Proj. No. 931048910
PB-AAC-884

PROJECT STATEMENT

Date: September 19, 1972

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A. PROJECT SUMMARY

1. Statistical

Project Title: Water Management Research in Arid and Sub-Humid Lands of the Developing Countries -- L.A.

New or Extension: Extension

Contractor: Utah State University
Logan Utah 84322

Principal Investigators: Howard B. Peterson, Project Director
Byron C. Palmer, Field Director

Duration: Current contract - June 1968 to March 1973
Proposed extension - April 1973 to March 1978

Funding to Date: $1,874,071 - Current contract to 3/31/73

Estimated Additional Cost: $3,025,000 - Proposed extension to 3/31/78

Funding by Fiscal Years:

1973	-	$550,000
1974	-	650,000
1975	-	700,000
1976	-	625,000
1977	-	500,000

Project Specialist: Alvin D. Ayers

Project Manager: James A. Urano

2. Narrative

The objective of this contract is to increase the level of knowledge of on-farm water management, especially in the tropics and, at the same time, provide competent assistance to USAID Missions in Latin America in developing the research capability of host country counterparts and institutions and regional agencies. Nine high priority project components are currently in operation with contractor field staff located in Brazil, Colombia, Ecuador and El Salvador. The contractor also has effective interchanges with USAIDs and research agencies in Bolivia, Chile, Guatemala, Honduras, Venezuela and Panama.

Field work with supporting activities on the contractor's campus is dealing with crop-water-fertilizer interaction through field research and demonstration plots, analyzing available hydrometeorological data to determine crop water requirements, establishing criteria for draining tropical zone soils, control of salinity, developing research station operations, adapting project management strategies to the developing countries' environment, evaluating the economic impact of improved technology and training developing countries' researchers through integrating the contract's activities with the high priority programs of the countries' research institutions.

B. EXPANDED NARRATIVE STATEMENT

1. Project Description and Background

This proposal is to extend, for an additional five years, the ongoing research project of Utah State University, Contract AID/csd-2167, dated June 1968. The general objective will remain unchanged and as stated in Article I, paragraph B of the original contract, will be:

> "To increase food production in the arid and sub-humid lands of the less developed countries through the improvement of water management practices and the integration of these with other good management and cultural practices."

In line with A.I.D.'s general policies, evaluation of the socio-economic implications of the research will be included. These will continue to involve the applicability of research results to requirements of the developing countries and the utilization by average farmers.

The specific objectives as listed in the Contract Article I-C continue to be applicable in improving the management of water in Latin America. They are under constant review as to importance, timeliness and suitability for research. However, at this time, they are viable and remain essentially unchanged as follows:

Specific Objectives

The specific research studies will be selected to meet the high priority needs of the LA area. These studies will include but not be limited to:

a. The development of knowledge and data on how best to conserve and utilize water falling on the land as rain and the most efficient means of supplementing needed soil moisture by limited amounts of irrigation water.

b. The development of knowledge and data that can be used for the economic on-farm design and construction of conveyance and delivery systems including structures for control and measurement of irrigation water.

c. The development of surface and sub-surface drainage systems to eliminate the hazards resulting from surface flooding and high water tables.

d. The identification of important factors affecting the degree of leveling of the various soils in the major climatic zones and the relationship of these factors to erosion, water infiltration, and good land use and cropping practices.

e. The development of methods of water application, including time and amounts, which are suitable and efficient for different soils of varying properties (water-holding capacities, intake rates, fertility, etc.,) with major crops.

f. The integration of these water-use factors into a productive cropping system consistent with farm size and available farming practices.

g. Where soil salinity and exchangeable sodium are problems, studies will include soil amendments, soil and water management procedures and use of salt-tolerant crops.

An important constraint imposed by A.I.D. is that the field work be done in Latin America and must complement and strengthen the high-priority objectives of the host country and USAID Missions. As a result of requests from developing countries and missions, the contractor identified, within the seven specific objectives listed above, nine high priority components of the On-Farm Water Management problem and initiated cooperative research in a number of Latin American countries. The nine research components are identified and the progress to date described in paragraphs (1) through (9), below.

(1) Irrigation Interaction with Crop Varieties, Plant Population and Fertilizers - Work has been centered in Brazil, Chile, Colombia, El Salvador and Venezuela. Three years' data in Chile show that the yield of corn can be increased from 3,800 to 7,600 Kg/ha with nitrogen fertilizer and improved water application techniques. These techniques are quickly being adopted by the communal and family farms growing 7,200 hectares of corn in the Aconcagua Valley. In Colombia, the yield of soybeans can be increased from about 680 to 1,080 Kg/ha with 11 cm. of water and to 1,780 Kg/ha with 22 cm. of water as indicated by the first year's data (1971). Data from the other countries are incomplete.

(2) Evapotranspiration and Water Requirements - Work on this component has used climatological data from Bolivia, Chile, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Venezuela and Panama. Because the nature of the work requires computer facilities, the analysis has been carried out at the Logan campus. However, a number of officials from the concerned countries mentioned have been involved in collecting and assembling the data in the field and have participated in the analysis at Logan. The analysis determines: (a) The amount of dependable precipitation, the tabulations showing the mathematical probability at various percentage of time levels of rainfall by regions per month; (b) the potential evapotranspiration demand or water requirement of plants by region, standardized to a short vigorously growing crop; and, (c) the actual crop-water-requirement by time of year and by region. Reports have now been published for Venezuela, Colombia, Guatemala and Panama.

(3) Drainage and Salinity - Research has been conducted mainly in Colombia and El Salvador with some work in Chile and Venezuela. A hydrologic model using computer techniques and a mole plow development program have been carried out at the Logan campus. A pilot drainage system, covering about six hectares and instrumented with observation wells and piezometers, has been installed in Colombia. Concrete tile drains, open drains, and imported perforated plastic drains are being tested. Salinity measurements and leaching studies are also underway. The data will be used for extension of drainage practices to the 16,000 hectares of Atlantico-3 in Colombia and similar areas elsewhere. Problems of controlling aquatic weeds in open drains and economic alternatives to open drains are being investigated in El Salvador. Perforated plastic pipe is being tested as a collector drain in combination with mole drains. The Colombia and El Salvador studies should produce vital data for designing and depth and spacing of drains. At Logan, the development of a plow for constructing low cost mole drains has been under development. Several models have been field tested and one of these is being used for field trials in both Colombia and El Salvador.

(4) Use of Available Moisture - Work was initiated in Chile and Venezuela but USAID and country priorities changed and this component is not now active.

(5) Assisting SUVALE of Brazil to set up Agricultural Research Stations - Irrigation research stations are not available in many Latin American countries and this was especially true in Brazil. Since they are a necessary component of research, the planning and development of such facilities was undertaken at three locations in the Sao Francisco Valley of Brazil. Two of these stations are now operative with irrigation systems, leveled land, seed storage facilities and plot layouts for field studies. Training sessions have been conducted for researchers as well as administrators of SUVALE.

(6) Water Rights and Water Law: Water Law Digest - Work on this component has centered in the Andean Pact countries with Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela providing the main source of the field data. Nearly 30,000 pages of water law data were collected from United States sources and taken to Quito, Ecuador for analysis and comparison with the field data. A detailed water law digest is being assembled and will be available sometime in 1973. In the meantime, the data have been used to facilitate the rewriting of the water laws of Ecuador.

(7) Land and Water Conservation Management Techniques - The aim of this component has been to develop methods for forecasting the results that may follow a particular water management decision or sequence of decisions. The complex combinations of management options including timing, amount and methods of application coupled with water supply, soils, water quality, and water table constraints present an almost infinite number of alternatives. One such complex problem was recognized in Colombia and the optimizing techniques of mathematical models were believed

to offer solutions. A simulation model was developed to utilize the unique capability of the hybrid computer (analog-digital) at the Logan campus and is being used for the Colombia problem. Two reports have been written and the work will have widespread application as a water management tool for comparing alternatives in reaching decisions. An application of the simulation model is also being applied to a problem in Chile. An additional technique using trickle irrigation is being researched in El Salvador where preliminary results indicate water savings of as much as 90 percent.

(8) Economics - The Economic Component of water management has been centered at the Logan campus with considerable field work and data collection being done in Bolivia, Ecuador and El Salvador. Economic benchmarks are being established in these countries and various levels of technological management are being subjected to economic comparisons.

(9) Training and Demonstration - Training of counterparts is a necessary component to any research program in the developing countries. In addition, the extension of research results to the farmers must ultimately take place if it is to make an impact. Such training has been underway in Brazil, Chile, Colombia, Ecuador and El Salvador. The real value of training was evident when the Utah team was required to leave Chile and three counterparts were given the responsibility of continuing the research. Should the political situation change, the USU team members will probably be invited to return to Chile periodically to assist in evaluation of results and formulating new plans.

The USU experience during the first four years of this contract indicates that each member of the USU field staff has had a major influence on the professional careers of about two to three country nationals per year, that an additional dozen or so men per year receive professional development through frequent meaningful face-to-face contacts, with perhaps an additional dozen being influenced by occasional contacts.

A significant start has been made on a number of facets of the complex water management problem and the momentum of an ongoing productive project should not be lost. The objectives are still expedient and it is expected that the priorities will not be altered substantially. Additional components may need to be added to complete an integrated approach to the problem. However, it is expected that the contractor will continue work on the components now accorded a high priority.

2. Significance to A.I.D. Objectives

Soil and water management continues to be one of the key problem areas selected by TA/AGR for continued attention. It is also a high priority area of work in the Regional Bureaus. The existing on-farm water management research under the Utah State University contract and its proposed extension is a very important part of A.I.D.'s effort to deal with this key problem area and its relativity to improved crop and livestock production. The project to date has identified a number of component

parts of the problem and has made substantial progress. Successful implementation of the findings to date will not only increase food production in Latin America but throughout the world by further developing the techniques and procedures which have application in other areas. These results have applicability to small as well as medium and large-sized farms.

The magnitude of the problem and the possible impact on world food production is indicated in the TA/AGR Strategy Paper of May 1972.

> "This research thrust will include problems of irrigation farming, of agriculture in humid regions utilizing natural rainfall, and of grassland agriculture where cropping is not feasible. Serious constraints on production have been identified in all three types of situations; but initial attention is concentrated on irrigation problems. In comparison with developed nations, irrigation farming in LDCs is only a fraction as productive as it should be. About 75 million hectares of the arable land in South America, Asia and Africa are now irrigated, but crop yields are low. Effective systems of soil and water management under the types of soils and climates found in the tropics are imperative to capitalize on breakthroughs such as the "miracle" rice package of improved varieties and practices, and the high-yield-potential Mexican wheats. These necessary basic researches have not been undertaken by international research centers.
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> "Farming in humid regions requires attention to water conservation, erosion control, and drainage -- which are factors that have received almost no research attention in the tropics. More than 600 million hectares of arable lands on three continents are producing the bulk of the foodstuffs in tropical regions. The urgent need for more production must involve improved land use. Permanently productive land management systems have not been developed in the tropics by the application of Western technology, and original research is required.
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> "The effective utilization of the 1-1/2 billion hectares of natural grasslands in the tropics and subtropics will depend on better utilization of limited rainfall and on improved land management. There has been virtually no research done in this field; but our U.S. experience and that of Australia suggests this is a fruitful research field for A.I.D."

A basic A.I.D. objective is to assist developing countries solve their food problem and achieve economic growth as rapidly and efficiently as possible, commensurate with national objectives. The extension of the USU contract is designed to maximize A.I.D.'s effective involvement in the developing countries' water management problems.

3. Relation to Existing Knowledge

The water management researchers at USU have access to one of the finest collections of scientific irrigation literature available anywhere. More than 75 years of research experience in irrigation and drainage have accumulated a significant storehouse of irrigation knowledge. Recently, the library holdings in this area have been increased substantially and completely updated under a 211(d) grant (AID/csd-2459), and the accessibility of all the information has been greatly increased by a computer indexing and retrieval system made possible by the grant. The researchers are aware of this existing knowledge and are at the forefront of the new technologies. The research, however, is not designed to produce new knowledge but rather to adapt what is known to the site-specific conditions of the developing countries and to develop methods to facilitate the technological infusion necessary to make sure the results are available, understood and utilized by these countries. Although designed as an adaptive research effort, the project is certain to produce information that will extend the knowledge frontier.

4. Relation to Other Research

The water management research contracts at Utah State University and Colorado State University have similar objectives. The major difference is the geographical location of the countries where the research is to be done. Because of the synergistic relationship between these two contracts, close cooperation has been established between USU and CSU and other CUSUSWASH 1/ universities. A good example is the research on water law and administration being carried out at both USU and CSU. Through cooperative study, three principal water law systems - North American (appropriations and riparian), the South American (Spanish), and the Near East (Moslem) are being analyzed and described. A more detailed description of the legal studies being conducted is given in Appendix A. In addition, the researchers at the two universities are coordinating their efforts and presently exchanging research results on the following:

a. Groundwater Recovery

Theory and models have been developed and tested for recovering best quality in both South America and Pakistan where percolated fresh water overlies highly saline water.

b. Evapotranspiration

USU has developed and refined equations to give better prediction of water use by plants in South America. CSU can test these equations to determine their precision and practical use in Asian countries.

1/ Council of U.S. Universities for Soil and Water Development in Arid and Sub-Humid Areas.

c. Crop Responses to Water and Fertilizer

Much research is being conducted by both universities,at different geographical locations, under different climatic and soils conditions, and utilizing different research designs. Consequently, it is presently difficult to compare results. However, standard designs are now being adopted in order that crop responses to water and fertilizer may be more readily compared, and minimized without losing statistical and economic significance, regardless of the location of the research.

The USU team is doing what is best characterized as refining the techniques for field experiments aimed at developing water-nutrient response surfaces. Initial research should have sufficiently precise data to give rather explicit pictures of response curves from which the CSU researchers can determine the best functional forms for an economic analysis of data for Pakistan and other Asian countries that will be involved in the extended phase of the project.

d. Evaluation of Irrigation Systems

A pattern of increasing collaboration between CSU and USU has emerged in the evaluation of irrigation systems abroad. This has been due, in part, to increased interest of CUSUSWASH in the subject of evaluation and in part to A.I.D.'s evaluation and project assessment efforts such as the evaluation of the NESA irrigation seminars. Considerable attention has been given at both institutions to the development of a simulation model to evaluate irrigation systems, including the design and development of new systems and the renovation of old systems, taking into account both physical and economic efficiency criteria.

The Utah staff has been using the soil fertility data collected under the North Carolina State contract, when establishing field trials in Latin America. Presently, Utah State is establishing cooperative research on water problems of tropical soils in Brazil with North Carolina State and Cornell Universities.

The work and reports of the International Research Centers (IRRI, CIMMYT, CIAT, IITA, CIP and ICRISAT [2/] as well as FAO, UNDP and the Foundations are monitored for information, support, and possible cooperation. Recommendations for the Venezuela and Chile experiments as well as some of the corn seed was obtained from CIMMYT.

The problems incidental to "settling in" -- formulating plans of work, assigning staff and other resources to programs -- were discussed at semi-annual meetings of the members of the CUSUSWASH consortium. These meetings have provided a forum for project directors, program leaders and involved professional staff and administrators. Member universities of the

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2/ IRRI - International Rice Research Institute; CIMMYT - International Corn and Wheat Center; CIAT - International Center for Tropical Agriculture; IITA - International Institute for Tropical Agriculture; CIP - International Potato Center; ICRISAT - International Crop Research Institute for the Semi-Arid Tropics.

consortium have established joint committees to facilitate research planning and exchange of information on such subjects as library improvement, publications, irrigation management; etc. These committees brought together scientists working on the SCU and USU research contracts and resulted in an exchange of information and joint publications.

The Irrigation Management Committee of CUSUSWASH produced a report on an integrated approach to agricultural research and development which takes into account the relevant components. If this concept is used as a general guide, each research program should become a component of a master development plan and will result in increased collaboration among member universities of the consortium.

5. Proposed Work Plan

a. Scope of Work

The range of the research activities falling within the objectives has been identified by Missions and host countries and agreed upon by the contractor and TA/AGR. The nine components of the program, as detailed in Section 1 above, remain the high priority items at this time. Though the dynamics of change may alter the emphasis and the priorities, it is expected that, with some minor changes, research on the present components of the program will continue.

The water management research institutions in each of the countries are collaborating with USU on various components of the program through working agreements as outlined in memoranda of understanding and through plans of work. In most cases, counterparts have been assigned and are actively engaged. Selected and responsible staff from host/cooperating countries have visited Logan to seek assistance in analyzing their data for special consultation or for study. Linkages with several universities have resulted in close collaboration by USU field staff in developing research programs and irrigation training programs. Several courses of study in host countries' institutions are based on courses taught at USU. The national institutions participate in the design of the field program, execute the programs with technical assistance from USU staff, and collaborate jointly in the analysis and evaluation of the results.

The Missions' primary role has been to identify areas of high priority interest and to assist in the writing of the memoranda of understanding. The Missions monitor the progress and advise the contractor on modifications required to reflect changing priorities.

b. Program of Work

The program of work to be carried out in the cooperating countries and on campus during the next five years is described in detail in Appendix B, under each of the nine components and the segments of the separate components on which work is under way or planned. The general time frame and level of effort are indicated in Section 10, Budget Analysis.

6. Research Methodology

In a broad sense water management problems throughout the world are quite similar. They differ primarily in degree and in their interrelationships with climate, soil characteristics, topography, type of crop, and sociological and economic factors. The research methodologies required for problem solving are also similar, varying in relation to the importance of the various factors mentioned above. Present levels of sophistication should be adequate for most, if not all, of the research contemplated in this project. In general, the contractors will utilize available knowledge and adapt it to meet the needs of the local situation. Careful consideration will be given to such contributing factors as size of farm, availability and type of labor and equipment, type of crop, inputs, supporting organizations and sociological environment and background.

The research under this project will be oriented toward field application using standard field plot techniques. Laboratory and greenhouse studies will be used to supplement and support the field research. Because some of the developing countries are located in tropical areas and have peculiar soils and rainfall distributions, special management procedures need to be designed to meet these conditions.

The specific research design will vary for each component and specific site. The design for a field trial on water-crop-fertilizer interactions will include treatment numbers and replications sufficient to measure statistically the significant differences in crop production that are induced by the treatments. In the water law study the concern is primarily with laws and customs pertaining to the role of water law in agricultural production and with identification of constraints that impede effective water management.

During the proposed 5-year extension of the USU contract, the procedure for the development of research plans and the conduct of the program will be as follows:

a. Determine the high priority issues with the host country and USAID Missions.

b. Discuss these priorities with the appropriate host country research agency.

c. Develop a memorandum of understanding with cooperating agencies.

d. Assign appropriate researchers.

e. Establish counterpart working relationships.

f. Prepare a detailed research design and plan of work for each year.

g. Lay out day-to-day field activities.

h. Execute program.

i. Evaluate program.

j. Feedback results of evaluation for modification of research components.

7. Researcher Competence

The high level of training, experience and overall competence of the USU participating scientists is well known to A.I.D. and has been documented in previous project reports to the Agency. Both the on-campus and field staffs possess high levels of competence in their areas of specialization. This has been demonstrated by successful planning and implementation of research projects in Latin America; by success in training counterparts in all phases of water management; by contributions to institution building; by research publications; and by advising and disseminating valid research information. A.I.D. has had a part in the building of this capability through the 211(d) grant awarded to Utah State to increase its competence in on-farm water management.

USU has also developed a foreign language competence for all staff assigned to the field in Latin America. Capability in Spanish or Portuguese has been one of the requirements recognized by the Department of Agricultural and Irrigation Engineering as essential to the efficient conduct of the field work. The present field staff and about twenty of the supporting on-campus professionals now have excellent language proficiency as a result of emphasis on the requirement, reinforced by an excellent training program.

The Utah Water Research Laboratory on the USU campus is new, modern and fully equipped to do all kinds of water-related research work. The computer facilities (digital, analog and hybrid) have been used for analysis of the ongoing project data. The hydraulic facilities, bacteriological and water quality laboratories are also available when needed. A 110-acre irrigation and drainage research farm is administered by the Department of Agricultural and Irrigation Engineering and has been used as a site for testing of the mole plow. This farm is equipped with irrigation wells, pipelines, pumps, drainage outlets and other facilities.

Background and support activities at USU available to this project also include recognized research and extension programs in engineering, economics, natural resources and agriculture. The excellent labrary facilities have already been mentioned.

8. Contribution to Institution Building

There has been a close collaboration between USU and host country institutions resulting in formal working agreements as shown below.

Country	Institution	Primary Role of Institution
Brazil	Sao Francisco Development Agency	Semi-autonomous agency developing resources of Sao Francisco watershed area.
Chile	Ministry of Agriculture, Dept. of Research	Studying many aspects of agricultural research.
	Ministry of Agriculture, Extension Dept. (SAG)	Develops technology transfer methods to farmers.
Colombia	Colombian Agrarian Institute	Operates agricultural research stations throughout country.
	Colombian Institute of Agrarian Reform	Administers Agrarian Reform Act and supervises irrigation projects.
Ecuador	Ministry of Hydraulic Works	Operates irrigation projects.
El Salvador	Ministry of Agriculture, Division of Research	Operates Experiment Stations.
	Ministry of Agriculture, Division of Irrigation	Operates irrigation projects.

Institution building was achieved in other ways as well. In Chile, the USU team collaborated with the Catholic University in curriculum development and with the Agricultural Research Services, Pa Platina station. A researcher at the station who was also a professor at the Catholic University, Mr. Juan Tosso, recently completed a Master's degree at USU and was available to take over and supervise the Chilean research when the USU team left.

Other Latin American officials who have received training at USU include: Engineer Jose Yepez, Chief of Ecuador's Meteorological Service in the Ministry of Hydraulic Works, who spent three months at Logan analyzing data from his country; and Engineer Fabio Carias from the Honduras Ministry of Agriculture, who analyzed the data from his country at USU. In addition, eleven Brazilians spent three months in training at USU during the summer of 1972. Through this process, the ongoing research contract has made a significant contribution to the strengthening of Latin American institutions.

The bibliography of water management literature compiled under the 211(d) grant has been publicized and is available to any requesting agencies. Approximately $80,000 worth of laboratory equipment has been located in host country research stations and three vehicles used by USU teams will be left in the field.

9. Utilization Plans

Although the contractor's first responsibility is for research results, USU realizes that the research must be problem oriented and that the results must be applicable to the local problems. Furthermore, the research must be designed to produce results which can and will be utilized. The researcher may need to present the results in a practical package and work with extension personnel to introduce new practices into the field.

In Chile, for example, this utilization was accomplished by recruiting Hilda Gonzales, Extension Corn Specialist, as a research associate. Mrs. Gonzales and her aides in the Extension Service (SAG) were influential in locating the eight field research farms at strategic, easily accessible places in the valley where the farmers and others could observe the results. Mrs. Gonzales was involved with the research and also planned the field days for the farmers as part of her extension responsibility. Utilization by nearby farmers was almost immediate and extension to the more distant areas followed rapidly.

Similar modi operandi are part of the contractor's plans for the continuing project.

10. Budget Analysis

A detailed budget for each component of the work was presented in the Contractor's proposal for the five-year extension. The budget requirement

by years for each of the nine research components and for project administration and technical backstopping is shown in the following table:

Proposed Budget

Water Management Research

Utah State University

Research Component	1973	1974	1975	1976	1977
1. Interaction	85,000	95,000	100,000	95,000	75,000
2. Evap.	60,000	60,000	55,000	45,000	30,000
3. Drainage	45,000	50,000	60,000	55,000	50,000
4. Avail. Water	15,000	25,000	25,000	25,000	20,000
5. Brazil	55,000	65,000	80,000	70,000	55,000
6. Water Rights	25,000	45,000	40,000	35,000	25,000
7. Simulation	30,000	65,000	80,000	55,000	40,000
8. Economics	100,000	100,000	100,000	95,000	85,000
9. Demonstration Training	55,000	60,000	70,000	60,000	50,000
10. Administration and Technical Backstopping	80,000	85,000	90,000	90,000	70,000
Totals	550,000	650,000	700,000	625,000	500,000
Grand Total					$3,025,000

Each component shown in the above table may have one or more segments of the research being carried out in one or more countries. The contractor has made an analysis of the ongoing research by component and country. The phasing, level of effort (man-months) and the budget for each component are shown in the charts presented as Figure 1.

11. Internal and External Reviews

Progress under the current project has been reviewed several times by TA/AGR and by RAC subcommittees. During the period January 24 to January 28, 1972, a special committee conducted a critical review of this project and the companion CSU activity. The team visited the campus of each of the contractors and met with regional bureau and TAB representatives in Washington. This team was composed of Dr. Marvin E. Jensen, Director, Snake River Conservation Research Center, ARS, USDA, Kimberly, Idaho, who served as Chairman; Dr. Earl O. Heady, Director of the Center for Agricultural and Economic Development, Iowa State University, Ames, Iowa; and Mr. Leland Anderson, Deputy Assistant Director, Agricultural Policy, USAID/Pakistan. This report dated February 10 (attached) included a recommendation that USU select countries, agro-climatic locations and water problems in a more systematic framework in terms of research approach and results which (a) have greater generalization, (b) cover a larger realm of agro-climatic conditions, and (c) offer the largest economic pay-off. The proposed extension of the contract includes an optimization procedure for responding to this recommendation (See Appendix C).

The proposal for a five-year extension of this contract with limited expansion to locations in Latin America has been favorably reviewed within TA/AGR. The draft proposal was circulated to agricultural specialists in the regional bureaus for review and comment. Resulting comments were constructive and generally favorable. Most of the suggestions have been incorporated into the proposal now submitted for RIGC review.

This Project Statement will also be circulated to the Inter-Bureau Agricultural Technical Committee for comment prior to the RIGC meeting and the results will be communicated to RIGC members at that meeting.

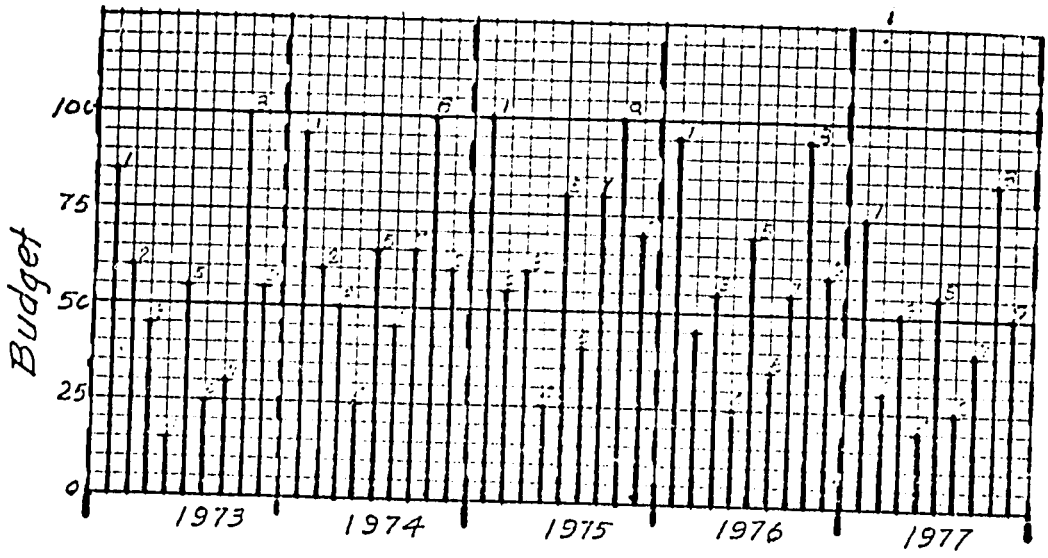
12. Proposing Office General Evaluation

The proposing office and the Latin American Regional Bureau enthusiastically recommend a five-year extension of this project. Utah State University has been effective in its relationships with USAIDs and with cooperating institutions and scientists. USU has been successful in placing qualified men in the field in a minimum period of time. Part of the effectiveness of the men under this contract has been their foreign language ability.

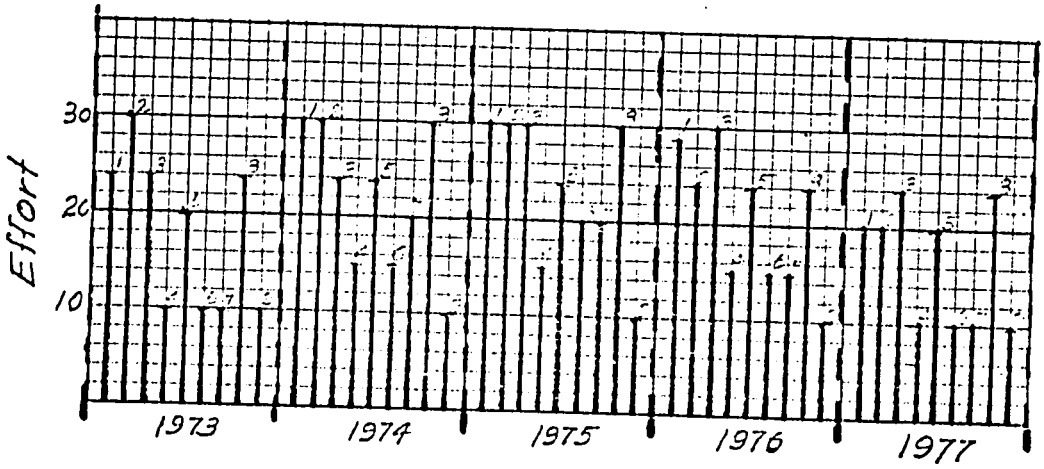
The major activity under the contract has been field research. These results as well as the limited on-campus research have been immediately

Figure 1

Component Budget
In Thousand Dollars.



Component Effort
In Man Months



Note: Each bar of the graph represents a component of the project, numbered 1 to 9 for each year. The 9 components are noted on the preceding table and explained in detail in Appendix B.

applicable in local programs. Some results and procedures such as the water use and requirement studies and water law are finding application not only in Latin America but in other A.I.D. and international programs.

The University has shown extraordinaly ability to coordinate and utilize its 211(d) grant in conjunction and in support of this research contract.

The University administration has given strong support to this research project and the 211(d) grant.

TA/AGR strongly recommends extension of this contract.

Omer J. Kelley, Director
Office of Agriculture

Alvin D. Ayers, Project Specialist

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOIL AND WATER CONSERVATION RESEARCH DIVISION
SNAKE RIVER CONSERVATION RESEARCH CENTER
ROUTE 1, BOX 186
KIMBERLY, IDAHO 83341

February 10, 1972

AIRMAIL

Dr. Omer J. Kelley, Director
Office of Agriculture
Bureau of Technical Assistance
A.I.D., Department of State
Washington, D. C. 20523

Re: Intensive Review of Water Management Research Contracts AID/csd-2162 and AID/csd-2167 with Colorado State University and Utah State University, respectively, January 24-28, 1972

Review Committee: Dr. Marvin E. Jensen, Chairman
Director, Snake River Conservation Research Center, Kimberly, Idaho

Dr. Earl O. Heady
Director of Center for Agriculture and Economic Development, Iowa State University, Ames, Iowa

Mr. Leland Anderson, Deputy Assistant Director/ Agricultural Policy, USAID/Pakistan

Dear Dr. Kelley:

As requested in your letter of January 17, 1972, our team conducted a thorough, on-site review of the water management research contracts at Utah State University (USU) on January 24 and at Colorado State University (CSU) on January 25. At USU we spent most of the time with Dr. H. B. Peterson, Project Director and Dr. B. C. Palmer, Project Field Director because most of the assigned staff members are located in the Field. Project leaders involved in the discussions were Drs. J. E. Christiansen, J. P. Riley, K. Unhanand, D. W. James, and A. LeBarron. At CSU we were able to discuss project activities with Dr. M. Albertson, Project Director, and each project leader from the six departments, (Drs. A. T. Corey, W. R. Schmehl, E. V. Richardson, K. C. Nobe, G. N. Jones, and D. M. Freeman), and other assigned staff members.

Dr. G. Corey, Party Chief, was not available. Additional discussions were conducted in Washington, D. C. on January 27 during a special review meeting held in Rm. 2884 of the New State Building (See attached agenda).

These two projects represent a major effort on the part of two universities, and according to Dr. Long, represent a significant portion of AID's central research program. Our team is well aware of the magnitude of these projects and their costs, but we also are aware of the tremendous impact improved on-farm water management can have on food production in less developed countries. Improved on-farm water management is essential over much of the world to realize the full potential increases from new varieties and fertilizers. Improved water management will also minimize the frequency and intensity of soil water deficits with its resulting detrimental effects on plant growth. The development and implementation of improved water management practices, however, will not be as rapid as changes in varieties or the addition of fertilizers. Research and application of improved on-farm water management is complex because it involves the management of crops, soils, fertilizers, rainfall, irrigation water, excess or drainage water and soil salinity in an integrated manner. Improved on-farm water management also usually requires capital outlays and improved practices must take place within the socio-economic constraints of the region.

Our team reviewed the projects relative to the broad, general objectives stated in the contracts, but placed more weight on those activities that were directly associated with on-farm practices. Most of the recommendations that follow are of a positive nature since we feel that both projects should be continued through their original durations, and should be extended for another three- to five-year year period to capitalize on the developing technology and scientific expertise at thse universities. We have, however, delineated several weak areas and have suggested modified approaches for project components.

Reasonable progress has been made in both contracts with some project objectives essentially attained. At USU, for example, several multivariable comprehensive field experiments are nearing the second crop year in South America; evapotranspiration deficit maps have been completed and printed for Ecuador; a water balance-salinity model is being evaluated in Colombia, and Chile has sent two engineers to USU to study methodology for using the model; and a water law digest of Latin America is nearing completion.

CSU has expanded the theory for operating "skimming wells" to remove fresh water from the aquifer without or with a minimum of saline water entering the wells; the development of a comprehensive bibliography on Pakistan Government and Administration and water related publications is nearing completion; a thorough analysis of soil samples from 11 representative soil profiles from Pakistan is near completion at CSU for sand, silt, and clay mineralogy, the dissolution potential of calcium-bearing minerals, and other chemical analyses related to exchangeable sodium and salinity; a multivariable experiment has been initiated in Pakistan to evaluate the effects of mixing saline well water with good quality canal water; and a movie has been prepared on land forming principles and techniques.

RECOMMENDATIONS: (Additional detail is given in the next section of this memorandum)

A. Funding:

1. CSU-AID/csd 2162 - We recommend maintaining the current level of funding, but encourage streamlining project management to reduce administrative costs. We also recommend limiting funding of projects to those needed to obtain immediate goals, increasing the field program relative to on-campus activities, and bringing more experience in on-farm water management research into project direction and management.

2. USU-AID/csd 2167 - We recommend increasing the level of funding for Utah State University to cover increased costs encountered due to increased salaries, overhead, allowances and travel requirements during the fiscal year to cover home leave or return of field scientists and their families. Project costs have been proportional to field activities in the development of the projects and opportunities are currently available for expansion of the program if funds are available.

B. Contract Direction and Management:

1. CSU - We recommend increasing the on-campus competence in on-farm water management in order to guide the funding of those projects that are more relevant to the immediate goals and to select those projects having a higher payoff potential.

2. We recommend a more active coordination of research planning, data analysis, and joint development and use of models for on-farm water management between the two universities.

3. We recommend CSU reconsider those project proposals for Pakistan which are not being activated by field counterparts. Vocal support without follow-up action implies Pakistan doubts about the merits or relevance of the projects.

4. We recommend that CSU reassess its priority rating of problems and the approval of project components. Some project components such as those conducted by the Civil Engineering Department appear to be premature relative to immediate goals.

5. We recommend that a clear policy be established on delineating priority problems. Once major research objectives are established, sufficient time must be allowed to develop, initiate and complete the research. These priorities can not be changed annually, or as AID Mission personnel changes if a viable research program is to be implemented in the field.

6. We recommend that CSU social science research focus on problems more specific to on-farm water delivery and use for agriculture.

7. We recommend that CSU scientists from the various disciplines should work jointly from the onset in selecting, formulating, designing and conducting the experiments.

8. We recommend that the economic research under both contracts oriented to water use and productivity be much more closely related to the specific problems for which the project was funded, and be a more highly integrated approach to major and common problems.

9. We recommend that future modeling work at CSU be an adaptation and quantitative application of models which generate solutions for the particular agro-climatic, water supply, and economic conditions of Pakistan.

10. We recommend that CSU adopt a funding policy that will encourage greater participation of scientists in off-campus research efforts with some regular support and guidance provided by senior scientists.

11. We recommend that USU select countries for field research projects in a more systematic frame-work so that the results will have greater generalization, cover a greater range of agro-climatic conditions, and have the largest economic payoff.

C. Specific Project Suggestions:

1. We recommend that CSU consider the existing Pakistan water delivery system as fixed in an alternative approach to developing improved on-farm water management practices. This approach would, in essence, consider the present operation of the canal network as an efficient system for delivery and recharge of an efficient ground water reservoir from which the bulk of the crop water requirements can be drawn by tube wells as needed and with great flexibility.

2. We recommend that both CSU and USU first compute the basic crop water requirements for all crops involved by growth stage and then use field experiments to validate the generalized computational procedures.

3. We recommend that CSU develop procedures to enable local research institutions to obtain field capacity data in situ instead of the 1/3-bar determinations which generally are not representative under all soil profile conditions.

4. We recommend that existing physical-biological-chemical plant growth models be adapted for predicting crop growth and that complex field experiments involving soil-water, fertilizer, and plant density be used to validate the predictions or calibrate the models for local use.

5. We strongly recommend that some projects with short term goals, but with high pay off potentials be initiated to develop confidence and rapport with the university scientists and to develop local support for the broader, more basic generalized, apsects of the research program.

6. We recommend that an entire water course in Pakistan be completely modified to demonstrate the best available technology and validate basic assumptions involved in the development of improved on-farm water management technology under the existing social and legal constraints, and technical capabilities.

III. ANALYSIS AND JUSTIFICATION FOR ACTIONS

B-2 University Coordination - While CUSUSWASH exists as a communication medium between the two universities, sufficient coordination of work is not yet evident. We recommend a more active coordination of research in terms of problem definition, applied models, research designs, problem coverage and general intellectual activities. This need extends beyond merely keeping each other informed and could even result in the joint preparation of models and methods of research and in generalizing findings for use in other countries for improved on-farm management of water.

B-3 Project Revisions - CSU should revise or prepare new field proposals for Pakistan. These projects should be less complicated and should be directly oriented toward short-term goals of improved on-farm water management. As these projects are completed, and as their benefits are demonstrated within test water courses, approval of future projects by Pakistan research and action agencies will move more rapidly. Action support should increase and vocal support without action should diminish.

B-4 Project Control - Since many projects and project components involve adaptive research, and many projects must be completed in sequence to continue progress toward immediate goals, a system for project control with approximate time tables should be considered at CSU to guide funding project components. Such a system also will simplify communication with AID relative to progress toward contract objectives.

B-6 Social Science and On-Farm Water Management Research - A large amount of work and output already has been attained at CSU in the general social sciences, particularly political science and legal aspects. Thus far, work in these fields has been descriptive of: (a) institutional, social, legal, natural, administrative and other variables and phenomena which condition agricultural

development; and (b) the laws upon which water use and distribution is based in Pakistan. In general, much of the work in political science is broader than the problems of on-farm water use and management and has reference to conditions which may retard or promote agricultural progress generally in less developed countries. We recognize that much of this work has been conducted under funding other than this specific contract. However, for future work in the social sciences, we recommend that the focus be on research and problems more specific to on-farm delivery and use of water for approved agriculture within the context of the project. Future emphasis should be more precisely on analytical methods, quantitative models and operational procedures which serve as direct guides in the improvement of administrative and legal structures which promote greater efficiency in on-farm water use. In this context, work in the social science fields may need greater direct integration (e.g., to not stop with a bibliography of Pakistani water law, but to specify legal structures consistent with quantitative findings of economists of the value or marginal productivity of water used for different locations, crops, seasons, water sources, etc.).

B-7 Interdiscipline Projects - Both universities have drawn a relevant set of disciplines into their projects. An important opportunity for productive interdisciplinary research thus prevails for the future. However, we believe that there is not yet (a) evidence of sufficient interdisciplinary interaction in the design of specific research projects, or (b) prospects for coordinated solutions of prevailing problems. While the various disciplines are present, active communication of personnel from different fields prevails and a common language is evident, especially at Colorado State University, it does not appear that sufficient effort has been devoted to joint: (a) selection of the facets of particular problems to be tackled; and (b) design of approaches for researching them. This appears to be especially true between: (1) economics and the social sciences; and (2) engineering and the physical sciences. Economics and sociology appear more as "elements which have been appended", rather than sciences which have had an integral part in the selection, design and pursuit of research directed to particular problems. Rather than an associated but somewhat independent set of individual projects selected by scientists from separate disciplines, we recommend a much more highly integrated approach to major and common problems. In other words, scientists drawn from relevant disciplines should work jointly from the onset in defining the dimensions of the problem, in designing methods to quantify or solve it and in concurrent implementation of the research. We

recognize that frequently only two or three disciplines can readily engage effectively in an interdisciplinary problem and that problems of high priority specific to a given discipline often prevail. However, presence of a group of persons from several disciplines working on independent problems which fall under a common umbrella does not necessarily provide an integrated interdisciplinary research program. In a similar context, research or experimental designs could better reflect the parameters necessary for both physical and economic on-farm improvements in use of water and other interacting resources.

B-8 Economics Research - Research and knowledge in agricultural economics still is lacking in both Latin America and Southeast Asia. However, research devoted to general problems of the agricultural sector (e.g., demand structure, aggregate supply response, general policies) could better qualify under projects other than those specifically oriented to on-farm utilization and management of water. We recognize, of course, that certain problems of more efficient use of water and related resources to promote economically efficient production increases frequently are external to the farm. We also recognize that there were initial phasing or sequencing problems (especially for Utah State University) in locating and initiating physical research to which economic research could then be related. For the future, however, we recommend that the economic research under both of these contracts oriented to water use and productivity be geared much more closely to the problem set for which the projects are funded. The problems selected for economic analysis should more nearly be central problems of water management and use. While demand, supply and policy analysis in general are relevant research topics in the countries involved, the justification for their pursuit should be under other projects funded by AID. Policy problems to be incorporated in water use and management projects would more nearly, for example, appear to be those of water pricing (or non-pricing), credit programs to allow sufficient investment in fertilizer, seeds and equipment for efficient use of water, effect of alternatives in water investment and use on employment and income distribution, districting and distribution to overcome farm externalities affecting water returns, tenure modifications to improve water use, etc. More specifically, central on-farm projects would seem to relate particularly to: (a) integrated research with agronomists to quantify interactions among water, fertilizer, salinity, soil and climate with economic mixes prescribed accordingly; (b) application of conventional programming models to determine

efficient management programs for: (1) farmers with unlimited water supplies; (2) farmers with limited water supplies; (3) farm groups with externalities in water use; (c) multiperiod models to analyze multiple cropping and interperiod uses of water for maximum returns; (d) definition of optimal investments in water distribution and application equipment in interaction with cropping systems; (e) deriving normative values and demands for water as a basic for scheduling prices, equity payments and compensation, restructuring water laws, etc.; (f) developing efficient village systems of water delivery where inter-farm externalities in water use prevail; (g) applying stochastic models for efficient conjunctive use of climatic, underground and canal water supplies, and etc. In general, the emphasis should be on the adaptation and application of on-farm models to solve the specific economic problems of efficient water use by the various strata of farms in the major water supply regimes and regions.

B-9 Application and Validation of Models - A considerable proportion of the research on the Colorado State University campus has been devoted to general modeling. These efforts have resulted in an output of rather broad theoretical nature and applicability. For future progress in on-farm water management, emphasis should be on the adaption and quantitative application of models which generate solutions for the particular agro-climatic, water supply, economic and institutional conditions of Pakistan. These models can illustrate the general applicability of modern models and computer solutions or simulations devoted to the parameters of water management under particular conditions. In the course of changing the focus to greater emphasis in the application and adaption of models to the specific problems of Pakistan, greater attention also needs to be given actual interdisciplinary coordination and integration of the work. In the case of Utah State University, it is possible that some additional effort should go into on-campus development of applied models to be later applied and validated in the field.

B-11 Systematic Selection of Projects - Utah State University has effectively responded to country and mission demands. This response has allowed the university to initiate a country program directed to specific water management problems in Latin America and to have early "visibility in the field"; to augment the knowledge of its specialists of Latin American on-farm water management problems and their solutions; and to build up the body of knowledge that these specialists have extended to other countries.

However, for the remainder of the current project and for extensions of it over the years, we recommend that the university attempt to select countries, agro-climatic locations and water problems on a more systematic frame-work in terms of research approach and results which: (a) have greater generalization; (b) cover a larger realm of agro-climatic conditions; and (c) pose the largest economic pay off in terms of commodities, resources and countries included. We recognize that this shift in emphasis requires greater set-up time and program costs, than does responses to situations which provide opportunities of immediate implementation. However, given the degree of success in short-run program implementation, we believe that greater focus now be given to longrun returns in terms of breadth of country resources included and regional application. Future budget allocations and gauges of project progress should recognize the greater complexity and costs inherent in a research program which searches out problems and locations for more systematic and broader applicability, than one which is characterized by response to situations where conditions allow immediate implementation.

C-1 Capitalizing on the Merits of Existing Water Distribution Network - The research results from most CSU research proposals imply severely limited adoption or utility until massive water distribution system and delivery practices are changed. Short term projects should consider the existing water distribution systems as a stable, effective means of recharging the ground water reservoir with some water delivered directly to the land. Tube wells should be considered as the primary source of irrigation water to meet variable crop water requirements with on-farm land leveling and water distribution systems developed to optimize crop production within a water course. Long term studies should consider conjunctive use of canal and ground water to minimize salinization problems, and legal studies should consider the required legal framework.

C-2 Delineating Crop Water Requirements by Growth Stage - Basic crop water requirement data for each major crop by stage of growth are necessary to optimize water course water distribution systems in Pakistan. These data can easily be obtained with sufficient accuracy for short term goals by adaptive research. Procedures developed at USU may suffice for the potential evapotranspiration component. As field experiments are conducted these calculations can be verified by soil sampling or neutron

scattering techniques. Projects underway or being initiated by the Agronomy and the Agricultural Engineering Departments will provide validation data if the required measurements are made.

C-3 Soil Parameters for Irrigation Design - The initial soil analyses conducted on-campus at CSU provide valuable basic data on mineralogical and plant nutrition characteristics of soils. However, procedures should be developed to enable securing field capacity data in the field instead of the 1/3-bar laboratory measurements since field capacity is strongly influenced by soil profile characteristics which cannot be preserved in small disturbed or undisturbed samples. Effective field capacity is also a function of evapotranspiration.

C-4 Crop Growth Models - Complex, multivariable field experiments involving irrigation, fertilizer, plant density variables provide a wealth of data, but are expensive to conduct and are very time consuming. The research results could be generalized to a greater degree if existing plant growth models were adapted to this problem or new models were developed utilizing basic plant growth model components. There are several such models under development or testing by other research institutions.

Sincerely yours,

Marvin E. Jensen, Chairman
Review Committee

WATER LAW ADMINISTRATION -- COMPLEMENTARY ACTIVITIES OF CSU AND USU

by

George E. Radosevich and David R. Daines
August 1, 1972

As subprojects within the research program of Colorado State University and Utah State University Water Management Research Project (USAID), two legal studies are being conducted which are designed to identify, compile and analyze the water laws and administrative institutions and procedures for the allocation, distribution and control of water resources in Pakistan and the Andean Pact Countries. Related and unique water law systems of other countries are being identified and examined for their past and future impact upon the water use systems mentioned above.

It has long been recognized that an integral part of effective water management is the identification of the legal system under which water, in conjunction with land, is controlled. The laws and organizations provide the mechanisms of control and frequently, although perhaps inadvertently, create constraints to improving water use practices. The research teams and disciplines of each university, operating within their respective areas of research and geographic commitment, will be provided with an expanded awareness of the role of water law in developing countries and the importance of taking into consideration the requirements and constraints exhibited thereunder.

Although operating independently, two legal researchers are pursuing a common goal of developing an expert awareness and gathering of information on the water laws, institutions and enforcement methods of the two major legal systems in operation under their jurisdiction of research.

George E. Radosevich, Attorney and Assistant Professor of Environmental Law and Economics, is conducting the legal research program at CSU. The primary purpose of his research is to identify, analyze, and describe the legal and institutional aspects of water distribution and control in Pakistan, in order to ascertain the role of water law on farm production and to identify inherent constraints that impede effective water management or may prevent the implementation of a proposed physical or economic program. In conjunction with the development of any program by the university or the country mission, it is anticipated the results of this research will provide the designers with the framework within which their program must operate.

