1,680	
	0 days	at	56	0	
TOTAL DIRECT COSTS				$ 7,553	
Indirect Costs					
University Overhead				1,923	
CID - DBA				53	
- G & A				755	
TOTAL INDIRECT COSTS				$ 2,731	
TOTAL COST OF ACTIVITY				$ 10,284	
Mission Buy-in Funding				$ 0	
WMS II Core Funding				$ 10,284	

official approval 1-24-84 (?)

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Activity Title: Small-scale Irrigation and Water Management in Niger, Preliminary Investigation

Description: Review of literature and examination of documents related to small-scale irrigation in the Sahel, and particularly Niger, at the offices of the Club du Sahel/CILSS in Paris. Refining proposal for research in Niger beginning in June, 1984 on the basis of literature and document review.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: Michael Walter & E. Walter Coward Jr. Phone: (607) 256-2177

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agr. Engineer					1	1	1	1	.5				4.5
											TOTAL		4.5

Project costs

Item		LTS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Graduate student	4.5 months @ $800	3,600	
TOTAL DIRECT COSTS		$ 3,600	
Indirect Costs			
University Overhead (43.1%)		1,552	
CID G&A		356	
TOTAL INDIRECT COSTS		$ 1,908	
TOTAL COST OF ACTIVITY		$ 5,508	
Mission Buy-In Funding		0	
LTS-II Core Funding		5,508	

Special Studies

Activity Title: Comparative Analysis of Farmer Participation Experience — WORLDWIDE — Code #3-04-046-83

Description: The overall goal of the special study on farmer participation and organization for water management is to produce a systematic analysis of reported materials on this topic with a focus on a) description of these experiences, b) prediction of water management performance outcomes associated with various modes of participation and forms of organization, and c) prescription of approaches that most likely to achieve desired improvements in water management. During FY 83 a small group of faculty and graduate students have developed an analytical schema for reviewing the literature. It is being used to review and catalog farmer participation cases. This review effort will continue in FY 84 and will be followed by a state-of-the-art paper reporting results and implications for the FAO/AID farmer participation workshop planned for Indonesia in July 1984. This report will also be reviewed in the proposed Workshop to Review Farmer Participation and Organization Issues (see Training & Technology Transfer).

Institutions: Managing: CORNELL Cooperating _____ Participating _____

Activity Coordinator: N. Uphoff Phone: (607) 256-6370

PERSONNEL BY DISCIPLINE	1983 Oct	Nov	Dec	FY 1984 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Political Scientist	1-	---	---										1
Grad.Stu.Rur.Soc.	2--	---	---										2
Grad.Stu.Planning	2--	---	---										2
												TOTAL	5

Project Costs

Item		WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Professional Personnel	1 PPM at $4,766	4,766	
Graduate Students	4 GPM at $1,133	4,532	
Other: (itemize, if large) Publication costs		2,000	
TOTAL DIRECT COSTS		$11,298	
Indirect Costs			
University Overhead (49.3%		5,108	
CID - DBA		1,129	
TOTAL INDIRECT COSTS		$ 6,237	
TOTAL COST OF ACTIVITY		$17,535	
Mission Buy-In Funding		$ 0	
WMS-II Core Funding		$17,535	
Carryover from FY-83		$17,535	
FY-84 Core Funding		$ 0	

WORLDWIDE

Activity Title: Small-Scale Irrigation Systems Special Study Completion

Description: Revision of small-scale irrigation concepts paper in light of summer field experiences in Sri Lanka, India, Bangladesh, Mexico, Peru, and Bolivia for November workshop (see training and technology transfer). Preparation of final version of paper based on workshop discussions. Recommendations for further study research.

Institutions: Managing: CORNELL Cooperating _____ Participating USU

Activity Coordinator: Jim Nickum, Barbara Lynch Phone: (607) 256-5095; 607 256-8483

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			1984									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Rural Sociologist	3	---	---										3
Agri.Engineer	.5	---	---										.5
Economist	1.5	---	---										1.5
Grad.Stu.Ag.Eng.	3	---	---										3
Grad.Stu.Rur.Soc	2	---	---										2
Grad.Stu.Ag.Econ.	6	---	---										6
												TOTAL	16.0

Project costs

Item			WMS-II FUNDING	MISSION CONTRIBUTION
Direct Costs				
Salaries & Benefits				
Professional Personnel	5 PPM	at $4,766	23,830	
Graduate Students	11 GPM	at $1,133	12,463	
Other Direct Costs			1,000	
TOTAL DIRECT COSTS			$37,293	
Indirect Costs				
University Overhead (49.3%)			$16,074	
CID G&A			3,692	
Total Indirect Costs			$19,766	
TOTAL COST OF ACTIVITY			$57,059	
Mission Buy-In Funding.....			$ 0	
WMS-II Core Funding.....			$57,059	
Carryover from FY-83			$34,094	

Special Studies

Code #3-04-097-84

SRI LANKA

Activity Title: Impact of Physical and Operational Rehabilitation on Equity of Water Distribution and Performance of Farmer Organizations.

Description: The purpose of this activity is to compare the relative benefits of physical rehabilitation of major irrigation schemes with the benefits derived from rehabilitating the operational and managerial infrastructure. With high costs incurred in physical rehabilitation, it is necessary to evaluate the impact of improving communications, upgrding in-scheme monitoring of water supplies and demand, and modifying water allocation and distribution procedures.

Institutions: Managing: CORNELL Cooperating: Participating _____

Activity Coordinator: Hammond Murray-Rust Phone: (607) 256-8463

PERSONNEL BY DISCIPLINE	FY 1984												
	1983			-				1984					
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	TOTAL
Agr. Engineer			---	---	.5	1.0	1.0						2.5
Grad.Student Agr.Engeering					.5	1.0	1.0	1.0	1.0	1.0	.5		6.0
											TOTAL		8.5

Project costs

Item		MNS-II FUNDING	MISSION CONTRIBUTION
Direct Costs			
Salaries & Benefits			
Professional Personnel	2.5 months	8,300	
Graduate Student	6 months		6,978
Per Diem	45 days @ $95	4,275	6,600
International Travel			2,500
Other Direct Costs:			
In-country travel		2,000	2,000
Data collection		1,000	2,000
Equipment rental		2,000	
DBA		200	
TOTAL DIRECT COST		$17,775	$20,078
Cornell Indirect Costs (43.1%)		6,957	4,015
CID GSA		1,760	
TOTAL INDIRECT COSTS		$ 8,717	$ 4,016
TOTAL COST OF ACTIVITY		$26,492	