To achieve this objective the effort is divided into three phases. In the Identification Phase, all source material pertaining to Pakistan water laws and institutions will be set forth in a bibliography. The Descriptive Phase will culminate in a report narrating the Pakistani water laws as they exist from legislated, customary and Islamic law. The final phase is designed to meet the requests of the USAID Mission in Pakistan as a prerequisite to the implementation of an improved water management program designed by the Mission and Project personnel. This phase entitled "The Developmental Phase" will yield a report containing the array of farmer water user organizational arrangements and a portfolio of the laws under which such organizational arrangements can be created.

In addition to meeting with a multitude of Pakistani and USAID personnel in Pakistan during his two visits to that country, Mr. Radosevich has also consulted with a number of water law experts in various countries to discuss certain facets of the Moslem water law system and to gain an insight and information on the unique characteristics of the water laws in those countries.

At Utah State University, Dr. David R. Daines is engaged in a similar study of the water laws of certain South American countries. His primary objectives have been the preparation of a water law summary and comparative digest of the Andean Pact Countries and to serve in an advisory capacity to the Ecuadorian government. Dr. Daines has been stationed in South America and has worked very closely with water law experts and engineers of Peru, Bolivia, and Ecuador in the preparation of revised water codes for those countries. It is anticipated that the summary and comparison for the Andean Pact Countries will provide the country planners, administrators, lawyers and those working toward improving the distribution of water resources with the multitude of legal principles familiar and subscribed to by those countries so that those suited to their own political, economic and social systems could be selected. Again, as in the case of Pakistan, it is the spectrum of alternatives that is important in assisting the developing countries.

The research activities and results carried on by Radosevich and Daines will greatly complement each other. As both studies progress, similarities and differences between the water law systems of two major areas of the world will be identified. Through this method of comparative study (appropriations and riparian), three principal water law systems - the North American, the South American (Spanish) and the Moslem - will be analyzed and described.

To facilitate a thorough understanding of the interface between Moslem and Spanish water law systems, the two water law specialists scheduled a joint research trip to Valencia, Spain in September, 1972 to consult with Dr. Vincente Ginera, Spanish water law specialist, to discuss the water laws and organizations in Spain and observe their operation through field trips in the vicinity. It is in this area, during the history of medieval Valencia, that the convergence of these two water law systems took place with the invasion of the Moors in Spain.

As a result of this cross integration and adoption of customs and practices it is concluded that an understanding of the present system in Valencia will greatly benefit the attainment of both researchers' objectives in two direct ways. The first is by providing a deeper insight into the evolution of the present systems in the subcontinent and South America. The second is by providing additional alternatives both in substantive law and organizational arrangements, for use and modification in the countries presently being assisted.

The studies are directly complementing each other by providing a broader background and increased number of alternative choices in laws and institutions. The interaction and joint research by the two water law specialists will provide information to advise other developing countries on substantive, procedural and organizational alternatives in water laws and organizations that can be tailored to meet their needs under their conditions. It is again emphasized, however, that the primary commitment of both specialists is to serve the needs of the specific countries in which water management research programs are currently being carried out.

One aspect of the legal effort, of particular importance in assisting developing nations with water legislation, is identification and description of the enforcement method alternative to insure the object implementation of water policy and law. Typically a very sound, proper and applicable system of water laws is designed which fails to provide the proper assurances that the administrative or judicial bodies can carry out the intent of the law.

The scope of water law research being conducted by the two universities will produce a description of water laws that operate in the four climatic zones of irrigation (the humid, sub-humid, arid and semi-arid) with emphasis upon the uniqueness of designing or developing laws conditioned to the circumstances under which they must operate. A portfolio of global legislation and organizational arrangements will be developed to serve as a basis for designing a legal system in requesting countries. The analysis and portfolio will demonstrate the interaction of water law with water resources management, irrigation development and the customary and social conditions of regions and delineate the similarities and dissimilarities between water law systems in the world. Through the identity of the Spanish, Moslem, Chinese, Soviet, European, American (Roman), etc., water laws the major international systems will be made available to draw upon.

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PROGRAM OF WORK*

WATER MANAGEMENT RESEARCH
UTAH STATE UNIVERSITY

April 1, 1973 to March 31, 1978

** Component P01: Irrigation Interaction with Crop Varieties, Plant Population and Fertilizers

The objectives for the next five years are as follows:

1. Generate production functions for one or more crops and for two or more crop growth factors.

   a. Ascertain actual yield potentials under intensive irrigation management for given soil and climatic regime.

   b. Provide for economic analysis of crop production in developing countries using modern systems of crop production management.

   c. Determine whether there are certain soil, chemical and physical properties that limit yield and evaluate ways and means to ameliorate or eliminate them on irrigated land, cooperating with the soils consortium.

2. For predicting conditions of crop growth and for guiding irrigation and fertilization:

   a. Calibrate indices of evaporative demand with consumptive use; soil moisture tension with plant availability.

   b. Calibrate indices of plant nutrient availability with fertilizer requirements.

3. Train professional agriculturists in host country on the design, execution and analysis of field experiments and demonstrations.

   a. Instill the concept of interaction among plant growth factors and optimization of plant growth factors for maximum plant growth.

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* As presented in Utah State University draft proposal for extension of contract AID/csd-2167 (September 1, 1972).

** P0: Plan of Operation (Utah State designation).

4. Publish results of five-year program in form and language appropriate for host country use.

a. Research bulletins

b. Extension circulars, leaflets, etc.

Chile Segment /

Description: The national agencies are continuing the interaction experiments in the Aconcagua Valley. They are planning a greater emphasis on the transfer of the technology to farmers in the region and in other areas. The experiments will be continued with the hope of achieving several interaction combinations.

Activities: USU will send short-term people to assist in the design of experiments, analyze the results and advise on the technology transfer component. They will observe the effectiveness of the transfer in terms of production increases and evaluate its success. If the political situation changes to the point of permitting the re-entry of full-time researchers, this will be very seriously considered because so many factors make research in Chile so attractive.

Colombia Segment /

Description: Colombia has agricultural research stations throughout the country, a rapidly developing demand for improved agricultural technology, an agrarian reform program which makes possible the implementation over large blocks of land, of decisions made by a fairly powerful individual known as a project director, and other plus factors. They have several important deficiencies including at present the lack of leadership ability to carry out statistically significant water-interaction experiments.

Activities: It is proposed to continue the interaction experiments as long as they are a priority item. The USAID mission's agricultural officer has indicated that the Cauca valley has greater need for the drainage component. If it moves there USU would prefer to move the interaction activities also in order to avoid physically separating the two-man team, since they do support each other. However, such a move is not proposed until the immediate objectives of work in the Atlantico-3 region are realized.

ICA is anxious to develop production functions for a fairly large number of crops. It is planned to assist them in selecting those crops which offer the best potential for economic return.

As their capability to meet the challenges of field plot interaction develops, USU will divert some resources to the determination of crop coefficients.

More effort will be made on the development of the technology transfer process - working with extension agents, project personnel and influential farmers.

El Salvador and Central America Segments

Description: Under a new Ministry of Agriculture reorganization it is likely that research will be strengthened. There is an urgent need to research and demonstrate to the farmers in the Zapotitan valley improved on-farm irrigation and fertilization practices. Probably no other place in El Salvador can profit as much by careful control of water and fertilizer application, because of the properties of the volcanic ash soil and the insufficiency of water to meet needs unless used at a very high efficiency. The economic success of farming in the Zapotitan valley will depend on the farmers finding out how to keep fertilizer from leaching out, how to handle the variation problem in infiltration rates created by the calcareous deposits in the fine textured lenzes, and how to conserve moisture in the coarse textured soil.

Activities: Professors Stutler and Kidman were moved in July 1972 to San Salvador from Chile. They have been asked to assist in the design and execution of new interaction experiments. Corn, tomatoes and melons have been selected for special trials. Others are being identified. The degree of involvement will be fairly intensive.

As local technicians gain experience, the USU staff will shift their attention from the design and daily plot work to evaluation and technology transfer, particularly to the design of technology transfer systems and the evaluation of their effectiveness.

This shifting of emphasis presupposes that local researchers do not turn over at a very high rate, otherwise it will be difficult to operate at the "technology transfer" level for the simple reason that a high turnover rate will result in little technology to transfer unless the staff remains at the plot experiment level of operation.

Other Water-Fertilizer Interaction Studies

Sufficient flexibility will be maintained to be able to make positive responses to other areas should it be necessary.

There has been some indication from staff of the AID Latin American Bureau that it would be helpful if USU "regionalized" its activities.

The proximity of the Central American countries to each other suggests them as a natural grouping for a regional approach to their problems.

Insofar as interaction experiments are concerned, a strategy will be needed that gives appropriate attention to the needs of each country and the resources of this contract and those already available in the country.

Even in Chile, where institutional development was quite good, Professors Kidman and Stutler found themselves frequently showing their counterparts the details of the cultural practices: such as how to start siphons, measure water, prepare seedbeds, etc.

Someone has to be on top of these and many other day-to-day problems. One missed operation and a year's work may be wasted.

One possible way to regionalize this program would be to invite agricultural engineers from other countries to come to El Salvador and work for a growing season with Kidman and Stutler. USU could assist them with their plot designs and the analyses of results and possibly harvesting operations. This would leave the seed bed preparation, planting, watering, fertilizing, weed, insect and bird control components completely in their hands.

The design and especially the evaluation components require knowledge of statistical analysis that is not generally available at the operating level. Practically all of the Latin Americans who have had sufficient training to do this work gravitate quickly into senior administrative jobs or private practice and for several reasons are not available.

Component P02: Evapotranspiration and Water Requirements

Five objectives are proposed for the next five years:

1. Using the data collected during the first five-year period, publish in English, Spanish and Portuguese a bulletin which provides field staff in all tropical countries with useful equations for relating evaporation and evapotranspiration to climatic data that is generally available in developing countries.

2. Collect available crop consumptive data and develop revised crop coefficients for temperate zone, semi-tropical and for tropical crops.

3. Continue the analysis of Latin American hydrometeorological data in order to modify the equations, taking into proper account the differences in the ways in which data are collected in the various countries.

4. Publish an Irrigation Requirements Manual for Latin America. (This would include a methodology with numerous examples of how to relate various levels of probability of precipitation occurrence with existing rainfall data.)

5. Publish a methodology to correlate the water-fertilizer interaction experiments with water availability to determine the economics of crop production. This would also include:

a. The development of a hydro-economic model for distributing short water supplies to crops and determining the unit value of water for a given supply.

b. The development of yield versus water supply and yield versus evapotranspiration functions and their relationship to soils and irrigation management.

c. Identification of "effective precipitation" and its relationship to infiltration and soil moisture capacity.

Additional technology transfer component would be primarily through four strategies.

1. Preparation of a publication showing meteorologic stations and equipment describing data requirements, equipment exposure requirements and other necessary conditions for obtaining adequate climatic data for the preparation of irrigation requirements and related agricultural development studies.

2. Training of at least two participants each year at Utah State University in the methodology of making country-wide irrigation requirements and climatic analysis studies. These are to be combination training and development planning assignments using data from the participants' country as a basis for the study and having as an objective, completion of the country-wide planning study.

3. Training of an estimated three graduate students from Latin America each year who desire to prepare a graduate thesis on irrigation requirements, moisture yield relationships, economic evaluation of moisture deficits or related subject fields.

4. Short courses in the various Latin American countries describing techniques methodology and benefits as related to irrigation requirements, analysis of moisture deficits, calculation of precipitation probabilities, development of hydro-economic models for determining the unit value of water, water supply as related to irrigation management and economic pre-feasibility studies as related to irrigation and water resource development.

Summary of Activities

1. Christiansen and Hargreaves will be maintained on the program collecting and publishing the data specified above.

2. USU graduate students will be used (especially those from Latin America) to collect and analyze data. Their theses and dissertations will be used in the preparation of the contract publications.

3. Opportunities will be sought to present data at seminars, particularly those taking place in Latin America.

4. Several key officials from Latin America will be invited (not at the project expense) to come to USU and work on specific data from their countries under Christiansen and Hargreaves supervision.

5. The data from Latin America will be supplemented by data collected from Asia, particularly Pakistan, through collaboration with CSU.

6. Several visits will be required into Latin America to collect and check on data, to strengthen existing contacts, especially where staff turnover has brought new people into key positions insofar as this program is concerned.

These objectives and activities conform to the Jensen Review Committee's recommendations.

Component P03: Drainage and Salinity

Background Statement

Seldom is an evaluation made of the effectiveness of a drainage system after the installation. The reasons for this are very obvious. The personnel responsible for the initial investigation and design are usually no longer involved. Those responsible for the maintenance are not research-minded, and they are always busy with other responsibilities. No one appears to be interested in determining whether the system is performing in the manner for which it was designed. Are the drain spacings greater than required to meet the initial assumptions in the design? Are they much closer than actually required? Are the drains deep enough to meet the requirements. Usually field tests are made to determine the hydraulic permeability or transmissibility of the soil before the design. Are the values obtained by these procedures valid, conservative or inadequate for the most efficient design?

Field investigations after completion of the construction work would answer many of these questions, and the knowledge gained would be of great value in future investigations and design of drainage systems in irrigated areas.

This type of drainage research would be much more economical than conventional field research where drainage systems are installed especially for such tests. The construction cost in such cases constitutes a very large portion of the total cost. Taking advantage of actual drain construction to make the required tests would greatly reduce the cost. The best results could be obtained where the research program could be planned and conducted in close cooperation with the designers and where it could be carried on during and after the construction period to determine more accurately the before and after conditions,

and the effectiveness of the system.

Description:

General: USU proposes to search out opportunities for studying existing drainage systems to find the answere to the questions. USU is particularly concerned with the heavy clay soils.

Colombian Segment

The Atlantico-3 work will be continued until its objectives are met, at which time Colombia's interests and priorities will be reviewed and possibly a move will be initiated to the Cauca valley.

El Salvador Segment

Drainage in the Zapotitan valley still requires studies on bank stabilization and drain tile spacing.

The effectiveness of an aquatic weed control technology transfer program initiated by one of the chemical companies is being observed. All the ditchbanks have been sprayed for a distance of 50 feet wherever the ditches cross the main roads. Signs have been put up saying "Mr. Farmer, you too can keep your ditches free of weeds by using our chemicals".

Component P04: Use of Available Moisture

Description: As the irrigation model mentioned earlier and detailed later under P07 is set up for an area, one component will be the maximization of the available moisture in both the totally "dry land" context and a supplemental irrigation situation.

Description of Activities

In order to provide input to the model, soil moisture, crop requirements and precipitation will have to be correlated. This may require some plot work and will be initiated as soon as a site has been selected.

Component P05: Assisting SUVALE of Brazil to Set Up Agricultural Research Stations

Description: The major objectives of the original program should have been reached by April 1973. Further work in Brazil is contingent upon USAID/Brazil specifying priorities which lie within the terms of the contract.

It is believed that a high priority item is increasing livestock production. A major limiting factor is feed and forage production. The development of irrigated pastures for dry season forage production will be important in any program to increase livestock production.

Description: At this point USU is awaiting clearance to discuss with USAID/Brazil their needs and priorities vis-a-vis the contract. Specifying activities will have to await these discussions.

Component P06: Water Rights and Water Law: Water Law Digest

Description: It is proposed that USU in collaboration with staff at Colorado State University, a portfolio of global legislation and organizational arrangements be developed to serve as a basis for designing a legal system in requesting countries. The analysis and portfolio will demonstrate the interaction of water law with water resources management, irrigation development and the customary and social conditions of regions and delineate the similarities and dissimilarities between water law systems in the world.

With the completion of the draft of the Andean Pact countries' Water Law Digest expected about January 1973, the following program is anticipated:

1. Present draft of digest to USAID/Washington for their review and suggestions.

2. Secure observations of CSU.

3. Publish the digest.

4. Distribute it to USAID missions, cooperating national agencies and selected interested professionals soliciting their observations and recommendations for further work.

5. A major effort will be made to draw the publication to the attention of legislators and project and agency managers. This will be done by preparing and presenting papers at seminars, conferences and workshops, writing for technical publications, incorporating information contained therein in formal course work at USU and CSU, accepting "visiting lecturer" assignments. After this "consolidation" takes place the contractor should be in a good position to begin data collection on a world-wide basis. This will require a somewhat different strategy. Data for the Andean Pact countries was collected primarily by first researching all available data in the U.S. then stationing Dr. Daines in Ecuador where he, through a number of personal visits, collected the data from the other countries. It is likely that data from many other countries can be collected on a TDY travel basis plus exchanges at conferences and seminars. Students will also be sent out to collect data. The Andean Pact Digest Program is considered as a large-scale pilot project which will guide the design of the detailed program components for the next five-year period. In general, the priority area will continue to be Latin America, but as the data collection for the non-Andean Pact countries begins to peak out, the methodology and resources can be directed toward other areas in accordance with AID's priorities.

Component P07: Land and Water Conservation Management Techniques

Managers operate at two levels. They must control a series of interrelated activities and they must see that each activity runs as efficiently as possible. All previously proposed components of this contract are directed at specific activities whose objectives are individually identifiable components of the whole on-farm water management problem. They do not represent all of the components with which a planner or manager has to deal.

Management tools are available to help managers give "due consideration" to all components of their tasks. It is proposed to locate an appropriate, fairly homogenous region in Latin America where institutions are well enough developed to be able to make and implement decisions of a water management nature that directly affect on-farm operations. The objective is to identify the region and institution, then work with the management of the institution in developing staff competence in using simulation models whose outputs are high priority items with the institution. The research component is to test the hypothesis that because of rather strong (or potentially strong) government supervision of farming operations in several Latin American countries, usually through agrarian reform and agricultural credit programs, there is a good opportunity for managers to optimize decisions for land use in an irrigation district by using some of the tools of management such as simulation and linear programming. This hypothesis will, if verified, identify to at least a significant degree the constraints within which it is valid.

Description of Activities

Colombia is a country where good possibilities exist to implement this program. Using the hydrologic model of Paul Riley to demonstrate the technique for limited decision making, it is proposed to offer to work with ICA and INCORA managers on a specific project to utilize model simulation to assist in determining the economic return and the effect on employment of a number of alternative uses of land in the project area.

Dr. Riley will be in Colombia in October to demonstrate the model. If the interest level is not high enough, the advice of the Latin America Bureau will be sought to help in locating another suitable country.

This program will require field data collection which will be carefully coordinated with the other contract components, especially P08, the Economic Component.

1. Several economics students will be sent into the area to begin gathering benchmark data.

2. Project manager(s) will be invited to USU for about three weeks to become familiar with the technique.

3. Finances will be worked out, hopefully with USAID/Mission participation, to permit several technicians to enroll at USU for detailed training in optimization techniques. The length of stay will depend on their previous training and experience. USU is thinking in terms of two men for two quarters if they know how to program a computer, can manipulate medium-sized mathematical matrices and have a working ability with partial differential equations.

4. The manager will identify their priority objectives and Dr. Riley and his staff will then work through a basic model using whatever data inputs are available.

5. USU staff will follow up with several visits in order to assist the technicians in overcoming programming difficulties and assist management in evaluating outputs.

Trickle Irrigation in El Salvador

This work will be continued until its technical and economic feasibility has been determined. This should take about two more years.

Component P08: Economic

Description and Objectives

This component will continue to provide the data needed to evaluate the economic impact of the other components. It will be carefully coordinated with P07, the land and water use management component, in order to insure adequate collection from the field of economic data and to make available such other components as market (both internal and external) elasticity projections for alternative cash crops.

Description of Activities

1. Student researchers will be sent into Colombia, El Salvador and Ecuador, and especially the region selected for P07, to collect benchmark data.

2. Dr. Allen LeBaron, Program Director, will assist Dr. Paul Riley in developing the P07 component.

3. Several publications will be issued dealing with:

   a. The benchmark studies and with the economic impact of crop production functions as these become identified through the water-fertilizer interaction experiments.

   b. The economic potential of model simulation in irrigation projects.

c. In collaboration with Dr. Olsen, the real costs of salinity and water table level control in the Atlantico-3 region of Colombia.

Component P09: Training and Demonstration

USU is anxious to see the results of the work "nationalized" and "institutionalized". Applied adaptive research is justified only by producing useful and used results. It is difficult to specify exactly what proportion of the limited resources of the contract should be dedicated to the technology transfer process.

Description of Activities

USU proposes to collaborate wherever possible with local technology transfer systems by helping several university professors in El Salvador, Colombia and Chile prepare their courses in irrigation management and by making data results available in easily usable form to indigenous agencies that wish to reprint it.

USU will also aid by participating in and convening where possible regional seminars and conferences dealing with these programs and by encouraging promising foreign students to become involved with the research program by attending USU and assuming certain program responsibilities.

The field staff will be oriented to the importance of seeking out teaching opportunities with their counterparts and by being alert to public relation opportunities so that AID/Washington and USAID/Missions and indigenous agencies become better acquainted with the program.

ABSTRACT

A STRATEGY FOR OPTIMIZING RESEARCH ON AGRICULTURAL SYSTEMS INVOLVING WATER MANAGEMENT

by

D. F. Peterson, Jack Heller, and H. B. Peterson*

Optimal cropping systems are highly site-specific. That this has been recognized is demonstrated by the acceptance of extensive field trials as a basis for project design and for providing the necessary extension-type information needed in initial developments or in changing agricultural patterns, both in the advanced and the developing countries. However, a consideration of transferable information using a systematic model should permit greatly increased efficiency of field trials and should help identify *in situ* opportunities which may not be apparent on an ad hoc basis. This work proposes a concept for such a model (see Table 1) and attempts to demonstrate its use through specific applications. Like all such models, it must be regarded as a "straw man" which will need continual refinement and development.

The single over-reaching factor relevant to transfer of information and technology for any crop system can be characterized as agricultural environment. Recognizing this, the model then describes that environment by identifying, through disaggregation, factors and descriptors which are significant to the transfer process in agriculture. The environmental vector is considered to be comprised of four basic dimensions: intimate physical and biological site conditions, external physical and biological resources, institutional, and economic. A second level of disaggregation identified the major descriptors under each of the four dimensions. At a third level the measurable components of each descriptor are listed. (Table 2 gives an expansion of the intimate physical and biological site conditions portion of the model.) Thus one has, under the "physical and biological" dimension, the descriptor "climate." One measurable component of climate is temperature; another is humidity, etc. Temperature regime may be quantitatively described by such indicators as a daily high, daily low, frost-free period, degree days, hourly variation, monthly average, etc.

Transfer can be made only in terms of specific crop or crop systems. Thus, for each site-related environmental vector there are large numbers of potential crops or crop systems. These systems are described by "indicators" such as germination, rapid growth, flowering, fruiting, harvest, etc., which can be related to environmental parameters. In

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order to optimize, one needs to know the quality of the transfer function, the potential action programs which might be taken in order to modify the environment, and the quality of the expected response, i.e., whether it is optimal, good, fair, poor, failure, or unknown.

If adequate measurements are made in site-specific field trials under different environmental conditions, specific points in the model space can be delineated. With even a few such points the geometry of the model space can begin to be understood with the result that more valid transfer interpolations can be made. As additional data are collected the resolution of the model can be improved as well as its geographical scope.

The application of this model should be most useful in organizing research efforts to minimize the number of site-specific studies necessary. The potential for optimizing research efforts to fill in the model space by utilizing transferable information and conducting site-specific field trials only to bridge critical areas is perhaps the most important contribution of the model. Furthermore, the model should afford a useful framework for the cataloging and retrieval of research information from a data bank.

A comprehensive evaluation of an agricultural system involves economic, social and environmental considerations as outlined in Table 3.

At present, the model does not include evaluation of social or environmental goals or objectives, e.g., maximum food production, maximum national income, income distribution, etc. Given such an objective or some agreed-upon mix of objectives, however, the model, hopefully, would lead to improvement in the strategy for research culminating in an improved program of action to accomplish that objective.

Of increasing urgency is the need to study the program mix to insure the maximum possible impact on food production. A project optimizing strategy is proposed.

An opportunity will be sought to introduce several optimizing techniques to the management of an irrigation project.

Future likely linkages with other universities and consortia are described with particular reference to Colorado State University and the tropical soils consortium.

A time phasing sequence of the components is proposed in Part IV.

Table 1. Condensed Summary of Model for Optimizing Comprehensive Agricultural Systems Involving Water Management

ENVIRONMENTAL VECTOR			PLANT MATERIAL VECTOR			
FRAMEWORK	DESCRIPTOR	MEASURABLE COMPONENTS	PRODUCTION INDICATOR	KNOWLEDGE TRANSFER	HUSBANDRY PROGRAM	EXPECTED RESPONSE
(INTIMATE PHYSICAL & BIOLOGICAL SITE CONDITIONS)	CLIMATE SOIL SOIL MOISTURE FERTILITY PESTS		PLANTING GERMINATION EARLY GROWTH RAPID GROWTH FLOWERING FRUITING RIPENING HARVEST	EXPLCIT OBJECTIVE SUBJECTIVE INADEQUATE UNKNOWN NONE	(CULTURAL PRACTICES) SCHEDULING IRRIGATION DRAINAGE FERTILIZER PESTICIDES PLANT MATERIAL	OPTIMUM GOOD FAIR POOR FAIL UNKNOWN
			PRODUCTION UNITS			
			HUSBANDRY INDICATOR	EXPERIENCE TRANSFER	ACTION PROGRAM	EXPECTED QUALITY
(EXTERNAL PHYSICAL & BIOLOGICAL RESOURCES	HUMAN WATER ENERGY CHEMICAL		(CULTURAL PRACTICES) SCHEDULING IRRIGATION DRAINAGE FERTILIZE PESTICIDE (PLANT MATERIAL)	EXPLICIT OBJECTIVE SUBJECTIVE INADEQUATE UNKNOWN NONE	ENGINEERING DEVELOPMENT EDUCATION EXTENSION ENFORCMENT ENLIGHTENMENT INFRASTRUCTURE INCENTIVES SUPPORTS ETC.	OPTIMUM GOOD FAIR POOR FAIL UNKNOWN
INSTITUTIONAL	LEGAL EDUCATIONAL RESEARCH FINANCIAL					
ECONOMIC	INCENTIVES (FACTOR MARKETS) (PRODUCT MARKETS)					PROGRAM COSTS PRODUCTION RETURNS

Table 2. Intimate Physical and Biological Site Conditions Portion of Model for Optimizing Comprehensive Research and Action Programs on Agricultural Systems Involving Water Management

ENVIRONMENTAL VECTOR			PLANT MATERIAL VECTOR			
	DESCRIPTOR	MEASURABLE COMPONENT	PRODUCTION INDICATOR	KNOWLEDGE TRANSFER FUNCTION	POTENTIAL HUSBANDRY PROGRAMS	EXPECTED RESPONSE
FRAMEWORK	CLIMATE	TEMPERATURE Daily High Daily Low Frost Free Period Degree Days Hourly Variation Monthly Average HUMIDITY Daily High Daily Low Monthly Average RAIN Daily History Monthly Average Intensity Probability LIGHT Daily Intensity Day Length WIND History Probability HAIL History Probability SNOW History Probability	PLANTING GERMINATION EARLY GROWTH RAPID GROWTH FLOWERING FRUITING RIPENING HARVEST	EXPLICIT OBJECTIVE SUBJECTIVE INADEQUATE UNKNOWN NONE	CULTURAL PRACTICES PLANTING DATE IRRIGATION SHADING Cover Crop Inter-plant CULTIVATION TRANSPLANTING SPECIAL HARVEST WIND BREAKS SUPPORT HOUSING LIGHTING NEW PLANT MATERIAL	OPTIMUM GOOD FAIR POOR FAIL UNKNOWN
INTIMATE PHYSICAL AND BIOLOGICAL SITE CONDITIONS	SOIL	TEXTURE Surface Sub-surface Profile Structure Surface Profile INFILTRATION CAPACITY PERMEABILITY SALINITY pH CHEMISTRY ORGANIC CONTENT BACTERIA TEMPERATURE			CULTURAL PRACTICES PLOWING SUB SOILING CULTIVATION RECLAMATION AMENDMENTS PLANTING DATE IRRIGATION DRAINAGE COVER CROP CROP ROTATION MANURING PLANT NEW MATERIAL	
	SOIL MOISTURE	QUANTITY PROFILE Surface 0 - 30 cm 30 - 60 cm 60 - 90 cm 90+ cm POTENTIAL PROFILE SALINITY PROFILE			CULTURAL PRACTICES IRRIGATION DRAINAGE CULTIVATION MULCHING COVER CROP AMENDMENTS PLANTING DATE CLIMATE MODIFICATION PLANT NEW MATERIAL	
	FERTILITY	NATURAL PROFILE Nitrogen Phosphorus Potassium Trace EXCHANGE ION TIE-UP RESIDUAL HOLDING CAPACITY			CULTURAL PRACTICES FERTILIZE MANURING CROP ROTATION ADDITIVES CULTIVATION IRRIGATION DRAINAGE COVER CROPS PLANT NEW MATERIAL	
	PESTS	FUNGUS INSECTS NEMATODES WORMS & SNAILS POLLUTANTS BIRDS ANIMALS RODENTS WEEDS			CULTURAL PRACTICES PLANTING DATE PESTICIDES MECHANICAL ELECTRICAL IRRIGATION DRAINAGE CULTIVATION PLANT NEW MATERIAL	
ALTERED AND INTEGRATED			PRODUCTION UNITS			

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PROJECT STATEMENT

Date: October 12, 1973 sl/

A. PROJECT SUMMARY

1. Statistical

Project Title:	Water Management Research in Arid and Sub-Humid Lands of the Developing Countries -- L.A.
New or Extension:	Extension - Two Years
Contractor:	Utah State University Logan, Utah 84322
Principal Investigators:	Howard B. Peterson, Project Director Byron C. Palmer, Field Director
Duration:	Current contract - June 1968 to March 1974 Proposed extension - April 1974 to March 1976
Funding to Date:	$2,403,071 - Current contract to 3/31/74
Estimated Additional Cost:	$1,225,000 - Proposed extension to 3/31/76

Funding by Fiscal Years: 1974 - $605,000
1975 - 620,000
1225

Technical Specialist: Dr. Donald Plucknett
Alternate: Dr. Tejpal Gill

2. Narrative

This project will expand upon and intensify the on-going AID/USU research program (Contract AID/csd-2167). The purpose of water management, especially in the tropics and, at the same time, provide competent assistance to USAID Missions in Latin America in developing the research capability of host country counterparts and institutions and regional agencies. Eight high priority project objectives are currently in operation with contractor field staff located in Brazil, Colombia, and El Salvador. The contractor also has effective interchanges with USAIDs and research agencies

in Bolivia, Chile, Ecuador, Guatemala, Honduras, Venezuela and Panama. The contractor is also a member of CUSUSWASH.[1/] This organization and AID have reviewed the project resulting in a much closer coordination of research between Utah and Colorado State. Water law research has focused on identifying constraints to efficient water use with the utilization of existing research also being stressed. Through cooperation with AID, Missions and CSU the overall project aims have been sharpened and more clearly defined to synergize the research results and magnify the transferability to developing countries.

Field work in Latin America with supporting activities on the contractor's campus is dealing with water-crop-fertilizer interaction through field research and demonstration plots, analyzing available hydrometeorological data to determine crop water requirements, establishing criteria for draining tropical zone soils, control of salinity, developing research station operations, adapting project management strategies to the developing countries' environment, evaluating the economic impact of improved technology and training developing countries' researchers through integrating the contract's activities with the programs of the countries' research institutions. The field activities have been selected from those high priority problems as designated by AID, Missions and Host Countries.

B. EXPANDED NARRATIVE STATEMENT

1. Project Description and Background

The attached proposal (Appendix A) is to extend, for an additional two years, the ongoing research project of Utah State University, Contract AID/csd-2167. The nature of the project is specified in detail in the contracting documents and in the subsequent annual reports of Utah State University.

a. Background

AID has identified water management as one of the key problems that must be solved to achieve the highest degree of technical assistance for developing countries. Limitations in the water availability for crop growth places serious restrictions on the productivity performance of all other agricultural inputs

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[1/] Council of U.S. Universities for Soil and Water Management in Arid and Sub-Humid Areas.

(seeds, plant nutrients, photosynthetic energy management etc). Thus water management relates directly to the availability of the food people eat affecting their nutrition, health and productive human energy. Water and water management is the critical problem and the critical location is the farmers field. Therefore, the general objective of this research is to increase food production in arid and sub-humid lands of the less developed countries with appropriate consideration given to increasing employment in the rural sector and utilizing local resources through the improvement of water management practices and the utilization of other production inputs.

The following specific objectives have been designed:

1. The development of knowledge and data on how best to conserve and utilize water falling on the land as rain and the most efficient means of supplementing needed soil moisture by a limited amount of irrigation water.

2. The development of knowledge and data that can be used for the economic design and construction of water conveyance and delivery systems including structures for control and measurement of irrigation water.

3. The development of surface and sub-surface water removal systems to eliminate the hazards resulting from surface flooding and high water tables.

4. The identification of important factors to be considered in land preparation and leveling of the various soils in the major climatic zones and the relationship of these factors to water management, erosion, water infiltration, and good land use and cropping practices.

5. The development and adaptation of methods of water application, including time and amounts, which are suitable and efficient for different soils of varying physical properties (water-holding capacities, intake rates, etc.) with major crops.

6. The integration of these water-use factors into a productive cropping system consistent with farm size and available farming practices.

7. Where soil, water quality, salinity and exchangeable sodium are problems, studies will include soil amendments, soil and water management procedures and use of salt-tolerant crops.

In general, CSU will address its efforts to specific needs of the Asian countries and USU to needs of the Latin American countries. However, the physical and socio-economic variables involved in each study will be carefully characterized to increase the extent to which the findings and resulting technology can be transferred successfully to other developing countries. Efficient research plot designs have been studied and adopted in common by the two universities, which will allow direct comparison of yield response surfaces to water and fertilization from the various countries where such studies are in progress. Coordination of studies at the two universities occurs through discussion of research results and plans at least every six months, through exchange of reports, and through joint development of work plans.

Utah State University is in the process of developing models which will eventually provide guidelines for optimizing crop production through management of water and other essential inputs. CSU personnel will participate in testing and refining these models by designing their research to elucidate cause and effect relationships and to obtain carefully characterized correlations between management, climate, soil and yield variables. Planning, on site and evaluative consultation between staffs of the two universities is an integral part of the cooperative development planned for this model.

8. The identification of institutional and policy factors - (legal, social, economic, religious, manpower, credit etc.) that influence the efficient distribution, management and utilization of water at the farm level.

An important constraint imposed by A.I.D. is that the field work be done in Latin America and must complement and strengthen the high-priority objectives of the host country and USAID Missions. As a result of discussions with developing countries and Missions a number of high priority researchable components of the above listed objectives were identified. Research on these components has gone forward and the progress is briefly described in the following paragraphs.

(1) Irrigation Interaction with Crop Varieties, Plant Population and Fertilizers - Work has been centered in Brazil, Chile, Colombia, El Salvador and Venezuela. Three years' data in Chile show that the yield of corn can be increased from 3,800 to 7,600 Kg/ha with nitrogen fertilizer and improved water application techniques. These techniques are quickly being adopted by the communal and family farms growing 7,200 hectares of corn in the Aconcagua Valley. In Colombia, the yield of soybeans can be increased from about 680 to 1,080 Kg/ha with 11 cm. of water and to 1,780 Kg/ha with 22 cm. of water.

(2) Evapotranspiration and Water Requirements - Work on this component has used climatological data from Bolivia, Chile, Brazil, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Venezuela and Panama. Because the nature of the work requires computer facilities, the analysis has been carried out at the Logan campus. However, a number of officials from the concerned countries mentioned have been involved in collecting and assembling the data in the field and have participated in the analysis at Logan. The analysis determines: (a) The amount of dependable precipitation, the tabulations showing the mathematical probability at various percentage of time levels of rainfall by regions per month; (b) the potential evapotranspiration demand or water requirement of plants by region, standardized to a short vigorously growing crop; and, (c) the actual crop-water-requirement by time of year and by region. Reports have now been published for Venezuela, Colombia, Guatemala and Panama.

(3) Drainage and Salinity - Research has been conducted mainly in Colombia and El Salvador with some work in Chile and Venezuela. A hydrologic model using computer techniques and a mole plow development program have been carried out at the Logan

campus. A pilot drainage system, covering about six hectares and instrumented with observation wells and piezometers, has been installed in Colombia. Concrete tile drains, open drains, and imported perforated plastic drains are being tested. Salinity measurements and leaching studies are also underway. The data will be used for extension of drainage practices to the 16,000 hectares of Atlantico-3 in Colombia and similar areas elsewhere. Problems of controlling aquatic weeds in open drains and economic alternatives to open drains are being investigated in El Salvador. Perforated plastic pipe is being tested as a collector drain in combination with mole drains. The Colombia and El Salvador studies should produce vital data for designing and depth and spacing of drains. At Logan, the development of a plow for constructing low cost mole drains has been under development. Several models have been field tested and one of these is being used for field trials in both Colombia and El Salvador. A report is now available describing the developing and testing of mole plows at the USU drainage farm.

(4) Use of Available Moisture - Research was initiated in Chile and Venezuela and some success to reduce drought damage was obtained in these countries. For accomplishments see Appendix A.

(5) Assisting SUVALE of Brazil to set up Agricultural Research Stations - Irrigation research stations are not available in many Latin American countries and this was especially true in Brazil. Since they are a necessary component of research, the planning and development of such facilities was undertaken at three locations in the Sao Francisco Valley of Brazil. These stations are now operative with irrigation systems, leveled land, seed storage facilities and plot layouts for field studies. Training sessions have been conducted for researchers as well as administrators of SUVALE.

An agreement has recently been signed by the Government of Brazil, USAID/Brazil and USU for reorienting the research programs of Brazil related to on-farm water management. USU will assist and participate in this effort in collaboration with the Brazil Ministry of Agriculture's Research Department. It is expected that much of the work will be carried out at Petrolina where there is a well equipped soils laboratory. Linkages with the North Carolina Soils project will be developed.

(6) Water Rights and Water Law: Water Law Digest - This research has centered in the Andean Pact countries with Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela providing the main

source of the field data. Nearly 30,000 pages of water law data were collected from United States sources and taken to Quito, Ecuador for analysis and comparison with the field data. A detailed water law digest is now completed for the Andean Pact countries. Draft copies of the publication are available in both English and Spanish and have been distributed to the appropriate government agencies in the countries concerned. A seminar is planned to review the publication and identify the laws and/or water rights which tend to restrain or facilitate good on-farm water management practices. The seminar is planned for Quito Ecuador in early 1974.

(7) Land and Water Conservation Management Techniques - The aim of this research has been to develop methods for forecasting the results that may follow a particular water management decision or sequence of decisions. The complex combinations of management options including timing, amount and methods of application coupled with water supply, soils, water quality, and water table constraints present an almost infinite number of alternatives. One such complex problem was recognized in Colombia and the optimizing techniques of mathematical models were believed to offer solutions. A simulation model was developed to utilize the unique capability of the hybrid computer (analog-digital) at the Logan campus and is being used for the Colombia problem. Two reports have been written and the work will have widespread application as a water management tool for comparing alternatives in reaching decisions. An application of the simulation model is also being applied to a problem in Chile. An additional technique using trickle irrigation is being researched in El Salvador where preliminary results indicate water savings of as much as 90 percent. A significant new feature of the work planned as part of the project extension is the systematization of all research activities by utilizing modeling techniques described in the USU proposal in 1972. The model has been further developed during the year and will be utilized to optimize research work. (See appendix - "A strategy for optimizing research on agricultural systems involving water management.") Data inputs are now required to improve the resolution of the model. Once the models have sufficient resolution to appear to be valid it is expected to have an impact on the data gathering with regard to what data are needed and how it is taken to be most useful.

A general goal of modeling and systematization is to be able to generate yield-response functions from data for a specific location to respond to questions such as:

a. What crops are most likely to provide the highest return on agricultural investment?

b. What are the water management and cultural practices which will provide the optimum yield for a selected crop?

Initially only those parameters (crop, soil, fertilizer, climate) which have a high degree of interaction with water will be included in the model. Other vectors such as disease, insects and weeds can be added as data are available. Sub routines should allow one to

a. predict the useable rainfall for a specific location

b. determine the best method of applying water on a specific soil for a given crop.

A number of important field activities to provide inputs into the model and improve its resolution are:

a. Identification of important water related variables

b. Characterization of the variables

c. Design of system routines and subroutines

d. Literature search for available data inputs

e. Specifications for field research requirements

f. Execution of field research and refining data inputs

g. Data inputs and problem solutions.

(8) Economics - The Economic Research on water management has been centered at the Logan campus with considerable field work and data collection being done in Bolivia, Ecuador and El Salvador. Economic benchmarks are being established in these countries and various levels of technological management are being subjected to economic comparisons. See Appendix A for list of publications.

(9) Training and Demonstration - Training of counterparts is a necessary component to any research program in the developing countries. In addition, the extension of research results to the farmers must ultimately take place if it is to make an impact. Such training has been underway in Brazil, Chile, Colombia,

Ecuador and El Salvador. The real value of training was evident when the Utah team was required to leave Chile and three counterparts were given the responsibility of continuing the research. During the change in the political situation, the USU team members were invited to return to Chile periodically to assist in evaluation of results and formulating new plans.

The USU experience during the first five years of this contract indicates that each member of the USU field staff has a major influence on the professional careers of about two to three country nationals per year, that an additional dozen or so men per year receive professional development through frequent meaningful face-to-face contacts, with perhaps an additional dozen being influenced by occasional contacts.

A significant start has been made on a number of facets of the complex water management problem and the momentum of an ongoing productive project should not be lost. The objectives are still expedient and it is expected that the priorities will not be altered substantially. Additional components may need to be added to complete an integrated approach to the problem. However, it is expected that the contractor will continue work on the components now accorded a high priority.

2. Significance to A.I.D. Objectives

Soil and water management continues to be one of the key problem areas selected by A.I.D. for continued attention. It is also a high priority area of work in the Missions and in the Regional Bureaus. The on-going on-farm water management research by Utah State University and Colorado State University is a very important part of A.I.D.'s effort to deal with this key problem area and its relativity to improved crop and livestock production, better and more food, enrichment of nutrition, enhancement of health and progress toward more productive human energy.

Both Utah State University and Colorado State University have identified and worked on a number of components of the problem and each has made substantial progress. Successful implementation of the findings to date will not only increase food production in Latin America but throughout the world by further developing the techniques and procedures which have application in other areas. These results have applicability to small as well as medium and large-sized farms.

The magnitude of the problem and the possible impact on

world food production is indicated in the TA/AGR Strategy Paper of May 1972.

> "This research thrust will include problems of irrigation farming, of agriculture in humid regions utilizing natural rainfall, and of grassland agriculture where cropping is not feasible. Serious constraints on production have been identified in all three types of situations; but initial attention is concentrated on irrigation problems. In comparison with developed nations, irrigation farming in LDCs is only a fraction as productive as it should be. About 75 million hectares of the arable land in South America, Asia and Africa are now irrigated, but crop yields are low. Effective systems of soil and water management under the types of soils and climates found in the tropics are imperative to capitalize on breakthroughs such as the "miracle" rice package of improved varieties and practices, and the high-yield-potential Mexican wheats. These necessary basic researches have not been undertaken by international research centers.
>
> "Farming in humid regions requires attention to water conservation, erosion control, and drainage -- which are factors that have received almost no research attention in the tropics. More than 600 million hectares of arable lands on three continents are producing the bulk of the foodstuffs in tropical regions. The urgent need for more production must involve improved land use. Permanently productive land management systems have not been developed in the tropics by the application of Western technology, and original research is required.
>
> "The effective utilization of the 1-1/2 billion hectares of natural grasslands in the tropics and subtropics will depend on better utilization of limited rainfall and on improved land management. There has been virtually no research done in this field; but our U.S. experience and that of Australia suggests this is a fruitful research field for A.I.D."

A basic A.I.D. objective is to assist developing countries solve their food problem and achieve economic growth as rapidly and efficiently as possible, commensurate with national objectives.

The extension of the USU contract is designed to maximize A.I.D.'s effective involvement in the developing countries' water management problems.

3. Relation to Existing Knowledge

The water management researchers at USU have access to one of the finest collections of scientific irrigation literature available anywhere. More than 75 years of research experience in irrigation and drainage have accumulated a significant storehouse of irrigation knowledge. Recently, the library holdings in this area have been increased substantially and completely updated under a 211(d) grant (AID/csd-2459), and the accessibility of all the information has been greatly increased by a computer indexing and retrieval system made possible by the grant. The researchers are aware of this existing knowledge and are at the forefront of the new technologies. The research, however, is not designed to produce new knowledge but rather to adapt what is known to the site-specific conditions of the developing countries and to develop methods to facilitate the technological infusion necessary to make sure the results are available, understood and utilized by these countries. Although designed as an adaptive research effort, the project is certain to produce information that will extend the knowledge frontier.

4. Relation to Other Research

The water management research contracts at Utah State University and Colorado State University have similar objectives. The major difference is the geographical location of the countries where the research is being done. Because of the synergistic relationship between these two contracts, close cooperation has been established between USU and CSU and other CUSUSWASH universities. A good example is the research on water law and administration being carried out at both USU and CSU. Through cooperative study, three principal water law systems - North American (Appropriations and Riparian), the South American (Spanish), and the Near East (Moslem) are being analyzed and described. In addition, the researchers at the two universities are coordinating their efforts and presently exchanging research designs and research results on the following:

a. Groundwater Recovery

Theory and models have been developed and tested for recovering the best quality water in both South America and Pakistan where percolated fresh water overlies highly saline water.

b. Effective Precipitation and Water Requirements

USU has developed several important crop water-use equations as necessary components of their longer range goals of determining probable effective precipitation and irrigation requirements. CSU is testing their precision and use in Asia.

c. Crop Responses to Water and Fertilizer

Much research has been conducted by both universities, at different geographical locations, under different climatic and soils conditions, and utilizing different research designs. Consequently, it is difficult to compare results. However, standard designs are now being adopted in order that crop responses to water and fertilizer may be more readily compared, and minimized without losing statistical and economic significance, regardless of the location of the research.

The USU team is doing what is best characterized as refining the techniques for field experiments aimed at developing water-nutrient response surfaces. Initial research should have sufficiently precise data to give rather explicit pictures of response curves from which the CSU researchers can determine the best functional forms for an economic analysis of data for Pakistan and other Asian countries that will be involved in the extended phase of the project.

d. Evaluation of Irrigation Systems

A pattern of increasing collaboration between CSU and USU has emerged in the evaluation of irrigation systems abroad. This has been due, in part, to increased interest of CUSUSWASH in the subject of evaluation and in part to A.I.D.'s evaluation and project assessment efforts such as the evaluation of the NESA irrigation seminars. Considerable attention has been given at both institutions to the development of a simulation model to evaluate irrigation systems, including the design and development of new systems and the renovation of old systems, taking into account both physical and economic efficiency criteria.

The Utah staff has been using the soil fertility data collected under the North Carolina State contract, when establishing field trials in Latin America. Presently, Utah State is establishing cooperative research on water problems of tropical soils in Brazil with North Carolina State and Cornell Universities, and North Carolina in Central America.

The work and reports of the International Research Centers (IRRI, CIMMYT, CIAT, IITA, CIP and ICRISAT [2/]) as well as FAO, UNDP and the Foundations are monitored for information, support, and possible cooperation. Recommendations for the Venezuela and Chile experiments as well as some of the corn seed was obtained from CIMMYT.

The problems incidental to "settling in" -- formulating plans of work, assigning staff and other resources to programs -- were discussed at semi-annual meetings of the members of the CUSUSWASH consortium. These meetings have provided a forum for project directors, program leaders and involved professional staff and administrators. Member universities of the consortium have established joint committees to facilitate research planning and exchange of information on such subjects as library improvement, publications, irrigation management; etc. These committees brought together scientists working on the SCU and USU research contracts and resulted in an exchange of information and joint publications.

The Irrigation Management Committee of CUSUSWASH produced a report on an integrated approach to agricultural research and development which takes into account the relevant components. If this concept is used as a general guide, each research program should become a component of a master development plan and will result in increased collaboration among member universities of the consortium.

5. Proposed Work Plan

a. Scope of Work

The range of the research activities falling within the objectives has been identified by Missions and host countries and agreed upon by the contractor and TA/AGR. The eight specific objectives of the program, as detailed above, remain the high priority items at this time. Though the dynamics of change may alter the emphasis and the priorities, it is expected that, with some minor changes, research on the present objectives of the program will continue.

[2/] IRRI - International Rice Research Institute; CIMMYT - International Corn and Wheat Center; CIAT - International Center for Tropical Agriculture; IITA - International Institute for Tropical Agriculture; CIP - International Potato Center; ICRISAT - International Crop Research Institute for the Semi-Arid Tropics.

The water management research institutions in each of the countries are collaborating with USU on various components of the program through working agreements as outlined in memoranda of understanding and through plans of work. In most cases, counterparts have been assigned and are actively engaged. Selected and responsible staff from host/cooperating countries have visited Logan to seek assistance in analyzing their data for special consultation or for study. Linkages with several universities have resulted in close collaboration by USU field staff in developing research programs and irrigation training programs. Several courses of study in host countries' institutions are based on courses taught at USU. The national institutions participate in the design of the field program, execute the programs with technical assistance from USU staff, and collaborate jointly in the analysis and evaluation of the results.

The Missions' primary role has been to identify areas of high priority interest and to assist in the writing of the memoranda of understanding. The Missions monitor the progress and advise the contractor on modifications required to reflect changing priorities.

b. Program of Work

The program of work to be carried out in the cooperating countries and on campus during the next two years is described in detail in Appendix A, under each of the objectives and the segments of the separate components on which work is under way or planned. The general time frame and level of effort are indicated in Section 10, Budget Analysis.

6. Research Methodology

In a broad sense water management problems throughout the world are quite similar. They differ primarily in degree and in their interrelationships with climate, soil characteristics, tpopgraphy, type of crop, and sociological and economic factors. The research methodologies required for problem solving are also similar, varying in relation to the importance of the various factors mentioned above. Present levels of sophistication should be adequate for most, if not all, of the research contemplated in this project. A model for optimizing agricultural systems through knowledge transfer has been developed and will be utilized. The model attempts to disaggregate the environment into significant components which are

also measurable. It uses crop production as the integrator of the agricultural system response to the water management and cultural program imposed at a specific site. This tool should aid in organizing available data and investigations. It should provide a useful outline to guide thought processes in research development and project analysis and be useful in data retrieval and analysis.

The research under this project will be oriented toward field application using standard field plot techniques. Laboratory and greenhouse studies will be used to supplement and support the field research. Because some of the developing countries are located in tropical areas and have peculiar soils and rainfall distributions, special management procedures need to be designed to meet these conditions. Careful consideration will be given to such contributing factors as size of farm, availability and type of labor and equipment, type of crop, inputs, supporting organizations and sociological environment and background.

During the proposed two-year extension of the USU contract, the procedure for the development of research plans and the conduct of the program will continue to be as follows:

a. Determine the high priority issues with the host country and USAID Missions.

b. Discuss these priorities with the appropriate host country research agency.

c. Develop a memorandum of understanding with cooperating agencies.

d. Assign appropriate researchers.

e. Establish counterpart working relationships.

f. Prepare a detailed research design and plan of work for each year.

g. Lay out day-to-day field activities.

h. Execute program.

i. Evaluate program.

j. Feedback results of evaluation for modification of research components.

7. Researcher Competence

The high level of training, experience and overall competence of the USU participating scientists is well known to A.I.D. and has been documented in previous project reports to the Agency. Both the on-campus and field staffs possess high levels of competence in their areas of specialization. This has been demonstrated by successful planning and implementation of research projects in Latin America; by success in training counterparts in all phases of water management; by contributions to institution building; by research publications; and by advising and disseminating valid research information. A.I.D. has had a part in the building of this capability through the 211(d) grant awarded to Utah State to increase its competence in on-farm water management.

USU has also developed a foreign language competence for all staff assigned to the field in Latin America. Capability in Spanish or Portuguese has been one of the requirements recognized by the Department of Agricultural and Irrigation Engineering as essential to the efficient conduct of the field work. The present field staff and about twenty of the supporting on-campus professionals now have excellent language proficiency as a result of emphasis on the requirement, reinforced by an excellent training program.

The Utah Water Research Laboratory on the USU campus is new, modern and fully equipped to do all kinds of water-related research work. The computer facilities (digital, analog and hybrid) have been used for analysis of the ongoing project data. The hydraulic facilities, bacteriological and water quality laboratories are also available when needed. A 110-acre irrigation and drainage research farm is administered by the Department of Agricultural and Irrigation Engineering and is being used as a site for testing of the mole plow. This farm is equipped with irrigation wells, pipelines, pumps, drainage outlets and other facilities.

Background and support activities at USU available to this project also include recognized research and extension programs in engineering, economics, natural resources and agriculture. The excellent library facilities have already been mentioned.

8. Contribution to Institution Building

There has been a close collaboration between USU and host country institutions resulting in formal working agreements as shown in the following table

Table 1 - Host Country Institutions having Working Agreements with USU

Country	Institution	Primary Role of Institution
Brazil	Ministry of Agriculture (MINAGRI)	General agricultural development
	Coordination of International Affairs (ICINGRA)	Coordinates collaborative agricultural programs with foreign agencies
	Secretariat of International Economic and Technical Cooperation (SUBIN) of the Ministry of Planning and General Coordination	Coordinates on a country-wide basis international technical programs
	Department of Agricultural Research (DNPEA)	Supervises agricultural research in MINAGRI
	Institute for Agricultural Research for the Northeast (IPEANE)	Responsible to DNPEA for agricultural research
	Ministry of the Interior (MINTER)	General development
	Sao Francisco Development Agency (SUVALE)	Semi-autonomous agency development resources of Sao Francisco watershed area
Chile	Minag. Dept of Research Minary Extension Dept. (SAG)	Studying many aspects of agricultural research Develops technology transfer methods to farmers
Colombia	Colombian Agrarian Institute (ICA) Colombian Institute of of Agrarian Reform (INCORA)	Operates agricultural research stations throughout country Administers Agrarian Reform Act and supervises irrigation projects
Ecuador	Min. of Hydraulic Works	Operates irrigation projects
El Salvador	Minag. Div. of Research Minag. Div. of Irrigation	Operates experiment stations Operates irrigation projects

Institution building was achieved in other ways as well. In Chile, the USU team collaborated with the Catholic University in curriculum development and with the Agricultural Research Services, La Platina station. A researcher at the station who was also a professor at the Catholic University, Mr. Juan Tosso, recently completed a Master's degree at USU and was available to take over and supervise the Chilean research when the USU team left.

Other Latin American officials who have received training at USU include: Engineer Jose Yepez, Chief of Ecuador's Metecrological Service in the Ministry of Hydraulic Works, who spent three months at Logan analyzing data from his country; and Engineer Fabio Carias from the Honduras Ministry of Agriculture, who analyzed the data from his country at USU. In addition, eleven Brazilians spent three months in training at USU during the summer of 1972. Through this process, the ongoing research contract has made a significant contribution to the strengthening of Latin American institutions.

The bibliography of water management literature compiled under the 211(d) grant has been publicized and is available to any requesting agencies. Approximately $80,000 worth of laboratory equipment has been located in host country research stations and three vehicles used by USU teams will be left in the field.

9. Utilization Plans

Although the contractor's first responsibility is for research results, USU realizes that the research must be problem oriented and that the results must be applicable to the local problems. Furthermore, the research must be designed to produce results which can and will be utilized. The researcher may need to present the results in a practical package and work with extension personnel to introduce new practices into the field.

In Chile, for example, this utilization was accomplished by recruiting Hilda Gonzales, Extension Corn Specialist, as a research associate. Mrs. Gonzales and her aides in the Extension Service (SAG) were influential in locating the eight field research farms at strategic, easily accessible places in the valley where the farmers and others could observe the results. Mrs. Gonzales was involved with the research and also planned the field days for the farmers as part of her extension responsibility. Utilization by nearby farmers was almost immediate and extension to the more distant areas followed rapidly.

Similar modi operandi are part of the contractor's plans for the continuing project.

10. Budget Analysis

A detailed budget for each component of the work is presented in the Contractor's proposal for the extension, and the budget requirement by years for each of the research components and for project administration and technical backstopping is contained in the proposal. See Appendix A.

Each component shown in the above table may have one or more segments of the research being carried out in one or more countries. The contractor has made an analysis of the ongoing research by component and country. The phasing, level of effort (man-months) and the budget for each component are shown in the contractors proposal. See Appendix A.

11. Internal and External Reviews

This project has been reviewed several times by TA/AGR and by RIGC and RAC. In January of 1972 a special committee conducted an intensive review of this project and the companion project at Colorado State. In November of 1972 the project was reviewed by RIGC and approval for a three year extension was recommended. (See RIGC minutes 11/13/72.) The project was reviewed by RAC in January of 1973 (see RAC minutes January 8-9, 1973) and was approved for one year subject to provisions which have been complied with as follows:

1. The project has been carefully reviewed by Missions concerned and by TA/AGR

2. Closer cooperation, joint planning and utilization of research results has been worked out between Utah State and Colorado State

3. Research on water laws is attempting to identify the legal and institutional factors constraining efficient water use and to form a basis for changing water laws

4. Project aims and procedures have been refined and

12. Proposing Office General Evaluation

The proposing office and the Latin American Regional Bureau enthusiastically recommend extension of this project. Utah State University has been effective in its relationships with USAIDs and with cooperating institutions and scientists. USU has been successful in placing qualified men in the field in a minimum period of time. Part of the effectiveness of the men under this contract has been their foreign language ability.

5 The major activity under the contract has been field research. These results as well as the limited on-campus research have been immediately applicable in local programs. Some results and procedures such as the water use and requirement studies and water law are finding application not only in Latin America but in other A.I.D. and international programs.

The University has shown extraordinary ability to coordinate and utilize its 211(d) grant in conjunction and in support of this research contract.

The University administration has given strong support to this research project and the 211(d) grant.

TA/AGR strongly recommends extension of this contract.

Omer J. Kelley, Director
Office of Agriculture

Donald Plucknett
Technical Specialist

J. B. Cordaro
Chief, Program Division

PROGRAM BUDGET FOR THE 12 MONTH PERIOD BEGINNING APRIL 1, 1974 *

Program No.	Description	Man Months	Salary	Consult	Fringe Benefits	Overhead	Travel	Allowance	Other Direct Costs	Equip. Material Supplies	Totals
1	Water Conservation: Determination of Useable Rainfall	30	43,740		6,690	19,980	9,510	9,510	1,890	3,780	95,100
2	Water Conveyance: Irrigation Water Measuring Structure	12	18,000		2,880	10,800	800	800	760	4,060	38,100
3	Drainage Research	6	8,740		1,330	3,990	1,900	1,900	380	760	19,000
4	Land Preparation and Grading	8	11,680		1,800	5,340	1,770	1,770	500	2,540	25,400
5	Water Applications: Irrigation Timing and Selection of Method	33	49,260		7,700	22,990	7,710	7,710	2,090	7,240	104,700
6	Integration of Water Use Factors into a Productive Cropping System	55	80,270	4,000	12,210	36,650	14,450	12,450	3,490	10,980	174,500
7	Water Quality and Salinity Control Research	19	28,530		4,430	14,600	4,210	4,210	1,210	3,110	60,300
8	Institutional Factors: Water Law Facilitators and Inhibitors	8	11,680		1,780	5,340	2,540	2,540	510	1,010	25,400
9	Administration	18	29,000		4,640	17,400	4,000	4,000	1,160	2,300	62,500
	Totals	189	280,900	4,000	43,460	137,090	46,890	44,890	11,990	35,780	605,000

*Socio-economic research will be part of the above activities.

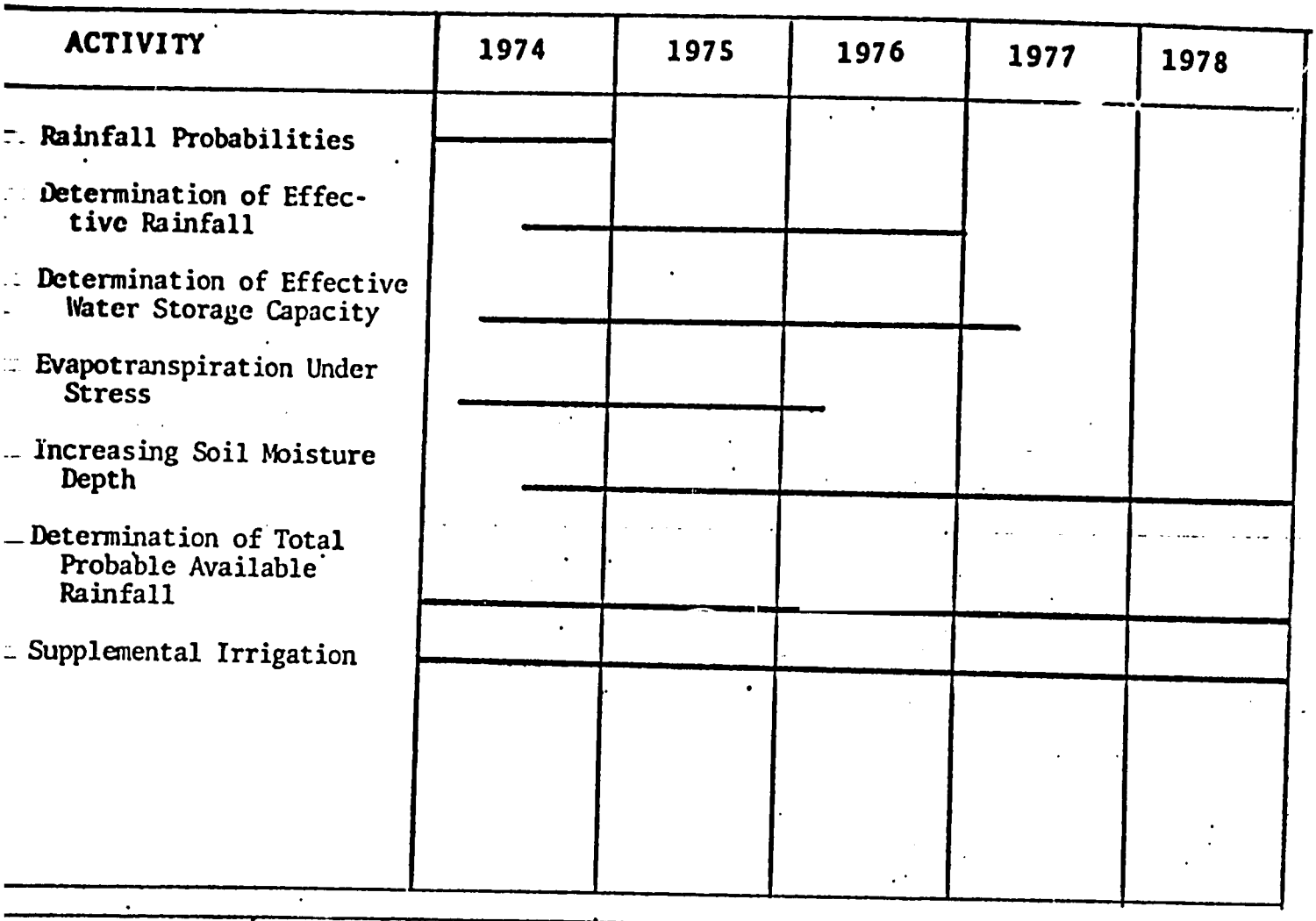
PROGRAM BUDGET FOR THE 12 MONTH PERIOD BEGINNING APRIL 1, 1975 *

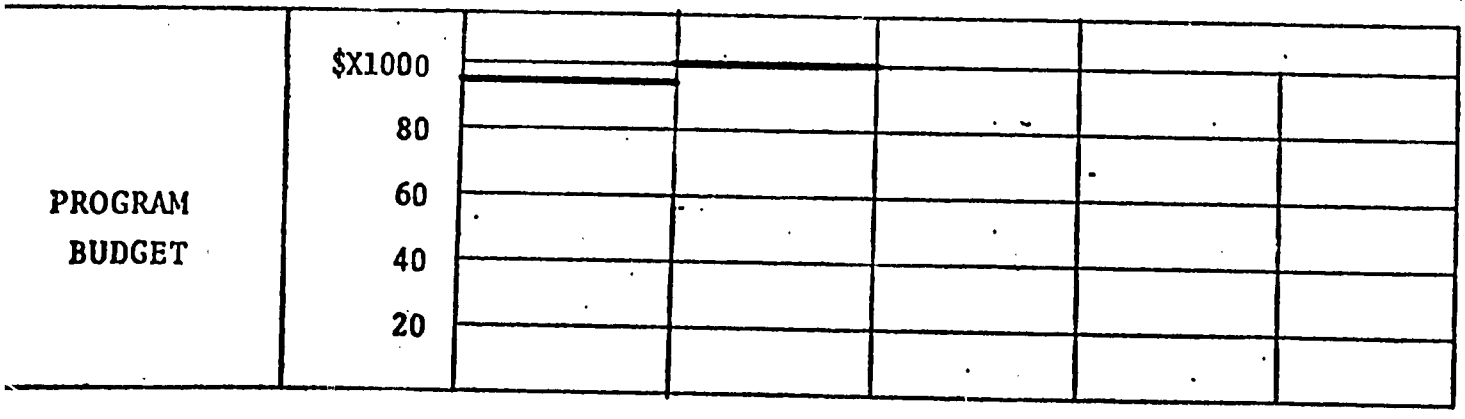
Program No.	Description	Man Months	Salary	Consult	Fringe Benefits	Overhead	Travel	Allowance	Other Direct Costs	Equip Material Supplies	Totals
1	Water Conservation: Determination of Useable Rainfall	33	51,000		8,160	23,300	7,000	7,000	1,500	2,040	100,000
2	Water Conveyance: Irrigation Water Measuring Structure	12	19,000		3,050	11,500	600	600	1,500	3,750	40,000
3	Drainage Research	6	9,300		1,400	4,200	2,000	2,000	300	800	20,000
4	Land Preparation and Grading	10	15,500		2,500	7,100	1,400	1,400	300	800	29,000
5	Water Application: Irrigation Timing and Selection of Method	33	52,200		8,200	24,300	5,000	9,000	2,000	3,300	104,000
6	Integration of Water Use Factors into a Productive Cropping System	50	77,400	3,000	11,800	35,300	8,000	15,000	5,000	14,500	170,000
7	Salinity Control Research	22	35,000		5,400	18,000	1,000	2,500	400	1,700	64,000
8	Institutional Factors: Water Law Facilitators and Inhibitors	9	14,000		2,500	7,400	1,500	1,000	300	1,300	28,000
9	Administration	18	31,000		4,900	18,400	4,000	4,000	1,000	1,700	65,000
	Totals	193	304,400	3,000	47,910	149,500	30,500	42,500	12,300	29,890	620,000

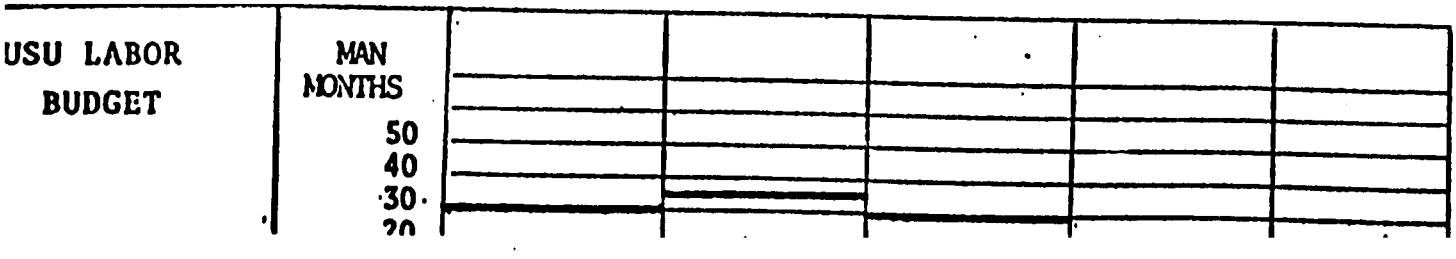
*Socio-economic research will be part of the above activities.

PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 1 - Determination of Useable Rainfall

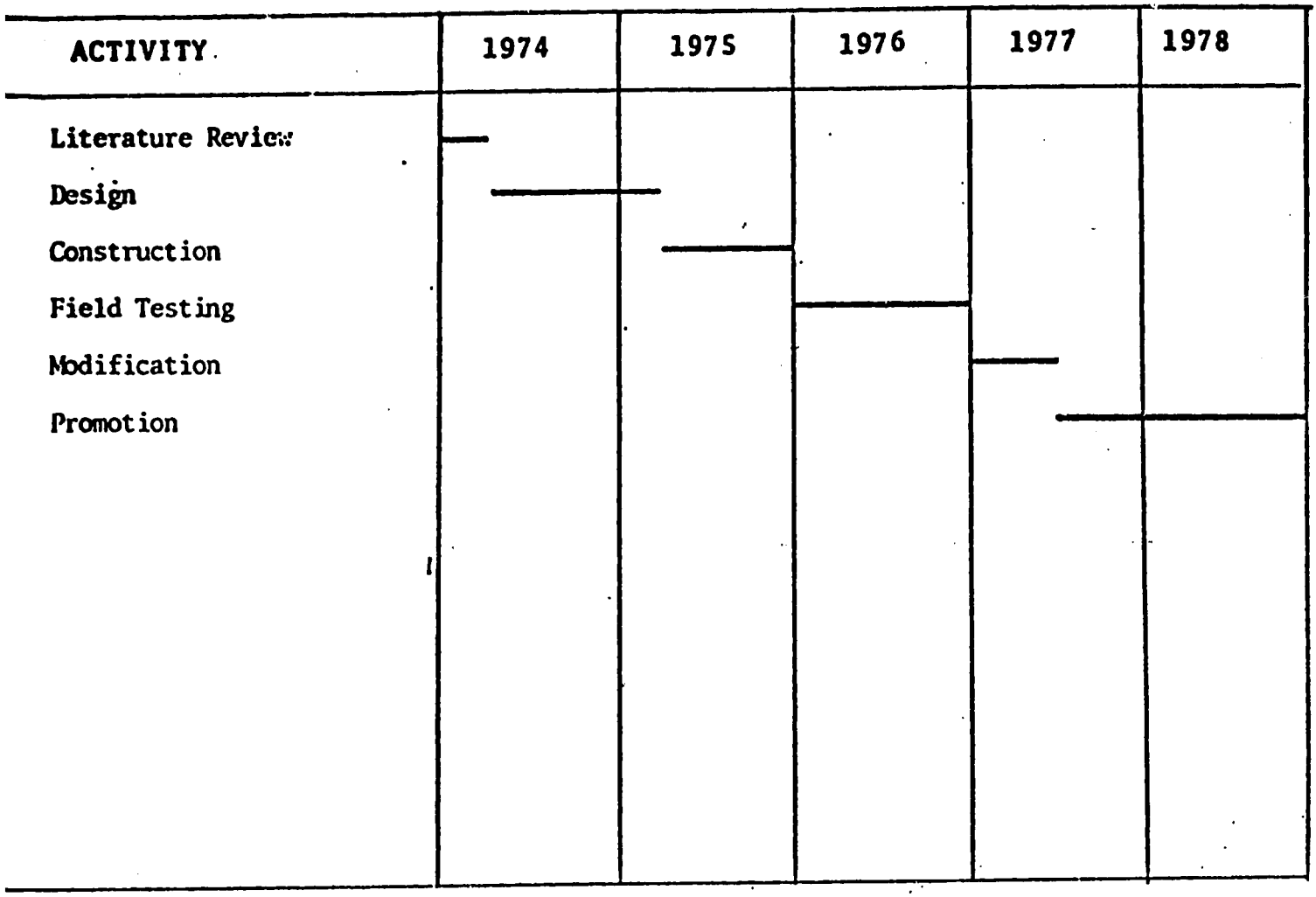


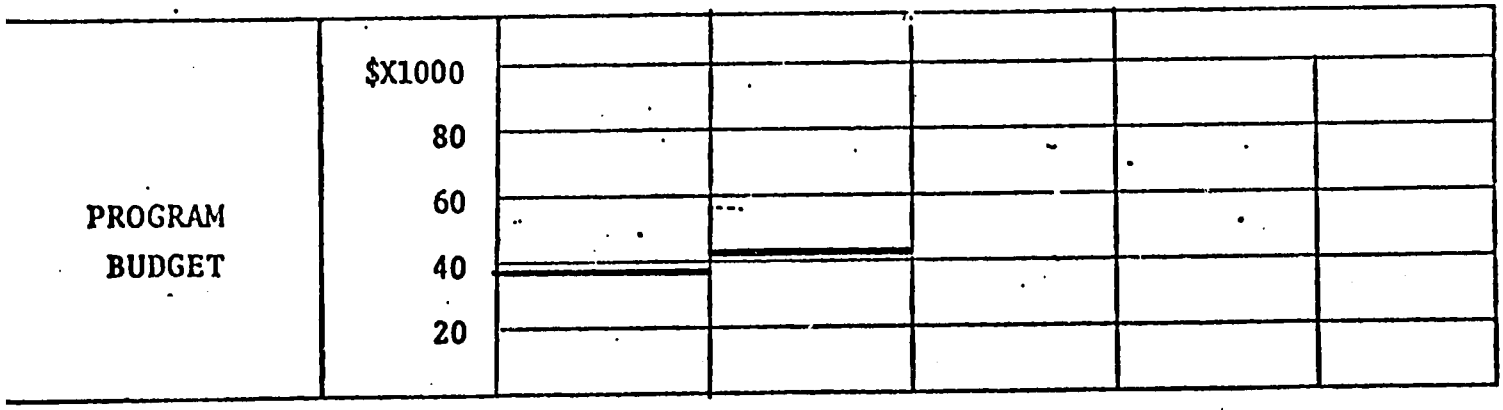


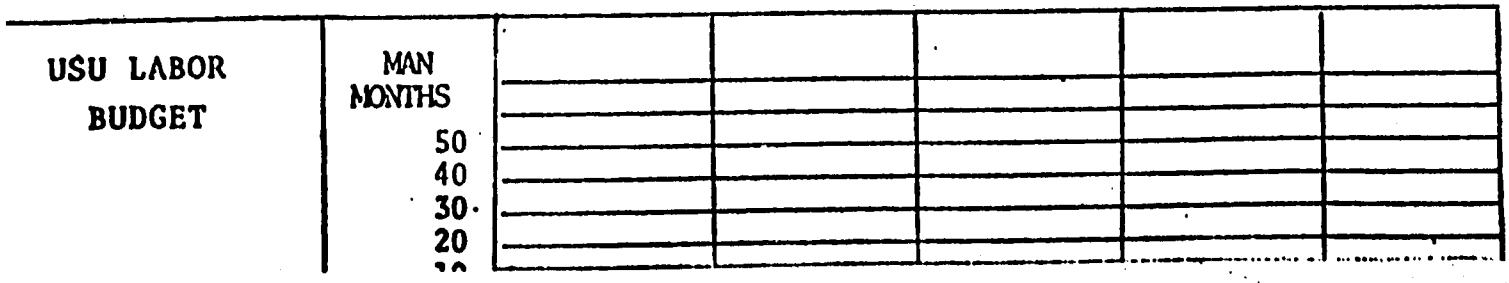


PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 2 · Irrigation Water Measuring Structure







PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 3 - Drainage Research

ACTIVITY	1974	1975	1976	1977	1978
Mole Plows					

PROGRAM BUDGET	$X1000					
	80					
	60					
	40					
	20					

JSU LABOR BUDGET	MAN MONTHS					
	50					
	40					
	30					
	20					
	10					

PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 4 - Land Preparation and Grading

ACTIVITY	1974	1975	1976	1977	1978
- Seed Bed Preparation					
- Grading					

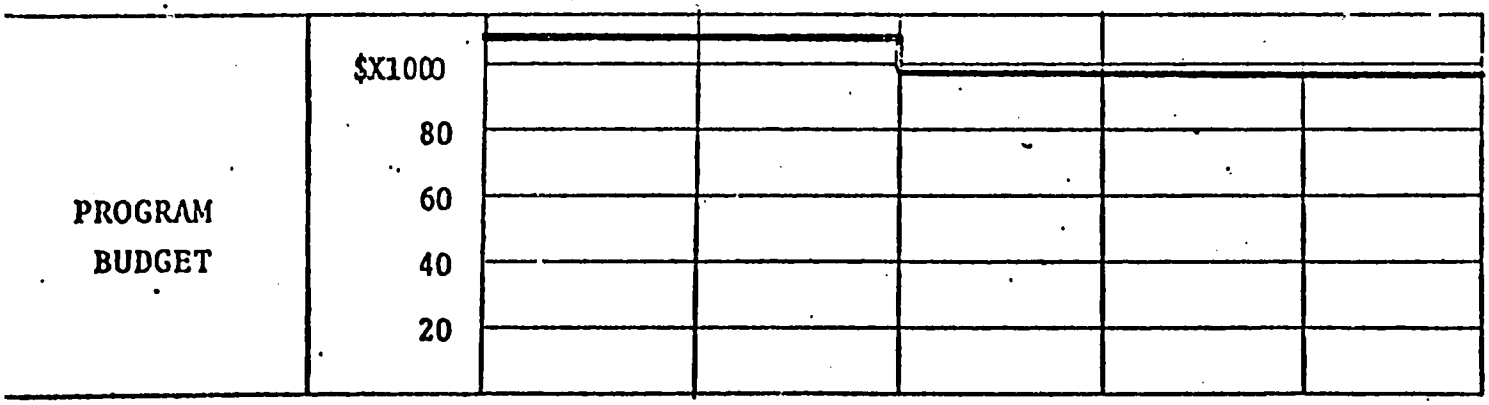
PROGRAM BUDGET	$X1000					
	80					
	60					
	40					
	20					

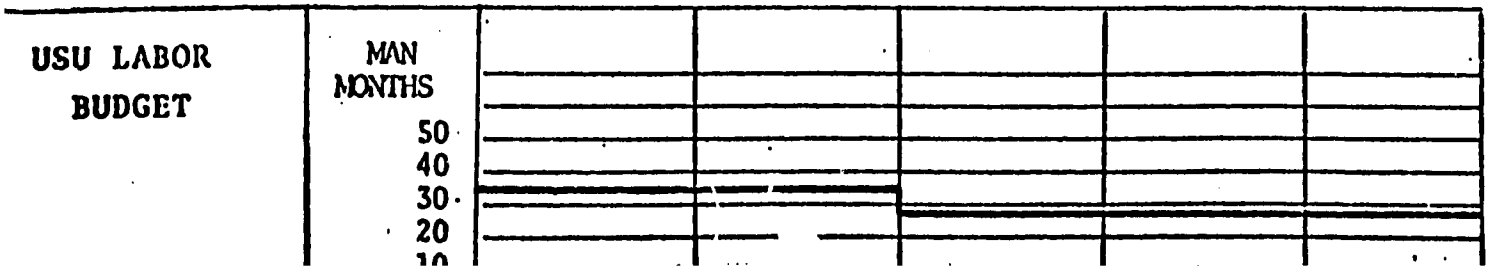
USU LABOR BUDGET	MAN MONTHS					
	50					
	40					
	30					
	20					
	10					

PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 5 - Irrigation Timing and Selection of Method

ACTIVITY	1974	1975	1976	1977	1978
Water Application Efficiency					
How to Irrigate					
Supplemental Irrigation					

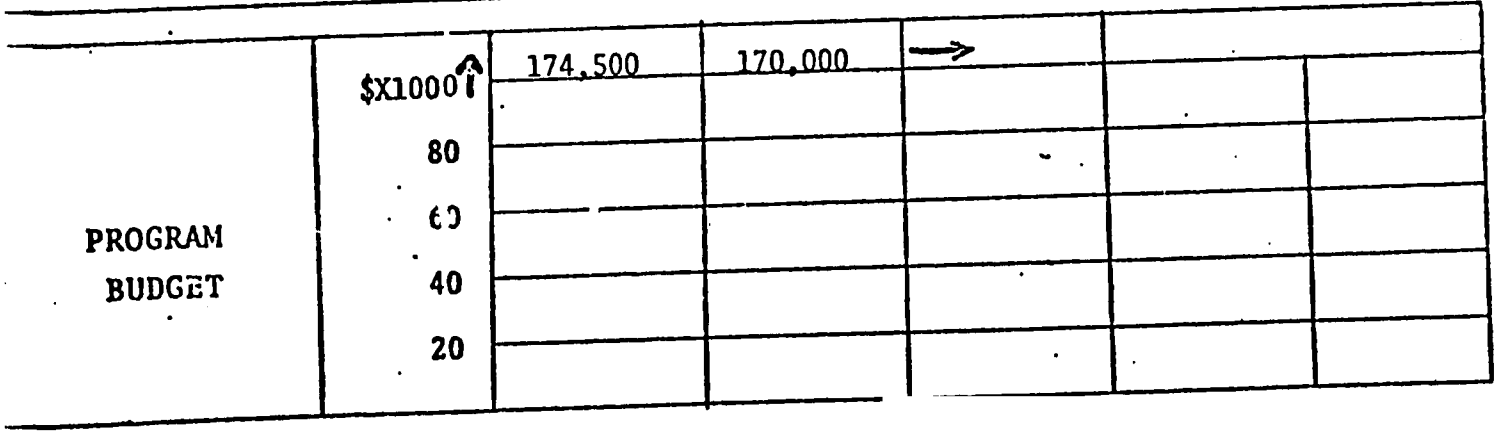


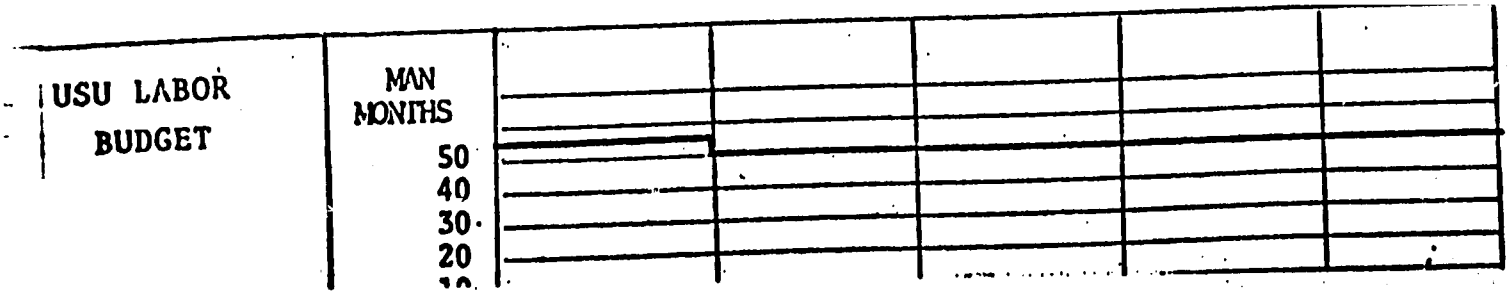


PROGRAM SCHEDULE AND ALLOCATION OF RESOURCES

PROGRAM 6. Integration of Water Use Factors

ACTIVITY	1974	1975	1976	1977	1978
Yield Response Surface Model					
Water-Fertilizer-Crop Variety Studies					
Researching the Methods					

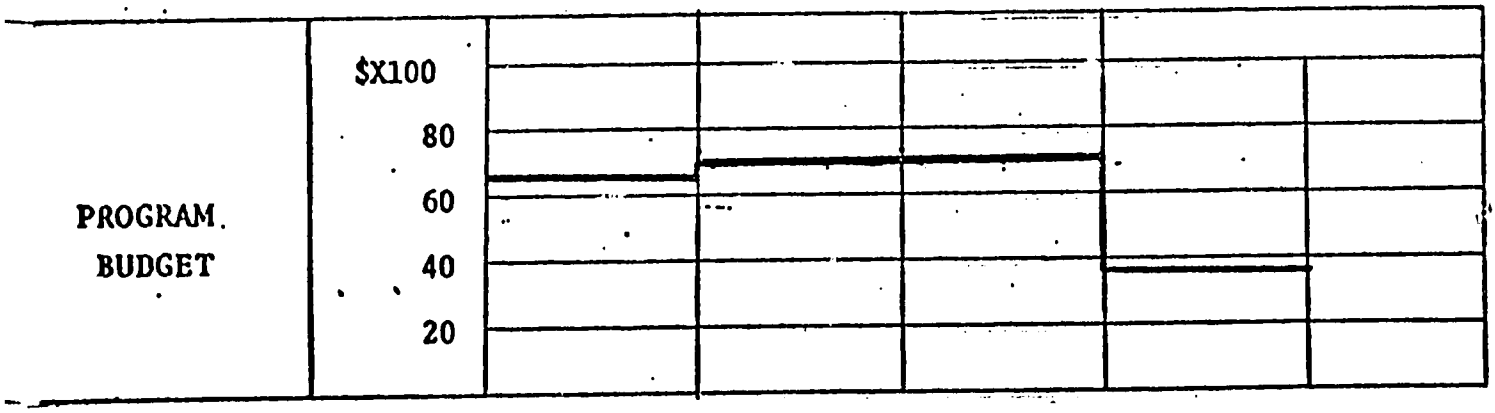


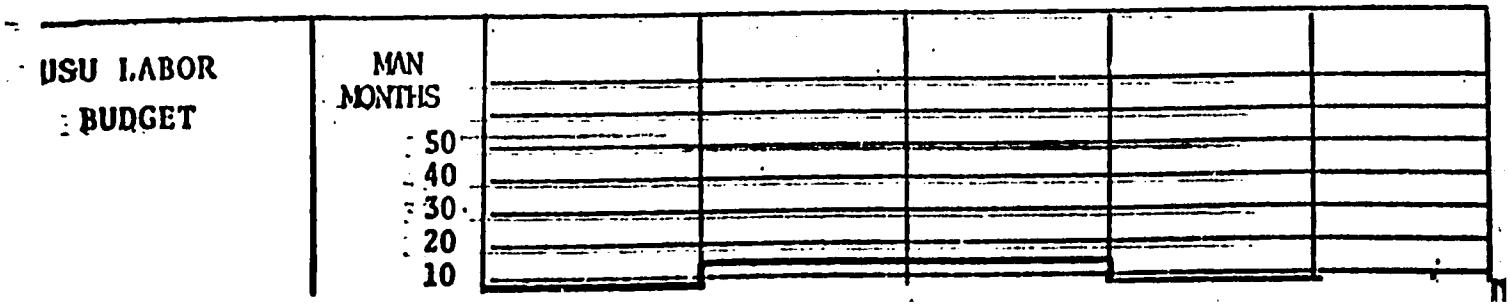


PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 7 - Salinity Control Research

ACTIVITY	1974	1975	1976	1977	1978
Field Research Technology Development for Salinity Control					
Drainage Manual					

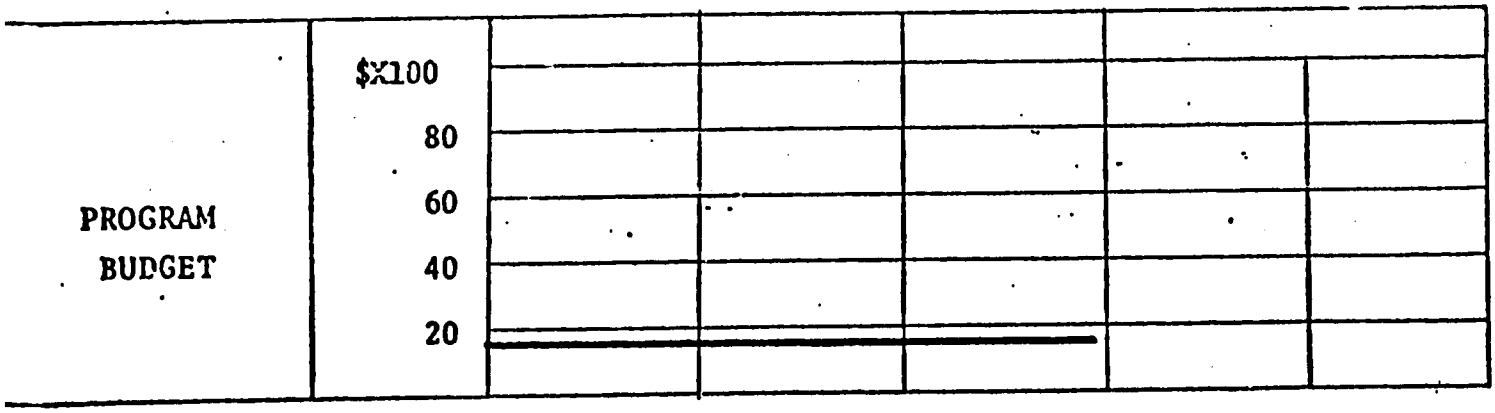


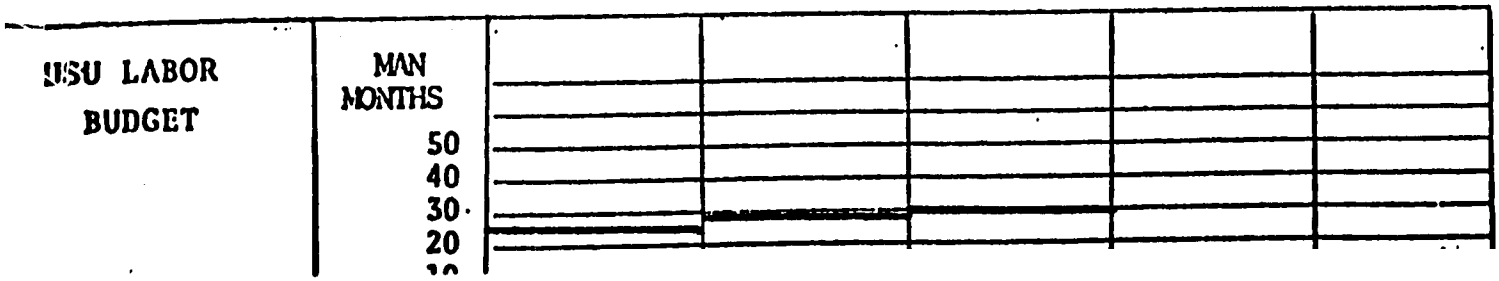


PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 8 - Water Law

ACTIVITY	1974	1975	1976	1977	1978
Central American Study					
Informal Practices					
Evaluation of Facilitators and Inhibitors					

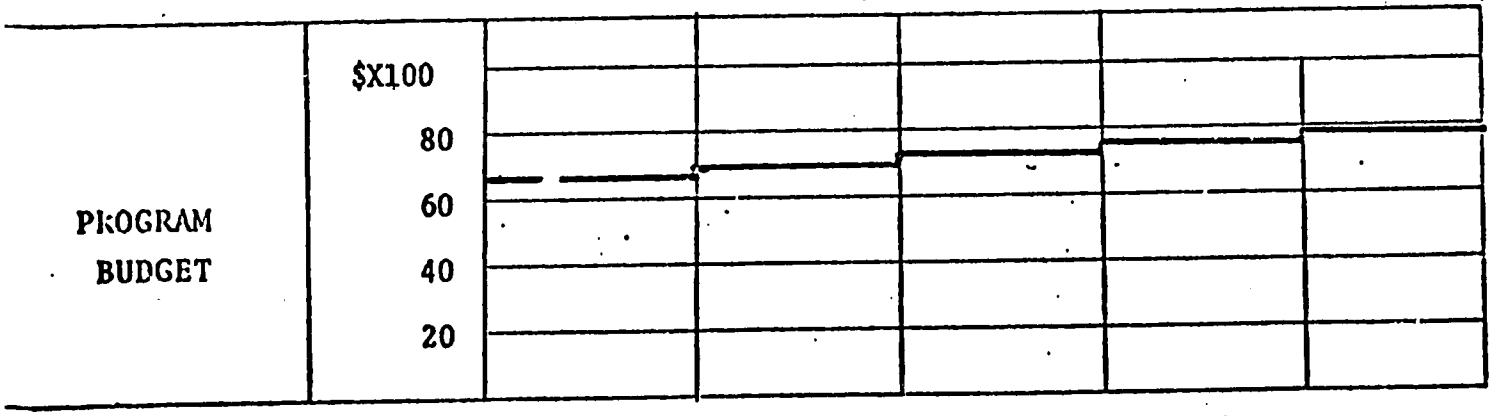


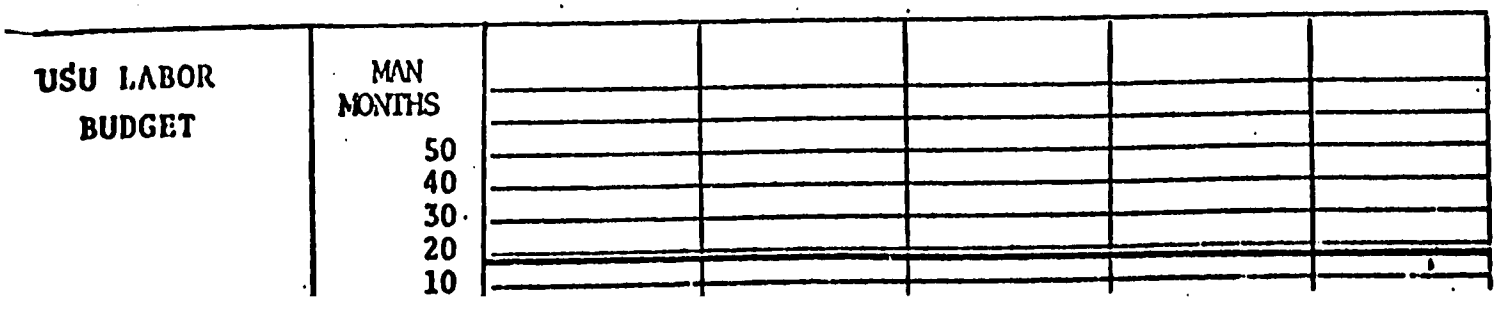


PROGRAM SCHEDULE AND
ALLOCATION OF RESOURCES

PROGRAM 9 - Administration

ACTIVITY	1974	1975	1976	1977	1978
Field Supervision					
Planning					
Programming					
Budgeting					
Personnel Administration					
Liaison					
etc.					





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PROJECT STATEMENT

Date: October 12,1973 32p.

A. PROJECT SUMMARY

1. Statistical

Project Title:	Water Management Research in Arid and Sub-Humid Lands of the Developing Countries --Asia
New or Extension:	Extension - Two Years
Contractor:	Colorado State University Fort Collins, Colorado 80521
Principal Investigators:	W. Doral Kemper, Project Director Gilbert L. Corey, Field Director
Duration:	Current contract - June 1968 to March 1974 Proposed extension - April 1974 to March 1976
Funding to Date:	$2,203,649 - Current contract to 3/31/74
Estimated Additional Cost:	$1,150,000 - Proposed extension to 3/31/76
Funding by Fiscal Years:	1974 - $560,000 1975 - 590,000
Technical Specialist:	A. Alvin Bishop
Alternate:	Donald L. Plucknett

2,203,649.
1150,000
3354.

2. Narrative

This project will expand upon and intensify the ongoing A.I.D./CSU research program (Contract AID/csd-2162). The basic objective to develop research information and scientific expertise in on-farm management and associated farming practices that are applicable to sub-humid areas in developing countries. Due to economies of scale and specialization that could be achieved by pooling the resources of experienced western universities, a consortium of four universities - known as CUSUSWASH[1/] was formed. This organization and A.I.D. have been used to review the project objectives to sharpen and limit the research to deal with increasing the

1/ Council of U.S. Universities on Soil and Water Development in Arid and Sub-Humid areas.

productivity of water and integrate the various components being carried out by Colorado State University and Utah State University to reduce duplication and magnify the transferability of results.

CSU was initially assigned the Near East-South Asia, with Pakistan selected as the study area from which would contribute meaningfully to all arid and sub-humid developing areas of the world. During the initial period of the contract, efforts were directed to on-campus research and establishing a sound basis for linkages with Pakistan agency and university personnel. These linkages were established and a very substantial field research program in Pakistan has been in operation for more than a year with considerable participation by USAID/Pakistan and the GOP.

During the two year extension period, emphasis will be on the sub-humid water management problems typified by the Indus basin irrigation system of Pakistan where ongoing work is making substantial progress. Cooperative studies are also underway at the Cantho University site in the Mekong Delta to provide guidelines for managing water for increased crop production on heavy clay delta soils. The project activity is now substantially in the field. The four man team (two agricultural engineers, an agronomist and an agricultural economist) will be continued in Pakistan and the soil-water advisor will be continued in Vietnam. Technical backstop support will be provided by TDY of CSU staff and relevant on-campus research.

The major irrigation water management problems in Pakistan have been identified. Government of Pakistan and USAID/Mission spokesmen agree that the major bottleneck to improving irrigation efficiency is at the on-farm and terminal watercourse level. The eight specific objectives for the research have been worked out and agreed upon by TA/AGR, CSU and USU. The work at both CSU and USU is directed at these problems. (See Proposal attached Appendix A and Expanded Narrative Statement)

Efforts to help Pakistani scientists solve these problems will focus on on-farm water management constraints. The major inputs will come from the scientists in the CSU field party already on duty in Pakistan. Other scientists in agronomy, civil engineering, sociology, political science, law and the field party counterparts on campus will continue to serve in a supporting role as part of the shift of effort from the campus to the field.

The project extension will continue to focus on the implementation of specific objectives in an in-country effort to solve on-farm water management problems. The field professionals will work closely with host country agency and university personnel. Emphasis will be on an interrelated problem-solving orientation rather than on separate discipline

efforts. While many disciplines will be involved, the key inputs to this process will come primarily from a continuing interaction of CSU and Asian scientists trained in agricultural engineering, agronomy, economics and sociology. In addition, particular expertise in the CUSUSWASH universities will be drawn upon to meet program requirements in host countries.

Many of the water management problems for large areas of agricultural land are typified by the Mekong Delta. Monsoon rains often bring annual flooding of these lands allowing the production of crops such as floating rice but preventing the use of higher yielding varieties and most other crops. During the remainder of the year these lands become dry usually preventing crop production unless irrigation is available. Studies relating to the water management problems of these heavy clay delta soils was started during the past year with a cooperative project involving a large number of interested agencies (see project agreement attached Appendix B). TA/AGR, through its contract with CSU, is supplying one professional for assignment in Vietnam to fulfill its agreement obligation.

B. EXPANDED NARRATIVE STATEMENT

1. Background, Objectives and Progress

The [illegible] proposal [illegible] is a request for extension of the ongoing A.I.D.-funded water management research project at Colorado State University (Contract AID/csd-2162). The nature of the project is specified in detail in the proposal, the contracting documents and in CSU's subsequent annual reports.

a. Background

To accelerate finding practical solutions to pressing water management problems, the Government of Pakistan - some years ago - requested technical assistance from the United States. By agreement, between the U.S. and the Government of Pakistan, it was decided that Colorado State University would provide assistance by supplying a team of scientists who would work with Pakistani institutions on research to improve water management. However, the agreement between A.I.D., CSU, and USU had a broader objective which was to develop through research an increasing fund of information and expertise in water management and associated farming practices which could be applied to sub-humid lands in all developing countries. It was obvious that the broader objective of developing water management principles adapted to the whole range of soil and climatic conditions would be accelerated if all the universities providing water management research assistance to foreign countries pooled their information and coordinated their programs. A formal framework for accomplishing this coordination was established in the form of CUSUSWASH.

In general, CSU will address its efforts to specific needs of the Asian countries and USU to needs of the Latin American countries. However, the physical and socio-economic variables involved in each study will be carefully characterized to increase the extent to which the findings and resulting technology can be transferred successfully to other developing countries. Efficient research plot designs have been studied and adopted in common by the two universities, which will allow direct comparison of yield response surfaces to water and fertilization from the various countries where such studies are in progress. Coordination of studies at the two universities occurs through discussion of research results and plans at least every six months, through exchange of reports, and through joint development of work plans.

Utah State University is in the process of developing models which will eventually provide guidelines for optimizing crop production through management of water and other essential inputs. CSU personnel will participate in testing and refining these models by designing their research to elucidate cause and effect relationships and to obtain carefully characterized correlations between management, climate, soil and yield variables. Planning, on site and evaluative consultation between staffs of the two universities is an integral part of the cooperative development planned for this model.

About 30 million acres of land in the Indus Valley of Pakistan are irrigated by the world's largest irrigation system -- the initial system, initiated 150 years ago, encompassed more land than could be irrigated adequately with water available. The benefits derived per unit of water have been smaller than in most other irrigation systems. The main reason for the low water use efficiencies appears to be the limited amount of technology used by the farmer. As in many of the other arid and sub-humid developing countries, land leveling, ditch lining, and proper location and design of farm ditches and irrigation structures have been incorporated on almost negligible portions of the total system resulting in a small percentage of the diverted water reaching the field.

In many instances irrigation serves only as insurance against complete crop failure. In most of the Pakistan system, proper irrigation combined with good fertilization, cultivation and high yielding varieties has not been used to attain the tremendous production potential available. Part of this failure to adopt new technology is probably due to the limited resources of the farmers, 61 percent of whom farm areas of less than 7.5 acres, operate near the subsistence level, and do not generate much capital for major improvements. However, since water use efficiency is also low on the larger farms, it must be concluded that one or more of the following may apply:

1) The technology from developed countries for increasing water use efficiency has not been adequately adapted and disseminated to prospective users.

2) This technology is not applicable to the physical and socio-economic conditions of the developing country.

3) The farmers have not been convinced that their investment in this technology will bring them a good return.

4) The farmer has not had the technical support, capital, or the credit to initiate the improvements.

To focus on water management problems where future development and control of river basin systems appears to be eminent and feasible, CSU has also embarked on a cooperative field study in the Mekong River Delta.

Some of the world's greatest rivers are still relatively unharnessed with huge quantities of water flowing to the sea and flooding their deltas during monsoon seasons. As the floodwaters leave the confines of the river channel their velocity decreases and the coarser sediments settle out on and near the banks. The finer sediments remain in suspension longer and constitute the major portion of the surface soils which lie some distance away from present river channels.

The flood season often offers opportunities to grow low yielding crops such as floating rice, but the unregulated water depth generally precludes the growth of the new high yielding rice varieties. During the remainder of the year the climate of these river basins and their deltas is often subhumid and growth of crops requires irrigation. Reservoirs in the upper reaches of these rivers have the potential to control the flooding and to supply water during the dry season and for irrigation in the lower deltas to produce electric power. Since the highest photosynthetic potential occurs during the dry season and since water control could allow three crops per year instead of one, water control on these deltas could be one of the world's greatest potentials for increasing food production.

However, the heavy clay surface soils of these deltas have an unstable structure which tends to disintegrate, destroying the larger pores when flood irrigated. The resulting soil has low water and air permeability and is often an unsatisfactory rooting media for upland crops. Drying of the sulphate portions of these deltas increases the acidity of the soils to points not tolerated by crops. Consequently, there is an urgent need to evaluate water management technologies and cropping systems to select those which are best adapted to heavy clay soils.

Realizing this need, the Regional Economic Development Office of AID/-Bangkok, USAID/Saigon, TA/AGR, The Mekong Committee and Agencies of the Government of South Vietnam developed a "Memorandum of Understanding" (See Appendix B) supporting a research program at Can Tho University in the Mekong Delta to obtain the desired information. Colorado State University in accord with their Contract with AID are supplying a water management adviser to this project, who was stationed at Can Tho University in June of 1973. A tropical soils adviser will be furnished at a later date by the University of Hawaii. The director and many of the staff for the project will be drawn from Can Tho University.

b. Objectives

The basic general objective of the ongoing research effort has been to increase food production in the arid and sub-humid lands of the developing countries. Health, nutrition and productive human energy are all related to the food people eat. Increased quantity and better quality food are possible through improvement of on-farm water management practices and the integration of these with other applicable management and cultural systems. The research has been directed to on-farm water management problems of arid and sub-humid land, with the research findings being applicable in principle to other developing countries with similar environmental conditions. The improvement of water management practices is a necessary condition to obtaining optimum economic returns from limited available water resources and from such inputs as manpower, improved seeds, increased use of fertilizers and pesticides, and modifications in the legal and associated institutional structures governing irrigated agricultural production in these developing Asian countries.

"The following set of specific objectives was designed to solve the water management problems which AID, USU and CSU have observed as being in the primary constraints on efficient water use and crop production in developing countries."

1. Development of knowledge and data on how best to conserve and utilize water falling on the land as rain and the most efficient means of supplementing needed soil moisture by limited amount of irrigation water.

2. Development of knowledge and data that can be used for the economic design and construction of water conveyance and delivery systems including structures for control and measurement of irrigation water.

3. Development of surface and subsurface water removal systems to minimize the hazards resulting from surface flooding and high water tables.

4. Identification of important factors to be considered in land preparation and leveling of the various irrigated soils in the major climatic zones and the relationship of these factors to water management, erosion, water infiltration, and good land use and cropping practices.

5. Development and adaptation of methods of water application, including time and amounts, which are suitable and efficient for different soils of varying physical properties (water-holding capacities, intake rates, etc.) with major crops.

6. Integration of these water-use factors into productive cropping systems consistent with farm size and available farming practices.

7. Where water quality, soil salinity and exchangeable sodium are problems, means will be developed for increasing crop production by using amendments and management practices which will improve water and soil properties and by using salt-tolerant crops.

8. The identification of institutional and policy factors (legal, social, economic, religious, manpower, credit, education, etc.) which influence efficient distribution, management and utilization of water on the farm level.

Emphasis of the CSU studies in Pakistan is primarily on objectives 2, 3, 4, 5, 6, 7, and 8. The CSU Vietnam studies contribute primarily to objectives 3, 5, and 6.

c. Progress to Date

The research to date has been aimed at a number of the components of the many faceted water management problem. Because of the constraints most of the early research was conducted on campus but in the past 18 months extensive field research has gotten under way. The emphasis and significant results have been concerned with three broad areas as follows:

1. Diagnosis of Problems

Surveys and studies conducted by CSU cooperators in Pakistan have identified the following problems: (a) inadequately designed and maintained watercourses are responsible for losses of from 10 to 30% of the irrigation water taken out of the canals for specific fields; (b) in many cases, most of the water applied in the field is passing through the root zone rather than being used by the crops due to irregular soil surfaces and inadequate knowledge of the crop needs and water delivery rates; (c) in slowly permeable soils irrigation water often stands on the surface for from one to five days, resulting in excessive evaporation losses and sealing the surface against entry of oxygen to the root zone; (d) the units of increased production per unit of water used are known to be considerabley greater for Mexipak wheat irrigated at tillering than for irrigations at other growth stages but the present irrigation and cropping systems do not allow the farmer to take full advantage of this water management possibility; (e) low recovery rates of fertilizer nitrogen are common for summer crops on basin flooded plots in Pakistan compared to recovery rates on furrow irrigated plots in the U.S.; (f) poor stands of summer crops are common and often due to inadequate water for germination, impenetrable crusting, or salinity; (g) salinity of groundwater

from a tubewell often increases with continued pumping to the level where the water is hazardous for crop production; (h) continuing increases in rural population accentuate the need for water management technology which will lead to more intensive agriculture and more productive employment opportunities; (i) many of the potential benefits derivable from improved water management require flexibility in timing of water and maintenance of water courses which are not available within the present irrigation rules and water user associations.

2. Development of New Technology or New Practices

In this area of research, the soils and crops have been studied to obtain data on the chemical, mineralogical and fertility status of the soils. Soil samples collected in Pakistan were analyzed at CSU. Permeability, moisture retention and the relationships between fertility and salinity have been studied. It has been found that application of phosphorus will overcome some of the depressing effects of salinity.

A mathematical model and computer program were developed to account for the effect of bicarbonate and other ions on the Na/Ca ratio of irrigation water equilibrated with calcareous soils, which improves guidelines for determining whether these waters should be used.

Dissolution rates, as water passes through beds of gypsum fragments have been determined as a function of flow rate, fragment size and ion content of the initial water. This data shows the feasibility of applying gypsum to fields by passing irrigation water through enlarged sections of the watercourse containing pit run gypsum, thereby avoiding crushing costs which can be over 40% of the total cost of gypsum in Pakistan.

Wetting slowly under capillarity has been shown to retain more large size pores in soil and to reduce the crust strength of soil as compared to soils brought quickly to saturation. This finding identifies furrow irrigation, in place of basin flooding, as a means for maintaining better structure, aeration and rooting media for crops.

On-campus studies of engineering structures for control or management of sediment in irrigation canals; techniques to maintain water quality and reduce salinity; and skimming wells to recover the fresh water overlying the salt water of many aquifers in Pakistan are now ready for detailed and extensive field testing. The full development of the groundwater resource and the necessary conjunctive use of groundwater and surface water will be facilitated if the skimming well is successful.

Field studies of land leveling and watercourse improvement are underway. One year's data from the land leveling plots indicate more uniform stands and substantially higher yields on the leveled lands.

Methods for producing social change by economic incentive or by removal of constraints are also being researched by CSU both on campus and in the field.

3. Implementation and Evaluation of New Technology

Interdisciplinary research in this area has been directed to the activities required to implement solutions to water management problems, and in addition to identify the constraints in implementing the new practices. An educational and training film on land leveling has been developed as a part of the activity. Interdisciplinary research is also directed toward improving human and institutional capabilities for adopting technological change.

Cooperative agreements have been developed which allow the planned and supervised improvements of five watercourses. Watercourse lining and realignment and land leveling will be introduced on a practical scale, facilitating identification and solution of practical field scale and socio-economic problems, and evaluation of benefit/cost ratios. These improved watercourses will then serve as large scale study units on which promising new water management technologies can be tested against traditional technology optimum under conditions of reasonable water supply and leveled land.

Economic analyses on the water courses have been planned to evaluate the research results before introducing the new technology to additional areas.

To date the research has produced a number of publications and special reports as shown in Appendix A.

2. Significance to A.I.D. Objectives

A.I.D. resources are being concentrated on a limited number of priority development problems -- one of these key problem areas of concentration is "Management of Soils and Water." In irrigated areas, improvement of the water management capability on the farm through adoption of modern irrigation application and scheduling techniques has immediate pay-off in the developing countries. It will generate more productive employment

for the farmer and provide employment opportunities for local labor. Undoubtedly this will have a positive impact on the quality of life for the landless laborers, subsistence level farmers and village artisans who are among the most underemployed groups in developing countries. Lacking is the technical manpower which must be trained for the task. Improving water management on the extensive areas now irrigated has tremendous potential in improving uniformity and density of crops and yields, as well as increasing yield per unit of available water. This is translated into more food of better quality for the health, nutrition and energy requirements of the low income farmers.

The significance of this project is that its successful implementation will not only increase food production with the associated health, nutrition and energy implications but will develop techniques and procedures which can be applied in other areas of the world. Accomplishments of this project, when transferred to other areas, will make possible the utilization of A.I.D. resources at an accelerated rate.

3. Relation to Existing Knowledge

The researchers are well aware of the vast storehouse of knowledge related to water management produced and practiced primarily in the developed countries. Recent advances in the science have placed the developing countries at a greater disadvantage but also have increased their potential. Therefore, the primary thrust will continue to be toward adapting the new knowledge to the problems common to the developing countries (adaptive research). The existing knowledge of water scheduling, methods of water application, conjunctive use of ground and surface water, proper amount and timing, land forming, watercourse improvement and many other practices and problems must be studied in relation to their applicability and acceptability (physical, social, economic, etc.). The studies are certain to yield data that will more clearly define the production function for various crops (yield vs. water and fertilizer) and thus fill a known deficiency in the existing knowledge base. The developing country also will benefit from the greatly increased production made possible by better utilization of the water resource.

4. Relation to Other Research

A close cooperating relationship in water management research has been established with the other universities involved in CUSUSWASH, particularly with Utah State University. Specific examples of the spinoff effect of the CSU research project in relation to other research include the following: a) Synergistic relationships with Utah State University; b) encouragement of researchers at Pakistan Agricultural University to develop their latent research potential; c) complementary research with FAO and the

and the United Nations regarding law and related institutions. These examples are presented in brief form below:

a. Synergistic Relationships with Utah State University

Water management researchers from the two institutions maintain continuing contact on research matters concerning all developing countries. The researchers meet twice a year at regularly scheduled intervals to give formal presentations with regard to water management research activities and accomplishments at home and abroad. In addition, individuals and committees meet more frequently on specific mutual problems. USU research activities in Latin America have involved not only arid and sub-humid areas but in addition they have accumulated significant data on crop response and other related information from humid areas. These latter data will be of particular value to researchers if CSU moves into consideration of water management problems in the more humid countries in Asia.

While each University operates in different geographic areas of the world - making joint analysis with the country of needs and requirements, establishes its own set of objectives and work priorities, and functions under a contract agreement with A.I.D., an increasing amount of research data, papers and reports are being exchanged. Detailed face-to-face discussions between University scientists on intricate research topics have begun to bear fruit. Increased exchange of scientific and research information concerning water management research will be coordinated with each University to the most meaningful extent. Researchers at the two Universities are coordinating their efforts and presently exchanging research results on the following:

1) Groundwater Recovery

Theory and models have been developed and tested for recovering the best quality water in both South America and Pakistan where percolated fresh water overlies highly saline water.

2) Evapotranspiration

USU has developed and refined equations to give better prediction of water use by plants in South America. CSU plans to test these equations to determine their precision and practical use in Asian countries.

3) Crop Responses to Water and Fertilizer

Much research at different geographical locations, under different climatic and soils conditions, and with different research designs, is being carried out by both Universities. Consequently, it is presently difficult to compare results. However, standard designs -

resulting from evaluations of the various designs used - are now being adopted in order that crop responses to water and fertilizer may be more readily compared, and cost minimized without losing statistical and economic significance, regardless of the location of the research.

The USU team is doing what is best characterized as refining the techniques for field experiments aimed at developing water-nutrient response surfaces. Initial research should have sufficiently precise data to give rather explicit pictures of response curves from which researchers can then determine the best functional forms for economic analysis of data for Pakistan and other Asian countries that may be involved in the extended phase of the project.

4) Furrow Irrigation

USU researchers working in the Aconcagua Valley of Chile found that furrow irrigation and associated fertilization and seeding in ridges practically doubled yields for acceptors of this technology. Political factors led to evacuation of this research team, but CSU researchers, aware of this work, are implementing this technology on watercourses in Pakistan. They are also determining the improved soil structure and decreased NO_3 leaching derived from furrow irrigation in laboratory studies to decide whether deep furrow irrigation is one of the best possibilities for handling water in heavy clay soils.

5) Water Law Legislation and Water Use Organizations

Attached in Appendix A is a description of the legal studies being conducted which are designed to identify, compile and analyze the water laws and administrative institutions and procedures for the allocation, distribution and control of water resources in Pakistan and the Andean Pact countries.

In summary, the potential exists for further increasing collaboration in water resources management research between the two Universities. The results of such collaboration during the next two-year period will lead to the publishing of water and soils management manuals; completion of specific research data with published conclusions; a more motivated and oriented institutional building program; better facilities and research data for training of developing country scientists for specialized water management research tasks in their home country; establishing and maintaining stronger linkages with developing countries through improving their competence and confidence in this field; and finally, improving the image of the United States by helping developing countries reach a level in water resource development and management where they can carry on themselves.

b. Encouragement of Researchers at Pakistan Agricultural University

Periodic visits to the University of Agriculture, Lyalpur campus by CSU on-campus researchers have provided numerous opportunities to enhance the latent research potential in a number of their departments that have relevance in water management research. The greatest degree of interaction between researchers at the two respective universities has been developed between the Departments of Economics and Sociology faculties. The Lyalpur faculty is divided into five separate departments: 1) Agricultural Economics; 2) Rural Sociology; 3) Farm Management; 4) Agricultural Marketing; and 5) Cooperative and Credit. Dr. Haider Ali Chaudhry, a rural sociologist by training, serves as Dean of the Faculty.

After several years of staff development, primarily through overseas graduate training, this Faculty now constitutes the best single resource for agricultural economics education in Pakistan. Several problems, such as excessive teaching loads and a shortage of research funds, reduce its preeminence in the area of agricultural economics research. Nonetheless, even where research is concerned, this Faculty stands among the leaders in its field in Pakistan. The Faculty has ten agricultural economists and several sociologists in addition to the Dean, who holds a Ph.D. degree.

c. Complementary Research with FAO and the United Nations

The Legislative Branch of FAO under the direction of Dr. Danti Caponera is engaged in water legislation research policy formulation, systems descriptions, and information dissemination through seminars, publications, and short-term consulting trips. Recently, FAO has revised and republished "Water Laws in Moslem Countries" by Caponera published originally in 1954. The research at CSU on Pakistani water laws is of mutual interest and benefit to both institutions and complementary cooperation has been established. Dr. Radosevich will complete a one year assignment with the United Nations soon and return to CSU to continue this research.

A similar relationship exists between CSU and the Water Resources Sections, Water and Transport Division of the U.N. Secretariat. The Section likewise is engaged in dissemination of materials and providing assistance on water legislation and institutions. The Section, through UNDP projects and through direct requests, assists over 20 nations with water policy and code formulation. The work of the consortium through the related and joint efforts of CSU and USU researchers is complementary to the efforts of the U.S., and exchange of information and materials continues to be of mutual advantage.

5. Proposed Work Plan

a. Scope of Work

Studies of the CSU Team, their cooperators and other Pakistani water management researchers have identified several water management technologies as having potentially high cost benefit ratios in Pakistan. These include water course improvement; land leveling; tailoring water applications to meet plant needs and soil capacity; furrow irrigation for better stands; better soil structure; improved fertilizer use and better oxygen supply to plant roots; achieving better quality and more timely water by small, properly designed "skimming wells"; and amendments and cultural techniques to permit the use of saline and sodic waters.

Many of these technologies are sufficiently well developed to warrant testing and evaluation under actual watercourse and farm conditions. Realizing this, the USAID Mission in Pakistan was given support to the development of two project agreements wherein field scale and socio-economic factors can be evaluated. They are the MONA Proposal and the SHADAB Proposal. The details of these two endeavors are outlined in Appendix A pg. 7 and 8. In addition, the CSU Team in Pakistan and the backstop support on the CSU Campus at Ft. Collins will continue to conduct research and field trial experiments to refine the technology of the afore-mentioned list of water management factors. The details of this proposed work is found on pg. 10 through 38 of Appendix A.

One soil scientist has been working at Can Tho University in the Mekong River Delta. A cooperative agreement has been developed to cover this research on management of the heavy clay delta soils (See Appendix B).

b. Program of Work

Appendix A, "Summary Schedule of Ongoing and Proposed Research" pp. 67-74, shows the program of activities to be undertaken during FY 74-75 and FY 75-76 of the project. As shown in the table, a substantial research effort is going forward in Pakistan and an essential supporting program is underway on campus. In addition, a moderate beginning has been initiated in Vietnam which will be continued. The table identifies the major elements of the work along with the intended level of effort. The detailed program of activities is contained in the contractors proposal (Appendix A).

6. Research Methodology

The research methods to be employed by the contractor have been developed jointly by CSU, USU, TA/AGR, USAIDs and the cooperating institutions of the countries involved. The annual CUSUSWASH reviews have provided inputs from other western universities so that a full scale coordinated research program is in progress. The details and methods being used by the contractor are described in the proposal (Appendix A) and the annual reports.

7. Researcher Competence

The high level of training, experience and overall competence of the CSU project participants has already been documented in detail in previous project reports. Relatively recent additions to the group of project participants, who have assumed major areas of responsibility, include the following: D. W. Kemper (Project Director), D. B. McWhorter (CSU Project Investigator in Agricultural Engineering), R. L. Tinnermeier (CSU Project Investigator in Economics), G. E. Radosevich (CSU Project Investigator in Law/Economics), C. DeMooey (CSU/Pakistan Field Party - Agronomy), W. Clyma (CSU/Pakistan Field Party - Agricultural Engineering), J. Eckert (CSU/Pakistan Field Party - Economics) and Sidney A. Bowers (CSU/Vietnam - Advisor in Water Management for Cooperative Heavy Clay Soils Project).

8. Contribution to Institution Building

Under this contract there has been close collaboration with host country institutions, agencies and personnel -- with the purpose of upgrading the institutions and leaving a permanent impact. The project has contact with practically all Pakistani agencies which have interest in irrigation water uses; project personnel have acted as advisors on the agencies' research and operational programs. Formal agreements have been developed as needs arose. Agencies and Institutions with which CSU has made useful contact through the project include:

Sind Agricultural University -- Tandojam
University of Punjab -- Lahore
Northwest Agricultural University -- Peshawar
Soil Conservation Service -- Rawalpindi
Atomic Energy Commission -- Karachi and Lyallpur
Rapid Soil Fertility -- Lahore
Water and Soils Investigation Division, WAPDA -- Lahore
Department of Agriculture, Sind -- Karachi
Department of Agriculture, Baluchistan -- Quetta

Department of Agriculture, Northwest -- Peshawar
Agricultural Research Institutes -- Quetta, Tandojam, Multan and Tarnab
National Institutes of Public Administration -- Lahore, Karachi
Pakistan Academy for Rural Development
Board of Revenue -- Lahore
Irrigation Department -- Lahore
Public Works Department -- Peshawar

Through project agreements, presently in force, working linkages and areas of cooperation have been established with those institutions listed below:

a. MONA Reclamation Project, WAPDA (Water and Power Development Agency)

To design, construct and evaluate various improved watercourses, i.e. pipeline, masonry lined, plastic lined, soil cement lined.

b. SHADAB Integrated Rural Development Project, Department of Agriculture, Punjab

c. Punjab Agricultural Research Institute, Lyallpur (Department of Agriculture, Punjab)

To cooperatively do research on effects of water quality on water requirements and crop production.

d. Directorate of Agricultural Engineering, Lyallpur (Department of Agriculture, Punjab)

To assist with Water Management demonstration plots on Machinery Demonstration Unit farm.

e. University of Agriculture, Lyallpur
(Department of Education, Punjab)

To cooperatively do research on social and economic aspects of on-farm water management -- Faculty of Agricultural Engineering.

To advise and cooperate on water-soil relations research -- Department of Soils

f. Irrigation, Drainage and Flood Control Research Council

g. Cantho University, Vietnam, et al

To determine best water management techniques and cropping sequences for optimizing crop production on heavy clay delta soils.

After establishing working relationships with most of the agencies working on water management in Pakistan, CSU took the leadership in organizing a Pakistan National Seminar to determine research priorities. The seminar was held in January 1973 and brought together for the first time most of the leading Pakistani scientists involved in water management; about one hundred forty people were in attendance. Priorities for research were discussed and scientists became acquainted with researchers and their work at institutions other than their own. The National Agricultural Research Council considered that the seminar was so productive that they expect to sponsor it as an annual event.

9. Utilization Plans

Increased attention is being given to utilization of research results and transfers in the field. TA/AGR, CSU, and USU have jointly planned for utilization and transfer mechanisms. Plans include systemization of data gathering to increase its transferability, seminars and workshops to disseminate the information in addition to the usual published reports.

Utilization of project production in an LDC is difficult to evaluate. There are generally many secondary benefits which tend to go unnoticed and are not enumerated. To consider only transfer to technologies resulting from research per se would be to omit a great portion of a successful program in a developing nation. To be successful such programs must be developed gradually with country support. However, the ultimate accolade which any developing country can bestow on a research endeavor is to clamor for its techniques and utilize its findings.

There has been a revolution in Pakistan relative to emphasis in improving on-farm water management. This has occured essentially during the past 18 months. Pakistan is moving fast, one might say almost recklessly, in adopting some of the concepts CSU has been promoting. For example:

a. The President of Pakistan appointed a high level engineering team to study water management and make recommendations relative to important programs. The CSU Team has been consulted by members of this Committee. High on the priority list of recommendations by the Committee are land leveling, watercourse rehabilitation, and on-farm water management.

b. A tube well promotion scheme has been inaugurated by the Government and now the Government has decided to promote small tube wells to lower water tables in saline areas.

c. A national effort is being promoted in precision land leveling. Two provinces are developing programs with USAID and SCS Teams from the United States to establish training centers to teach precision land leveling techniques.

d. The Integrated Rural Development Program - Punjab has received funding for an experimental program to test the feasibility of water course lining. Plans call for the brick lining of 150 miles of water courses in 15 districts. Farmers are cooperating by providing labor and some of them are acting as contractors for construction. The plans and discussions which led to this program were definitely influenced by the CSU Team.

e. The Agricultural Research Council has published the recommendations developed at the CSU sponsored Water Management Seminar. Practically all research agencies are now conscious of the necessity for better water and soil moisture measurements. Personnel at eight research locations have requested assistance and made efforts at measuring water and soil moisture to make their research more quantitative. Personnel at five locations have received training and practical experience on the evaluation of existing irrigation systems and practices needed to increase water use effectiveness.

f. As a result of CSU input, research agencies at seven locations are preparing to look into the interaction of soil fertility and other agronomic factors with soil moisture variables. At two locations field trials have been initiated, even before funds have been made available.

Certainly not all the above listed developments can be credited solely to the CSU project in Pakistan. The USAID Mission has cooperated closely with the program and fortunately the time was exactly correct to develop such endeavors. However, the current emphasis and enthusiasm within the Government of Pakistan will wane unless research keeps pace and defines limits and quantifies cost/benefit ratios on the various technologies being adopted.

10. Budget Analysis

CSU, with A.I.D. support, has invested heavily in obtaining the services of high level scientists for work in the field and maintaining a highly interested and motivated on-campus staff and faculty group backstopping the technical research work in Pakistan, as well as conducting much of the formal training of Pakistani students, officials,

and others. Thus at this point of time, TA/AGR feels the project is off the pad and in orbit. The payoff in research results promises to be great and should compensate for any loss of time suffered in the past. Add to this payoff the potential which exists for a far greater water resources research collaboration between CSU and USU.

However, to capitalize on AID/Washington, CSU and Mission investments, it will be necessary to carry on the project for an additional two-year period. A detailed budget for the two years is given in Appendix A. The general budget for the two-year extension is also shown in Appendix A giving the rupee support by the Mission.

The estimated man-months used in developing the budget is shown in Appendix A, "Estimated Man Months on this Water Management Research" pg. 61, prepared by CSU. This Table indicates that the present level of effort by CSU in the field amounts to more than 60 man-months/year supported by about 22 man-months of host country time for each man-month supplied by CSU. This will increase slightly for FY-76.

11. Internal and External Reviews

Progress under the current project has been reviewed several times by TA/AGR and by RIGC and RAC. In January of 1972 a special committee conducted an intensive review of this project and the companion USU activity. In November 1972 the project was reviewed by RIGC and approval for an additional three years was recommended (See RIGC Minutes 11/13/72). The project was reviewed by RAC in January of 1973 (See RAC Minutes Jan. 8-9, 1973) and approved for one year subject to provisions which have been complied with as follows:

a. Project activity has been shifted substantially from campus to Pakistan.

b. A new proposal has been developed.

c. Field reviews have been conducted by TA/AGR and the USAID/Pakistan. In addition, TA/AGR has made a substantial investment in reviewing the entire water management research program of A.I.D. with a workshop and a symposium.

d. CUSUSWASH and especially USU were intimately involved in planning the research.

The proposal for a two-year extension of this contract was reviewed within TA/AGR. The draft proposal was circulated to regional bureau agriculturalists for review and comment. Resulting comments were constructive and generally favorable. Most of the suggestions have been incorporated into the revised proposal.

12. Proposing Office General Evaluation

The proposing office, USAID/Pakistan and USAID/Vietnam rate this project as of the highest priority. Considerable changes have taken place in the past year. Five full-time scientists are now in the field supported by TDY from campus. A full-time project director has given extra efforts to improving the project along the lines suggested by internal reviews and RAC. Cooperative arrangements between USAID/Pakistan, Pakistani institutions, and CSU are extremely good. The Mission is contributing to local costs and program planning and is developing major Mission programs based on the research activities. Rupee funds amounting to about $300,000 over the next three years have been made available through the Pakistan Agricultural Research Council and support by the Mission. Enthusiasm is high in Pakistan.

The modest start being made in Vietnam also appears to be timely and well supported by cooperating agencies. The Mission has supplied some $50,000 for site development and cooperation by Cantho University, GVN agencies, RED, and the Mekong Committee is excellent.

In the past year a Basic Ordering Agreement has been signed with CSU and A.I.D. is now using the expertise of CSU in various missions by Task Orders against the Basic Agreement. Thus the procedure for utilizing the research results, as well as the researchers, has been developed and is now available for servicing technical assistance assignments and requests for USAIDs and/or regional bureaus.

TA/AGR strongly recommends continuing support for this project and the related important activities.

Omer J. Kelley, Director
Office of Agriculture

A. Alvin Bishop
Technical Specialist

J. B. Cordaro, Chief
Program Division

TA/AGR:11/12/73

APPENDIX I. BUDGET BREAKDOWN BY OBJECTIVES

PROGRAM BUDGET FOR THE 12 MONTH PERIOD BEGINNING APRIL 1 1974

Objective	Description	Man Months Including Secretarial	Salary	Consult	Fringe Benefits	Overhead	Travel and Transport	Allowance Differential and Education	Other Direct Costs	Equip. Material Supplies	Totals
1	Water conservation: Determination of useable rainfall	No work by CSU Contract on this objective at present.									
2	Water conveyance, control & measurement	16	24,300	4,000	2,302	11,000	3,700	4,200	1,310	3,900	54,712
3	Drainage & wells	27	41,200	4,000	3,800	18,600	6,000	7,100	2,220	6,600	89,520
4	Land preparation and grading	20	30,500	3,000	2,810	13,800	4,600	5,250	1,640	4,900	66,500
5	Water application: Methods, amounts and scheduling	38	53,000	6,000	4,510	24,690	7,400	8,400	2,630	7,800	114,430
6	Integration of water use factors into a productive cropping system	21	32,030	4,000	2,960	14,400	5,460	5,502	1,720	5,200	71,272
7	Water quality and salinity control	12	18,300	-0-	1,690	8,237	3,040	3,150	1,000	2,900	38,317
8	Institutional & policy factors which influence water distribution, management & utilization	18	27,500	1,500	2,540	12,400	4,800	4,720	1,480	4,450	59,390
9	Administration	25	36,500	-0-	3,520	23,400	3,200	-0-	5,000	-0-	71,620
	Totals	177	263,330	22,500	24,132	126,527	38,200	38,322	17,000	35,750	565,761

PROGRAM BUDGET FOR THE 12 MONTH PERIOD BEGINNING APRIL 1, 1975

Objective	Description	Man Months Including Secretarial	Salary	Consult	Fringe Benefits	Overhead	Travel and Transport	Allowance Differential and Education	Other Direct Costs	Equip. Material Supplies	Totals
1	No work by CSU Contract on this objective at present.										
2	Water conveyance, control and measurement	16	25,800	4,000	2,410	11,500	3,400	4,350	1,760	3,680	56,900
3	Drainage and wells	23	37,200	5,000	3,460	16,500	5,640	6,215	2,530	6,030	82,575
4	Land preparation and grading	21	34,000	2,000	3,160	15,002	4,700	5,700	2,320	4,910	71,79[illegible]
5	Water application: Methods, amounts and scheduling	41	60,800	5,000	5,270	27,890	7,340	9,500	3,860	7,810	127,470
6	Integration of water use factors into a productive cropping system	28	45,200	4,000	4,200	20,100	6,040	7,600	3,080	6,480	96,700
7	Water quality and salinity control	7	11,334	1,000	1,053	5,000	1,300	1,900	770	1,450	23,807
8	Institutional & policy factors which influence water distribution and utilization	18	29,000	1,500	2,710	12,900	3,980	4,900	1,980	4,240	61,210
9	Administration	25	36,500	-0-	3,830	25,800	3,300	-0-	5,000	-0-	74,4[illegible]
	Totals	179	275,634	22,500	26,093	132,002	35,700	40,165	21,300	34,600	594,884

Project Review Report - RIGC (11/13/72)

Project: Water Management Research in Arid and Sub-Humid Lands of the LDC's, Asia

Contractor: Colorado State University

Manager: James A. Urano (TA/AGR)

Discussion Highlights:

1. Dr. Blume informed those present that USAID Mission to Pakistan is in favor of this project. The Mission suggested that Colorado State University's annual report should contain a separate section for field activity of this contract.

2. The additional activity proposed for Viet Nam and Mekong Delta underwent considerable discussion with the result that RIGC recommended: (1) concise work plan be prepared before project is funded, and (2) this project will provide one fulltime expert and TDY consultants to the Viet Nam operation.

Action: RIGC recommends approval of the project for 3 years duration providing that: (1) formal USAID/GOP documentation and selection procedures be required henceforth for Pakistani graduate and post doctorate assistants, (2) CSU request for National Science Foundation funds for the MONA project are withdrawn for the time being, (3) on-campus cost (exclusive of assistantships) and TDY assignments are held below overseas budget, (4) the field party submit a report of its activities for inclusion in the annual report as a separate section, (5) a formal review of this project is held during CY 1975, and (6) suitable work plan for the Viet Nam - Mekong activity is provided by the contractor before TAB commits resources to this project.

Motion by Blume; Seconded by Johnson

Vote: Unanimous

APPENDIX II. PROGRAM SCHEDULE AND ALLOCATION OF RESOURCES

PROGRAM 2 - Water Conveyance Control and Measurement

ACTIVITY	1974	1975	1976	1977	1978
Evaluation of present watercourses					
Design & planning of improved watercourses					
Installation of new watercourses & measurement & control structures					
Physical evaluation of watercourses & measurement & control structures					
Modification & Improvement					
Socio-Economic evaluation of watercourse improvement					
Develop guidelines for construction & management of improved watercourses					
PROGRAM BUDGET $100,000					
80,000					
60,000					
40,000					
20,000					
CSU LABOR BUDGET MAN MONTHS 50					
40					
30					
20					
10					

PROGRAM SCHEDULE AND ALLOCATION OF RESOURCES

PROGRAM 3 - Drainage and Wells

ACTIVITY	1974	1975	1976	1977	1978
Develop mathematical & computer models for skimming wells - miscible case					
Use computer models to predict skimming well performance					
Survey groundwater and construct skimming wells in the field					
Test skimming wells in the field & evaluate computer models					
Conduct economic analysis & write guidelines for construction, operation & maintenance of wells					
Test methods of surface drainage on heavy clay soils					
Develop guidelines for surface drainage					
PROGRAM BUDGET $100,000 / 80,000 / 60,000 / 40,000 / 20,000					
CSU LABOR BUDGET MAN MONTHS 50 / 40 / 30 / 20 / 10					

PROGRAM SCHEDULE AND ALLOCATION OF RESOURCES

PROGRAM 4 - Land Preparation and Grading

ACTIVITY	1974	1975	1976	1977	1978
Crop yields & water distribution evaluated on fields prior to leveling					
Fields levelled & graded to precision standards					
Crop yields & water distribution evaluated on levelled and unlevelled fields					
Costs analyzed and economics of land grading determined					
PROGRAM BUDGET $100,000 / 80,000 / 60,000 / 40,000 / 20,000					
CSU LABOR BUDGET MAN MONTHS 50 / 40 / 30 / 20 / 10					

PROGRAM SCHEDULE AND ALLOCATION OF RESOURCES

PROGRAM 5 - Water Application: Methods, Amounts and Scheduling

ACTIVITY	1974	1975	1976	1977	1978
Evaluate surface shaping & water & fertilizer placement in terms of NO_3 leaching, seedling emergence & physical properties of the soil					
Determine crop yields, water distribution & fertilizer N recovery under basin, border & furrow irrigation in the field					
Assemble information on water users associations adaptable to country conditions & encourage & assist in formation of such associations as requested by host government					
Determine consumptive use at selected sites, evaluate consumptive use equations for major crops					
Assemble data on & determine incremental yield increase at growth stages of major crops to determine timing for most efficient use of limited water					
Develop guidelines for water scheduling where flexible delivery is possible					
Write a training manual for & help train water schedulers and crop planners					
PROGRAM BUDGET — $120,000 / 100,000 / 80,000 / 60,000 / 40,000					
CSU LABOR BUDGET — MAN MONTHS: 50 / 40 / 30 / 20 / 10					

ALLOCATION OF RESOURCES

PROGRAM 6 - Integration of Water Use Factors Into Pr ictive Cropping Systems

ACTIVITY	1974	1975	1976	1977	1978
Determine crop response surfaces to irrigation & fertilizer on wheat, rice, maize & cotton					
Develop irrigation & fertilizer recommendations for economically optimum production of wheat, rice, maize and cotton					
Determine effect of seed water content and irrigation method on seedling emergence					
Develop catalog of consumptive uses and yields of crops during all potential growing seasons					
Develop guidelines for adapting cropping patterns & fertilization to existing (or otherwise attainable) water supplies to optimize economic return					
Determine solubilization as water passes through beds of rock phosphate & write report on potential for bringing nutrients & amendments to farms in developing countries via irrigation water from cheap minerals					
Determine best methods of cultivation & application of water to heavy clay soils for production of upland crops					
Determine crop rotations & fertilization to optimize economic return from water control on heavy clay soils					

PROGRAM BUDGET	$100,000					
	80,000					
	60,000					
	40,000					
	20,000					

CSU LABOR BUDGET	MAN MONTHS					
	50					
	40					
	30					
	20					
	10					

PROGRAM SCHEDULE AND ALLOCATION OF RESOURCES

PROGRAM 7 - Water Quality and Salinity Control

ACTIVITY	1974	1975	1976	1977	1978
Determine effects of water table depth, cropping system & irrigation on salt & water movement and plant growth					
Determine yields & stands as affected by irrigation with saline water and as modified by fertilization					
Compare gypsum, organic matter and other amendments and develop guidelines for most economical reclamation of sodic soils					
Determine physical and economic feasibility of distributing gypsum to the field via water than has been exposed to gypsum surfaces & fragments					
Determine pumping, canal water & amendments for tolerable Na and salt					

PROGRAM BUDGET	$100,000					
	80,000					
	60,000					
	40,000					
	20,000					
U LABOR BUDGET	MAN MONTHS					
	50					
	40					
	30					
	20					
	10					

PROGRAM SCHEDULE A
ALLOCATION OF RESOURCES

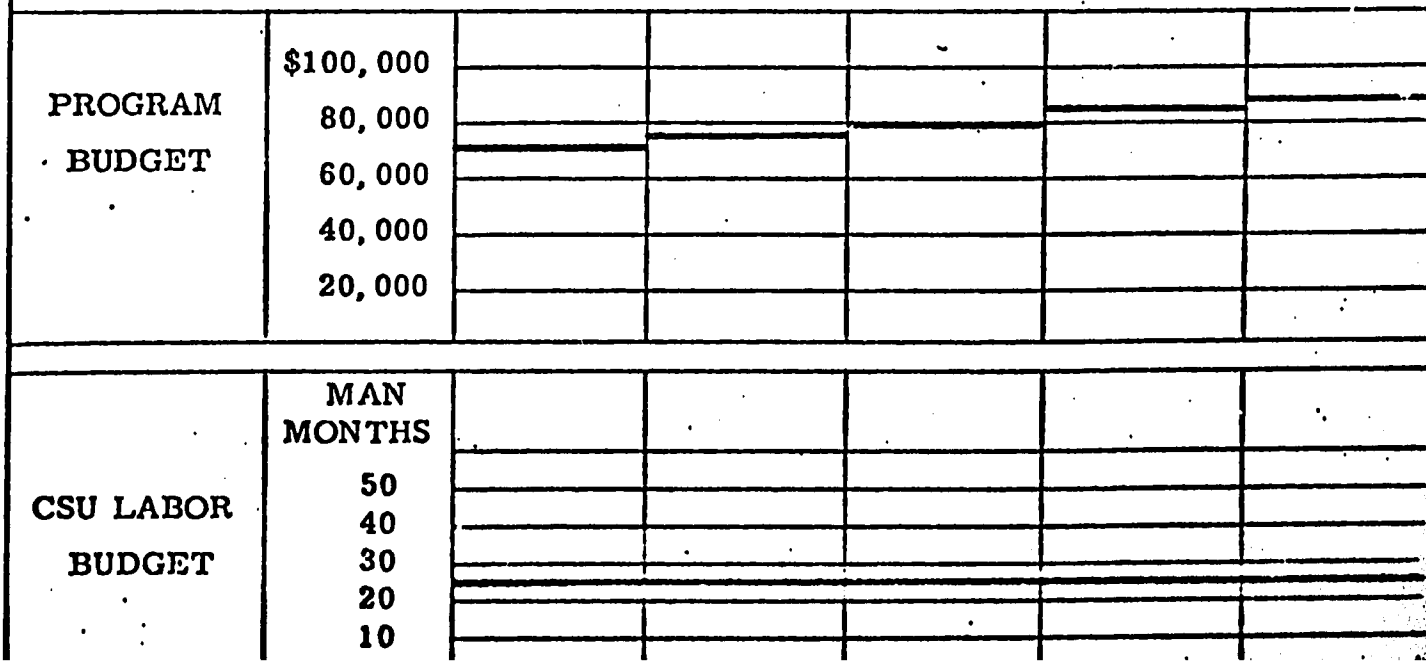
PROGRAM 8 - Institutional and Policy Factors Which Influence Water Distribution, Management and Utilization

ACTIVITY		1974	1975	1976	1977	1978
Develop a catalog of alternative water user organizations, policies & laws, and assist in host countries as requested to improve laws & institutions which facilitate time and amount of water delivery						
Evaluate utilization of water management technologies (leveling, watercourse improvement, furrowing, etc.) to determine: acceptance by the small farmer & identification of facilitators (credit, equipment, policies, etc.) which allow the small farmer to benefit from the technology						
PROGRAM BUDGET	$100,000					
	80,000					
	60,000					
	40,000					
	20,000					
CSU LABOR BUDGET	MAN MONTHS					
	50					
	40					
	30					
	20					
	10					

PROGRAM SCHEDULE / .)
ALLOCATION OF RESOURCES

PROGRAM 9 - Administration

ACTIVITY	1974	1975	1976	1977	1978
Field Supervision					
Planning					
Programming					
Budgeting					
Personnel Administration					
Liaison					
Etc.					



PD-AAC-884 9310489 (13)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS PART I

1. TRANSACTION CODE: [A] A = ADD, C = CHANGE, D = DELETE — PAF
2. DOCUMENT CODE: 5
3. COUNTRY ENTITY: DS/AGR RDA-4 — Type C. Field Service
4. DOCUMENT REVISION NUMBER: 5 — 14p
5. PROJECT NUMBER (7 digits): [931-0489.11B]
6. BUREAU/OFFICE: A. SYMBOL: DSB; B. CODE: [08]
7. PROJECT TITLE (Maximum 40 characters): [On Farm Water Management/Utilization]
8. PROJECT APPROVAL DECISION — ACTION TAKEN: [ ] A = APPROVED, D = DISAPPROVED, DE = DEAUTHORIZED
9. EST. PERIOD OF IMPLEMENTATION (Extension): YRS. [0 C] QTRS [1]

10. APPROVED BUDGET AID APPROPRIATED FUNDS ($000) (Extension)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	D. LOAN	thru 9/30/77 F. GRANT	G. LOAN	1st FY 78 I. GRANT	J. LOAN	2nd FY 79 L. GRANT	M. LOAN
(1) FN	141 I	953	---	2029	---	30	---	---	---
(2)									
(3)									
(4)									
TOTALS				2029	---	30	---	---	---

A. APPROPRIATION	N. 3rd FY O. GRANT	P. LOAN	Q. 4th FY R. GRANT	S. LOAN	LIFE OF PROJECT T. GRANT	U. LOAN
(1) FN	---	---	---	---	2059	---
(2)						
(3)						
(4)						
TOTALS	---	---	---	---	2059	---

11. PROJECT FUNDING AUTHORIZED (ENTER APPROPRIATE CODE(S)) 1 - LIFE OF PROJECT, 2 - INCREMENTAL, LIFE OF PROJECT: A. GRANT: 2; B. LOAN: -

C. PROJECT FUNDING AUTHORIZED THRU: FY 78

12. INITIAL PROJECT FUNDING ALLOTMENT REQUESTED ($000): B. ALLOTMENT REQUEST NO. _____

A. APPROPRIATION	C. GRANT	D. LOAN
(1)		
(2)		
(3)		
(4)		
TOTALS		

13. FUNDS RESERVED FOR ALLOTMENT
TYPED NAME (Chief, SER/FM/FSD)
SIGNATURE
DATE

14. SOURCE/ORIGIN OF GOODS AND SERVICES: [ ] 000 [ ] 941 [ ] LOCAL [ ] OTHER _____

15. FOR AMENDMENTS, NATURE OF CHANGE PROPOSED

This amendment increases the funding level of the subject project by $30,000 (an increase from $2,029,000 to $2,059,000) and extends the life of the project by two months (an extension from January 1, 1978 to February 28, 1978). This funding increase and extension will allow the continuation of services of one agronomist and one irrigation engineer in Peru. An AID Mission funded project will then pick up the costs for continuation of services of these two technicians.

FOR PPC/PIAS USE ONLY	16. AUTHORIZING OFFICE SYMBOL	17. ACTION DATE MM DD YY	18. ACTION REFERENCE (Optional)	ACTION REFERENCE DATE MM DD YY

AID 1330-6 (3-76)

PROJECT AUTHORIZATION AND REQUEST
FOR ALLOTMENT OF FUNDS

PART II

ENTITY : DS Bureau

PROJECT : On-Farm Water Management/Utilization-Utah State University

PROJECT NUMBER: 931-0489.11B

I hereby authorize an increase, in FY 1978 grant funds, of $30,000 (from $2,029,000 to $2,059,000) for a two month extension (from January 1 to February 28, 1978) of the subject project. These additional funds and extension will enable the contractor, Utah State University, to continue to provide the services of one agronomist and one irrigation engineer to the AID Mission/Peru until implementation of a new Mission funded project which will pick up funding for services of these two technicians.

for Sander Levin
Assistant Administrator
Bureau for Development Support

Date Dec 8 1977

Clearance:
DS/AGR/SWM:GCorey
DS/AGR:LHesser
DS/PPU:RSimpson
LA/DR:Weinberg

DS/AGR/SWM:SEngberg:jal:12-6-77

Ref:
1. Memo Valdez to Levin dated Dec. 5, 1977
2. Action Memo Hesser to AA/DSB dated Dec. 7, 1977

December 7, 1977

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR DEVELOPMENT SUPPORT

FROM: DS/AGR, Leon F. Hesser

Problem: The On-Farm Water Management/Utilization project in Latin America (#931-0489.11B) with Utah State University needs to be extended for two months and will require $30,000 in additional funds.

Discussion: The subject project was initiated in FY 1968 and was scheduled to terminate on March 31, 1977. At the requests of the A.I.D. Missions in Ecuador, El Salvador and Peru, the project was extended for nine months (to December 31, 1977) in order to provide specific utilization products for on-going and future in-country programs. A total of $199,000 has been obligated to fund this nine month extension.

The A.I.D. Mission in Peru is in the process of initiating an On-Farm Water Management project which utilizes research results and technical expertise developed under the Utah State University project. An agronomist and irrigation engineer, funded under the current DSB contract with Utah State, are now providing technical assistance to the A.I.D. Mission/Peru in designing the mission project. Once implementation of this project has begun, it is planned that these two Utah State technicians will continue work under a mission-funded contract. The Peru Mission had planned to begin project implementation by January 1, 1978. Unfortunately the Government of Peru's clearance process is taking longer than originally planned and the January 1, 1978 date will not be met. Therefore, in order to avoid a break in funding of the two Utah State technicians, the Peru Mission has requested, through the LA Bureau, that DSB extend its current contract (AID/ta-C-1103) with Utah State for two months. (See attached Memo-A. Valdez to Sander Levin.) The estimated cost of this two month extension for services of the two technicians is $30,000.

Recommendation: That you sign the attached PAF for a two month extension costing $30,000 for the subject project.

Clearance:
DS/PPU:RSimpson Date 12/6/77
LA/DR:Weinberg Date 12/7/77

DS/AGR/SWM:SEngberg:jal:12/6/77:235-8877

Clearance:
DS/PPU:RSimpson RCS Date 12/8/77
LA/DR:FWelz _____ Date _____

DS/AGR/SWM:SEngberg:jal:12/6/77:235-8877

DS/AGR:GCorey _____ Date 12/6/77
DS/AGR:KBrundage _____ Date 12/6/77

EXPEDITE

December 5, 1977

MEMORANDUM

TO : AA/DSB, Mr. Sander Levin

FROM : AA/LA, Abelardo Valdez

SUBJECT: Mission Request for continued DSB funding of Utah State University Contract in Peru

REF : Lima 10292

The current Utah State University contract in Peru funded by DSB will expire on December 31, 1977. Drs. Olsen and Kidman (and eventually Kidman's replacement) will be supported after this date by Mission funds under the On-Farm Water Management project.

As a result of recent AID/W approval of the On-Farm Water Management project, the Mission is proceeding with the documentation and negotiation for a project agreement with the GOP. Unfortunately, the GOP clearance process can vary between 30 to 120 days. For this reason, the Mission believes it will be difficult to arrange Mission funding for Olsen and Kidman by the end of December.

Therefore, in order to avoid the possibility of a break in the funding for the Utah State personnel, the Mission has requested that DSB extend the period of funding through the end of February 1978 for both Drs. Olsen and Kidman. Since the only remaining delay is in obtaining GOP project agreement, we do not foresee the need for any further extensions beyond February 1978.

We have appreciated your support in previously extending DSB funding for Olsen and Kidman from September to December 1977. Given the significance of these last two months of extended funding, it appears to be in the best interests of all if DSB were able to continue to support the Utah State team for this additional period.

Ref No: 1206-04
Action: DS/AGR for AA/DS signature
Due Date 12/12
Copies To: Levin

STATE ROUTING SLIP

RUSH

DATE 12/7/77

TO: Name or Title	Organ. Symbol	Room No.	Bldg.	Initials	Date
1. DS/AGR:KBrundage					
2. DS/AGR:LHesser → SEngberg					
3. LA/DR:FWelz					
4. DS/PPU:Molfetto-Simpson					
5. AA/DSB:Belcher (Levine)					

	Approval		For Your Information		Note and Return
	As Requested	X	Initial for Clearance		Per Conversation
	Comment		Investigate		Prepare Reply
	File		Justify		See Me
	For Correction		Necessary Action	X	Signature

REMARKS OR ADDITIONAL ROUTING

Enclosed is Action Memo, PAF and PIO/T for 2 month extension costing $30,000 for "On-Farm Water Management/Utilization-Utah State" as requested by LA Bureau.

Ms. Belcher has stated that she would concur in this extension if a request was forthcoming from Deputy AA/LA. His request is included herein.

Funds for this extension must be obligated by the Contract Office before Dec. 31, 1977. Therefore request PPU to send "advance action PIO/T" to Contracts ASAP!!

Stephen B Engberg

FROM: (Name and Org. Symbol)	ROOM NO. & BLDG.	PHONE NO.
DS/AGR/SWM:SEngberg	420 RHG	235-8877

RUSH

FORM JF-29 (Formerly Forms DS-10, AID-50 A, IN-68) 3-68

*GPO: 1969 O 345-219 (147)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS PART I

1. TRANSACTION CODE: [A] (A = ADD, C = CHANGE, D = DELETE) — PAF
2. DOCUMENT CODE: 5
3. COUNTRY/ENTITY: TA/AGR — RDA-4
   Type c. Field Service
4. DOCUMENT REVISION NUMBER: 4
5. PROJECT NUMBER (7 digits): 931-0489
6. BUREAU/OFFICE: A. SYMBOL: TAB; B. CODE: 08
7. PROJECT TITLE (Maximum 40 characters): On Farm Water Management/Utilization
8. PROJECT APPROVAL DECISION — ACTION TAKEN: [ ] A = APPROVED, D = DISAPPROVED, DE = DEAUTHORIZED
9. EST. PERIOD OF IMPLEMENTATION: YRS. 00 QTRS 4

10. APPROVED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	D. LOAN	E. ~~PRIOR~~ THRU 9/30/76 F. GRANT	G. LOAN	H. 1st FY 77 I. GRANT	J. LOAN	K. 2nd FY 78 L. GRANT	M. LOAN
(1) FN	141 I	953	---	1830	---	199	---	---	---
(2)									
(3)									
(4)									
TOTALS				1830	---	199	---	---	---

A. APPROPRIATION	N. 3rd FY 79 O. GRANT	P. LOAN	Q. 4th FY 80 R. GRANT	S. LOAN	LIFE OF PROJECT T. GRANT	U. LOAN
(1) FN	---	---	---	---	2029	---
(2)						
(3)						
(4)						
TOTALS	---	---	---	---	2029	---

11. PROJECT FUNDING AUTHORIZED — A. GRANT 1 — B. LOAN ---
(ENTER APPROPRIATE CODE(S)) 1 - LIFE OF PROJECT 2 - INCREMENTAL LIFE OF PROJECT
C. PROJECT FUNDING AUTHORIZED THRU FY 77

12. INITIAL PROJECT FUNDING ALLOTMENT REQUESTED ($000):

A. APPROPRIATION	B. ALLOTMENT REQUEST NO. C. GRANT	D. LOAN
(1)		
(2)		
(3)		
(4)		
TOTALS		

13. FUNDS RESERVED FOR ALLOTMENT
TYPED NAME (Chief, SER/FM/FSD)
SIGNATURE
DATE

14. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [ ] LOCAL [ ] OTHER

15. FOR AMENDMENTS, NATURE OF CHANGE PROPOSED

This amendment increases the funding level of the subject project by $8,000 (an increase from $2,021,000 to 2,029,000). These additional funds are required as a result of negotiations between the A.I.D. Contract Office and the Contractor-Utah State University for the additional services as authorized in the PAF Revision #3 for this project.

FOR PPC/PIAS USE ONLY	16. AUTHORIZING OFFICE SYMBOL	17. ACTION DATE MM DD YY	18. ACTION REFERENCE (Optional)	ACTION REFERENCE DATE MM DD YY

AID 1330-6 (7-76)

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

ENTITY : TA/Bureau

PROJECT : On-Farm Water Management/Utilization - Utah State University

PROJECT NUMBER: 931-0489

I hereby authorize an increase in FY 77 grant funds of $8,000 (from $191,000 to $199,000) for the subject project. The additional $8,000 in FY 77 funds are required as a result of negotiatio between the A.I.D. Contract Office and the Contractor - Utah State University for the additional six months of technical services as authorized in the previous PAF (Revision #3). This PAF hereby raises the total approved funding level for the subject project from $2,021,000 to $2,029,000.

Curtis Farrar
Assistant Administrator
for Technical Assistance

Date:_____

Clearances:
TA/AGR/SWM:GLCorey (draft)_____
TA/AGR:LHesser_____
TA/PPU:RSimpson_____
LA/DR:DChaij (by phone)_____

References:
PAF Revision #3

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS PART I

1. TRANSACTION CODE: [A] (A ADD, C CHANGE, D DELETE) — PAF — 2. DOCUMENT CODE: 5

3. COUNTRY/ENTITY: TA/AGR — RDA-4
Type c. Field Service

4. DOCUMENT REVISION NUMBER: 3

5. PROJECT NUMBER (7 digits): 931-0489

6. BUREAU/OFFICE: A. SYMBOL: AB — B. CODE: 08

7. PROJECT TITLE (Maximum 40 characters): On-Farm Water Management/Utilization

8. PROJECT APPROVAL DECISION — ACTION TAKEN: [ ] A APPROVED, D DISAPPROVED, DL DEAUTHORIZED

9. EST. PERIOD OF IMPLEMENTATION: YRS. 00 QTRS 4

10. APPROVED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	Thru 9/30/76 F. GRANT	Thru 9/30/76 G. LOAN	1st FY 77 I. GRANT	1st FY 77 J. LOAN	2nd FY 78 L. GRANT	2nd FY 78 M. LOAN
(1) FN	141 I	953	-	1830	-	191	-	-	-
(2)									
(3)									
(4)									
TOTALS				1830	-	191	-	-	-

A. APPROPRIATION	N. 4TH FY 79 O. GRANT	N. 4TH FY 79 P. LOAN	Q. 5TH FY 80 R. GRANT	Q. 5TH FY 80 S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) FN	-	-	-	-	2021	-
(2)						
(3)						
(4)						
TOTALS	-	-	-	-	2021	-

11. PROJECT FUNDING AUTHORIZED (ENTER APPROPRIATE CODE(S): 1 = LIFE OF PROJECT, 2 = INCREMENTAL LIFE OF PROJECT): A. GRANT: 1 — B. LOAN: -

C. PROJECT FUNDING AUTHORIZED THRU: FY 77

12. INITIAL PROJECT FUNDING ALLOTMENT REQUESTED ($000)

B. ALLOTMENT REQUEST NO. _____

A. APPROPRIATION	C. GRANT	D. LOAN
(1)		
(2)		
(3)		
(4)		
TOTALS		

13. FUNDS RESERVED FOR ALLOTMENT

TYPED NAME (Chief, SER FM/FSD)

SIGNATURE

DATE

14. SOURCE/ORIGIN OF GOODS AND SERVICES: [XX] 000 [ ] 941 [ ] LOCAL [ ] OTHER _____

15. FOR AMENDMENTS, NATURE OF CHANGE PROPOSED

This amendment increases the funding level of the subject project by $35,000 (an increase from $1,986,000 to $2,021,000). These funds are required for six additional man-months of technical services to be provided by an agronomist working in Peru and will facilitate orderly transition of funding responsibilities to the Latin America Bureau/Peru Mission for any further technical expertise.

All other conditions remain the same.

FOR PPC/PIAS USE ONLY	16. AUTHORIZING OFFICE SYMBOL	17. ACTION DATE MM DD YY	18. ACTION REFERENCE (Optional)	ACTION REFERENCE DATE MM DD YY

AID 1330-6 (7-76)

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

ENTITY : TA/Bureau

PROJECT : On-Farm Water Management/Utilization - Utah State University

PROJECT NUMBER: 931-0489

I hereby authorize an increase in FY'77 grant funds of $35,000 (from $156,000 to $191,000) for the subject project thereby raising the approved funding level from $1,986,000 to $2,021,000. The additional $35,000 in FY'77 funds authorized will permit two agronomists under contract AID/ta-C-1105 to continue their services in Peru until the termination of the contract on December 31, 1977. This authorization will enable USAID/Peru to process and approve a Mission funded follow-on project which will utilize the services of the agronomists.

JS Belcher for C Farrar

Curtis Farrar
Assistant Administrator
for Technical Assistance

Date: June 24 '77

Clearances:

TA/AGR/SWM:GLCorey (draft) SBE
TA/AGR:LHesser (draft) SBE
TA/PPU:RSimpson
LA/DR:DVanhaij (draft) SBE

References

1. Action Memo: Hesser to AA/TA (attached)

2. PAF (original) including supporting documentation referenced therein for the subject project (attached)

JUN 24 '77

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR TECHNICAL ASSISTANCE

FROM: TA/AGR, Leon F. Hesser

Problem: The authorized funding level for the On-Farm Water Management/Utilization project (#931-1162) in Latin America needs to be increased from $156,000 to $191,000.

Discussion: In order to implement the subject project the water management contract (AID/ta-C-1103) with Utah State University was extended from April 1 to 31 December 1977 in order to provide specific utilization products as requested by the Missions in Ecuador, El Salvador and Peru.

Among the project's activities was the provision of an agricultural engineer to remain in Peru until December 31, 1977 and for an agronomist to remain there through June 30, 1977. USAID/Peru was developing an on-farm water management development project in the Sierra and it was anticipated that the Mission would want to pick up the agricultural engineer upon initiation of that project on January 1, 1978.

After developing the project the Mission and Latin America Bureau realized that the technical assistance would require at least two scientists and have asked that the agronomist be allowed to continue in Peru until December 31, 1977, on the TAB contract, after which he also would be picked up under the Mission funded program. (see attached Memo - Cox LA/DP to Gunning TA/PPU dated 6/8/77).

As an interim measure, an unfunded PIO/T has been processed to amend the contract to permit continuation of both specialists in Peru through December 31, 1977, although funds currently in the contract are only sufficient to carry them until October 1, 1977.

The Latin America Bureau has stated there is insufficient time for them to process a contract by October 1, especially since their project has several issues yet to be resolved before final AID/W approval will be obtained.

The scope of work, except for the six additional man months of services by the agronomist, would remain unchanged with both scientists developing research, demonstrational, and extension programs to provide Sierra farmers with better water management. This work is necessary for

efficient utilization of previous TAB funded research in a Mission funded water management project. The budget for the required $35,000 funding increase is attached.

Recommendation: That you sign the attached PAF to increase the authorized funding level for the subject project to $191,000 ~~and the attached Contract Review Sheet.~~

TA/RCA/RRM:GCorey:dmw:06/15/77X58877 Clearances:

TA/FPU:RSimpson Date

LA/DR:DChaij Date 6/15/77

OPTIONAL FORM NO. 10
JULY 1973 EDITION
GSA FPMR 101 CFR 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : TA/PPU, Mr. John Gunning

DATE: June 6, 1977

FROM : LA/DP, Edward Coy

SUBJECT: TAB Project in Peru - On-Farm Water Management.

As Mr. Francis of my staff discussed with you several weeks ago, a problem has arisen in connection with contractor funding under the TAB project, On-Farm Water Management, Utah State University (USU) contract number AID/TA-C-1103. As you are aware, the responsibility for this project is being shifted from TAB to the Peru Mission in FY 1978. A Mission Project Paper is currently under review by AID/Washington and approval is expected soon. However, it is not anticipated that FY 1978 funds for this project will be available (alloted, obligated, and put into a contract) much before the end of 1977. And therein lies the problem.

The project finances two Utah State University scientists. Under the current TAB contract with USU, one of these scientists, Dr. Olsen, is funded through December 30, 1977 but the other, Dr. Kidman, is covered only through June 30, 1977. In an effort to rationalize this situation and to forestall Kidman's mid-June departure, we asked TAB to amend the current contract to finance both Olsen and Kidman through September 30 by using funds currently programmed for Olsen for the period of July 1 - December 31. I understand that TAB is working on this amendment and that USU has concurred in the change.

This of course still leaves a total of six worker months (October 1 through December 31 for both Olsen and Kidman) unfunded and we have explored various ways within LA Bureau of covering this period. Unfortunately, we have been unsuccessful. As a result, it is requested that TAB consider funding these six months afterwhich the Peru Mission will pick up the financing under the new project. We will be in contact with Mr. Douglas Clark in TA/AGR regarding this request.

COST REIMBURSEMENT CONTRACT WITH AN EDUCATIONAL INSTITUTION

PD-AAC-884 9310489 (M)

AGENCY FOR INTERNATIONAL DEVELOPMENT NEGOTIATED CONTRACT NO. AID/ta-c-1103

32g.

NEGOTIATED PURSUANT TO THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED, AND EXECUTIVE ORDER 11223	TOTAL ESTIMATED CONTRACT COST $1,360,000.00 (See Article V)
CONTRACT FOR: Technical Research Services	CONTRACTOR (Name and Address) Utah State University
PROJECT NO: 931-17-120-489-73	NAME
ISSUING OFFICE (Name and Address) U.S. Department of State Agency for International Development SER/CM/COD/TAB Washington, D. C. 20523	STREET ADDRESS Logan, Utah 84321 CITY, STATE, AND ZIP CODE
ADMINISTRATION BY Issuing Office	COGNIZANT SCIENTIFIC/TECHNICAL OFFICE Bureau for Technical Assistance Office of Agriculture (TA/AGR)
MAIL VOUCHERS (Original and 3 copies) TO: Agency for International Development SER/FM/CSD Washington, D. C. 20523	ACCOUNTING AND APPROPRIATION DATA PIO/T NO. 931-17-120-489-73-31[illegible] APPROPRIATION NO. 72-11[illegible] ALLOTMENT NO. 402-31-099-00-22-41 Amount: $605,000.00
EFFECTIVE DATE April 1, 1974	ESTIMATED COMPLETION DATE June 30, 1976

The United States of America, hereinafter called the Government, represented by the Contracting Officer executing this Contract, and the Contractor, an educational institution chartered by the State of Utah with its principal office in Logan, Utah, agree that the Contractor shall perform all the services set forth in the attached Schedule, for the consideration stated therein. The rights and obligations of the parties to this contract shall be subject to and governed by the Schedule and the General Provisions. To the extent of any inconsistency between the Schedule and the General Provisions and any specifications or other provisions which are made a part of this contract, by reference or otherwise, the Schedule or the General Provisions shall control. To the extent of any inconsistency between the Schedule and the General Provisions, the Schedule shall control.

This Contract consists of this Cover Page, the Table of Contents, and the Schedule consisting of 12 pages, the General Provisions (Form AID 1420-23C), dated 9-73, and the Additional General Provisions (Form 1420-23D) dated 9-73

NAME OF CONTRACTOR Utah State University	UNITED STATES OF AMERICA AGENCY FOR INTERNATIONAL DEVELOPMENT
BY (Signature of authorized individual) M. K. Jeppesen	BY (Signature of Contracting Officer)
TYPED OR PRINTED NAME M. K. Jeppesen	TYPED OR PRINTED NAME
TITLE Contracts Officer	CONTRACTING OFFICER V. C. Porelli
DATE May 31, 1974	DATE 29 MAY 1974

AID 1420-23A (4-73)

Contract No. AID/ta-c- 1103

TABLE OF CONTENTS

ARTICLE I - SCOPE OF CONTRACT

A. The Contractor, as an independent entity and not as an agent of the Government, shall furnish his best efforts to complete the Statement of Work as set forth herein.

B. This is a cost reimbursement type of contract for the furnishing of technical research services. The Contract consists of the following:

(1) Cover Page and Table of Contents.

(2) Schedule consisting of eighteen (18) Articles.

(3) Eight (8) Attachments

ARTICLE II - STATEMENT OF WORK

A. The Statement of Work applicable to this contract is composed of the following:

1. The Scope of Work shown as Attachment A to this contract

2. The Contractor's technical proposal dated April 15, 1974 entitled, "Proposal for Extending the On-Farm Management Research Contract between the United States Agency for International Development and Utah State University for an Additional 27 Months from April 1, 1974 to June 30, 1976." Said Contractor's technical proposal is herein incorporated by reference, and is termed Reference A.

B. The Scope of Work shall have precedence over any other element of the Statement of Work.

ARTICLE III - PERIOD OF CONTRACT

The effective date of this contract is April 1, 1974. The expiration date of this contract is June 30, 1976.

ARTICLE IV - LEVEL OF EFFORT

A. It is estimated that a total of 446.5 man-months of U.S. Personnel effort will be required to complete the Statement of Work herein. Non-U.S. Personnel effort is not funded under this contract, and the estimates herein are advisory only.

B. The following is an estimate of the number of man-months required for the indicated period:

April 1, 1974 through March 31, 1975 - U. S. Personnel

Home Office Professional	90.5 Man-months
Home Office Non-Professional	39.5 Man-months
Field Staff Professional	71.0 Man-months
Field Staff Non-Professional	6.0 Man-months
TOTAL	206.5 Man-months

April 1, 1974 through March 31, 1975 - Non - U. S. Personnel (Not Funded Under Contract)

Field Staff Professional	80.0 Man-months
Field Staff Non-Professional	120.0 Man-months
TOTAL	200.0 Man-months

April 1, 1975 through June 30, 1976 - U.S. Personnel

Home Office Professional	104.6 Man-months
Home Office Non-Professional	45.4 Man-months
Field Staff Professional	82.5 Man-months
Field Staff Non-Professional	7.5 Man-months
TOTAL	240 Man-months

April 1, 1975 through June 30, 1976 - Non - U.S. Personnal
(Not Funded Under Contract)

Field Staff Professional	92.8 Man-months
Field Staff Non-Professional	139.2 Man-months
Total	232.0 Man-months

C. The Contractor shall utilize the above estimates for performance of the Statement of Work herein. Adjustments in the level of effort may be made with the written approval of the Contracting Officer.

The estimated levels of effort above are illustrative only; however, the Contractor shall utilize the estimates to the maximum extent practicable in the performance of the Statement of Work herein.

ARTICLE V - ESTIMATED COST

A. The total estimated cost of this contract to the Government is $1,380,000.00. The total estimated cost is the ceiling cost of this contract beyond which the Government assumes no liability for costs.

B. Within the total estimated cost, the sum of $605,000.00 is hereby obligated for performance of the services in the period April 1, 1974 through March 31, 1975. Notwithstanding the ceiling amount set forth in paragraph A above, the Government shall assume no responsibility for costs

incurred in the period 4-1-74 through 3-31-75 in excess of the obligated amount.

ARTICLE VI - BUDGET

A. The Budget Schedule set forth as Attachment B hereto imposes limitations for reimbursement of dollar costs for individual line-items for the period of the contract.

B. The Contractor shall not exceed the grand total amount set forth for the budget periods, nor the grand total for the period of contract.

C. The firm budget represents the total funds authorized to be expended by the Contractor in the applicable period.

D. The projected budget represents the estimated costs for the applicable period.

E. Within the firm budget, the Contractor may adjust line item amounts as reasonably necessary for the performance of this contract.

ARTICLE VII - COSTS REIMBURSABLE

A. The United States dollar costs allowable under this contract shall be limited to reasonable, allocable, and necessary costs determined in accordance with General Provision No. 7 entitled "Allowable Cost and Payment."

B. Additional Provisions regarding non-U.S. dollar reimbursable costs are set forth in Article XV - SPECIAL PROVISIONS, and such costs shall be limited to reasonable, allocable and necessary costs determined in accordance with General Provision No. 7 entitled "Allowable Cost and Payment."

ARTICLE VIII - ESTABLISHMENT OF OVERHEAD RATE

A. Purusant to General Provision Clause 8, entitled "Negotiated Overhead Rates," pending establishment of final overhead rates provisional payments on account of allowable indirect costs shall be made on the basis of the following negotiated provisional rates applied to the base set forth in paragraph VIII B below:

Provisional Rate

Period	Rate
From: 7-1-72	On Campus: 60%
To : Until Amended	Off Campus: 30%

B. The base to which the above rates apply shall be composed of direct salaries and wages. Direct salaries and wages include the prorated costs of vacations, holidays, and sick leave, but excludes overtime premiums. Fringe benefit costs such as social security, retirement, and health insurance are treated as other direct costs and are excluded from the base.

ARTICLE IX - FEDERAL RESERVE LETTER OF CREDIT

A. A.I.D. shall open a Federal Reserve Letter of Credit in the amount of $605,000.00 available for obligation under this Contract against which the Contractor may present payment vouchers. The amount drawn down by the Contractor during any calendar month shall not exceed $50,000.00. Within the foregoing ceiling amount, the amount of the payment voucher shall not be in an amount less than $10,000, nor more than $1,000,000 but within the specific dollar ceiling on monthly withdrawals. The amount drawn down, including unexpended amounts previously drawn down, will not exceed by more than $10,000 the anticipated amount of expenditures for the following seven (7) day period.

B. The terms and conditions governing the use of the FRLC are set forth in Attachment E hereto.

ARTICLE X - PRE-CONTRACT COSTS

The allowable cost of performance of this contract shall include all allowable and allocable costs which have been incurred by the Contractor in anticipation of this contract on or after April 1, 1974, but prior to the date of the Contracting Officer's signature shown on page no. 1 hereof, and which, if incurred after the date of the Contracting Officer's signature would have been considered as items of allowable and allocable costs under Article VII above; provided however, that such precontract costs shall not exceed $100,000.00.

ARTICLE XI - TECHNICAL DIRECTIONS - CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE

A. The Contracting Officer's Technical Representative (COTR) for this contract is Mr. Donald Plucknett. Mr. Plucknett may be contacted as follows:

U. S. Department of State
Agency for International Development
TA/AGR, Rm. 3246 NS
Washington, D. C. 20523
Telephone: 202 - 632- 1036

B. The COTR is responsible for the technical aspects of the contract and technical liaison with the contractor. The COTR is also responsible for the inspection and acceptance of any deliverable items or reports under the contract, and such other specific responsibilities as may be set forth in the contract.

The COTR is not authorized to make any commitments or otherwise obligate the Government, nor is he authorized to make any changes which affect the provisions of the contract. Any such changes requested by the Contractor shall be addressed to the Contracting Officer through the COTR. No such changes shall be made without the expressed written authorization of the Contracting Officer.

C. The COTR represents the Cognizant Scientific/Technical Office shown on the Cover page hereof, and shall be responsible for representing that Office in all technical matters.

D. The COTR designated in paragraph A above may be changed at any time by Administrative amendment to this contract.

ARTICLE XII - KEY PERSONNEL

A. The Key Personnel which the Contractor shall furnish for the performance of this contract are set forth in Reference A hereto as those indiviauals proposed by the Contractor.

B. The personnel specified as Key Personnel are considered to be essential to the work being performed hereunder. Prior to diverting or replacing any of the specified individuals, the Contractor shall notify the Contracting Officer (through the COTR) reasonably in advance and shall submit justification, including proposed replacements, in sufficient detail to permit evaluation of the impact on the contract. No diversion or replacement, other than as set forth in Reference A, shall be made by the contractor without the written consent of the Contracting Officer, provided that the Contracting Officer may ratify in writing such diversion or replacement, and that such ratification shall constitute the consent of the Contracting Officer required

by this clause.

C. The listing of key personnel may, with the consent of the contracting parties, be amended from time to time during the term of the contract to either add or delete personnel as appropriate.

ARTICLE XIII - REPORTS

A. The following reports are deliverable at the time and in the form required below:

1. Research Annual Report for the year ending October 31, 1974 due December 31, 1974 and Research Annual Report for the Year ending October 31, 1975 due December 31, 1975. The reports shall be submitted in accordance with Attachment F entitled "Guidelines for Preparation of the Research Annual Report" dated January 20, 1972. One hundred (100) copies shall be submitted to the COTR.

2. Fiscal and Administrative report setting forth actual and estimated expenditures for the period April 1, 1974 through March 31, 1975. Such reports shall be submitted on or before February 28, 1975.

B. The Contractor is not required to submit the semi-annual annual report set forth in General Provision 12 paragraph (a) but shall be responsible for furnishing the information required by the paragraph upon request by the Contracting Officer.

C. Final report in accordance with paragraph (c) of General Provision No. 12.

ARTICLE XIV - ATTACHMENTS

The following is a list of all Attachments to this contract. Attachments are a part of this contract and have, where indicated, the full force and effect of any other provision of the contract.

Attachment	Title
A	Scope of Work
B	Budget Schedule
C	General Provisions
D	Additional General Provisions
E	Federal Reserve Letter of Credit - Terms and Conditions
F	Guidelines for Preparation of the Research Annual Report dated January 20, 197
G	Cost Accounting Standards
H	Contractor's Information Package

ARTICLE XV - SPECIAL PROVISIONS

A. Project Continuity - Inasmuch as this contract provides for the continuation of the research program carried out under AID Contract No. AID/csd-2167,

the following is a list which includes, but is not limited to, those items and benefits generated by contract AID/csd-2167 and hereby transferred to this contract:

1. All items of property subject to the Government Furnished Property clause.

2. Employee longevity credit of personnel transferred to this contract.

3. Unused annual and sick leave of personnel transferred to this contract

4. Service credit for the establishment of home leave applicable to personnel transferred to this contract.

All items and benefits set forth as transferred to this contract shall be subject to the provisions of this contract.

B. Equipment - For the purpose of paragraph (b) of General Provision No. 16, the Government shall make the purchase or provide for the lease of any motor vehicle to be used under the terms of the contract. Vehicles are considered long lead time items, and as such the contractor's request for vehicles must be made as soon as the need for such vehicle is known to the contractor. A minimum lead time of 120 days is needed for any such furnishing of vehicles. The request for purchase of any vehicle shall include all specifications for such vehicle including make, model and required options.

C. Salaries and wages paid to locally hired persons may not, without the specific written approval of the Mission Director or his designee, exceed the level of salaries paid to equivalent personnel by the AID Mission in the Cooperating Country, or the prevailing rates in the Cooperating Country, as determined by A.I.D., paid to personnel of equivalent technical competence.

ARTICLE XVI - GENERAL PROVISIONS

The General Provisions, shown as Attachment C hereof, shall apply to this contract. Modifications to these General Provisions are set forth in Article XVIII herein. The General Provisions are set forth in AID Form 1420-23C (9-73).

ARTICLE XVII - ADDITIONAL GENERAL PROVISIONS

Additional General Provisions, shown as Attachment D hereto, shall apply to this contract. Modifications to these Additional General Provisions are set forth in Article XVIII herein. The Additional General Provisions are set forth in AID Form 1420-23D (9-73).

ARTICLE XVIII - MODIFICATIONS TO GENERAL PROVISIONS

The following additions, deletions, supplements and modifications shall affect the General Provisions as indicated.

A. With regard to General Provision No. 2 and in accordance with paragraph (a)(1) of Additional General Provision No. 3, the Contracting Officer hereby gives the required approval for individuals required to travel outside the United States; provided, however, that concurrence with the assignment and/or travel of any and all such individuals is obtained in writing from the Contracting Officer's Technical Representative prior to their assignment and/or travel.

This approval shall not apply to any other clause or provision of this Contract with respect to Contracting Officer approvals.

B. With regard to General Provision No. 12, see Article XVII - Reports.

C. With regard to General Provision No. 16, see paragraph B of Article XV - Special Provisions.

D. With regard to General Provision No. 17, paragraph (c), Title, title of all property acquired by the Contractor for use within the United States is hereby transferred to the Contractor.

Title for all property acquired for use outside the United States shall be retained by the Government.

E. With regard to General Provision No. 33, it is otherwise provided that whenever weights and measures are required or authorized, all quantities and measures shall be made, computed, and recorded in the metric and/or English system according to the standards of the country, the requi- ents of research program continuity and compatibility, and the scientific or engineering requirements of the contract.

F. Additional General Provision No. 5 is supplemented so that unless otherwise approved by the Contracting Officer orientation and/or language training shall be required of any individual assigned outside the United States for a continuous period of more than ninety (90) days.

G. Pursuant to paragraph (a) of Additional General Provision No. 16, title is retained to all property acquired for use by the Contractor outside of the United States. All other requirements of the General Provision remain the same.

H. Additional General Provision No. 17 is supplemented so that all correspondence regarding this contract will reference, as a minimum, the contract number hereof.

I. The following is added as Additional General Provision No. 19.

"19. Third Country and Cooperating Country Nationals."

The compensation, leave and holidays, allowances and differentials, travel, transportation and shipment of effects for Third Country National (TCN) and Cooperating Country National (CCN) employees, if their use is authorized under the contract, will be subject to AID's policy outlined in Manual Order 1423.7. It is noted that unless otherwise provided, TCN's and CCN's employed under this contract are not eligible for allowances and differentials.

J. Attachemnt H entitled Cost Accounting Standards is hereby incorporated as Additional General Provision No. 20.

Scope of Work

On-Farm Water Management Research Contract
Utah State University

I. Scope of Work - Work Plan

A. General Objective

The general objective of this research is to increase food production in the arid and sub-humid lands of the less developed countries with appropriate consideration given to increasing employment in the rural sector and utilizing local resources through the improvement of water management practices and the utilization of those with other good management procedures.

B. Specific Scope of Work

Utah State University shall use its best efforts in:

1. Development of knowledge and data on how best to conserve and utilize water falling on the land as rain and the most efficient means of supplementing needed soil moisture by a limited amount of irrigation water.

2. Development of knowledge and data that can be used for the economic design and construction of water conveyance and delivery systems including structures for control and measurement of irrigation water, especially on the farm.

3. The development of surface and sub-surface water removal systems to minimize the hazards resulting from surface flooding and high water tables.

4. Identification of important factors to be considered in land preparation and grading of the various soils in the major climatic zones and the relationship of these factors to water management, erosion, water infiltration and good land use and cropping practices.

5. Development and adaptation of methods of water application, including time and amounts, which are suitable and efficient for different soils of varying properties (water-holding capacities, intake rate, etc.) with major crops.

6. Integration of these water use factors into productive cropping systems consistent with farm size and available farming practices.

7. Development of means for increasing crop production by using amendments and management practices which will improve water and soil properties and by using salt tolerant crops in those areas where water quality, soil salinity and exchangeable sodium are problems.

8. The identification of institutional and policy factors (legal, social, economic, religious, manpower, credit, etc.), that influence the efficient distribution, management and utilization of water at the farm level.

II. Level of Effort Guidelines

A. Services are now being performed in, and it is anticipated that services will continue to be performed in, El Salvador, Colombia, Brazil, Ecuador, Chile, Bolivia and Guatemala with Contractor's professional personnel now located in the first four of these Latin American countries.

B. As AID's and LDC requirements warrant, and subject to the availability of funds and qualified personnel under this contract, AID and the Contractor shall, within the parameters outlined in the Scope of Work in part I above, develop programs for services in other selected LDC's and shall, as needed for such purposes, develop special "task forces" and "work plans" tailored to the needs of AID and the LDC's as circumstances warrant. If supplemental funding and additional personnel must be assigned or employed for special "task forces" and problem-oriented activities, then such funding and additional personnel shall be provided by supplemental agreement.

Contract No. AID/ta-c-1103
ATTACHMENT B
Budget Schedule

	Period FR: 4/1/74 TO: 3/31/75	Period FR: 4/1/75 TO: 6/30/76	Total
Salaries and Wages	$285,740	$387,860	$673,600
Consultants	4,000	3,750	7,750
Fringe Benefits	43,460	59,880	103,340
Overhead	132,250	179,510	311,760
Travel and Transportation	46,890	38,130	85,020
Allowances	44,890	53,130	98,020
Other Direct Costs	11,990	15,380	27,370
Equipment	35,780	37,360	73,140
TOTAL	$605,000	$775,000	$1,380,000

FEDERAL RESERVE LETTER OF CREDIT FOR ADVANCE PAYMENT

A. A.I.D. shall open a Federal Reserve Letter of Credit in the amount of $605,000.00 available for obligation under this Contract against which the Contractor may present payment vouchers. The amount drawn down by the Contractor during any calendar month shall not exceed $50,000.00 Within the foregoing ceiling amount, the amount of the payment voucher shall not be in an amount less than $10,000, nor more than $1,000,000 but within the specific dollar ceiling on monthly withdrawals. The amount drawn down, including unexpended amounts previously drawn down, will not exceed by more than $10,000, the anticipated amount of expenditures for the following seven (7) day period.

B. In no event shall the accumulated total of all such payment vouchers exceed the amount of the Federal Reserve Letter of Credit.

C. If at any time, the Contracting Officer determines that the Contractor has presented payment vouchers in excess of the amount or amounts allowable in A and B above, the Contracting Officer may: (1) cause the Federal Reserve Letter of Credit to be suspended or revoked; or (2) direct the Contractor to withhold submission of payment vouchers until such time as, in the judgment of the Contracting Officer, an appropriate level of actual, necessary and allowable expenditures has occured or will occur under this Contractor and/or (3) request the Contractor to repay to A.I.D. the amount of such excess. Upon receipt of the Contracting Officer's request for repayment of excess advance payments, the Contractor shall promptly contact the Contracting Officer to make suitable arrangements for the repayment of such excess funds.

D. Procedure for Contractor

1. After arranging with a commercial bank of its choice for operation under this Letter of Credit and obtaining the name and address of the Federal Reserve Bank or branch serving the commercial bank, the Contractor shall deliver three (3) originals of Standard Form 1194, "Authorized Signature Card for Payment Vouchers on Letters of Credit signed by those official(s) authorized to sign payment vouchers against the Federal Reserve Letter of Credit and by an official of the Contractor who has authorized them to sign.

2. Upon execution of the Agreement, the Contractor shall receive one certified copy of the Federal Reserve Letter of Credit.

3. The Contractor shall confirm with his commercial bank that the Federal Reserve Letter of Credit has been opened and is available if funds are needed.

4. To receive payment, the Contractor shall:

(a) Periodically, although normally not during the last five days of the month, prepare payment vouchers (Form TUS 5401) in an original and three copies.

(b) Have the original and two copies of the voucher signed by the authorized official(s) whose signature(s) appear on the Standard Form 1194.

(c) Present the original and duplicate and triplicate copy of the Form TUS 5401 to his commercial bank.

(d) Retain the quadruplicate copy of the voucher.

5. After the first payment voucher (Form TUS 5401) has been processed, succeeding payment vouchers shall not be presented until existing balance of previous payments have been expended or are insufficient to meet current needs.

6. In preparing the payment voucher, the Contractor assigns a voucher number in numerical sequence beginning with 1 and continuing in sequence on all subsequent payment vouchers submitted under the Federal Reserve Letter of Credit. The current status of the pertinent Federal Reserve Letter of Credit Funds shall be presented on the reverse side of the last two copies of the Form TUS 5401 in the following format:

Cash on hand prior to preceding advance	$_____
Plus amount of last advance on TUS 5401 No.___	_____
Less payments subsequent to last advance	_____
Equals cash on hand prior to receiving current advance on TUS 5401 No. ___	_____

7. A report of expenditures shall be prepared and submitted quarterly to the Controller. This report, submitted on Standard Form 1034, "Public Voucher for Purchases and Services Other Than Personal" shall be supported by certifications, listing of withdrawals and documentation as required. This report shall have attached, as a minimum, an itemization of expenditures and shall identify funds expended in accordance with the total obligated amount of the approved budgets taking into account the limitations imposed therein.

8. The report of expenditures on Standard Form 1034 is reviewed against the Contract provisions, and any improper disbursement is disallowed. The Contractor is notified of the reason for the disallowance and is directed to adjust the next periodic report of expenditures to reflect the disallowance and to reduce its next payment voucher against the Federal Reserve Letter of Credit by the amount of the disallowance.

9. Simultaneously with the submission of the report of expenditures, the Contractor submits to the Controller a status report on the Federal Reserve Letter of Credit as of the close of the period covered by the report of expenditures. The report is prepared in the following format:

Federal Reserve Letter of Credit No.___

Period from _____ through _____

A. Letter of Credit Position

1. Current amount of FRLC (including amendments) through reporting period $_____
2. Payment Vouchers on Letter of Credit presented (Form TUS-5401):
   a. Credited prior to reporting period $_____
   b. Credited during reporting period via TUS-5401 Voucher Nos. _____ through _____ inclusive $_____
   c. Presented but not credited during report via TUS-5401's numbered _____ through _____ inclusive $_____
3. Total of all Payment Vouchers against FRLC credited or presented $_____
4. Balance of FRLC not drawn or requested this reporting period $_____

B. Cash Position

1. Cash on hand at beginning of period $_____
2. Plus: cash drawn during period $_____
3. Plus: refunds, rebates or other amounts received, to the extent allocable to to disbursements charged against this FRLC $_____
4. Total cash available (sum of 1, 2, and 3) $_____
5. Less: disbursements during period $_____
6. Balance of cash on hand at close of reporting period $_____
7. Estimated number of days requirements covered by balance on had (Item 6 above)
   Days: _____

E. Refund of Excess Funds

1. If all costs have been settled under this Contract and the Contractor fails to comply with the Contracting Officer's request for repayment of excess Federal Reserve Letter of Credit funds, the Government shall have the right, on other contracts held by the Contractor to withhold payment of Federal Reserve Letter of Credit or other advances and/or withhold reimbursements due the Contractor in the amount of the excess being held by the Contractor.

2. If the Contractor is still holding excess Federal Reserve Letter of Credit funds on a grant, contract or similar agreement under which the work has been completed or terminated but all costs have not been settled, the Contractor agrees to:

(a) Provide within 30 days after requested to do so by the Contracting Officer, a breakdown of the dollar amounts which have not been settled between the Government and the Contractor. (The Contracting Officer will assume no costs are in dispute if the Contractor fails to reply within 30 days.);

(b) Upon written request of the Contracting Officer, return to the Government the sum of dollars, if any, which represent the difference between (1) the Contractor's maximum position on claimed costs which have not been reimbursed and (2) the total amount of unexpended funds which have been advanced under the Contract; and

(c) If the Contractor fails to comply with the Contracting Officer's request for repayment of excess Federal Reserve Letter of Credit funds, the Government shall have the right, on other contracts, grants or similar agreements held with the Contractor, to withhold payment of Federal Reserve Letter of Credit or other advances and/or withhold reimbursements due the Contractor in the amount of the excess being held by the Contractor.

Contract No. AID/ta-c-1103
ATTACHMENT F

January 20, 1972

GUIDELINES FOR PREPARATION

OF THE

RESEARCH ANNUAL REPORT

The attached guidelines suggest the format and the detail for annual research reports that are required in all research contracts. The research contractor will submit thirty-five copies of the report with appendices to the A.I.D. Project Manager. The A.I.D. Project Manager will submit two copies to TA/RUR and two copies to the A.I.D. Reference Center.

The outline should prove useful to the contractor in preparing the report, and provide an improved basis for annual project reviews. The contractor is encouraged to develop a self-contained report as outlined below in approximately fifteen double-spaced pages. Additional material may be annexed as necessary for a comprehensive report. The fifteen page report is intended to provide a barebones statement of the effectiveness of research resources and methods in producing research results according to annual work plans, and the significance of these research results for the solution of the problem being addressed. Annexed material is essential for a critical review of assertions regarding findings, significance, etc.

REPORT SUMMARY 1/

A. 1. Project Title and Contract Number:

2. Principal Investigator, Contractor and Mailing Address:

3. Contract Period (as amended): 2/ from _____ to _____

4. Period covered by Report: from _____ to _____

5. Total A.I.D. funding of contract to date:

6. Total expenditures and obligations through previous contract year: 3/

7. Total expenditures and obligations for current year: 3/

8. Estimated expenditures for next contract year:

B. Narrative Summary of Accomplishments and Utilization

(In this space provide a concise statement of the principal accomplishments during (1) the period of the report and (2) life of the project in relation to research objectives and actual or potential operational significance.

This information does not substitute for a full discussion of the same points required in the body of the Annual Research Report as outlined below.)

1/ "Report Summary": Statistical Information (Item A) and the Narrative Summary of Accomplishments (Item B) should be reported on a single page. This page will be for general public use as well as project management purposes, and should be written for a general rather than a technical audience.

2/ Item 3 - Contract Period (as amended): Report the original date of the contract and closing date as prescribed by the contract or any amendment thereto.

3/ Items A 6-8: These items refer to expenditures including firm obligations by the contractor. Obligations are the contractor's legal, but unpaid commitments, i.e., subcontracts, purchase orders, etc.; and other related accruals through the end of the reporting period. A "contract year" is one between anniversary dates of the contract.

ANNUAL RESEARCH REPORT

A. General Background

Prepare a concise statement that provides the background and rationale that led to the initiation of the project. This summary should state the nature and importance of the problem to which the research is addressed, and the rationale that links the research activity to the problem.

B. Statement of Project Objectives as Stated in the Contract

The purpose of this section is to record in a precise and concise way the objectives of the research project. The objectives as stated in the contract may have been interpreted, expanded or further defined in other documents and mutually agreed to by A.I.D. and the contractor. This section should reflect the contractual objectives as modified by these supplementary understandings.

C. Continued Relevance of Objectives

Does your research to date, or other circumstances, indicate a need for modification of project objectives as stated in the contract? If so, in what respects?

D. Accomplishments to Date

1. Findings: Provide a statement of the principal and significant findings and other accomplishments for the reporting period as they relate to the anticipated results in the year's work plan. (See material for the year similar to that requested in G.1. below for the coming year.)

Discuss the operational significance of the findings of the current year's research for attainment of project objectives as stated in Section B above. The discussion should include reference to existing knowledge, recent research findings by others, and cumulative findings and accomplishments of this project.

Also discuss side effects of the work, positive or negative. For example, do the findings to date suggest unexpected complications for the application of findings; do they suggest the need for more direct approaches to the problem than were originally anticipated; or is the research developing information and insights not expected in the scope of the work?

2. Interpretation of Data and Supporting Evidence:

Summarize briefly the evidence and analysis that support the findings cited above. To permit a critical analysis of the evidence and analysis, expand as necessary in an appendix to each copy of the report.

3. Research Design: State briefly any significant modifications made in the research design prior to the current reporting period.

Are the present techniques, instruments or mode of inquiry appropriate and/or optimal for the study design? In view of the findings of the past year or your experience with the research measures employed, do you recommend modifying (1) the research design or (2) research techniques? For example, have there been special problems of data availability, sampling, data processing, or ineffective techniques? Have research findings revealed technical relationships that suggest a continuation of present methods or do they suggest a new approach?

E. Dissemination and Utilization of Research Results

1. Briefly describe efforts made under the contract to disseminate the results of the research project. Attach as appendices two lists: (1) a bibliographic list and an abstract not exceeding 200 words of papers and publications developed under the contract and (2) a list of short statements that identify each known use of materials produced by the project for seminars, conferences, translations, or as background material for speeches, policy statements, etc.

2. Cite evidence and cases known to you that findings of the research project are being used in LDCs, the U.S., or both, in training, direct application to the problem, etc.

3. Has the experience of the past year suggested new or more effective ways to expand the use of research results? If so, discuss the experience and as appropriate include proposed steps in the work plan (Item G below). Indicate whether your proposals can be carried out under current provisions of the contract, or would require new contract arrangements by A.I.D.

4. Discuss the extent and nature of considerations to involve LDC personnel and/or institutions as an appropriate activity of the project. If judged appropriate, discuss the kind and extent of LDC involvement in (a) planning the project, (b) the execution of the field work, (c) the analysis and reporting of results. Plans to involve LDCs in the future should be reflected in the work plan in Item G (4) below.

5. Under separate cover forward four copies of publications, seminar reports, translations and other materials representing efforts to disseminate results of the research project, and evidence of the results being utilized by LDC or U.S. people or institutions.

F. Statement of Expenditures and Obligations and Contractor Resources

Provide a statement of [illegible] expenditures and obligations related to the budget plan for the year. This statement should show expenditure and obligations for each of the (1) major inputs (Personnel, equipment, travel, etc.) according to (2) the major accomplishments or work targets that had been planned for the year's work.

Identify significant problems or accomplishments in the progress of the project related to the volume, effectiveness, or scheduling of the manpower, equipment, travel, etc., made available by these expenditures.

Discuss significant changes or modifications in project management, in the staffing pattern, physical facilities, institutional environment, etc.

G. Work Plan and Budget Forecast for Coming Year

Taking into consideration the past year's progress and expenditures and the work remaining to be done over the life of the project, present a work plan and budget for the coming year.

1. anticipated accomplishments for the coming year.

2. procedures to be used and activities to be carried out.

3. significant factors that you anticipate that will promote or impede accomplishments.

4. a plan for dissemination and utilization of the expected results of the research in the U.S. and in LDCs as applicable.

5. a budget statement that shows planned expenditures for each of the major inputs (personnel, equipment, travel, LDC involvement, etc.) according to the major accomplishments, or work targets that are planned for the coming year's work.

H. Appendices

Reports of technical data and analyses (Par. D. 2)
A bibliographic list with abstracts of papers and publications (Par. E. 1)
A list of uses made of research findings and reports (Par. E. 1)
Other appendices as appropriate.

ADDITIONAL
GENERAL PROVISION NO. 20

COST ACCOUNTING STANDARDS

(a) Unless the Cost Accounting Standards Board has prescribed rules or regulations exempting the Contractor or this contract from standards, rules, and regulations promulgated pursuant to 50 U.S.C. App. 2168 (P.L. 91-379, August 15, 1970), the Contractor, in connection with this contract shall:

(1) By submission of a Disclosure Statement, disclose in writing his cost accounting practices as required by regulations of the Cost Accounting Standards Board. The required disclosures must be made prior to contract award unless the Contracting Officer provides a written notice to the Contractor authorizing postaward submission in accordance with regulations of the Cost Accounting Standards Board. The practices disclosed for this contract shall be the same as the practices currently disclosed and applied on all other contracts and subcontracts being performed by the Contractor and which contain this Cost Accounting Standards clause. If the Contractor has marked the Disclosure Statement to indicate that it contains trade secrets and commercial or financial information which is privileged and confidential, the Disclosure Statement will be protected and will not be released outside of the Government.

(2) Follow consistently the cost accounting practices disclosed pursuant to (1), above, in accumulating and reporting contract performance cost data concerning this contract. If any change in disclosed practices made for the purposes of any contract or subcontract subject to Cost Accounting Standards Board requirements, the change must be applied prospectively to this contract, and the Disclosure statement must be amended accordingly. If the contract price or cost allowance of this contract is affected by such changes, adjustment shall be made in accordance with subparagraph (a)(4) or (a)(5), below, as appropriate.

(3) Comply with all Cost Accounting Standards in effect on the date of award of this contract or if the Contractor has submitted cost or pricing data, on the date of final agreement on price as shown on the Contractor's signed certificate of current cost or pricing data. The Contractor shall also comply with any Cost Accounting Standard which hereafter becomes applicable to a contract or subcontract of the Contractor. Such compliance shall be required prospectively from the date of applicability to such contract or subcontract.

(4) (A) Agree to an equitable adjustment as provided in the Changes clause of this contract if the contract cost is affected by a Disclosure Statement change which the Contractor is required to make pursuant to (3), above. If the Contractor has not been required to file a Disclosure Statement but is required pursuant to (a) (3), above, to change an established practice, then an equitable adjustment shall similarly be agreed to.

(B) Negotiate with the Contracting Officer to determine the terms and conditions under which any Disclosure Statement change other than changes under (4) (A), above, may be made. A change to a Disclosure Statement may be proposed by either the Government or the Contractor, provided, however, that no agreement may be made under this provision that will increase costs paid by the United States under this contract.

(5) Agree to an adjustment of the contract price or cost allowance, as appropriate, if he or a subcontractor fails to comply with an applicable Cost Accounting Standard or to follow any practice disclosed pursuant to subparagraphs (a) (1) and (a) (2), above, and such failure results in any increased costs paid by the United States. Such adjustment shall provide for recovery of the increased costs to the United States together with interest thereon computed at the rate determined by the Secretary of the Treasury pursuant to P.L. 92-41, 85 Stat. 97, or 7 percent per annum, whichever is less, from the time the payment by the United States was made to the time the adjustment is effected.

(b) If the parties fail to agree whether the Contractor or subcontractor has complied with an applicable Cost Accounting Standard, rule, or regulation of the Cost Accounting Standards Board and as to any cost adjustment demanded by the United States, such failure to agree shall be a dispute concerning a question of fact within the meaning of the Disputes clause of this contract.

(c) The Contractor shall permit any authorized representatives of the head of the agency, the Cost Accounting Standards Board, or the Comptroller General of the United States to examine and make copies of any documents, papers, or records relating to compliance with the requirements of this clause.

(d) The Contractor shall include in all negotiated subcontracts which he enters into the substance of this clause except paragraph (b), and shall require such inclusion in all other subcontracts of any tier, except that this requirement shall apply only to negotiated subcontracts in excess of $100.000 where the price negotiated is not based on:

(i) Established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(ii) Prices set by law or regulation.

NOTE:

1. Subcontractors shall be required to submit their Disclosure Statements to the Contractor. However, if a subcontractor has previously submitted his Disclosure Statement to a Government Contracting Officer he may satisfy that requirement by certifying to the Contractor the date of such Statement and the address of the Contracting Officer.

2. In any case where a subcontractor determines that the Disclosure Statement information is privileged and confidential and declines to provide it to his Contractor or higher tier subcontractor, the Contractor may authorize direct submission of that subcontractor's Disclosure Statement to the same Government offices to which the Contractor was required to make submission of his Disclosure Statement. Such authorization shall in no way relieve the Contractor of liability as provided in paragraph (a) (5) of this clause. In view of the foregoing and since the contract may be subject to adjustment under this clause by reason of any failure to comply with rules, regulations, and Standards of the Cost Accounting Standards Board in connection with covered subcontracts, it is expected that the Contractor may wish to include a clause in each such subcontract requiring the subcontractor to appropriately indemnify the Contractor. However, the inclusion of such a clause and the terms thereof are matters for negotiation and agreement between the Contractor and the subcontractor, provided that they do not conflict with the duties of the Contractor under its contract with the Government. It is also expected that any subcontractor subject to such indemnification will generally require substantially similiar indemnification to be submitted by his subcontractors.

(e) The terms defined in Sec. 331.2 of Part 331 of Title 4, Code of Federal Regulations (4 CFR 331.2) shall have the same meanings herein. As there defined, "negotiated subcontract" means "any subcontract except a firm fixed-price subcontract made by a Contractor or subcontractor after receiving offers from at least two firms not associated with each other or such Contractor or subcontractor, providing (1) the solicitation to all competing firms is identical, (2) price is the only consideration in selecting the subcontractor from among the competing firms solicited, and (3) the lowest offer received in compliance with the solicitation from among those solicited is accepted."

(End of Clause)

COST REIMBURSEMENT CONTRACT WITH AN EDUCATIONAL INSTITUTION

FOR INTERNATIONAL DEVELOPMENT NEGOTIATED CONTRACT NO. AID/La-c-1100

PD-AAC-884

NEGOTIATED PURSUANT TO THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED, AND EXECUTIVE ORDER 11223	TOTAL ESTIMATED CONTRACT COST See Articles VI and XI
CONTRACT FOR: Technical Research Services	CONTRACTOR (Name and Address) Colorado State University
PROJECT NO: 931-17-120-480-73	NAME c/o Contracts and Grants Office
ISSUING OFFICE (Name and Address) U. S. Department of State Agency for International Development SER/CM/COD/TAB Washington, D. C. 20523	STREET ADDRESS Fort Collins, Colorado 80523
	CITY, STATE, AND ZIP CODE
ADMINISTRATION BY Issuing Office	COGNIZANT SCIENTIFIC/TECHNICAL OFFICE Bureau for Technical Assistance Office of Agriculture (TA/AGR)
MAIL VOUCHERS (Original and 3 copies) TO: Agency for International Development SER/FM/CSD Washington, D. C. 20523	ACCOUNTING AND APPROPRIATION DATA PIO/T NO. 931-17-120-480-73-21(550-41 APPROPRIATION NO. 72-11X1023 ALLOTMENT NO. 402-31-999-00-22-10 AMOUNT: $565,712.00
EFFECTIVE DATE April 1, 1974	ESTIMATED COMPLETION DATE June 30, 1976

The United States of America, hereinafter called the Government, represented by the Contracting Officer executing this Contract, and the Contractor, an educational institution chartered by the State of Colorado with its principal office in Fort Collins, Colorado, agree that the Contractor shall perform all the services set forth in the attached Schedule, for the consideration stated therein. The rights and obligations of the parties to this contract shall be subject to and governed by the Schedule and the General Provisions. To the extent of any inconsistency between the Schedule and the General Provisions and any specifications or other provisions which are made a part of this contract, by reference or otherwise, the Schedule or the General Provisions shall control. To the extent of any inconsistency between the Schedule and the General Provisions, the Schedule shall control.

CERTIFIED A TRUE COPY THIS
5th DAY OF June, 74
BY Denise Cochert

This Contract consists of this Cover Page, the Table of Contents, and the Schedule consisting of 29 pages, the General Provisions (Form AID 1420-23C), dated 9-73, and the Additional General Provisions (Form 1420-23D) dated 9-73

NAME OF CONTRACTOR Colorado State University	UNITED STATES OF AMERICA AGENCY FOR INTERNATIONAL DEVELOPMENT
BY (Signature of authorized individual) Galen E. Frantz	BY (Signature of Contracting Officer) E. U. Forelli
TYPED OR PRINTED NAME Galen E. Frantz	TYPED OR PRINTED NAME E. U. Forelli
TITLE Contracts and Grants Administrator	CONTRACTING OFFICER
DATE May 22, 1974	DATE MAY 23 1974

AID 1420-23A (6-73)

ARTICLE I - SCOPE OF CONTRACT

A. The Contractor, as an independent entity and not as an agent of the Government, shall furnish his best efforts to complete the Statement of Work as set forth herein.

B. This is a cost reimbursement type of contract for the furnishing of technical research services. The Contract consists of the following:

(1) Cover page and Table of Contents,

(2) Schedule consisting of eighteen (18) articles,

(3) Nine (9) Attachments

ARTICLE II - STATEMENT OF WORK

A. The Statement of Work applicable to this contract is composed of the following:

1. The Plan of Work shown as Attachment A to this contract

2. The Contractor's technical proposal dated October 10, 1973 entitled "Colorado State University Proposal to the United States Agency for International Development for Support of Water Management Research to Improve Crop Production in Developing Countries." Said Contractor's technical proposal is herein incorporated by reference.

3. The supplement to the Contractor's proposal as contained in Colorado State University letter dated April 5, 1974 as excerpted in pertinent part and set forth in Attachment B hereto.

4. Document entitled "Technical Approach and Plan for Implementation of On-Farm Water Management Research in Arid and Subhumid Lands of the Less Developed Countries," which document as submitted by the Contractor's letter dated April 5, 1974 is herein incorporated by reference.

B. The Plan of Work shall have precedence over any other element of the Statement of Work.

ARTICLE III - PERIOD OF CONTRACT

The effective date of this contract is April 1, 1974. The expiration date of this contract is June 30, 1976.

ARTICLE IV - LEVEL OF EFFORT

A. It is estimated that a total of 448.7 man months of effort will be required to complete the Statement of Work herein.

B. The following is an estimate of the number of man-months required for the indicated period:

April 1, 1974 through March 31, 1975

Home Office Professional	33.0 Man-months
Home Office Non-Professional	91.2 Man-months
Field Staff Professional	76.0 Man-months
Field Staff Non-Professional	00.0 Man-months
Total	200.2 Man-months

April 1, 1975 through June 30, 1976

Home Office Professional	29.0 Man-months
Home Office Non-Professional	114.5 Man-months
Field Staff Professional	105.0 Man-months
Field Staff Non-Professional	00.0 Man-months
Total	248.5 Man-months

C. The Contractor shall utilize the above estimates for performance of the Statement of Work herein. Adjustments in the level of effort may be made with the written approval of the Contracting Officer.

ARTICLE V - ESTIMATED COST

A. The total estimated cost of this contract to the Government is $1,306,592.00. The total estimated cost is the ceiling cost of this contract, beyond which the Government assumes no liability for costs.

B. Within the total estimated cost, the sum of $565,712.00 is hereby obligated for performance of the services in the period April 1, 1974 through March 31, 1975. Notwithstanding the ceiling amount set forth in paragraph A. above, the Government shall assume no responsibility for costs

incurred in the period 4-1-74 through 3-31-75 in excess of the obligated amount.

ARTICLE VI - BUDGET

A. The Budget Schedule set forth as Attachment C hereto imposes limitations for reimbursement of dollar costs for individual line-items for the period of the contract.

B. The Contractor shall not exceed the grand total amount set forth for the budget periods, nor the grand total for the period of contract.

C. The firm budget represents the total funds authorized to be expended by the Contractor in the applicable period.

D. The projected budget represents the estimated costs for the applicable period.

E. Within the firm budget, the Contractor may adjust line item amounts as reasonably necessary for the performance of this contract.

ARTICLE VII - COSTS REIMBURSABLE

A. The United States dollar costs allowable under this contract shall be limited to reasonable, allocable, and necessary costs determined in accordance with General Provision No. 7 entitled "Allowable Cost and Payment."

B. Additional Provisions regarding non-U.S. dollar reimbursable costs are set forth in Article XV - SPECIAL PROVISIONS, and such costs shall be limited to reasonable, allocable and necessary costs determined in accordance with General Provision No. 7 entitled "Allowable Cost and Payment."

ARTICLE VIII- ESTABLISHMENT OF OVERHEAD RATE

A. Pursuant to General Provision Clause 8, entitled "Negotiated Overhead Rates," pending establishment of final overhead rates provisional payments on account of allowable indirect costs shall be made on the basis of the following negotiated provisional rates applied to the base set forth in paragraph VIII B below:

Provisional rate Period	Rate
From: 7-1-69 To : Until Amended	On Campus: 64% Off Campus: 23%

B. The base to which the above rates apply shall be composed of direct salaries and wages including costs of vacation, holiday and sick pay, retirement costs and overtime premiums. Those fringe benefits applicable to direct salaries and wages are treated as direct costs.

ARTICLE IX - FEDERAL RESERVE LETTER OF CREDIT

A. A.I.D. shall open a Federal Reserve Letter of Credit in the amount of $565,712.00 available for obligation under this Contract against which the Contractor may present payment vouchers. The amount drawn down by the Contractor during any calendar month shall not exceed $50,000.00. Within the foregoing ceiling amount, the amount of the payment voucher shall not be in an amount less than $10,000, nor more than $1,000,000 but within the specific dollar ceiling on monthly withdrawals. The amount drawn down, including unexpended amounts previously drawn down, will not exceed by more than $10,000, the anticipated amount of expenditures for the following thirty (30) day period.

B. The terms and conditions governing the use of the FRLC are set forth in Attachment F hereto.

ARTICLE X - PRE-CONTRACT COSTS

The allowable cost of performance of this contract shall include all allowable and allocable costs which have been incurred by the Contractor in anticipation of this contract on or after April 1, 1974, but prior to the date of the Contracting Officer's signature shown on page no. 1 hereof, and which, if incurred after the date of the Contracting Officer's signature would have been considered as items of allowable and allocable costs under Article VII above; provided however, that such precontract costs shall not exceed $100,000.00.

ARTICLE XI - TECHNICAL DIRECTIONS - CONTRACTING OFFICER'S TECHNICAL REPRESENTATIVE

A. The Contracting Officer's Technical Representative (COTR) for this contract is Mr. Donald Plucknett. Mr. Plucknett may be contacted as follows:

U. S. Department of State
Agency for International Development
TA/AGR, Rm. 3246 NS
Washington, D. C. 20523
Telephone: 202 - 632- 1036

B. The COTR is responsible for the technical aspects of the contract and technical liaison with the contractor. The COTR is also responsible for the inspection and acceptance of any deliverable items or reports under the contract, and such other specific responsibilities as may be set forth in the contract.

The COTR is not authorized to make any commitments or otherwise obligate the Government, nor is he authorized to make any changes which affect the provisions of the contract. Any such changes requested by the Contractor shall be addressed to the Contracting Officer through the COTR. No such changes shall be made without the expressed written authorization of the Contracting Officer.

C. The COTR represents the Cognizant Scientific/Technical Office shown on the Cover Page hereof, and shall be responsible for representing that Office in all technical matters.

D. The COTR designated in paragraph A above may be changed at any time by Administrative amendment to this contract.

ARTICLE XII - KEY PERSONNEL

A. The Key Personnel which the Contractor shall furnish for the performance of this contract are set forth in Attachment B hereto as those individuals proposed by the Contractor.

B. The personnel specified as Key Personnel are considered to be essential to the work being performed hereunder. Prior to diverting or replacing any of the specified individuals, the Contractor shall notify the Contracting Officer (through the COTR) reasonably in advance and shall submit justification, including proposed replacements, in sufficient detail to permit evaluation of the impact on the contract. No diversion or replacement, other than as set forth in Attachment B, shall be made by the contractor without the written consent of the Contracting Officer, provided that the Contracting Officer may ratify in writing such diversion or replacement, and that such ratification shall constitute the consent of the Contracting Officer required

by this clause.

C. The listing of key personnel may, with the consent of the contracting parties, be amended from time to time during the term of the contract to either add or delete personnel as appropriate.

ARTICLE XIII - REPORTS

A. The following reports are deliverable at the time and in the form required below:

1. Research Annual Report for the year ending October 31, 1974 due December 31, 1974 and Research Annual Report for the Year ending October 31, 1975 due December 31, 1975. The reports shall be submitted in accordance with Attachment G entitled "Guidelines for Preparation of the Research Annual Report" dated January 20, 1972. One hundred (100) copies shall be submitted to the COTR.

2. Fiscal and Administrative report setting forth actual and estimated expenditures for the period April 1, 1974 through March 31, 1975. Such reports shall be submitted on or before February 28, 1975.

B. The Contractor is not required to submit the semi-annual annual report set forth in General Provision 12 paragraph (a), but shall be responsible for furnishing the information required by the paragraph upon request by the Contracting Officer.

C. Final report in accordance with paragraph (c) of General Provision No. 12.

D. Project Report required by paragraph D7 of Article XV- Special Provisions

ARTICLE XIV - ATTACHMENTS

The following is a list of all Attachments to this contract. Attachments are a part of this contract and have, where indicated, the full force and effect of any other provision of the contract.

Attachment	Title
A	Plan of Work
B	Excerpt of Colorado State University letter dated April 5, 1974.
C	Budget Schedule
D	General Provisions
E	Additional General Provisions
F	Federal Reserve Letter Of Credit - Terms and Conditions
G	Guidelines for Preparation of the Research Annual Report dated January 20, 1972.
H	Cost Accounting Standards
I	Contractor's Information Package

ARTICLE XV - SPECIAL PROVISIONS

A. Project Continuity. Inasmuch as this contract provides for the continuation of the research program carried out under AID contract No. AID/csd-2162,

the following is a list which includes, but is not limited to, those items and benefits generated by contract AID/csd-2162 and hereby transferred to this contract:

1. All items of property subject to the Government Furnished Property clause.

2. Employee longevity credit of personnel transferred to this contract.

3. Unused annual and sick leave of personnel transferred to this contract.

4. Service credit for the establishment of home leave applicable to personnel transferred to this contract.

All items and benefits set forth as transferred to this contract shall be subject to the provisions of this contract.

B. Equipment. For the purpose of paragraph (b) of General Provision No. 16, the Government shall make the purchase or provide for the lease of any motor vehicle to be used under the terms of the contract. Vehicles are considered long lead time items, and as such the contractor's request for vehicles must be made as soon as the need for such vehicle is known to the contractor. A minimum lead time of 120 days is needed for any such furnishing of vehicles. The request for purchase of any vehicle shall include all specifications for such vehicle including make, model and required options.

C. Pakistan Project. For the purpose of implementing the Statement of Work regarding research operations in Pakistan, the following provisions apply:

1. Travel to Pakistan shall be funded from U. S.-owned local currency which A.I.D. has determined to be in excess of its needs. To furnish such funds, A.I.D. will issue Government Transportation Requests (GTR) for authorized international travel of personnel employed under this contract.

2. Whenever travel to Pakistan is contemplated, the Contractor shall specifically request a GTR in the request for approval of travel required by Additional General Provision No. 3 entitled "Personnel" (as modified).

3. The following list includes, but is not limited to, those items and services which shall be furnished or be paid for by the USAID Mission to Pakistan:

a. housing

b. in-country travel

c. air freight

d. sea freight

e. miscellaneous personal and project support facilities and services

f. Equipment, equipment support and maintenance, and supplies.

D. Viet Nam Project. For the purpose of implementing the Statement of Work regarding research operations in Viet Nam, the following provisions apply:

Senior Advisor to the Heavy Delta Clays Soils Project (hereinafter referred to as the Project) in Can Tho, Vietnam. The Senior Advisor will be responsible for Project implementation, and will be assigned in accordance with the Key Personnel clause of the contract.

2. Senior Advisor shall be operationally responsible to the cognizant USAID Mission Director, and shall be responsible for the administration of the Project as further set forth herein.

3. USAID/Saigon shall make necessary arrangement for Vietnamese currency accounts. The currency accounts shall be used for the purpose of Project implementation and the Senior Advisor shall have the authority and responsibility for expending the funds made available under such accounts.

4. USAID/Saigon shall make a total amount of VN$19,280,000 (piasters) available to the Senior Advisor for the purpose of complete Project implementation. Expenditures shall be made for purposes as provided elsewhere herein, and expenditures made hereunder shall be made with the approval of the Mission Director or his designee. The total amount (as determined by USAID/Saigon) of funds available as of April 1, 1974 is hereby obligated.

The following accounting and appropriation data is cited below:

PIO/T No. : 730-363-3-(41)40093

APPROPRIATION NO.: 72 FT 800

ALLOTMENT NO. : 168-50-730-05-69-00

AMOUNT : VN$19,280,000 (piasters)

Vietnamese currency made available hereunder shall be used for, but not be limited to, the following expenses:

a. Salaries of local-hire Project employees

b. Per diem and travel costs for Project implementation

c. Commodities (fuel, equipment and vehicle maintenance, fertilizers pesticides, office supplies, etc.)

d. Building maintenance, fabrication and repairs.

6. Project staffing plan. The staffing plan shall include a sufficient number of local-hire employees in appropriate job categories. The staffing plan shall be subject to the approval of the Mission Director or his designee.

7. One copy of each report required under the contract shall be marked "Project File" and sent directly to USAID/Saigon Program Division.

8. The following list includes, but is not limited to, those items and services which shall be furnished or paid for by USAID/Saigon or Cooperating Government:

a. Office space and equipment

b. Housing and utilities

c. Furniture

d. Household equipment (stoves, refrigerators, etc.)

e. Transportation in Cooperating Country.

9. USAID/Saigon shall assist the contractor's employees in obtaining medical care, APO, PX, commissary, staff house, and other privileges at the

of assignment on the same basis as available to direct hire personnel.

10. Except as otherwise approved by the Contracting Officer or Mission Director, all costs of salary, expenses, international travel or personal expense of the Senior Advisor shall be borne under the U. S. dollar contract budget.

11. Vouchers involving local Vietnamese currency shall be mailed to USAID/Saigon Voucher Examination Branch ADFM.

12. Specific administrative responsibilities regarding the budget and Project implementation shall include, but not be limited to, the following:

a. Recruit and employ those local personnel necessary to the Project.

b. Receive advance funds, in Vietnamese currency, for Project items of purchase.

c. Disburse, then voucher on a continuing revolving basis, all advanced funds.

d. Expend, in Vietnamese currency, funds for miscellaneous expenses for Project operation.

e. Account for all Project funds received and disbursed.

13. Salaries and wages paid to locally hired persons may not, without the specific written approval of the Mission Director or his designee, exceed the level of salaries paid to equivalent personnel by the AID Mission in the Cooperating Country, or the prevailing rates in the Cooperating Country, as determined by A.I.D., paid to personnel of equivalent technical competence.

14. The following procedure will be used for the making of payment in local Vietnamese currency:

a. Payment

The USAID will, upon request from the Contractor in accordance with Paragraph b. next below, make an initial advance to the Contractor in the amount of VN $1,000,000, and thereafter will reimburse the Contractor an amount equal to reported expenditures in order to replenish the fund on a monthly basis upon submission of a Contract Performance Statement, which indicates the status of the progress of the work and value of the work accomplished, until such time as the total of reimbursements effected added to the initial advance equals the amount of the commitment stated hereinabove. Contractor will attach a copy of this Amendment to his first piaster voucher. Thereafter, vouchers for expenditures submitted by the Contractor will not be reimbursed but will be applied to liquidate the remaining outstanding advance. In the event the total amount of subsequent vouchers are insufficient to liquidate the amount of the outstanding advance, the Contractor will refund the difference to USAID in accordance with Paragraphs d. and e. below.

b. Advance

Contractor may submit to USAID a voucher form supplied by USAID properly executed; requesting an advance of Vietnamese piaster funds in the agreed upon amount required to establish a working fund.

c. Replenishment Vouchers

Contractor may submit to USAID voucher forms, properly executed, in such detail as may be required by the Mission Director , in

the amount of piaster expenditures made during the period covered, which voucher forms shall be supported by the Contract Performance Statement described in a. above.

d. Final Voucher

A voucher form, properly executed, marked "NO PAY" and "FINAL VOUCHER" will be submitted to USAID within 90 days following the end of the month in which services were completed or terminated and supported by the Contract Performance Statement described in a. above for support of the final voucher for piaster payment and a refund check as prescribed by Paragraph e. next below for the balance of funds remaining on hand and not obligated by the Contractor, if any.

e. Refund of Unexpended Funds

The Contractor shall make a repayment to USAID of all unexpended portions of the advance Vietnamese piaster funds not otherwise obligated under the Contract for a legally binding transaction.

15. So long as the policy of the U. S. Government generally bars the presence in Vietnam of dependents of U. S. Government personnel, the Contractor will obtain agreement from all U. S. individuals to be working in Vietnam under this contract not to permit their dependents to be in Vietnam except as otherwise agreed to by the Mission Director in writing. The Mission Director will keep the Contractor informed of any general exceptions to or changes in the U. S. Government policy on dependents.

16. Dependents of regular staff members scheduled for assignments

of at least twenty-four months in Vietnam may proceed to and reside at an intermediate post, provided that prior clearance is obtained from the Contract Officer and the Ambassador or AID Mission Director at such intermediate post, and that the dependents remain at said intermediate post for a period of not less than twelve months. The costs and allowances associated therewith shall be reimbursable on the same basis as and in accordance with USAID/Saigon policies for USAID/Saigon direct hire personnel.

Reimbursement is not authorized for any import or similar type duties which may be charged by country in which intermediate post is located.

Regular staff members assigned to duty tours under this amendment, with dependents in the United States, are entitled to Separate Maintenance allowance and visitation rights to the United States and return in accordance with USAID/Saigon policies for USAID/Saigon direct-hire personnel.

17. The Contractor will be reimbursed for actual transportation costs and travel allowances of U. S. contractor employees from the cooperating country to rest haven post of family on the same basis as provided to USAID employees at the post of assignment when families are prohibited from residing in the cooperating country with the employee.

18. The Contractor shall comply, and shall require all of his employees to comply, with all applicable Republic of Vietnam laws and regulations to include black market and other currency laws, U. S. Government

directives and regulations, the Contractor shall not employ, in the performance of this contract, and person who has violated any of these laws or regulations.

a. The Contractor agrees to terminate the employment of any individual who has been determined by the Mission Director, or his designee, to be unacceptable for employment under U. S. Government contracts. This determination will be made in accordance with policies and administrative procedures promulgated by the U. S. Embassy to deny employment to those employees who have engaged in currency violations, black market transactions, or other activities contrary to the best interests of the U. S. Government. The Contracting Officer, on being advised of this determination, will inform the Contractor, who hereby agrees to terminate the employment of such individual. The Contractor will insert a clause in all employment agreements with U. S. and Third Country National employees indicating an understanding of, and agreement to abide by, this provision. Only U. S. and Third Country National employees who have agreed to abide by this provision will be acceptable for employment under this contract.

b. Failure of the Contractor to comply with the requirements of this clause shall be sufficient cause for termination of this contract under the clause entitled "Termination for Convenience of the Government."

ARTICLE XVI - GENERAL PROVISIONS

The General Provisions, shown as Attachment D hereof, shall apply t this contract. Modifications to these General Provisions are set forth in Article XVIII herein. The General Provisions are set forth in AID Form 1420-23C (9-73).

ARTICLE XVII - ADDITIONAL GENERAL PROVISIONS

Additional General Provisions, shown as Attachment E hereto, shall apply to this contract. Modifications to these Additional General Prov are set forth in Article XVIII herein. The Additional General Provisio are set forth in AID Form 1420-23D (9-73).

ARTICLE XVIII - MODIFICATIONS TO GENERAL PROVISIONS

The following additions, deletions, supplements and modifications s affect the General Provisions as indicated.

A. With regard to General Provision No. 2 and in accordance wi paragraph (a)(1) of Additional General Provision No. 3, the Contracting Officer hereby gives the required approval for individuals required to outside the United States; provided, however, that concurrence with the assignment and/or travel of any and all such individuals is obtained in writing from the Contracting Officer's Technical Representative prior t their assignment and/or travel.

This approval shall not apply to any other clause or provi of this Contract with respect to Contracting Officer approvals.

B. With regard to General Provision No. 12, see Article XIII -

C. With regard to General Provision No. 16, see paragraph B of Article XV - Special Provisions.

D. With regard to General Provision No. 17, paragraph (c), Title, title of all property acquired by the Contractor for use within the United States is hereby transferred to the Contractor.

Title for all property acquired for use outside the United States shall be retained by the Government.

E. With regard to General Provision No. 33, it is otherwise provided that whenever weights and measures are required or authorized, all quantities and measures shall be made, computed, and recorded in the metric and/or English system according to the standards of the country, the requirements of research program continuity and compatibility, and the scientific or engineering requirements of the contract.

F. Additional General Provision No. 5 is supplemented so that unless otherwise approved by the Contracting Officer orientation and/or language training shall be required of any individual assigned outside the United States for a continuous period of more than ninety (90) days.

G. Pursuant to paragraph (a) of Additional General Provision No. title is retained to all property acquired for use by the Contractor outsi of the United States. All other requirements of the General Provision remain the same.

H. Additional General Provision No. 17 is supplemented so that a correspondence regarding this contract will reference, as a minimum, the contract number hereof.

I. The following is added as Additional General Provision No. 1

"19. Third Country and Cooperating Country Nationals."

The compensation, leave and holidays, allowances and differentials, travel, transportation and shipment of effects for Third Country National (TCN) and Cooperating Country National (CCN) employees, if their use is authorized under the contract, will be subject to AID's policy outlined in Manual Order 1423.7. It is noted that unless otherwise provided, TCN's and CCN's employed under this contract are not eligible for allowances and differentials.

J. Attachemnt H entitled Cost Accounting Standards is hereby incorporated as Additional General Provision No. 20.

Contract No AID/ta-c-1100
ATTACHMENT 1

PLAN OF WORK
ON-FARM WATER MANAGEMENT RESEARCH

I. General Objective

The general objective of this research is to increase food production in the arid and sub-humid lands of the less developed countries with appropriate consideration given to increasing employment in the rural sector and utilizing local resources through the improvement of water management practices and the utilization of those with other good management procedures.

II. Specific Work Plan - Colorado State University shall use its best efforts in:

A. Development of knowledge and data on how best to conserve and utilize water falling on the land as rain and the most efficient means of supplementing needed soil moisture by a limited amount of irrigation water.

B. Development of knowledge and data that can be used for the economic design and construction of water conveyance and delivery systems including structures for control and measurement of irrigation water, especially on the farm.

C. The development of surface and sub-surface water removal systems to minimize the hazards resulting from surface flooding and high water table

D. Identification of important factors to be considered in land preparation and grading of the various soils in the major climatic zones and the relationship of these factors to water management, erosion, water infiltration and good land use and cropping practices.

E. Development and adaptation of methods of water application, including time and amounts, which are suitable and efficient for different soils of varying properties (water-holding capacities, intake rate, etc.) with major crops.

F. Integration of these water use factors into productive cropping systems consistent with farm size and available farming practices.

G. Development of means for increasing crop production by using amendments and management practices which will improve water and soil properties and by using salt tolerant crops in those areas where water

quality, soil salinity and exchangable sodium are problems.

H. The identification of institutional and policy factors (legal, social, economic, religious, manpower, credit etc.), that influence the efficient distribution, management and utilization of water at the farm level.

Contract No. AID/ta-c-1100
ATTACHMENT B

SUPPLEMENT TO CONTRACTOR'S TECHNICAL PROPOSAL
DATED OCTOBER 10, 1973 (EXCERPT OF CONTRACTOR'S LETTER DATED APRIL 5, 1974)

"I have reviewed the "Statement of Work" furnished by you and the work proposed in the attached "Technical Approach and Plan for Implementation" is organized to show how the planned research contributes to the specific objectives.

The major elements of this proposal are those which were submitted to in a proposal to TA/AGR last October. That proposal should be referred to if more detail is needed on how the proposed research is based on previous findings and emerging needs. However, since last October there have been several developments which indicate a need for staffing changes. These developments and staffing changes proposed to take care of new needs are outlined as follows:

Findings of the CSU field party and their cooperators in Pakistan indicate that better water management could increase the water actually available to crops by more than 200% (rather than 50%, which was the previous estimate), and decrease water logging and salinization. Awareness of this potential is developing a growing desire in the Pakistan Government to improve its crop production through improved water management and Pakistan Government officials and agencies have asked the CSU field party to assist and consult on several additional new and ongoing water management research projects. These include:

1. Evaluation of benefits derived from alignment and improvement of watercourses, land leveling and associated improved cultural practices at the new Integrated Rural Development Project at Lar in the Punjab.

2. Evaluation of efficiencies of present pumping systems and of needs for new pumping system designs in the Punjab (the Pakistan Engineering University in the Punjab).

3. Management of supplemental irrigation to optimize crop production in the higher rainfall areas (Islamabad University).

4. Expansion of the network of research stations determining consumptive use to include studies at D.I. Khan and Quetta in the Northwest Frontier Provinces and Baluchistan. (Information obtained to be used for scheduling irrigation for optimizing crop production.)

5. To advise and cooperate on all the ongoing water management research at the Mona Research Center in addition to the newly funded water management studies which have been initiated in cooperation with their research personnel.

6. Requests by the Central Government "to assist in developing guidelines and a plan for improving 10,000 watercourses in Pakistan."

Response to these requests will provide research data and opportunities to adapt water management technology to the solution of relevant and pressing problems, which contribute directly to the stated objectives of this project.

To meet these new requests and take advantage of the inherent opportunities to advance our research objectives it will be necessary to increase the engineering and agronomic components of our Pakistan field team and provide additional insight into the farmer reaction to water management technology. An ability to obtain feedback from the farmers to determine why they do or do not adopt the preferred technology is an essential factor in building technology packages which will be within reach of the small and subsistence level farmers.

To carry out the research program outlined in the proposal submitted last October and to satisfy these developing needs and research opportunities, we propose the personnel indicated on the attached budget sheets" (See element No. 4 of the Statement of Work)

"The major elements of the staffing pattern and proposed changes are:

1. S. A. Bowers will continue to develop the Mekong Delta Soils Management Study at Can Tho University, South Vietnam.

2. Wayne Clyma (Irrigation Specialist), C. J. deMooy (Soil Specialist), and Jerry Eckert (Economist) will remain in Pakistan and will be joined by Alan Early (Agricultural Engineer with background in water management and crop planning for efficient water use), Max Lowdermilk (specialist in techniques for adapting, delivering and evaluation technology developed for farmers in developing countries) and W. D. Kemper, Agronomist-Agricultural Engineer with background in soil water management).

3. G. V. Skogerboe (Agricultural Engineer with background in water measurement, salinity management and irrigation) will become codirector of the project with W. D. Kemper. During the period, June 1, 1974, to June 30, 1976, Skogerboe will direct the CSU project from the Fort Collins Campus handling contacts with TA/ACR and the Contracts Office, and supervising the campus research efforts. Kemper will assist in direction as needed.

4. W. D. Kemper will replace Gilbert L. Corey as Chief of the CSU Field Team in Pakistan in June, 1974. He will supervise the field program and coordinate the technical aspects of the field program, including the Mekong Delta Soils Management Study, with the research on campus, and will coordinate the Pakistan research with USAID/Islamabad.

Contra[illegible]o. AID/ta-c-1100

ATTACHMENT C

Budget Schedule

	Period FR: 4-1-74 TO: 3-31-75	Period FR: 4-1-75 TO: 6-30-76	Total
Salaries and Wages	$274,481	$366,300	$ 640,781
Consultants	3,000	15,000	18,000
PERA	24,180	36,300	60,480
Overhead	123,340	153,800	277,140
Travel and Transportation	44,426	38,000	82,426
Allowances	46,565	61,780	108,345
Other Direct Costs	17,200	25,600	42,800
Equipment	15,720	17,500	33,220
Research Operations	16,800	26,600	43,400
Total	$565,712	$740,880	$1,306,592

14 60,000 / 12 / 5,000

1150 / 156,592

GENERAL PROVISIONS

Cost Reimbursement Contract With An Educational Institution

INDEX OF CLAUSES

1. DEFINITIONS (JUNE 1973)

(a) "Administrator" shall mean the Administrator or the Deputy Administrator of the Agency for International Development.

(b) "AID" shall mean the Agency for International Development.

(c) "Campus Coordinator" shall mean the representative of the Contractor at the Contractor's home institution, who shall be responsible for coordinating the activities carried out under the Contract.

(d) "Consultant" shall mean any especially well-qualified person who is engaged on a temporary or intermittent basis and who is not an officer or employee of the Contractor.

(e) "Contracting Officer" shall mean the person executing this Contract on behalf of the United States Government and any other Government employee who is a properly designated Contracting Officer; and the term includes, except as otherwise provided in this Contract, the authorized representative of a Contracting Officer acting within the limits of his authority.

(f) "Contractor" shall mean the educational institution providing services hereunder.

(g) "Contractor Employee" shall mean an employee of the Contractor assigned to work under this Contract.

(h) "Economy Class" air travel (also known as jet-economy, air-coach, tourist-class, etc.) shall mean a class of air travel which is less than first-class.

(i) "Federal Procurement Regulations (FPR)", when referred to herein, shall include AID Procurement Regulations (AIDPR).

(j) "Government" shall mean the United States Government.

(k) "Personnel Compensation" shall mean the periodic remuneration received by a Contractor employee for services rendered exclusive of post differential and allowances associated with overseas service, except as otherwise stated. The term compensation includes payments for personal services including fees, honoraria, and stipends for graduate students, but excludes earnings from sources other than the individual's professional or technical work, as well as overhead, and other charges.

2. APPROVALS (JUNE 1973)

All approvals made under the Contract by the Contracting Officer, or Mission Director, shall be in writing and obtained by the Contractor

ADDITIONAL GENERAL PROVISIONS

COST REIMBURSEMENT CONTRACT WITH AN EDUCATIONAL INSTITUTION

(Additional General Provisions for an Overseas Cost Reimbursement Contract with an Educational Institution are also attached, and except for the clauses omitted as specified on the preceding page, such Additional General Provisions are incorporated in this Contract.)

INDEX OF CLAUSES

1. DEFINITIONS (JUNE 1973)

(a) "Campus Personnel" shall mean representatives of the Contractor performing services under the Contract at the Contractor's home institution and shall include the Campus Coordinator.

(b) "Contractor's Chief of Party" shall mean the representative of the Contractor in the cooperating country who shall be responsible for supervision of the performance of all duties undertaken by the Contractor in the cooperating country.

(c) "Cooperating Country or Countries" shall mean a foreign country in which there is an AID assistance program or activity administered by AID in which services are to be rendered hereunder.

(d) "Cooperating Country National" shall mean an individual who is a citizen or resident of the cooperating country.

(e) "Cooperating Government" shall mean the government of the cooperating country.

(f) "Dependents" shall mean:

(1) Spouse;

(2) Children (including step and adopted children) who are unmarried and under 21 years of age or, regardless of age, are incapable of self-support;

(3) Parents (including step and legally adoptive parents), of the employee or of the spouse, when such parents are at least 51 percent dependent on the employee for support;

(4) Sisters and brothers (including step or adoptive sisters or brothers) of the employee, or of the spouse, when such sisters and brothers are at least 51 percent dependent on the employee for support, unmarried and under 21 years of age, or, regardless of age, are incapable of self-support.

(g) "Local Currency" shall mean the currency of the cooperating country.

(h) "Mission" shall mean the United States AID Mission to, or principal AID office in, the cooperating country.

(i) "Mission Director" shall mean the principal officer in the Mission in the cooperating country or his designated representative.

(j) "Participants" shall mean nationals of the cooperating country brought to the United States or to third countries for training.

(k) "Regular Employee" shall mean a Contractor employee appointed to serve one year or more in the cooperating country.

(l) "Resident" shall mean an individual who has been physically present for 3 consecutive years, substantially uninterrupted, in a country.

(m) "Short-Term Employee" shall mean a Contractor employee appointed to serve less than one year in the cooperating country.

(n) "Third Country National" shall mean an individual who is neither a U.S. citizen, U.S. resident, or a cooperating country national.

(o) "Traveler" shall mean the Contractor's regular employees, dependents of the Contractor's regular employees, the Contractor's short-term employees, consultants, campus coordinator, or other professional personnel on its staff, prospective regular or short-term em-

Contract No. AID/ta-c-1100
ATTACHMENT F

FEDERAL RESERVE LETTER OF CREDIT

TERMS AND CONDITIONS

A. A.I.D. shall open a Federal Reserve Letter of Credit in the amount o $565,712.00 available for obligation under this Contract against which the Contractor may present payment vouchers. The amount drawn down by the Con tractor during any calendar month shall not exceed $50,000.00. Within the foregoing ceiling amount, the amount of the payment voucher sha not be in an amount less than $10,000, nor more than $1,000,000 but within the specific dollar ceiling on monthly withdrawals. The amount drawn down, including unexpended amounts previously drawn down, will not exceed by more than $10,000, the anticipated amount of expenditures for the follo thirty (30) day period.

B. In no event shall the accumulated total of all such payment vouchers exceed the amount of the Federal Reserve Letter of Credit.

C. If at any time, the Contracting Officer determines that the Contractor has presented payment vouchers in excess of the amount or amounts allowable in A and B above, the Contracting Officer may: (1) cause the Federal Reserve Letter of Credit to be suspended or revoked; or (2) direct the Contractor to withhold submission of payment vouchers until such time as, in the judgment of the Contracting Officer, an appropriate level of actual, necessary and allowable expenditures has occured or will occur under this Contract; and/or (3) request the Contractor to repay to A.I.D. the amount of such excess. Upon receipt of the Contracting Officer's request for repayment of excess advance payments, the Contractor shall promptly comply with such request.

ure for Contractor

1. After arranging with a commercial bank of its choice for operation r this Letter of Credit and obtaining the name and address of the Federal Reserve Bank or branch serving the commercial bank, the Contractor shall deliver three (3) originals of Standard Form 1194, "Authorized Signature Card for Payment Vouchers on Letters of Credit signed by those official(s) authorized to sign payment vouchers against the Federal Reserve Letter of Credit and by an official of the Contractor who has authorized them to sign.

2. Upon execution of the Agreement, the Contractor shall receive one certified copy of the Federal Reserve Letter of Credit.

3. The Contractor shall confirm with his commercial bank that the Federal Reserve Letter of Credit has been opened and is available if funds are needed.

4. To receive payment, the Contractor shall:

(a) Periodically, although normally not during the last five days of the month, prepare payment vouchers (Form TUS 5401) in an original and three copies.

(b) Have the original and two copies of the voucher signed by the authorized official(s) whose signature(s) appear on the Standard Form 1194.

(c) Present the original and duplicate and triplicate copy of the Form TUS 5401 to his commercial bank.

(d) Retain the quadruplicate copy of the voucher.

5. After the first payment voucher (Form TUS 5401) has been processed, succeeding payment vouchers shall not be presented until existing balance of previous payments have been expended or are insufficient to meet current needs.

6. In preparing the payment voucher, the Contractor assigns a [illegible]cher number in numerical sequence beginning with 1 and continuing in sequen[illegible] on all subsequent payment vouchers submitted under the Federal Reserve Letter Credit. The current status of the pertinent Federal Reserve Letter of Credit Funds shall be presented on the reverse side of the last two copies of the For TUS 5401 in the following format:

Cash on hand prior to preceding advance	$_____
Plus amount of last advance on TUS 5401 No.___	_____
Less payments subsequent to last advance	_____
Equals cash on hand prior to receiving current advance on TUS 5401 No. ___	_____

7. A report of expenditures shall be prepared and submitted quarter to the Controller. This report, submitted on Standard Form 1034, "Public Vouc for Purchases and Services Other Than Personal" shall be supported by certific listing of withdrawals and documentation as required. This report shall have attached, as a minimum, an itemization of expenditures and shall identify fund expended in accordance with the total obligated amount of the approved budgets taking into account the limitations imposed therein.

8. The report of expenditures on Standard Form 1034 is reviewed against the Contract provisions, and any improper disbursement is disallowed. The Contractor is notified of the reason for the disallowance and is directed to adjust the next periodic report of expenditures to reflect the disallowance and to reduce its next payment voucher against the Federal Reserve Letter of Credit by the amount of the disallowance.

Contemporaneously with the submission of the report of expenditures submits to the Controller a status report on the Federal Reserv Letter of Credit as of the close of the period covered by the report of expend The report is prepared in the following format:

Federal Reserve Letter of Credit No.___

Period from _____ through _____

A. Letter of Credit Position

1. Current amount of FRLC (including amendments) through reporting period $_____
2. Payment Vouchers on Letter of Credit presented (Form TUS-5401):
   a. Credited prior to reporting period $_____
   b. Credited during reporting period via TUS-5401 Voucher Nos. _____ through inclusive $_____
   c. Presented but not credited during report via TUS-5401's numbered _____ through _____ inclusive $_____
3. Total of all Payment Vouchers against FRLC credited or presented $_____
4. Balance of FRLC not drawn or requested this reporting period $_____

B. Cash Position

1. Cash on hand at beginning of period $_____
2. Plus: cash drawn during period $_____
3. Plus: refunds, rebates or other amounts received, to the extent allocable to to disbursements charged against this FRLC $_____
4. Total cash available (sum of 1, 2, and 3) $_____
5. Less: disbursements during period $_____
6. Balance of cash on hand at close of reporting period $_____
7. Estimated number of days requirements covered by balance on had (Item C above)
   Days: _____

E. Refund of Excess Funds

1. If all costs have been settled under this Contract and the Contract fails to comply with the Contracting Officer's request for repayment of exces Federal Reserve Letter of Credit funds, the Government shall have the right, other contracts held by the Contractor to withhold payment of Federal Reserve Letter of Credit or other advances and/or withhold reimbursements due the Co tractor in the amount of the excess being held by the Contractor.

If the Contractor is still holding excess Federal Reserve Letter of Credit funds on a grant, contract or similar agreement under which the work has been completed or terminated but all costs have not been settled, the Contractor agrees to:

(a) Provide within 30 days after requested to do so by the Contracting Officer, a breakdown of the dollar amounts which have not been settled between the Government and the Contractor. (The Contracting Officer will assume no costs are in dispute if the Contractor fails to reply within 30 days.);

(b) Upon written request of the Contracting Officer, return to the Government the sum of dollars, if any, which represent the difference between (1) the Contractor's maximum position on claimed costs which have not been reimbursed and (2) the total amount of unexpended funds which have been advanced under the Contract; and

(c) If the Contractor fails to comply with the Contracting Officer's request for repayment of excess Federal Reserve Letter of Credit funds, the Government shall have the right, on other contracts, grants or similar agreements held with the Contractor, to withhold payment of Federal Reserve Letter of Credit or other advances and/or withhold reimbursements due the Contractor in the amount of the excess being held by the Contractor.

ATTACHMENT G

January 20, 1972

GUIDELINES FOR PREPARATION

OF THE

RESEARCH ANNUAL REPORT

The attached guidelines suggest the format and the detail for annual research reports that are required in all research contracts. The research contractor will submit thirty-five copies of the report with appendices to the A.I.D. Project Manager. The A.I.D. Project Manager will submit two copies to TA/RIG and two copies to the A.I.D. Reference Center.

The outline should prove useful to the contractor in preparing the report, and provide an improved basis for annual project reviews. The contractor is encouraged to develop a self-contained report as outlined below in approximately fifteen double-spaced pages. Additional material may be annexed as necessary for a comprehensive report. The fifteen page report is intended to provide a barebones statement of the effectiveness of research resources and methods in producing research results according to annual work plans, and the significance of these research results for the solution of the problem being addressed. Annexed material is essential for a critical review of assertions regarding findings, significance, etc.

REPORT SUMMARY 1/

A. 1. Project Title and Contract Number:

2. Principal Investigator, Contractor and Mailing Address:

3. Contract Period (as amended): 2/ from _____ to _____

4. Period covered by Report: from _____ to _____

5. Total A.I.D. funding of contract to date:

6. Total expenditures and obligations through previous contract year: 3/

7. Total expenditures and obligations for current year: 3/

8. Estimated expenditures for next contract year:

B. Narrative Summary of Accomplishments and Utilization

(In this space provide a concise statement of the principal accomplishments during (1) the period of the report and (2) life of the project in relation to research objectives and actual or potential operational significance.

This information does not substitute for a full discussion of the same points required in the body of the Annual Research Report as outlined below.)

1/ "Report Summary": Statistical Information (Item A) and the Narrative Summary of Accomplishments (Item B) should be reported on a single page. This page will be for general public use as well as project management purposes, and should be written for a general rather than a technical audience.

2/ Item 3 - Contract Period (as amended): Report the original date of the contract and closing date as prescribed by the contract or any amendment thereto.

3/ Items A 6-8: These items refer to expenditures including firm obligations by the contractor. Obligations are the contractor's legal but unpaid commitments, i.e., subcontracts, purchase orders, etc.; and other related accruals through the end of the reporting period. A "contract year" is one between anniversary dates of the contract.

ANNUAL RESEARCH REPORT

A. General Background

Prepare a concise statement that provides the background and rationale that led to the initiation of the project. This summary should state the nature and importance of the problem to which the research is addressed, and the rationale that links the research activity to the problem.

B. Statement of Project Objectives as Stated in the Contract

The purpose of this section is to record in a precise and concise way the objectives of the research project. The objectives as stated in the contract may have been interpreted, expanded or further defined in other documents and mutually agreed to by A.I.D. and the contractor. This section should reflect the contractual objectives as modified by these supplementary understandings.

C. Continued Relevance of Objectives

Does your research to date, or other circumstances, indicate a need for modification of project objectives as stated in the contract? If so, in what respects?

). Accomplishments to Date

1. Findings: Provide a statement of the principal and significant findings and other accomplishments for the reporting period as they relate to the anticipated results in the year's work plan. (See material for the year similar to that requested in G.1. below for the coming year.)

Discuss the operational significance of the findings of the current year's research for attainment of project objectives as stated in Section B above. The discussion should include reference to existing knowledge, recent research findings by others, and cumulative findings and accomplishments of this project.

Also discuss side effects of the work, positive or negative. For example, do the findings to date suggest unexpected complications for the application of findings; do they suggest the need for more direct approaches to the problem than were originally anticipated; or is the research developing information and insights not expected in the scope of the work?

2. Interpretation of Data and Supporting Evidence:

Summarize briefly the evidence and analysis that support the findings cited above. To permit a critical analysis of the evidence and analysis, expand as necessary in an appendix to each copy of the report.

3. Research Design: State briefly any significant modifications made in the research design prior to the current reporting period.

Are the present techniques, instruments or mode of inquiry appropriate and/or optimal for the study design? In view of the findings of the past year or your experience with the research measures employed, do you recommend modifying (1) the research design or (2) research techniques? For example, have there been special problems of data availability, sampling, data processing, or ineffective techniques? Have research findings revealed technical relationships that suggest a continuation of present methods or do they suggest a new approach?

E. Dissemination and Utilization of Research Results

1. Briefly describe efforts made under the contract to disseminate the results of the research project. Attach as appendices two lists (1) a bibliographic list and an abstract not exceeding 200 words of papers and publications developed under the contract and (2) a list of short statements that identify each known use of materials produced by the project for seminars, conferences, translations, or as background material for speeches, policy statements, etc.

2. Cite evidence and cases known to you that findings of the research project are being used in LDCs, the U.S., or both, in training, direct application to the problem, etc.

3. Has the experience of the past year suggested new or more effective ways to expand the use of research results? If so, discuss the experience and as appropriate include proposed steps in the work plan (Item G below). Indicate whether your proposals can be carried out under current provisions of the contract, or would require new contract arrangements by A.I.D.

4. Discuss the extent and nature of considerations to involve LDC personnel and/or institutions as an appropriate activity of the project. If judged appropriate, discuss the kind and extent of LDC involvement in (a) planning the project, (b) the execution of the field work, (c) the analysis and reporting of results. Plans to involve LDCs in the future should be reflected in the work plan in Item G (4) below.

5. Under separate cover forward four copies of publications, seminar reports, translations and other materials representing efforts to disseminate results of the research project, and evidence of the results being utilized by LDC or U.S. people or institutions.

F. Statement of Expenditures and Obligations and Contractor Resources

Provide a statement of expenditures and obligations related to the budget plan for the year. This statement should show expenditure and obligations for each of the (1) major inputs (Personnel, equipment, travel, etc.) according to (2) the major accomplishments or work targets that had been planned for the year's work.

Identify significant problems or accomplishments in the progress of the project related to the volume, effectiveness, or scheduling of the manpower, equipment, travel, etc., made available by these expenditures.

Discuss significant changes or modifications in project management, in the staffing pattern, physical facilities, institutional environment, etc.

G. Work Plan and Budget Forecast for Coming Year

Taking into consideration the past year's progress and expenditures and the work remaining to be done over the life of the project, present a work plan and budget for the coming year.

1. anticipated accomplishments for the coming year.
2. procedures to be used and activities to be carried out.
3. significant factors that you anticipate that will promote or impede accomplishments.
4. a plan for dissemination and utilization of the expected results of the research in the U.S. and in LDCs as applicable.
5. a budget statement that shows planned expenditures for each of the major inputs (personnel, equipment, travel, LDC involvement, etc.) according to the major accomplishments, or work targets that are planned for the coming year's work.

II. Appendices

Reports of technical data and analyses (Par. D. 2)
A bibliographic list with abstracts of papers and publications (Par. E. 1)
A list of uses made of research findings and reports (Par. E. 1)
Other appendices as appropriate.

PROVISION J. 20

COST ACCOUNTING STANDARDS

(a) Unless the Cost Accounting Standards Board has prescribed rules or regulations exempting the Contractor or this contract from standards, rules, and regulations promulgated pursuant to 50 U.S.C. App. 2168 (P.L. 91-379, August 15, 1970), the Contractor, in connection with this contract shall:

(1) By submission of a Disclosure Statement, disclose in writing his cost accounting practices as required by regulations of the Cost Accounting Standards Board. The required disclosures must be made prior to contract award unless the Contracting Officer provides a written notice to the Contractor authorizing postaward submission in accordance with regulations of the Cost Accounting Standards Board. The practices disclosed for this contract shall be the same as the practices currently disclosed and applied on all other contracts and subcontracts being performed by the Contractor and which contain this Cost Accounting Standards clause. If the Contractor has marked the Disclosure Statement to indicate that it contains trade secrets and commercial or financial information which is privileged and confidential, the Disclosure Statement will be protected and will not be released outside of the Government.

(2) Follow consistently the cost accounting practices disclosed pursuant to (1), above, in accumulating and reporting contract performance cost data concerning this contract. If any change in disclosed practices made for the purposes of any contract or subcontract subject to Cost Accounting Standards Board requirements, the change must be applied prospectively to this contract, and the Disclosure Statement must be amended accordingly. If the contract price or cost allowance of this contract is affected by such changes, adjustment shall be made in accordance with subparagraph (a)(4) or (a)(5), below, as appropriate.

(3) Comply with all Cost Accounting Standards in effect on the date of award of this contract or if the Contractor has submitted cost or pricing data, on the date of final agreement on price as shown on the Contractor's signed certificate of current cost or pricing data. The Contractor shall also comply with any Cost Accounting Standard which hereafter becomes applicable to a contract or subcontract of the Contractor. Such compliance shall be required prospectively from the date of applicability to such contract or subcontract.

(4) (A) Agree to an equitable adjustment as provided in the Changes clause of this contract if the contract cost is affected by a Disclosure Statement change which the Contractor is required to make pursuant to (3), above. If the Contractor has not been required to file a Disclosure Statement but is required pursuant to (a) (3), above, to change an established practice, then an equitable adjustment shall similarly be agreed to.

(B) Negotiate with the Contracting Officer to determine the terms and conditions under which any Disclosure Statement change other than changes under (4) (A), above, may be made. A change to a Disclosure Statement may be proposed by either the Government or the Contractor, provided, however, that no agreement may be made under this provision that will increase costs paid by the United States under this contract.

(5) Agree to an adjustment of the contract price or cost allowance, as appropriate, if he or a subcontractor fails to comply with an applicable Cost Accounting Standard or to follow any practice disclosed pursuant to subparagraphs (a) (1) and (a) (2), above, and such failure results in any increased costs paid by the United States. Such adjustment shall provide for recovery of the increased costs to the United States together with interest thereon computed at the rate determined by the Secretary of the Treasury pursuant to P.L. 92-41, 85 Stat. 97, or 7 percent per annum, whichever is less, from the time the payment by the United States was made to the time the adjustment is effected.

(b) If the parties fail to agree whether the Contractor or subcontractor has complied with an applicable Cost Accounting Standard, rule, or regulation of the Cost Accounting Standards Board and as to any cost adjustment demanded by the United States, such failure to agree shall be a dispute concerning a question of fact within the meaning of the Disputes clause of this contract.

(c) The Contractor shall permit any authorized representatives of the head of the agency, the Cost Accounting Standards Board, or the Comptroller General of the United States to examine and make copies of any documents, papers, or records relating to compliance with the requirements of this clause.

(d) The Contractor shall include in all negotiated subcontracts which he enters into the substance of this clause except paragraph (b), and shall require such inclusion in all other subcontracts of any tier, except that this requirement shall apply only to negotiated subcontracts in excess of $100.000 where the price negotiated is not based on:

(i) Established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(ii) Prices set by law or regulation.

NOTE:

1. Subcontractors shall be required to submit their Disclosure Statements to the Contractor. However, if a subcontractor has previously submitted his Disclosure Statement to a Government Contracting Officer he may satisfy that requirement by certifying to the Contractor the date of such Statement and the address of the Contracting Officer.

In any case where a subcontractor determines that the disclosure statement information is privileged and confidential and declines to provide it to his contractor or higher tier subcontractor, the Contractor may authorize direct submission of that subcontractor's Disclosure Statement to the same Government offices to which the Contractor was required to make submission of his Disclosure Statement. Such authorization shall in no way relieve the Contractor of liability as provided in paragraph (a) (5) this clause. In view of the foregoing and since the contract may be subject to adjustment under this clause by reason of any failure to comply with rules, regulations, and Standards of the Cost Accounting Standards Board in connection with covered subcontracts, it is expected that the Contractor may wish to include a clause in each such subcontract requiring the subcontractor to appropriately indemnify the Contractor. However, the inclusion of such a clause and the terms thereof are matters for negotiation and agreement between the Contractor and the subcontractor, provided that they do not conflict with the duties of the Contractor under its contract with the Government. It is also expected that any subcontractor subject to such indemnification will generally require substantially similiar indemnification to be submitted by his subcontractors.

(e) The terms defined in Sec. 331.2 of Part 331 of Title 4, Code of Federal Regulations (4 CFR 331.2) shall have the same meanings herein. As there defined, "negotiated subcontract" means "any subcontract except a firm fixed-price subcontract made by a Contractor or subcontractor after receiving offers from at least two firms not associated with each other or such Contractor or subcontractor, providing (1) the solicitation to all competing firms is identical, (2) price is the only consideration in selecting the subcontractor from among the competing firms solicited, and (3) the lowest offer received in compliance with the solicitation from among those solicited is accepted."

(End of Clause)

REPORT

1977 IRRIGATION INSTITUTIONS ANDEAN TRAVELING WORKSHOP

2p.

The subject workshops were conducted jointly by David R. Daines, Director, and D. Craig Anderson, Field Director of the Andean Irrigation Institutions Study, which study formed the basis for the workshops.

The sessions were based on documents distributed in advance to participants which contained the tabulations and preliminary analysis of the results of a two-year study of existing irrigation user organizations in Ecuador, Colombia, Bolivia, and Chile, and on problems on a country-by-country basis.

Workshops were held on the following schedules:

Ecuador -	Quito	15	Partic.	Date:	Monday, April 17
	Milagro	19	"	"	Wednesday, April 19
Bolivia -	La Paz	16	"	"	Tuesday, April 26
	Cochabamba	20	"	"	Wednesday, April 29
Chile -	Santiago	35	"	"	Monday, May 2 & Tuesday, May 3
	Total	105			

The participants were officials and functionaries of governmental ministries concerned with irrigation and rural institutions. However, in Chile, a substantial number of the participants (12) were from the private sector and were officials of private irrigation organizations.

There were no similar studies available providing general descriptive information about such organizations, and all participants accepted this study as providing them with a general description of such institutions. The participants also provided valuable inputs into the interpretations of the data in the study. There were extensive discussions on issues related to the subject user organizations. The discussions generally covered the pros and cons of more or less governmental regulation, aid, or supervision, factors contributing to institutional effectiveness and efficiency, and the legal factors affecting such operations.

The nature and sophistication of the discussions varied greatly from country to country. In Bolivia, the irrigation organizations are generally rudimentary and relatively few in number, and the prior knowledge of the participants of the status or issues was very minimal. There the seminars were more of an educational process.

In Ecuador, there was more discussion, apparently because of the greater exposure of participants to the subject types of organizations, and more pre-conceived notions concerning the issues. The Chilean seminars revealed a very high intensity of interest and knowledge of sophisticated policy considerations involved in the general issues outlined in the previous paragraph, and the participants established an organization for continued dialogue on similar issues related to irrigation water user association.

Signed this 18th day of July, 1978

David R. Daines

DAVID R. DAINES

WATER MANAGEMENT WORKSHOP

El Salvador
June 14-17, 1977

To terminate the water management research activities of Utah State University in El Salvador under contracts AID/csd-2167 and AID/ta-C-1103, a four-day workshop was held in the CENTA auditorium at Santa Tecla, El Salvador, June 14 through 17, 1977. The workshop was directed by Tom Fullerton, USU; Nestor Gonzalez, Directorate General of Irrigation and Drainage (DGRD); and Francisco Garcia, National Center of Agricultural Technology (CENTA). Kern Stutler and Dave James, USU, also participated in the workshop.

The general format for each of the four days was as follows. During the morning, research results obtained during the contract period were presented and discussed by the participants. Following this general discussion, four to six work groups were formed, and the afternoons were spent drafting extension-type leaflets based on the research results. 32 engineers and agronomists were in attendance from two agencies of the Ministry of Agriculture and Livestock; CENTA, the research and extension agency, and DRGD, the irrigation development agency. The workshops served an additional useful purpose in getting these two agencies together to discuss problems related to El Salvador's irrigated agriculture.

General topics for presentation and discussion included:

Irrigation Water and Nitrogen Fertilizer Interactions in Corn, Rice and Pasture

Tomato and Corn Production Under Different Irrigation Methods

Use of Lysimeters for Measuring Evapotranspiration

Furrow Irrigation of Soybeans, Corn and Beans

Furrow Infiltration, Irrigation Frequencies and Depth of Application

During the workshop, ten extension pamphlets for Salvadorean farmers were prepared in draft form based on the research results and practices evolved during the contract period in El Salvador. The Ministry of Agriculture, through its office of information, assumed the responsibility of preparing the articles in final form and printing them for distribution.

The workshop was very successful, not only in exposing the technicians to the research results, but also affording them the opportunity to apply them to the local situation and help prepare information for their farmers. There was a great deal of enthusiasm on the part of the participants and Ministry officials stated that they would like this kind of presentation by other technical missions working with agriculture in El Salvador.

9310491 (47)

PD-AAC-804

GSA FORM NO. 10
1973 EDITION
41 CFR 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : LA/DR, Mr. Daniel Chaij

DATE: December 7, 1976

FROM : TA/AGR, Leonard H. Otto

SUBJECT: Transition of Utah State Contract - AID/ta-C-1103 to Utilization

TA/AGR has prepared the attached proposal to continue the Utah State Water Management contract in Latin America through a transition period. This proposal is based on meetings between your office, TA/AGR, and the Directors from Peru and El Salvador and the cables from Peru, El Salvador and Ecuador.

If you approve, we would seek funding for and expedite this proposal. Please note that we would provide for both Olsen and Kidman in Peru up through September 30, 1977. An alternative plan would be to provide for Kidman through June 31, and Olsen through December 31. The only rationale for this would be if your Bureau feels unable to pick Olsen up on 1 October 1977.

We would appreciate your early evaluation, so we can get cables to the concerned Missions.

cc:
TA/AGR:GCorey
DPeterson

5010-110

9310489 (19)

PD-AAC-804

ACTIVITIES INVOLVED IN EXTENSION OF AID/ta-C-1103
UTAH STATE UNIVERSITY

A. Provision of two scientists (irrigation engineer and agronomist) in Peru from 1 April 1977 through September 30, 1977.

- to provide for a logical transition between the centrally funded research activity to Mission related utilization of research results.

- to develop a demonstration and extension program, based on the research outputs, which will reach small farmers in the Sierra.

- to provide complementary services to on-going USAID/Peru programs in agriculture/irrigation.

Estimated Cost - $65,120

B. Provide for research data analyses, publications, and presentation of data through workshops in El Salvador. To be accomplished by 1 July 1977.

- to collect field data on all on-going projects

- to analyze data and prepare following publications.

1. Year-round pangola pasture production in El Salvador, C.A.: The soil moisture and nitrogen fertilizer requirements.

2. Irrigation and nitrogen fertilizer management for upland rice production in Central America.

3. Predicting corn yields at various levels of management intensity for soil moisture and nitrogen fertility in Central America.

4. Soil moisture and nitrogen fertility management for wet season sorghum production to the Zapotitan Valley, El Salvador.

5. Dry bean production under surface irrigation in the Atiocoyo District of El Salvador.

6. Soybean production under surface irrigation in the Atiocoyo District of El Salvador.

7. Yields of hybrid corn varieties under surface irrigation in the Atiocoyo District of El Salvador.

- to conduct a seminar/workshop in El Salvador to present a summary of research findings during life of project.

Estimated Cost - $40,615

C. Provide for dissemination of data on irrigation institution studies gathered in Ecuador, Peru, Chile, Bolivia and Colombia. To be accomplis by 1 July 1977.

- to compile, analyze and summarize all data into country specific reports.

- to conduct workshops to present the data in Bolivia and Ecuador.

Estimated Cost - $33,550

D. Provide for On-Campus Management of above described activities

Estimated Cost - $12,000

E. Proposed Budget

1. Peru:

a) Irrigation engineer (E. C. Olson)	
salary and post differential - 6 months	$18,050
fringe benefits	4,950
allowances	5,800
overhead	4,950
	$33,750
b) Agronomist (Don Kidman)	
salary and post differential - 6 months	$17,325
fringe benefits	4,720
allowances	4,600
overhead	4,725
	$31,370
TOTAL	$65,120

2. El Salvador:

Salaries (Fullerton, Stutler, James) - 3 months	$17,395
fringe benefits	4,200
allowances	2,900
overhead	8,620
travel and transportation	2,500
publications and misc.	5,000
TOTAL	$40,615

3. Ecuador (Institutional Studies)

Salaries (Anderson, Daines, Andrew) - 3 months	$15,015
fringe benefits	3,605

allowances		1,500
overhead		7,535
travel and transportation		6,000
publications and misc.		3,500
	TOTAL	$33,550

4. Campus Administration

Salaries - 3 months @2500		7,500
overhead @60%		4,500
	TOTAL	$12,000
	GRAND TOTAL	$151,285

OPTIONAL FORM NO. 10
JULY 1973 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

Corey

TO : TA/AGR, Leonard H. Otto

DATE: November 23, 1976

FROM : TA/AGR, Leon F. Hesser

SUBJECT: Utah State University Water Management Research Contract

We have strong cables (attached) from Missions in Peru, El Salvador and Ecuador asking that we, in effect, extend the contract to allow a more orderly phase-out. (I have seen no cable yet from Guatemala, although LA may have one.) Also attached is a draft memo from Girard to Farrar asking that we support Olsen (and possibly Kidman) in Peru thru FY 77. (The Peru Mission asks that this support be extended through December 31, 1977.)

Under the assumption that the LA Bureau does support these requests, I am sympathetic to some amount of bridging. Certainly, in Peru we should support Olsen through September 30, 1977 and perhaps even through December 31, 1977. I believe we should also try to accommodate the El Salvador and Ecuador Missions requests, if we can get a quick budget estimate and have a chance of finding the money. I am not sure about Kidman; if LA does not intend to keep him on in Peru, I wonder whether we should; but I could be convinced if the budget doesn't get too big.

Obviously, we need to move rapidly, because all the USU field staff are now on notice to depart post by December 31, 1976. Could you please work with Gil Corey as soon as he gets in, with Dan Chaij and with Al Bishop to try to sort this out. You might also counsel with Roger Ernst if he is available, and with McDermott. Keep in touch with PPU through Doug Clark so they will not be surprised. As soon as it all falls in place, we will need to put together a formal approval document for an extension.

Also, we need to get at least an interim cable out to the Missions right away.

Attachments

cc: TA/AGR:GLCorey, w/attachments
DJClark, w/o attachments
JKMcDermott, w/o attachments
RErnst, w/o attachments

MEMORANDUM

December 27, 1976

TO : AA/TA, Mr. Curtis Farrar

FROM : TA/AGR, Leon F. Hesser

SUBJECT: On-Farm Water Management - Utah State University - Documentation for Nine Month Extension

Enclosed herein for your approval are the Project Authorization Form (PAF) and supporting documentation for a nine month extension (through December 31, 1977) with funding in the amount of $156,000 for the project "On-Farm Water Management" in Latin America with Utah State University. This extension is being made to facilitate specific needs of AID missions in Latin America which arose out of the decision to not continue this research project for another three year contract period. Funding for this extension was included in the December 12, 1976 revision of the TA/AGR FY 1977 OYB.

Enclosures:
A. Girard to Farrar Memo, 12/14/76
B. Farrar to Girard Memo, 12/21/76
C. Project Authorization and Request for Allotment of Funds (PAF)
D. Farrar to Murphy Memo, 12/11/75
E. RAC Minutes December 3/4/73
F. Project Paper Amendment

Clearances:
TA/PPU:RSimpson RS Date: 1/7/77

OPTIONAL FORM NO. 10
JULY 1973 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : AA/TA, Mr. Curtis Farrar
THRU : TA/PPU, John Gunning

DATE: December 17, 1976

FROM : TA/AGR, Leon F. Hesser

SUBJECT: On-Farm Water Management - Utah State University - Documentation and Funding for Nine Month Extension

Enclosed herein for your approval are the Project Authorization Form (PAF) and supporting documentation for a nine month extension (through December 31, 1977) costing $156,000 for the project "On-Farm Water Management" in Latin America with Utah State University. This extension is being made to facilitate specific needs of AID missions in Latin America which arose out of the decision to not continue this research project for another three year contract period. Since the need for this extension was not anticipated during the FY 78 ABS Review in the Summer/Fall 1976, a request for additional funds required for this extension ($156,000) has been submitted to PPC and approved which thereby increases the FY 77 base funding level for RDA-4 "Water and Tropical Soils Management" from $2,928,000 to ~~$3,084,000~~.

Not used.

8010-110

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

9310489 (H)

PD-AAC-884-E

MEMORANDUM

DEC 23 1976

TO : AA/LA, Mr. E. N. S. Girard II

FROM : AA/TA, Curtis Farrar

SUBJECT: Utah State University Water Management Contract

With reference to your memorandum dated December 14, 1976, TA/AGR is preparing documents for my approval which would extend the Utah State contract in South America for nine months to include under TAB funding the following:

1. Provision for Dr. Edwin Olson in Peru through December 1977.

2. Provision of Dr. Don Kidman in Peru through June 1977.

3. El Salvador data analysis and preparation of five publications to be presented in a seminar in El Salvador.

4. Presentation of irrigation institution survey data in two workshops to be held in Ecuador and Bolivia.

Items 3 and 4 result from Mission requests, San Salvador 5241 and Quito 7960 attached.

We feel that providing for Dr. Kidman in Peru through FY 77 or FY 77 and FY 78 would not be prudent especially since his work would be Mission oriented and thereby should not logically be centrally funded.

Clearances

TA/AGR:LHesser _____
LA/DR:DChaij _____
TA/AGR/SWM:GCorey _____

TA/AGR/SWM:GLCorey:12/21/76

Department of State TELEGRAM

UNCLASSIFIED 6062

PAGE 01 QUITO 07960 101636Z

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ACTION AID-31

INFO OCT-01 /032 W

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R 101410Z NOV 76
FM AMEMBASSY QUITO
TO SECSTATE WASHDC 2194
INFO AMEMBASSY LIMA
AMEMBASSY SAN SALVADOR
AMEMBASSY GUATEMALA

UNCLAS QUITO 7960

AIDAC

E.O. 11652: N/A
SUBJECT: UTAH STATE UNIVERSITY WATER MANAGEMENT RESEARCH CONTRACT

REF: STATE 257982

1. MISSION HAS REVIEWED IMPLICATIONS REFTEL COMMENTS. FOLLOWING RECOMMENDATIONS ARE PROPOSED BY USAID/ECUADOR.

2. THE WORK OF CRAIG ANDERSON, USU WATER RIGHTS SPECIALIST, IN ECUADOR HAS BEEN SUBSTANTIAL. HE SHOULD BE ALLOWED TO COMPLETE PHASE ONE OF HIS RESEARCH ACTIVITY SO THIS CAN BE PACKAGED IN FINAL FORM AND BE PROVIDED GOE AND OTHER PARTICIPATING COUNTRIES FOR THEIR USE. TO DO LESS WOULD NEGATIVE THE FINE RESEARCH EFFORT AND IN EFFECT BE A BREACH OF PROMISE TO COOPERATING COUNTERPART INSTITUTIONS AND PERSONNEL THROUGHOUT THE REGION.

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THESE SEMINARS TO BE CONDUCTED. MISSION ALSO BELIEVES THE DATA AND ITS IMPLICATIONS FOR WATER DEVELOPMENT ACTIVITIES ADDRESSED TO CONCERNS OF THE SMALL FARMERS WILL BE AN IMPORTANT REFERENCE FOR FUTURE AID SUPPORTED ACTIVITIES.

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5. PLEASE ADVISE.
BLOOMFIELD

Department of State **TELEGRAM**

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ACTION AID-20 11/17/76 Hessen

INFO OCT-01 /021 W

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P 162010Z NOV 76
FM AMEMBASSY SAN SALVADOR
TO SECSTATE WASHDC PRIORITY 2691

UNCLAS SAN SALVADOR 5241

AIDAC

E.O. 11652: N/A
SUBJECT: UTAH STATE UNIVERSITY CONTRACT AID/CSD-2167 AND TA-C-1103

REF: STATE 257982

1. MISSION IS CONCERNED THAT AID/W HAS MADE DECISION TO TERMINATE SUBJECT CONTRACT WITH NO APPARENT PROVISION FOR PHASE-OUT PERIOD WHICH WOULD PERMIT THE CONTRACT EMPLOYEE IN EL SALVADOR, TOM FULLERTON, TO BRING ABOUT AN ORDERLY TERMINATION AND WRAP UP OF PROJECT ACTIVITIES IN THE COUNTRY. THE CONTRACTOR HAS ADVISED US THAT UNLESS ADDITIONAL FUNDS ARE FORTHCOMING CONTRACT ACTIVITIES IN EL SALVADOR MAY HAVE TO TERMINATE BY THE END OF DECEMBER OF THIS YEAR. ALTHOUGH WE WERE AWARE OF THE PROGRAMMED CONTRACT TERMINATION DATE OF MARCH 31, 1977, THIS INFORMATION WAS PROVIDED ONLY INDIRECTLY THROUGH A NOTIFICATION THAT FULLERTON WOULD BE DEPARTING. MOREOVER, WE HAD UNOFFICIAL INFORMATION INDICATING THAT THERE MIGHT BE A NEW CONTRACT DIRECTED TOWARD APPLICATION OF EXISTING TECHNOLOGY. ACTIVITIES UNDER THE CONTRACT HAVE BEEN CARRIED ON IN EL SALVADOR FOR SIX YEARS AND CONSIERABLE RESEARCH INFORMATION HAS BEEN GENERATED. FULLERTON REPORTS THAT A NUMBER OF ACTIVITES HAVE BEEN PROGRAMMED FOR APERTOD ESTIMATED TO RUN THROUGH JUNE 30 AND WHICH INCLUDE ANALYSIS OF RESEARCH RESULTS, PREPARATION OF EXTENSION
TYPE PULBICATIONS, A SEMINAR AND WORK-SHOPS TO DISCUSS RESEARCH RESULTS AND THEIR APPLICATION IN SOLVING PROBLEMS OF ON-FARM WATER-MANAGEMENT, AND DEVELOPMENT OF

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SURFACE IRRIGATION GUIDELINES FOR DRY SEASON PRODUCTION OF CORN, BEANS AND SOYBEANS. USAID BELIEVES FAILURE TO COMPLETE THE ABOVE ACTIVITIES WOULD RESULT IN A SERIOUS LOSS OF PLANNED PROJECT OUTPUT.

2. DURING RECENT VISIT TO MISSION, CONTRACT REPRESENTATIVE HOWARD PETERSON INDICATED THAT AID/W BELIEVED MISSION DID NOT PLACE PRIORITY ON WATER RESOURCES MANAGEMENT. ONCE AGAIN, WE WISH TO MAKE CLEAR OUR POSITION THAT WATER RESOURCES MANAGEMENT IS A VERY HIGH PRIORITY ACTIVITY IN EL SALVADOR; WE WERE NEVER ASKED OUR OPINION AND WE NEVER INDICATED IT WAS NOT A HIGH PRIORITY. IT SHOULD BE NOTED THAT THIS COUNTRY EXPERIENCES A SIX MONTH DRY PERIOD DURING WHICH TIME LAND AVAILABILITY FOR PRODUCTION IS MADE EVEN MORE SCARCE. THIS IS ONE OF THE REASONS WHY WE PLACE IMPORTANCE ON ASSURANCE FROM AID/W THAT RESOURCES WILL BE PROVIDED TO ALLOW COMPLETION OF THE PROGRAMMED PROJECT ACTIVITIES. ANY COMMENTS REGARDING THE PROJECT IN THE PAST WHICH MAY HAVE BEEN INTERPRETED AS BEING ADVERSE, WERE MADE ONLY TO SUGGEST THAT CHANNELS OF COMMUNICATION COULD BE IMPROVED AND TO EXPRESS THE CONCERN THAT THE TYPE OF RESEARCH BEING CONDUCTED UNDER THE PRESENT PROEJCT WAS NOT THE MOST APPROPRIATE FOR EL SALVADOR. MISSION WAS NEVER GIVEN OPPORTUNTTY BY TAB/W TO COMMENT ON STRUCTURE OF THIS PROJECT AND WE NEVDJRECEIVED OFFICIAL WORD THAT AID/W HAD DECIDED TO TERMINATE PROJECT NOR WERE WE REQUESTED TO COMMENT ON TERMINATION OF PROEJCT. A WELL-CONCEIVED REGIONAL PROEJCT IN WATER RESOURCES MANAGEMENT WOULD BE WELCOMED BY THE MISSION AND GOES.

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4. FULLERTON ESTIMATES COST OF ACCOMPLISHING ACTIVITIES DESCRIBED IN PARA 1 ABOVE TO BE ROUGHLY $60,000 FOR THE PERIOD JANUARY 1 TO JUNE 30, 1977. THIS INCLUDES HIS WORK IN EL SALVADOR, THE PROPOSED SEMINAR COST AND THE COST OF THE ON-CAMPUS EFFORT IN DATA ANALYSES AND WRITE UP OF PROJECT RESULTS.

5. MISSION STRONGLY ENCOURAGES AID/W TO ASSURE APPROPRIATE FUNDING TO ACCOMPLISH THESE ACTIVITIES. PLEASE ADVISE.. LOZANO

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Department of State TELEGRAM

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ACTION AID-50

INFO OCT-01 IGA-02 EB-07 /069 W 109824

R 141605Z NOV 76
FM AMEMBASSY LIMA
TO SECSTATE WASHDC 2667

UNCLAS SECTION 1 OF 2 LIMA 10393

AIDAC

EO 11652: N/A
SUBJ: UTAH STATE UNIVERSITY WATER MANAGEMENT RESEARCH
CONTRACT AID/TA-C-1143

REF: STATE 277939

1. NOVEMBER 3 AND 4 MEETINGS IN AID/W INVOLVING TA/AGR PERSONNEL AND USAID/PERU DIRECTOR AND CHIEF AGRICULTURE RURAL DEVELOPMENT OFFICER, LA/DR, AND LA/DP DISCUSSED FUTURE OF SUBJECT CONTRACT IN PERU. IT WAS AGREED THAT TA/AGR WOULD PROVIDE ADDITIONAL FUNDING NECESSARY TO CONTINUE SUBJECT CONTRACT FROM MARCH 31, 1977 [illegible] SEPTEMBER 30, 1977. (MISSION REQUESTS, IF POSSIBLE, THAT TA/AGR [illegible] TO 9/30/77 TO ALLOW MINIMAL TIME FOR ALLOTMENT OF FY 78 FUNDS AND NEGOTIATION OF CONTRACT.) IT WAS ALSO AGREED THAT, SINCE THE SERVICES OF UTAH STATE UNIVERSITY (USU) ARE HIGHLY PERTINENT TO CURRENT AND FUTURE ASSISTANCE OF USAID/PERU IN AGRICULTURAL SECTOR, AND SMALL FARMER WATER RESOURCE UTILIZATION SPECIFICALLY, MISSION SHOULD PROVIDE FOR CONTINUATION OF USU'S SERVICES UNDER NON FY 1978 MISSION FUNDED PROJECT. AT REQUEST OF AID/W, MISSION IS THEREFORE SUBMITTING THE FOLLOWING INFORMATION TO BE INCLUDED ON SEPARATE GRANT ACTIVITY SHEET FOR INCLUSION IN FY 78 CP. DUE TO TIME CONSTRAINTS, IT WAS FURTHER DECIDED THAT ONLY FORMAL PROJECT DOCUMENTATION MISSION REQUIRED TO SUBMIT IS PROJECT PAPER (PP). ACCORDINGLY, A PROJECT PAPER WILL BE SUBMITTED AS EARLY IN CY 1977 AS POSSIBLE.
2. GRANT ACTIVITY SHEET PROJECT INFORMATION
PROJECT TITLE: ON-FARM WATER MANAGEMENT
PROJECT NO.: 527-0170

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PRINCIPAL CONTRACTORS/AGENCIES: UTAH STATE UNIVERSITY
INITIAL OBLIGATION: FY 1978
SCHEDULED FINAL OBLIGATION: FY 1980

GOAL
TO INCREASE PRODUCTIVITY, NUTRITION, AND INCOME AMONG THE RURAL POOR IN PERU.

PURPOSE
TO CREATE AND DEMONSTRATE THE VALIDITY OF ALTERNATIVE "ON-THE-FARM" WATER USE SYSTEMS FOR INCREASING PRODUCTIVITY IN SMALL FARMER IRRIGATION PROJECTS IN THE HIGHLANDS (SIERRA) AND IN THE ADJACENT HIGH JUNGLE.

BACKGROUND
IN PERU, DUE TO THE LIMITED AGRICULTURAL LAND BASE, HIGH POPULATION DENSITY AND ERRATIC AND/OR LIMITED RAINFALL, WATER IS A SCARCE RESOURCE THE IMPROVED MANAGEMENT OF WHICH COULD PERMIT SUBSTANTIAL INCREASE IN AGRICULTURAL PRODUCTION AND A CORRESPONDING INCREASE IN THE ECONOMIC AND SOCIAL WELFARE OF SMALL FARMERS. THE GOVERNMENT OF PERU HAS ASSIGNED HIGH PRIORITY TO THE OPTIMUM UTILIZATION OF WATER RESOURCES. THE GOVERNMENT IN COLLABORATION WITH UTAH STATE UNIVERSITY (USU) HAS ESTABLISHED A SPECIAL OFFICE IN THE MINISTRY OF AGRICULTURE FOR APPLIED RESEARCH AND DEMONSTRATION IN ON-FARM WATER MANAGEMENT OF SMALL IRRIGATION SYSTEMS.
SEVERAL DEMONSTRATION PLOTS HAVE BEEN SELECTED AND SEVERAL COUNTERPART
ENGINEERS HAVE RECEIVED EXPERIENCE AND TRAINING. THROUGH THE EFFORTS OF THIS KEY GROUP OF PERUVIAN TECHNICIANS AND TECHNICAL ASSISTANCE PROVIDED BY USU, COLLABORATION HAS BEEN ESTABLISHED WITH SCIENTISTS OF OTHER NATIONAL AND INTER-NATIONAL INSTITUTIONS INTERESTED IN THE OPTIMUM UTILIZATION OF WATER RESOURCES FOR IMPROVING AGRICULTURAL PRODUCTION IN PERU. THIS GROUP HAS ALSO PLAYED A MAJOR ROLE IN THE SELECTION AND DESIGN OF THE IRRIGATION DEMONSTRATION STATIONS THAT WILL BE ESTABLISHED IN THE SIERRA UNDER THE RECENTLY SIGNED AID LOAN TO PERU FOR THE IMPROVEMENT OF SMALL IRRIGATION SYSTEMS IN THE SIERRA.

OUTPUTS
THIS PROJECT WILL PRODUCE TRAINED TECHNICIANS REQUIRED TO PROMOTE THE DEMONSTRATION AND EXTENSION OF BETTER IRRIGATION AND AGRONOMIC

PRACTICES AMONG SMALL ARMERS. IT WILL EXPAND AND STRENGTHEN THE ON-FARM WATER USE DEMONSTRATION AND EXTENSION NETWORK. OVERALL AGRICULTURAL PRODUCTION IN THE SIERRA AND HIGH JUNGLE WILL BE INCREASED BY IMPROVING THE EFFICIENCY OF WATER AND FERTILIZER USE. THROUGH THE HIGHER WATER USE EFFICIENCIES ATTAINED, ADDITIONAL WATER WILL BE AVAILABLE TO ENABLE MORE LAND TO BE IRRIGATED. THE EFFECT OF DROUGHT IN THE SIERRA AND HIGH JUNGLE WILL BE REDUCED BY PROMOTING THE CONCEPT OF SUPPLEMENTAL IRRIGATION. THE PROJECT WILL INTRODUCE CONCEPTS OF MULTIPLE-CROPPING TO MAKE MORE EFFICIENT USE OF THE LIMITED RESOURCES AVAILABLE.

THE PROJECT WILL ALSO PROMOTE THE POSSIBILITY OF UTILIZING ALTERNATIVE SOURCES OF ENERGY (GRAVITY, WIND, HYDRAULIC, ETC.) INSTEAD OF OIL, GASOLINE, OR ELECTRICITY FOR PUMPING AND IRRIGATING. IN HIGH RAINFALL REGIONS THE EXCESS WATER WILL BE MANAGED THROUGH THE INTRODUCTION OF IMPROVED SURFACE DRAINAGE PRACTICES. MANAGEMENT OF WATER RESOURCES WILL BE USED TO REDUCE THE EFFECT OF FROST DAMAGE WHERE PRACTICAL. THE INCIDENCE OF PLANT AND ANIMAL DISEASES WILL ALSO BE REDUCED THROUGH IMPROVED MANAGEMENT OF WATER CONDITIONS ON THE SOIL. PRACTICAL EXTENSION BULLETINS WILL BE DEVELOPED AND DISSEMINATED.

HOST COUNTRY AND OTHER DONORS
THE GOVERNMENT WILL CONTRIBUTE MORE THAN 50 PER CENT OF THE DIRECT COSTS REQUIRED FOR IMPLEMENTING THE PROJECT, AS WELL AS THE USE OF RESEARCH/DEMONSTRATION FACILITIES NOT INCLUDED IN DIRECT PROJECT COST ESTIMATES. ALTHOUGH SEVERAL BILATERAL DONORS, INCLUDING BELGIUM, CANADA, ISRAEL AND WEST GERMANY PROVIDE ASSISTANCE IN IRRIGATION AND WATER CONTROL ON A CAPITAL PROJECT LEVEL AND WITH EMPHASIS ON THE COASTAL AREAS OF PERU, AID'S PROJECT WILL BE AIMED PRIMARILY AT THE SMALL FARMER FAMILIES OF THE SIERRA AND HIGH JUNGLE WHICH CONSTITUTE ALMOST 50 PER CENT OF THE COUNTRY'S POPULATION.

Department of State TELEGRAM

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ACTION AID-59

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TO SECSTATE WASHDC 2668

UNCLAS SECTION 2 OF 2 LIMA 10393
AIDAC
TOTAL PROGRAM INPUT REQUIREMMENTS:
U.S. TECHNICIANS

A. SIXTY MONTHS OF LONG TERM ASSISTANCE AS FOLLOWS:
(1) IRRIGATION ENGINEER (36 MONTHS) TO PROVIDE ASSISTANCE IN IRRIGATION SYSTEM DESIGN, WATER MEASUREMENT, IRRIGATION REQUIREMENT IRRIGATION SCHEDULING, WATER QUALITY EVALUATION, SALT BALANCE CONTROL, DRAINAGE, WATER WELLS, PUMPING, SMALL STORAGE RESERVOIR, DEMONSTRATION AND EXTENSION TECHNIQUES, AND COMPLEMENTARY SERVICES TO OTHER ON-GOING USAID PROGRAMS IN AGRICULTURE/IRRIGATION.

(2) AGRONOMIST (24 MONTHS) TO PROVIDE ASSISTANCE IN DETERMINATION OF CROP WATER REQUIREMENTS, COLLECTION OF METEOROLOGICAL DATA, SOIL-WATER-FERTILITY RELATIONSHIPS, IRRIGATION TIMING AND AMOUNT, CROP MANAGEMENT PRACTICES UNDER IRRIGATED CONDITIONS, SOIL WATER DETERMINATION, DEMONSTRATION AND EXTENSION TECHNIQUES AND COMPLEMENTARY SERVICES TO OTHER ON-GOING USAID PROGRAMS.

B. SHORT TERM CONSULTANTS (SIX MONTHS) IN SPECIALIZED FIELDS OF SOIL PHYSICS, BIOMETEOROLOGY, FIELD PLOT TECHNIQUE, SMALL STRUCTURE DESIGN, AND EXTENSION METHODS.

COMMODITIES
SMALL EQUIPMENT INCLUDING LABORATORY EQUIPMENT, WATER MEASUREMENT DEVICES, SOIL WATER DETERMINATION EQUIPMENT, PIPE, HYDRAULIC RAINS, WIND MILLS, SPRINKLERS, AND SOIL SAMPLING EQUIPMENT.

PARTICIPANTS-
A SHORT-TERM TRAINEES

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OTHER COSTS
EXPENDABLE MATERIALS, SUPPLIES, IN-COUNTRY TRAVEL, AND INCOUNTRY TRAINING.

3. MISSION UNDERSTANDS THAT UTAH STATE UNIVERSITY WILL BE SUBMITTIN DIRECTLY TO AID/W A BUDGET FOR ABOVE PROJECT INPUTS. MISSION'S PRELIMINARY ESTIMATED OF CONTRACTOR'S LIFE OF PROJECT COSTS, I.E. FY 1978 THROUGH FY 1980, WOULD BE AS FOLLOWS:

(IN U.S. THOUSANDS)

PROJECT INPUT	FY 1978	FUTURE YEAR OBLIGATIONS	TOTAL
U.S. TECHNICIANS	130	170	300
PARTICIPANTS	6	10	16
COMMODITIES	5	5	10
OTHER COSTS	30	46	76
TOTAL OBLIGATION	171	231	402

OTHER COSTS INCLUDES PROVISION OF OVERHEAD CALCULATED AT 15 PER CENT OF U.S. TECHNICIANS COSTS.

4. MISSION HAS JUST RECEIVED REFTEL WHICH PROVIDES PARAMETERS FOR FUNDING OF PROPOSED NEW PROJECT DURING THREE YEARS IT WILL BE FUNDED BY MISSION. USAID FEELS STRONGLY THAT INPUTS OUTLINED IN PARA 3 ABO F
CAN AND WILL BE JUSTIFIED IN FORTHCOMING PROJECT PAPER (PP) SUBMISSION.
DEAN

Department of State TELEGRAM

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FM AMEMBASSY SAN SALVADOR
TO SECSTATE WASHDC PRIORITY 2691

UNCLAS SAN SALVADOR 5241

AIDAC

E.O. 11652: N/A
SUBJECT: UTAH STATE UNIVERSITY CONTRACT AID/CSD-2167 AND YA-C-1103

REF: STATE 257082

1. MISSION IS CONCERNED THAT AID/W HAS MADE DECISION TO TERMINATE SUBJECT CONTRACT WITH NO APPARENT PROVISION FOR PHASE-OUT PERIOD WHICH WOULD PERMIT THE CONTRACT EMPLOYEE IN EL SALVADOR, TOM FULLERTON, TO BRING ABOUT AN ORDERLY TERMINATION AND WRAP UP OF PROJECT ACTIVITIES IN THE COUNTRY. THE CONTRACTOR HAS ADVISED US THAT UNLESS ADDITIONAL FUNDS ARE FORTHCOMING CONTRACT ACTIVITIES IN EL SALVADOR MAY HAVE TO TERMINATE BY THE END OF DECEMBER OF THIS YEAR, ALTHOUGH WE WERE AWARE OF THE PROGRAMMED CONTRACT TERMINATION DATE OF MARCH 31, 1977, THIS INFORMATION WAS PROVIDED ONLY INDIRECTLY THROUGH A NOTIFICATION THAT FULLERTON WOULD BE DEPARTING. MOREOVER, WE HAD UNOFFICIAL INFORMATION INDICATING THAT THERE MIGHT BE A NEW CONTRACT DIRECTED TOWARD APPLICATION OF EXISTING TECHNOLOGY. ACTIVITIES UNDER THE CONTRACT HAVE BEEN CARRIED ON IN EL SALVADOR FOR SIX YEARS AND CONSIDERABLE RESEARCH INFORMATION HAS BEEN GENERATED. FULLERTON REPORTS THAT A NUMBER OF ACTIVITES HAVE BEEN PROGRAMMED FOR APERIOD ESTIMATED TO RUN THROUGH JUNE 30 AND WHICH INCLUDE ANALYSIS OF RESEARCH RESULTS, PREPARATION OF EXTENSION
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3. THE PAY-OFF FOR THE PRESENT PROJECT WILL COME DURING THE NEXT SEVERAL MONTHS. OUR APPEAL IS THAT AID/W PROVIDE ASSURANCE THAT CONTRACTOR WILL HAVE RESOURCES AVAILABLE TO COMPLETE THE PROGRAMMED ACTIVITIES FOR EL SALVADOR AS STATED ABOVE.

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5. MISSION STRONGLY ENCOURAGES AID/W TO ASSURE APPROPRIATE FUNDING TO ACCOMPLISH THESE ACTIVITIES. PLEASE ADVISE.. LOZANO

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Department of State TELEGRAM

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ACTION AID-31

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INFO AMEMBASSY LIMA
AMEMBASSY SAN SALVADOR
AMEMBASSY GUATEMALA

UNCLAS QUITO 7960

AIDAC

E.O. 11652: N/A
SUBJECT: UTAH STATE UNIVERSITY WATER MANAGEMENT RESEARCH CONTRACT

REF: STATE 257962

1. MISSION HAS REVIEWED IMPLICATIONS REFTEL COMMENTS. FOLLOWING RECOMMENDATIONS ARE PROPOSED BY USAID/ECUADOR.

2. THE WORK OF CRAIG ANDERSON, USU WATER RIGHTS SPECIALIST, IN ECUADOR HAS BEEN SUBSTANTIAL. HE SHOULD BE ALLOWED TO COMPLETE PHASE ONE OF HIS RESEARCH ACTIVITY SO THIS CAN BE PACKAGED IN FINAL FORM AND BE PROVIDED GOE AND OTHER PARTICIPATING COUNTRIES FOR THEIR USE. TO DO LESS WOULD NEGATIVE THE FINE RESEARCH EFFORT AND IN EFFECT BE A BREACH OF PROMISE TO COOPERATING COUNTERPART INSTITUTIONS AND PERSONNEL THROUGHOUT THE REGION.

3. THEREFORE, WE BELIEVE THAT, THE WORKSHOPS WHICH WERE PLANNED BY USU WITH HOST COUNTRY INSTITUTIONS FOR PRESENTING THE RESEARCH FINDINGS AND THEIR POTENTIAL USE IN THE COUNTRIES MUST BE SUPPORTED BY AID, EVEN IF IT MEANS A SMALL EXTENSION OF SUBJECT CONTRACT. THIS OUTREACH MECHANISM IS VITAL TO ASSURE THAT HOST COUNTRY INSTITUTIONS DO FULLY UNDERSTAND AND APPRECIATE SIGNIFICANCE OF USU RESEARCH DATA DEVELOPED. THE GOE DEFINITELY WANTS

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4. USAID/E IS MAKING EVERY EFFORT IN A PHASE-DOWN SITUATION TO COMPLETE ON-GOING BILATERAL PROGRAMS IN A COMPLETE AND SUBSTANTIVE MANNER. THE USU CONTRACT CLOSE-OUT CANNOT MEET OUR CLOSE-OUT CRITERIA WITHOUT AID/W SUPPORT PER PARA 2 AND 3 ABOVE. THIS MISSION STRONGLY ENCOURAGES AID/W TO ASSURE APPROPRIATE FUNDING TO CONTRACTOR FOR MEETING THESE MINIMUM COMMITMENTS. SPECIFIC DETAILS ON COST REQUIREMENTS SHOULD BE REQUESTED FROM THE CONTRACTOR. THIS MISSION CAN PROVIDE SUPPLEMENTARY DETAILS AND INFORMATION AS REQUIRED.

5. PLEASE ADVISE.
BLOOMFIELD

9310489 (4)

RESEARCH

PD-AAC-884

Project Title Water Management Research in Arid & Sub-humid Lands of the LDCs

Project Number 931-17-120-489

Starting Date 6/28/68 Termination Date 6/28/73

Cumulative Obligations (in thousand $) June 30, 1968 294
FY 1969 Actual
FY 1970 Estimate 300
FY 1971 Proposed 350

Name of Contractor(s) Utah State University
Contract Number(s) csd-2167
Cooperating Sponsor(s) LA Bureau, CIDIAT/OAS, USAID Missions & Ministries in Brazil, Colombia, Chile, Venezuela
Project Summary
Date of PROM 4/68 Date Approved (FY) (RAC) 5/68 Evaluation Date (PAR)No

Purpose: The Spring Review listed water management as a subject which merits priority research attention. The improvement of water management practices and the integration of these practices with other essential management and cultural practices is basic to effective agricultural development. This problem has long been recognized and it has been a point of intensive concentration in ARD. Further emphasis is given the essential of good water management when it is recognized that good crop land is limited and costly to develop.

Description of Activity: To determine water management research needs in Latin America, a team from Utah State University visited countries in Central and South America. In cooperation with USAID and ministry representatives, country needs for on-farm water management research were determined. Sub-projects to implement work on these major problems were prepared, reviewed by AID/W and USAIDs and are now being implemented. The research is being closely coordinated with the CIDIAT program of OAS and with AID-sponsored projects on soils, fertilizers and water with TVA, North Carolina State University, Cornell University, and Colorado State University. 211(d) grants in the field of water management to Utah State University, Colorado State University and the University of Arizona are giving support to this research program by building upon U.S. competence.

Accomplishments: A team visited El Salvador, Honduras, Colombia, Peru, Chile, and Brazil. Six sub-projects were approved by AID/W and forwarded to the concerned missions. Four USU project scientists are presently in LA on TDY working to initiate projects in Colombia, Venezuela, and Chile. Brazil has indicated the desire to participate in the program in the near future and El Salvador at a later date.

Future Targets: To follow up with USAID missions on their research needs in water management and to help meet these needs through cooperative research assistance through this USU contract. Scientists will be posted in LA to conduct the research.

9310489 (22)

PD-AAC-884

MEMORANDUM

TO : AA/TA, Mr. Curtis Farrar

December 14, 1976

FROM : AA/LA, E. N. S. Girard II

SUBJECT: Utah State University Water Management Contract

The Peru Mission feels strongly that the Utah State University (USU) Water Management contract should be continued in Peru since it has been integrated into the $11 million A.I.D. loan for small-scale irrigation projects.

Neither the Mission nor our Bureau had programmed for this activity and, consequently, there are no financial resources with which to continue the project at this time. In a meeting held on November 5 between TAB and Mission management, it was agreed that TAB would continue funding the USU contract through December 1977 to allow the L.A. Bureau time to pick up the project in the FY 78 program.

The purpose of this memorandum is to request that TAB consider the following possibilities:

1. That TAB provide FY 1977 funds to support Dr. Edwin Olsen, now in Peru, through December 1977. The L.A. Bureau would then support Olsen for a three-year period, i.e. FY 78-80.

2. That TAB also provide funds to support Dr. Don Kedman for either FY 77 or FY 77 and 78; the two-year period would be preferable to the Mission, Dr. Kedman and Utah State University.

Please advise us of your decisions so that we may make the necessary adjustments in the FY 1978 Congressional Presentation.

LA DEC 1975

M E M O R A N D U M

TO : AA/TA, Mr. Curtis Farrar

FROM : AA/LA, E. N. S. Girard II

SUBJECT: Utah State University Water Management Contract

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The purpose of this memorandum is to request that TAB consider the following possibilities:

1. That TAB provide FY 1977 funds to support Dr. Edwin Olsen, now in Peru, through December 1977. The L.A. Bureau would then support Olsen for a three-year period, i.e. FY 78-80.

2. That TAB also provide funds to support Dr. Don Kedman for either FY 77 or FY 77 and 78; the two-year period would be preferable to the Mission, Dr. Kedman and Utah State University.

Please advise us of your decisions so that we may make the necessary adjustments in the FY 1978 Congressional Presentation.

Clearances:
LA/DR, Robert Simpson (draft)
Marshal Brown _____
C.B.Weinberg _____

LA/DR/RD:DAChaij:bey:12/10/76

RESEARCH (On-going) -16

9310489 (25)

PD-AAC-884

PROJECT SUMMARY

Major Type of Activity: Key Problem Area--Water and Tropical Soils Management

Project Title: Water Management Research in Arid and Sub-Humid Lands of the LDCs, NESA

Contractor: Colorado State University

Contract Number: AID/csd-2162

Contractor Liaison Officer: Dr. M. Albertson
Title: Director of Research

Project Number: 931-17-120-489
Present: 73-3102720

Project Duration: Started 6/28/68 Termination Date 6/28/73

Comments This university has also received a 211(d) grant

Budget:
a) Funds obligated through FY 69 : $369,240
b) Funded for FY 70 : 455,000
c) Funds requested for FY 71 : 450,000
d) Estimated fund requirement FY 72: 450,000

TA/AGF Project Monitor: Dr. Alvin D. Ayers

Purpose: The improvement of water management practices and the integration of these practices with other essential management and cultural practices is basic to effective agricultural development. This problem has long been recognized, and it has been a point of intensive concentration in TA/AGF. Further emphasis is given the essential of good water management when it is recognized that good crop land is limited and costly to develop.

Description of Activity: Under this contract CSU is to assist with water development and water management needs in Pakistan. To determine the priority needs, a research team spent several weeks in Pakistan with USAID representatives from agricultural experiment stations, universities and the Government of Pakistan. The research under this contract will be aimed at water management problems in the semi-arid lands but will be applicable in principle to similar conditions in other regions. Improvement of water management practices are needed to obtain maximum economic returns from limited water resources and production inputs.

Accomplishments: As a result of a team visit to Pakistan, seven sub-projects were approved and work initiated on the CSU campus. These include: skimming of fresh water from aquifers in which fresh water is underlain by saline water, economic analyses to achieve an efficient allocation of water in Pakistan, evaluation of mineral-water-iron equilibria that relate to water management practices, organization of agricultural development in West Pakistan, management optimization of water resource systems for increased agricultural production, optimization of the conveyance, delivery and application of water to the farm and production of a film on land levelling. GOP's recent approval of the long pending PROAG will enable CSU to start work on a full-time basis in West Pakistan.

Future Plans: In addition to its on-campus research, CSU will post two scientists in Pakistan. Some of the research data will be obtained on TDY assignments.

TA/AGF:M.Galli:7/15/70;revised 8/8/70

PROJECT SUMMARY

Major Type of Activity: Key Problem Area--Water and Tropical Soils Management

Project Title: Water Management Research in Arid and Sub-Humid Lands of the LDCs, LA

Contractor: Utah State University

Contract No.: AID/csd-2167

Contractor Liaison Officer: Dr. A. Alvin Bishop
Title: Professor, Civil Engineering

Project Number: 931-17-120-489
Present: 73-3102723

Project Duration: Started 6/28/68 Termination Date 6/28/73

Comments: This university has also received a 211(d) grant.

Budget:

a)	Funds obligated through FY 69	:	$294,750
b)	Funded for FY 70	:	450,000
c)	Funds requested for FY 71	:	500,000
d)	Estimated fund requirement FY 72:		550,000

TA/AGF Project Monitor: Dr. Alvin D. Ayers

Purpose: The improvement of water management practices and the integration of these practices with other essential management and cultural practices is basic to effective agricultural development. This problem has long been recognized and it has been a point of intensive concentration in TA/AGF. Further emphasis is given the essential of good water management when it is recognized that good crop land is limited and costly to develop.

Description of Activity: To determine water management research needs in Latin America, a team from Utah State University visited countries in Central and South America. Country needs for on-farm water management research are determined in cooperation with USAID and Ministry representatives. Sub-projects to implement work on these problems are prepared, reviewed by AID/W and USAIDs and are now being implemented. The research is being closely coordinated with CIDIAT program of OAS and with AID-sponsored projects on soils, fertilizers and water with TVA, North Carolina State University; Cornell University and Colorado State University.

Accomplishments: A team visited El Salvador, Honduras, Colombia, Peru, Chile, and Brazil; since then, several others have requested assistance. Six sub-projects were approved by AID/W and forwarded to the concerned missions. Four USU project scientists have completed TDY assignments. Work was initiated in Chile, El Salvador and Bolivia. USU is now assigning personnel to these countries for regular tours of duty.

Future Plans: To follow up with USAID missions on their research needs in water management and to help meet these needs through cooperative research assistance through this USU contract. Scientists will be posted in LA to conduct the research.

TA/AGF:M.Galli:7/15/70; revised 8/8/70

9310489 (24)

AID 1250-1
(6-68)

PD-AAC-884

PROJECT AGREEMENT

BETWEEN THE DEPARTMENT OF STATE, AGENCY FOR INTERNATIONAL DEVELOPMENT (AID), AN AGENCY OF THE GOVERNMENT OF THE UNITED STATES OF AMERICA, AND MINISTRY OF AGRICULTURE, CINPRA, SUBIN

AN AGENCY OF THE GOVERNMENT OF BRAZIL

PRO AG

ARDO

PROG

EXO

CONT

AID/W 16
PRPC 16
SUBIN 6
ARDO 3
LGS 3
CONT 4
RIO 3
EXO
PER
GSO
C&R

The above-named parties hereby mutually agree to carry out a project in accordance with the terms set forth herein and the terms set forth in any annexes attached hereto, as checked below:

[X] PROJECT DESCRIPTION ANNEX A
[ ] FOREIGN CURRENCY STANDARD PROVISIONS ANNEX
[ ] STANDARD PROVISIONS ANNEX
[ ] SPECIAL LOAN PROVISIONS ANNEX

This Project Agreement is further subject to the terms of the following agreement between the two governments, as modified and supplemented:

[X] GENERAL AGREEMENT FOR TECHNICAL COOPERATION	DATE: Dec. 19, 1950
[ ] ECONOMIC COOPERATION AGREEMENT	DATE
[X] (other) Special Technical Services Agreement	DATE: May 30, 1953

1. PROJECT/ACTIVITY NO.: Contract AID/csd-2167
PAGE 1 OF 11 PAGES

2. AGREEMENT NO.

3. [ ] ORIGINAL OR REVISION NO.

4. PROJECT/ACTIVITY TITLE: Water Management and Usage Research Program

931-11-120-489

5. PROJECT DESCRIPTION AND EXPLANATION
(See Annex A attached)

6. AID APPROPRIATION SYMBOL

7. AID ALLOTMENT SYMBOL

8. AID FINANCING [ ] DOLLARS [ ] LOCAL CURRENCY	PREVIOUS TOTAL (A)	INCREASE (B)	DECREASE (C)	TOTAL TO DATE (D)
(a) Total				
(b) Contract Services				
(c) Commodities				
(d) Other Costs				
9. COOPERATING AGENCY FINANCING - DOLLAR EQUIVALENT @ $1.00 =				
(a) Total				
(b) Technical and other Services				
(c) Commodities				
(d) Other Costs				

10. SPECIAL PROVISIONS (Use Additional Continuation Sheets, If Necessary)

11. DATE OF ORIGINAL AGREEMENT	12. DATE OF THIS REVISION	13. ESTIMATED FINAL CONTRIBUTION DATE
July 25, 1973		

14. FOR THE COOPERATING GOVERNMENT OR AGENCY
SIGNATURE: _____ DATE: _____
TITLE:

15. FOR THE AGENCY FOR INTERNATIONAL DEVELOPMENT
SIGNATURE: Leonard Unger DATE: July 25, 1973
TITLE:

PROJECT AGREEMENT
BETWEEN AID AND
MINISTRY OF AGRICULTURE, CINGRA, SUBIN
AN AGENCY OF THE GOVERNMENT OF
BRAZIL

1. Project/Activity No.: Contract AID/csd-2167
2. Agreement No.:
3. ☐ Original or Revision No. ____
4. Project/Activity Title: Water Management and Usage Research Program

I. PARTES DESTE CONVÊNIO

São partes do presente Convênio, o Ministério da Agricultura (MINAGRI); a Coordenação de Assuntos Internacionais de Agricultura (CINGRA); a Secretaria de Cooperação Econômica e Técnica Internacional (SUBIN), do Ministério do Planejamento e Coordenação Geral; e a Agência Norte-Americana para o Desenvolvimento Internacional (USAID/Brasil).

I. PARTIES OF THIS AGREEMENT

The parties to this Agreement are the Ministry of Agriculture (MINAGRI); Coordination of International Agricultural Affairs (CINGRA); Secretariat of International Economic and Technical Cooperation (SUBIN) of the Ministry of Planning and General Coordination; and the United States Agency for International Development (USAID/Brazil).

II. OBJETIVOS

De conformidade com o contrato AID/csd-2167 da AID/W, a Universidade Estadual de Utah (USU), com a aprovação da USAID/Brasil, prestará colaboração técnica ao Departamento Nacional de Pesquisa Agropecuária (DNPEA) em um Programa de Pesquisa sobre a Necessidade, Manejo e Uso da Água.

II. OBJECTIVES

In accordance with Contract AID/csd-2167 of AID/W, Utah State University with the approval of USAID/Brazil will give technical assistance to the National Department for Agricultural Research (DNPEA) with its Water Management and Usage Research Program.

III. FINALIDADES

A finalidade deste documento é definir as responsabilidades do Governo do Brasil (GOB), através do MINAGRI que, neste caso específico, atuará representado pelo Departamento Nacional de Pesquisa Agropecuária (DNPEA); do Governo dos Estados Unidos da América, através do seu "Bureau" de Assistência Técnica em Washington (TAB/AID/W); e da USAID/Brasil, no fornecimento de técnicos, recursos materiais e apoio logístico, com a finalidade de desenvolver

III. GOALS

This document defines the responsibilities of the Government of Brazil (GOB), through MINAGRI which in this particular case is represented by DNPEA; the government of the United States of America through the Technical Assistance Bureau in Washington (TAB/AID/W); and of USAID/Brazil for furnishing technicians, resources and logistical support with the view of developing and improving the Management and Usage of Water and Research in

e melhorar o Manejo da Água e a Pesquisa sobre a sua Necessidade e Uso no Brasil, para o melhor aproveitamento dos recursos naturais, humanos, técnicos e financeiros disponíveis, visando ao melhoramento sócio-econômico do Brasil, com ênfase especial na região semi-árida do Nordeste brasileiro.

the Water Requirements in Brazil, for the best utilization of the natural, human, technical and financial resources available for the socio-economical betterment of Brazil with emphasis on the semi-arid regions of Northeast Brazil.

IV. PLANO DE AÇÃO

A - PESQUISA SOBRE AS NECESSIDADES DA AGUA PARA IRRIGAÇÃO NO NORDESTE

Com relação a esta parte do Programa, a USU enviará um especialista altamente qualificado em programação de computador, de acordo com o que ficou acertado entre a USU, o MINAGRI e a USAID/Brasil, para cooperar com o MINAGRI no seguinte:

1. Desenvolvimento de um programa para a avaliação da correlação entre o clima e a produção agrícola, bem assim para delinear áreas onde a agricultura originária de chuva é possível e as plantas a serem aí cultivadas; áreas nas quais uma irrigação complementar é requerida e respectivas culturas; áreas a serem cultivadas sob irrigação e respectivas culturas e o mais eficiente método de uso da água, tomando-se em consideração as propriedades físicas do solo e a eficiência de fertilizantes aplicados às culturas.

IV. PLAN OF ACTION

A - RESEARCH ON WATER REQUIREMENTS FOR IRRIGATION FOR THE NORTHEAST

For this part of the program USU will provide a highly qualified specialist in computer programming, in accordance with the understanding between USU, MINAGRI and USAID/Brazil to cooperate with MINAGRI in the following:

1. Development of a program for the evaluation of the relationship of climate to agricultural production and to delineate areas where rain fed agriculture is feasible and the crops that can be cultivated; areas where supplementary irrigation is needed and the crops to be grown therein; and areas where irrigation is required and the crops to be cultivated therein, and the most efficient method of using water, taking into consideration the physical properties of the soils and the efficiency of fertilizer applications to the crops.

2. Isto será conseguido, sobretudo, através da elevação do nível de competência dos técnicos brasileiros, por meio de cursos sobre análises, em computador, dos dados disponíveis em Climatologia; das análises dos resultados do programa acima; da confecção de mapas de isoetas, mostrando áreas de umidade deficiente e através do auxílio da pesquisa aplicada, utilizando os resultados do computador e de outras análises técnicas.

B - PESQUISA SOBRE MANEJO E USO DA ÁGUA

No que diz respeito a esta parte do Programa, a USU fornecerá um especialista em pesquisa de irrigação, por 2 anos, a ser localizado no Nordeste, em Petrolina, a critério do MINAGRI. Quando necessário e por mútuo acordo entre os convenentes (MINAGRI, USAID/Brasil), a USU enviará, por curto período, especialistas em áreas específicas.

Como descrito nas seções que se seguem, e aceito mutuamente pelo MINAGRI e a USAID/Brasil, os especialistas em pesquisa de irrigação:

1. Cooperarão e assistirão o MINAGRI, através do Departamento Nacional de Pesquisa Agropecuária - DNPEA, na avaliação dos programas de pesquisa existentes e farão recomendações para os novos programas de pesquisa, prioridades e cronogramas. Cooperando com seus contrapartes brasileiros e com a USAID/Brasil, eles assistirão no melhoramento do

2. This will be accomplished mainly through the raising of the level of competence of Brazilian technicians by courses in computer analysis of the available climatological data, analysis of the results of the above program, making of isohytal maps showing areas of moisture deficiency, and through the use of applied research utilizing the results of the computer and other forms of technical analysis.

B - RESEARCH ON WATER MANAGEMENT AND USAGE

In accordance with the terms of this part of the Agreement, USU will provide a technician in irrigation research for a period of two years to be located in the Northeast, at Petrolina, the location to be selected by MINAGRI. When needed and with mutual agreement of all contracting parties USU will furnish specialists in specific fields for short term TDY's

As shown in the following sections and with mutual agreement of MINAGRI and USAID/Brazil, the specialists in irrigation will:

1. Cooperate with and assist MINAGRI through National Department for Agricultural Research (DNPEA) to evaluate existing research programs, make recommendations for new research programs, priorities and schedules. Cooperating with their Brazilian counterparts and with USAID/Brazil, they will assist in bettering the exchange of technical

intercâmbio de informação técnica entre os órgãos, de maneira a tirar-se vantagens quanto aos resultados das pesquisas passadas, presentes e futuras.

information among the organizations so that they will obtain the benefits of past, present and future research.

2. Ficarão sediados no Nordeste e, juntamente com os seus contrapartes, serão responsáveis pelos trabalhos ali desenvolvidos. Quando solicitado, viajarão a qualquer parte do país para discussão sobre o progresso dos vários aspectos do programa. Assistirão, ainda, na melhoria da capacitação da equipe brasileira para planejar, desenvolver e executar programas de pesquisa em Necessidade, Manejo e Uso da Água e na aplicação daí decorrente, através de demonstrações, consultas, cursos e seminários.

2. The USU team will be headquartered in the Northeast and, with their counterparts, will be responsible for the work there. When requested, they will travel to whatever part of the country necessary for discussions of the progress of the various aspects of their program. They will also assist in improving the capability of the Brazilian technicians to plan, develop and execute research programs in Water Requirements and its Management and Use and applications resulting therein, by demonstrations, consultations, courses and seminars.

V. RESPONSABILIDADES

A - Da Agência Norte-Americana para o Desenvolvimento Internacional (USAID):

Através do seu contrato AID/csd-2167 com a Universidade Estadual de Utah (USU), a USAID concorda em:

1. No que diz respeito à Pesquisa do Manejo da Água, providenciar os serviços de um especialista em Pesquisa de Irrigação, para um período inicial de dois anos.

2. Quanto à parte relativa à Necessidade de Água para Irrigação, fornecer os serviços de um especia-

V. RESPONSIBILITIES

A - Of the United States Agency for International Development (USAID):

Through its contract AID/csd-2167 with Utah State University, USAID agrees:

1. For the portion pertaining to the Water Management and Usage Research, will provide the services of a specialist in Irrigation Research for an initial period of two years.

2. For the portion pertaining to the Water Requirements for Irrigation, will provide the services of a

lista em Pesquisa de Necessidade de Água para Irrigação por um período de seis meses em cada ano, durante dois anos. Parte do tempo do especialista será gasto na USU. Ele também estará disponível para vir ao Brasil, quando solicitado e por mútuo acordo das partes convenentes, para uma estada de até 60 dias. Com o regresso do primeiro grupo de bolsistas treinados nos Estados Unidos, esse técnico virá assistir o referido grupo especialmente na aplicação prática dos resultados da pesquisa hidroclimatológica desenvolvida.	specialist in Irrigation Water Requirements Research for a period of six months annually for two years. Part of the time of this specialist will be spent in USU. He will also be available at the request of and with the concurrence of all contracting parties for short TDY's for a total additional period not to exceed 60 days. Upon the return of the first group of participants trained in the United States, the specialist will come to assist the group especially in the practical application of the results of the hydroclimatological research.
3. Fornecer especialistas por prazo curto em campos especializados, quando solicitado pelos convenentes.	3. Furnish specialists for short term TDY's in special fields when requested by the participating agencies.
4. Fornecer, dependendo da disponibilidade de recursos, outros pesquisadores, quando necessário e após mútuo acordo entre as partes, com base no desenvolvimento organizacional e necessidades operacionais.	4. Within the limits of available funds furnish other research technicians when deemed necessary and with the full concurrence of the contracting parties in accordance with organizational development and operational needs.
5. Prover , de acordo com o contrato AID/csd-2167: salário, diárias, viagens internacionais, embarque de equipamento, materiais domésticos, bem como ajuda de custo e bens de consumo para todo o pessoal da USU.	5. Will provide under contract AID/csd-2167: salary, per diem, international travel, shipment of equipment, material and household effects and living allowance for housing and utilities for all USU personnel in Brazil.
6. Fornecer um veículo para uso do pessoal da USU, durante a implementação deste programa. Este veículo passará para o acervo do DNPEA, ao término do acordo.	6. Will furnish a vehicle for the use of USU personnel during the contract implementation period. The vehicle will be transferred to DNPEA upon the conclusion of the contract.
7. Fornecer pessoal e outras facilidades, incluindo o uso de um	7. Will furnish personnel and facilities including the use of a

computador nos Estados Unidos, para análises de dados climatológicos e aplicação dos resultados. Proviendo ciar também o uso de equipamentos especializados e sofisticados nesse setor quando tal equipamento não for disponível no Brasil.

8. Fornecer equipamento, facilidades e pessoal para cursos ou treinamento para bolsistas que sejam mandados para a USU para estudos pós-graduados ou cursos de curta duração, depois que sejam acordadas mutuamente as bases financeiras para pagamento de salários, diárias e custo das viagens.

computer in the United States for the analysis of climatological data and for the application of the results. They will also provide the use in the field of specialized and sophisticated equipment when such equipment is not available within Brazil.

8. Furnish equipment, facilities and staff for courses or training for participants that may be sent to USU for post-graduate work or short courses, after financial arrangements for paying the salaries, per diem and costs of the travel have been mutually agreed upon.

A USAID concorda também em:

1. Assumir responsabilidades de articulação e orientação junto ao MINAGRI e à USU, para levar avante os objetivos do programa.

2. Prover serviços tais como: consecução de "visas", importação de equipamento, veículos e objetos de uso pessoal, acesso à assistência médica dos EE.UU., às vantagens em educação e demais benefícios derivados das disposições gerais do Convênio.

USAID also agrees to:

1. Provide liaison and monitoring responsibilities with MINAGRI and USU to further the objectives of the program.

2. Provide such services as facilitating visas, importation of equipment, vehicles, and personal effects and access to U.S. provided health and educational facilities and other benefits derived from the general provisions agreement.

B.- DO MINISTÉRIO DA AGRICULTURA

1. Promover coordenação técnica e administrativa através do INSTITUTO DE PESQUISA AGROPECUÁRIA DO NORDESTE - IPEANE, que ficará diretamente responsável pela execução do programa. Fornecer, no mínimo, dois especialistas como contrapartida

B - OF THE MINISTRY OF AGRICULTURE

1. Furnish technical and administrative coordination through INSTITUTE FOR AGRICULTURAL RESEARCH FOR THE NORTHEAST - IPEANE who will be directly responsible for the implementation of the program. Furnish, as a minimum, 2 counterparts for the

ao especialista em Pesquisa de Irrigação, além de outro para o programa de pesquisa em Necessidade de Água para Irrigação.

2. Fornecer equipamento de campo suficiente para atender às finalidades do programa, e dar apoio ao programa de pesquisa e à sua execução através dos recursos do PROTERRA.

3. Instalar a equipe de especialistas de acordo com as necessidades do programa, fornecendo serviços de secretária e de tradução, bem como transporte no país, quando o veículo da USU não for suficiente.

4. Fornecer equipamento de campo, maquinária agrícola, equipamento de laboratório, material técnico, sementes, adubo e demais facilidades necessárias para planejar e implementar o programa de pesquisa de campo, acordado com a USU.

5. Fornecer tempo de computador para programas a serem processados no Brasil, de acordo com as necessidades do projeto.

6. Providenciar tradução e facilidades de publicação para produção de boletins técnicos, mapas, etc., em língua portuguesa.

7. Providenciar, através da CINGRA, para todo o pessoal da USU, imunidades e privilégios iguais aos conferidos ao pessoal da USAID no Brasil.

8. Indicar, pelos menos, três bolsistas por ano para serem treinados na USU e/ou no Brasil, na

Research Specialist in Irrigation in addition to one counterpart for the research program for the Water Requirements for Irrigation.

2. Furnish sufficient field equipment for the needs of the program and to support the research program and its execution through the resources of PROTERRA.

3. Locate the specialist team in accordance with needs of the program, furnish secretarial and translation services and transportation within the country when the USU vehicle does not suffice.

4. Furnish field equipment, agricultural and laboratory equipment, technical materials, seeds, fertilizers, and other needs and facilities for planning and implementing the field research agreed upon with USU.

5. Provide the use of computer time for programs within Brazil for the needs of the program.

6. Provide translation and publication facilities for the production of technical bulletins, maps, etc., in the Portuguese language.

7. Provide through CINGRA immunities and privileges for all USU personnel as accorded to USAID personnel in Brazil.

8. Provide at least three participants per year to learn the methodology and application of computer

metodologia e aplicação da análise em computador de dados climatológicos.

9. Fornecer todos os salários, diárias, transporte, etc., para todos os empregados brasileiros que trabalhem neste programa no Brasil.

10. Designar candidatos para possíveis cursos pós-graduados na USU no campo de Manejo e Uso da Água ou Irrigação e Drenagem, depois que tenham sido realizados entendimentos financeiros satisfatórios com respeito aos salários, diárias e despesas de viagem para esses cursos.

11. Na medida dos recursos financeiros disponíveis, fornecer ao técnico da USU designado por longo prazo, a ser instalado no Nordeste, habitação mobiliada, eletrodomésticos, luz, água, e gás, diárias, transportes no país e demais despesas locais, de modo a reservar os recursos em dólares para ampliação da assistência técnica ao projeto.

analysis of climatological data to be trained at USU and/or in Brazil.

9. Provide all of the salaries, per diem, transportation, etc., for all Brazilians working on this program in Brazil.

10. Designate candidates for possible post-graduate courses at USU in the field of Water Management and Usage and/or Irrigation and Drainage, after satisfactory financial arrangements have been made for their salaries, per diem, and costs for the travel expenses for these courses.

11. To the extent of financial resources available, furnish to the USU long-term technician to be installed in the Northeast furnished housing, utilities, local per diem, in-country transportation and all other local costs in order to conserve dollars resources to permit augmentation of technical assistance to the project.

VI. DESENVOLVIMENTO E USO DOS DADOS TÉCNICOS E RELATÓRIOS

A equipe da USU avaliará, para o MINAGRI e a USAID/Brasil, o progresso dos trabalhos, através de relatórios trimestrais e relatórios anuais para o MINAGRI, com número razoável de cópias para a USAID/Brasil. Um relatório final será apresentado no término do contrato.

VI. DEVELOPMENT AND USE OF TECHNICAL DATA AND REPORTS

The USU team will evaluate the progress of the work for MINAGRI and USAID/Brazil by preparing quarterly and annual reports for MINAGRI with appropriate copies for USAID/Brazil. A final report will be submitted at the end of the contract period.

Um plano anual de trabalho será preparado dentro de sessenta dias depois da chegada da equipe da USU. Este plano de trabalho será submetido à aprovação do MINAGRI e da USAID/Brasil.

An annual plan of work will be prepared within sixty days of the arrival of the team in Brazil. This plan of work will be submitted to MINAGRI and USAID/Brazil for approval.

Será permitido à USU realizar alguns estudos baseados no programa de pesquisa executado no Brasil, a fim de favorecer os objetivos globais do contrato AID/csd-2167, desde que seja concedido crédito adequado ao MINAGRI e à USAID/Brasil.

USU will be permitted to pursue some studies based on the research work in Brazil in order to benefit the overall objectives of Contract AID/csd-2167 provided appropriate credit is given to MINAGRI and USAID/Brazil.

VII. GENERALIDADES

O MINAGRI se compromete a apoiar o programa do Ministério do Interior (MINTER) para criação de um Instituto de Tecnologia e Treinamento em Irrigação do Nordeste, localizando a equipe técnica de "Pesquisa sobre o Manejo e Uso da Água" em Petrolina, no Estado de Pernambuco.

VII. GENERAL

MINAGRI agrees to support the Ministry of Interior (MINTER) program in the creation of the Institute for Technology and Training in Irrigation in the Northeast, stationing the Water Management and Usage Research Team at Petrolina, in the State of Pernambuco.

VIII. DURAÇÃO E VALIDADE

Este Convênio será válido na data de aposição da última assinatura e continuará em vigência por dois (2) anos, a contar do início da data de validade. O acordo poderá ser abreviado, modificado ou prorrogado, depois de mútuo entendimento entre as partes convenentes.

VIII. VALIDITY AND DURATION

This agreement will become valid on the date of the last signature shown below and shall continue in force for a period of two years after the initial date of validity. The Agreement can be shortened, modified or extended upon the mutual agreement of the parties to this agreement.

AID 1330-1A (3-70)	PROJECT AGREEMENT BETWEEN AID AND MINISTRY OF AGRICULTURE, CINGRA, SUBIN	1. Project/Activity No. Contract AID/csd-2167	PAGE 11 OF 11 PAGES
PRO AG CONTINUATION SHEET		2. Agreement No.	3. ☐ Original or Revision No.
ANNEX	AN AGENCY OF THE GOVERNMENT OF BRAZIL	3. Project/Activity Title Water Management and Usage Research Program	

MINISTÉRIO DA AGRICULTURA

Data:

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID/Brazil)

Date: July 25, 1973

COORDENAÇÃO DE ASSUNTOS INTERNACIONAIS DA AGRICULTURA (CINGRA)

Data:

SECRETARIA DE COOPERAÇÃO ECONÔMICA E TÉCNICA INTERNACIONAL (SUBIN)

Data:

De acordo:

DIVISÃO DE COOPERAÇÃO TÉCNICA (DCT) DO MINISTÉRIO DAS RELAÇÕES EXTERIORES

For the Cooperating Government or Agency	For the Agency for International Development
SIGNATURE: DATE: TITLE:	SIGNATURE: DATE: TITLE:

AID 1330-1 (9-64)

PRO AG

9310489 (25)

931-11-120-489

PROJECT AGREEMENT

BETWEEN THE DEPARTMENT OF STATE, AGENCY FOR INTERNATIONAL DEVELOPMENT (AID), AN AGENCY OF THE GOVERNMENT OF THE UNITED STATES OF AMERICA, AND

INSTITUTO COLOMBIANO AGROPECUARIO (ICA) PD-AAC-884

AN AGENCY OF THE GOVERNMENT OF COLOMBIA

The above-named parties hereby mutually agree to carry out a project in accordance with the terms set forth herein and the terms set forth in any annexes attached hereto, as checked below:

☐ PROJECT DESCRIPTION ANNEX A ☐ FOREIGN CURRENCY STANDARD PROVISIONS ANNEX

☒ STANDARD PROVISIONS ANNEX ☐ SPECIAL LOAN PROVISIONS ANNEX

This Project Agreement is further subject to the terms of the following agreement between the two governments, as modified and supplemented:

☒ GENERAL AGREEMENT FOR TECHNICAL COOPERATION	DATE 7/23/62
☐ ECONOMIC COOPERATION AGREEMENT	DATE
☐ (other)	DATE

1. PROJECT/ACTIVITY NO. AID Contract csd-2167

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2. AGREEMENT NO. 6

3. ☒ ORIGINAL OR REVISION NO.

4. PROJECT/ACTIVITY TITLE

SALINITY RESEARCH PROGRAM

5. PROJECT DESCRIPTION AND EXPLANATION

(See Annex A attached)

6. AID APPROPRIATION SYMBOL: AID Contract

7. AID ALLOTMENT SYMBOL: csd-2167

8. AID FINANCING ☐ DOLLARS ☐ LOCAL CURRENCY	PREVIOUS TOTAL (A)	INCREASE (B)	DECREASE (C)	TOTAL TO DATE (D)
(a) Total				
(b) Contract Services				
(c) Commodities				
(d) Other Costs				
9. COOPERATING AGENCY FINANCING - DOLLAR EQUIVALENT $1.00=				
(a) Total				
(b) Technical and other Services				
(c) Commodities				
(d) Other Costs				

HHarper RDO

WNicolai ADM

HRSharlach APO

JOPhilpott PO

JJSconce ADO

10. SPECIAL PROVISIONS *(Use Additional Continuation Sheets, If Necessary)* U.S. Dollar costs of contract services furnished under this Agreement are provided from central funds furnished by the Agency for International Development and are not charged to the U.S. AID Mission program in the country. The purpose of this Pro/Ag is to set forth Project goals and to specify responsibilities of the contributing parties for FY'71. In the near future USAID will transmit by letter to Planeacion and ICA information containing the exact FY'71 funding by AID/W of this project.

11. DATE OF ORIGINAL AGREEMENT	12. DATE OF THIS REVISION	13. ESTIMATED FINAL CONTRIBUTION DATE
September 15, 1970		December 31, 1971

14. FOR THE COOPERATING GOVERNMENT OR AGENCY

SIGNATURE: Jorge Ortiz Mendez DATE:

TITLE: Inst. Colombiano Agropecuario ICA

15. FOR THE AGENCY FOR INTERNATIONAL DEVELOPMENT

SIGNATURE: Marvin Weissman DATE:

TITLE: Director, USAID/Colombia

Jorge [illegible] Lara, Jefe
Departamento Nacional de Planeación

I. INTRODUCTION

Pursuant to the principles set forth in the Act of Bogotá, the Charter of Punta del Este, and the General Agreement for Economic, Technical and Related Assistance signed July 23, 1962, this Project Agreement to provide assistance as further defined hereunder is entered into between the Colombian Agricultural and Livestock Institute (hereinafter called "ICA"), as represented by the Director General, the National Department of Planning, as represented by the Director, and the Agency for International Development (hereinafter called "AID"), as represented by the Director of the Agency's Mission in Colombia.

II. CURRENT SITUATION

INCORA is carrying out irrigation and reclamation works in 15 irrigation districts in the country. Some areas: Atlántico, Huila, Tolima, Valle and Bolívar-Sucre, are already experiencing salinity problems with Atlántico being the most acute. There is little existing knowledge regarding the kinds of water management that can hold salinity or drainage problems in check. Furthermore, the production responses from applications of water to different crop varieties needs to be tested systematically in the various regions of the nation.

III. SPECIFIC OBJECTIVES OF THE PROJECT

This project provides for the technical assistance to ICA by Utah State University in planning and carrying out a program of water management research

I. INTRODUCCION

De acuerdo con los principios establecidos en el Acta de Bogota, la Carta de Punta del Este y el Convenio General para Asistencia Económica, Técnica y Afines, firmado el 23 de julio de 1962, se celebra el presente Acuerdo de Proyecto para asesorar como se define mas adelante, al Instituto Colombiano Agropecuario (en adelante denominado "ICA"), representado por su Director General, el Departamento Administrativo de Planeación Nacional, representado por su Director, y la Agencia para el Desarrollo Internacional (en adelante denominada "AID"), representada por el Director de la Misión en Colombia.

II. SITUACION ACTUAL

INCORA está adelantando obras de irrigación y adecuación de tierras en 15 distritos de riego en el país. Algunas regiones como Atlántico, Huila, Tolima, Valle, Bolívar-Sucre están experimentando problemas de salinidad, encontrándose la situación mas crítica en el Departamento de Atlántico. Existe muy poco conocimiento relacionado con los métodos de manejo de agua que puedan mantener bajo control los problemas de salinidad y drenaje. Además, las respuestas en la produccion a la aplicacion de riego a distintos tipos de cultivos requieren chequeo sistematico en las distintas regiones del pais.

III. OBJETIVOS ESPECIFICOS DEL PROYECTO

Este proyecto suministra asistencia tecnica al ICA mediante los servicios del personal de la Universidad del Estado de Utah en el planeamiento y desarro-

at selected research stations or locations in Colombia. The data and information obtained will be used in the national development of land and water resources in Colombia and elsewhere as applicable in accordance with Article VII - GENERAL, paragraph(e) of this Agreement. Such information will be of special interest to agencies such as INCORA in the development of irrigation districts and to farmers in general. It is expected that this program will be an integral part of the program of ICA for research in Colombia.

IV. SCOPE OF WORK OF TECHNICAL ASSISTANCE

The work outlined in this section will be undertaken in the Departments of Atlantico and Magdalena by the USU staff members assigned to the program as described in Annex A, working directly with the counterparts assigned by ICA. The USU staff members will provide the technical leadership to plan and implement the research program jointly with their counterparts.

1. Description

a. Field work on the light soils (in Atlantico # 3)

(1) Studies to obtain data on drain characteristics and spacing.

(2) Determine the nature and extent of the salinity and/or

llo de un programa de investigacion de manejo de aguas en estaciones experimentales y en localidades seleccionadas del pais. Los datos e informaciones obtenidas en el proyecto serán usadas en el desarrollo general de los recursos de tierras y aguas en Colombia y en otras partes en donde sean aplicables, según se menciona en el literal (e) del Artículo VII. Estas informaciones serán de especial interés para entidades como el INCORA en el desarrollo de los distritos de riego y a los agricultores en general. Se espera que este programa sea parte integral de la investigación del ICA en Colombia.

IV. ALCANCE DEL TRABAJO DE SERVICIOS TECNICOS

El trabajo descrito en esta sección se llevará a cabo en los departamentos de Atlántico y Magdalena por el personal asignado por la Universidad de Utah, según se describe en el Anexo A, para trabajar directamente con las contrapartes asignadas por el ICA. En consulta directa con sus contrapartes, el personal de la Universidad de Utah suministrará dirección técnica en el planeamiento y ejecutará conjuntamente los programas de investigación.

1. Descripción

a. Trabajos de campo en suelos livianos (Atlántico # 3)

(1) Estudios para obtener información sobre características de los drenajes y su distanciamiento.

(2) Determinar la naturaleza y alcance del problema salino y/o sódico

sodic problem through both physical and chemical laboratory analysis of soil samples.

(3) Conduct field trials on plots adjacent to the newly constructed open drains where water table building will not interfere with the studies.

b. Field work on the heavy soils

(1) Determine the criteria by which subsurface drainage can be accomplished economically.

(2) Investigate management practices that will minimize water table build-up and optimize productivity and farmer income under given conditions.

c. The following tasks will be undertaken:

(1) Determine the hydraulic conductivity, specific yield, and transmissibility of the subsoils in representative areas.

(2) Establish an experimental area in a selected site where a pilot drainage system can be installed.

(3) Determine the rate of water table build-up and the effectiveness of the pilot drainage system.

(4) Investigate the irrigation interactions with crop varieties, plant populations, and fertilizers for optimum production of crops.

mediante analisis de laboratorio tanto físicos como químicos de muestras de suelos.

(3) Efectuar pruebas de campo donde el fluctuante nivel freático no interfiera con los estudios.

b. Trabajo de campo en suelos pesados

(1) Determinar el criterio por el cual el drenaje superficial pueda llevarse a cabo económicamente.

(2) Investigar prácticas de manejo que reduzcan la rata de crecimiento del nivel freático para obtener máxima productividad a ingresos para el agricultor en estas condiciones.

c. Se llevarán a cabo los siguientes trabajos:

(1) Determinar la conductividad hidráulica, rendimientos específicos y transmisibilidad de los subsuelos en áreas representativas.

(2) Establecer un área experimental en un sitio seleccionado en donde pueda instalarse un sistema piloto de drenaje.

(3) Determinar la rata de crecimiento del nivel freático y la efectividad del sistema piloto de drenaje.

(4) Investigar la inter-acción de la irrigación en diferentes variedades de cultivos, densidad de plantas y fertilizantes para obtener óptima producción en las cosechas.

(5) Determine actual and potential evapotranspiration.

(6) Supplement data now being obtained at existing meteorological stations in the area. (Important parameters such as wind velocity are not now being measured.)

(7) Measure surface run off from both rainfall and irrigation on the experimental areas.

(8) Tests of a modified mole drain system will be made at selected sites in Colombia prior approval of ICA.

V. PURPOSE OF THIS AGREEMENT

The purpose of this Agreement is to provide the technical services of two long term and no less than 14 man-months of short term consultant services from Utah State University to assist the Colombian Agriculture and Livestock Institute (ICA) to accomplish objectives set forth above.

VI. RESPONSIBILITIES

AID hereby agrees to the following responsibilities and commitments:

1. To finance from FY'71 funds not less than 24 man months of technical services to ICA by 2 full time USU specialists and not less than 14 months of short term consultant services. These funds will cover salaries, per diem, national and international travel,

(5) Determinar la evapotranspiración real y potencial.

(6) Complementar las informaciones obtenidas en la actualidad en las estaciones meteorológicas de la zona. (Parámetros importantes como la velocidad del viento no se están midiendo actualmente).

(7) Medir la escorrentía superficial de la precipitación pluvial y del riego en las áreas experimentales.

(8) Se harán pruebas de un sistema modificado de dren-topo en las áreas de trabajo en sitios seleccionados previo visto bueno del ICA.

V. PROPOSITO DE ESTE ACUERDO

El propósito de este Acuerdo es suministrar servicios técnicos de dos técnicos de tiempo completo y no menos de 14 meses hombre de servicios consultivos de personal de la Universidad del Estado de Utah para ayudar al Instituto Colombiano Agropecuario (ICA) a lograr los objetivos descritos anteriormente.

VI. RESPONSABILIDADES

Por el presente Acuerdo AID se compromete a cumplir las siguientes responsabilidades y compromisos:

1. Financiar de fondos del año fiscal de 1971 no menos de 24 meses hombre de servicios técnicos para el ICA, prestados por dos especialistas de tiempo completo de la Universidad del Estado de Utah, y no menos de 14 meses hombre de servicios consultivos.

housing allowances, and other normal benefits.

2. To provide 2 (4-wheel drive, preferably 3/4 ton pick-ups)vehicles, maintenance and essential technical equipment to carry out the program as described in Annex A.

ICA hereby agrees to the following responsibilities and commitments.

1. To provide the salaries and as appropriate, the per diem, and travel of the Colombian personnel assigned to this project as described in Annex B.

2. To provide land area with adequate water supply to assure irrigation when needed.

3. To provide office space, secretarial assistance, supplies and other necessary administrative facilities which in ICA's judgement be required for effective operation of USU and Colombian personnel assigned to this project.

4. To provide farm machinery and other equipment necessary to land preparation, cultivating, harvesting, irrigation and other such necessary work.

VII. GENERAL

a) It should be understood that it is AID's intention, pending availability of funds, to continue support of

Estos fondos cubrirán salarios, viáticos, viajes nacionales e internacionales, alojamiento y demás prestaciones.

2. Suministrar dos vehículos, de doble transmisión y de preferencia de 3/4 de tonelada tipo pick-up, su mantenimiento y equipo técnico esencial para el desarrollo del programa según se describe en el Anexo A.

ICA se compromete a cumplir las siguientes responsabilidades y compromisos:

1. Sufragar los salarios y según se requiera los viáticos y costos de viajes nacionales del personal colombiano asignado al proyecto según lo descrito en el Anexo B.

2. Suministrar tierra y abastecimiento de agua adecuado para asegurar el riego cuando sea necesario.

3. Suministrar oficinas, servicios secretariales, elementos y otras facilidades administrativas que a juicio del ICA sean necesarias para la efectiva operación del personal colombiano y extranjero asignado al proyecto.

4. Suministrar maquinaria agrícola y otros equipos necesarios para la preparación de tierras, cultivos, cosechas, riego y otros trabajos.

VII. GENERAL

a) Queda entendido que es intención de AID, sujeto a la disponibilidad de fondos, continuar el programa

the project in FY'72. Preferably regional funds would be utilized, but barring that, central funds will be used.

b) Utah State University will submit to USAID, ICA and National Planning Department for approval the curriculum vitae of full time and short term technicians to be assigned to the project.

c) Since the experimental programs involve several disciplines, it is anticipated that specialist help will be needed to answer specific problems as they arise in the field. Where possible the technical expertise within ICA and AID through contract personnel now in Colombia, will be requested to help solve the problem. Where this is not possible technical consultants on a TDY basis will be available from Utah State University. Estimated need of USU TDY staff is indicated in Annex A.

d) A yearly detailed work plan will be prepared within 60 days after the arrival of USU full time staff to serve as a work guide, which will be submitted to ICA, AID and National Planning Department for approval. ICA will attach to the approval a work plan for each technician. USU staff will inform ICA, IN CORA, AID and National Planning Department of major developments in the field work and will prepare semi-annual reports to above agencies.

durante el año fiscal de 1972, utilizando preferencialmente fondos regionales o fondos centrales.

b) La Universidad del Estado de Utah someterá al ICA, USAID y al Departamento Administrativo de Planeación para selección y aprobación, los curriculum vitae de los técnicos de tiempo completo y de los consultores previstos para el programa.

c) Puesto que los programas experimentales comprenden varias disciplinas, se anticipa que la ayuda de especialistas será necesaria para resolver problemas específicos a medida que estos se presenten. En cuanto sea posible se solicitará asesoría técnica para resolver estos problemas al ICA o a la AID, a través del personal bajo contrato en la actualidad. Cuando esto no fuere posible, consultores a corto plazo de la Universidad de Utah estarán disponibles. La necesidad estimada de servicios consultivos se indica en el Anexo A.

d) Un plan de trabajo anual detallado será preparado dentro de los 60 días siguientes a la llegada del personal de tiempo completo de la Universidad de Utah, como gúia de trabajo, el cual será sometido para aprobación al ICA, al Departamento Nacional de Planeación y a la AID. El ICA adjuntará a la aprobación una descripción del trabajo para cada técnico. El personal de Utah informará al ICA, AID y al Departamento Nacional de Planeación sobre el desarrollo de sus actividades y preparará un informe semestral para estas entidades.

a) The USU staff as well as ICA or INCORA staff will be permitted to use data from the studies undertaken in the program for thesis or dissertations in pursuing a program for the Master's or Ph.D.s degrees, Copies of these dissertations and technical reports written under the entire program will be submitted directly to ICA and INCORA.

f) Upon termination of this Agreement vehicles and equipment granted by Utah State University will be assigned to ICA Department of Agricultural Engineering.

g) The presentation of the services rendered as well as the economic and social benefits accrued therefrom shall be publicized as being promoted under the Alliance for Progress.

h) In the event of any discrepancies between the Spanish and English texts of this Agreement, the English text shall prevail.

e) Tanto el personal de Utah como el de ICA e INCORA se les permitirá utilizar información de los estudios realizados en el programa para tesis o disertaciones en programas de post-grado para Masters o Ph.D.s. Copias de los trabajos de tesis, disertaciones e informes técnicos adelantados bajo el proyecto global serán suministradas directamente al ICA y a INCORA.

f) A la terminación del presente contrato los equipos y vehículos donados por Utah serán asignados al Departamento de Ingeniería Agrícola del ICA.

g) La presentación de los servicios prestados, así como los beneficios sociales y económicos derivados del presente Acuerdo, deberán recibir publicidad como promovidos bajo el marco de la Alianza para el Progreso.

h) En caso de presentarse alguna discrepancia entre los textos en inglés y español, la versión en inglés prevalecerá.

ANNEX A

Contributions Utah State University

Personnal **FY 1971**

1 Drainage & Irrigation Engineer
1 Agricultural Engineer - Irrigation Inter-actions crops, soils.
1 Drainage consultant
1 Experimental Design and Analyst Consultant
1 Evapotranspiration and Water Requirements Consultant
2 Tech. assistants for research progs.

Vehicles and Equipment

2 Vehicles

Equipment and supplies for a value not less than US$5,000 which include the following:

a) Neutron meter to determine moisture content of soils
b) Equipment for steel pipeline installation for the neutron meter.
c) Gamma-rays unit to determine physical parameters of soils.
d) 2 lysimeters
e) 2 flow meters
f) 120 soil moisture meters
g) 150 Gypsum blocks
h) Maintenance tools for the above equipment.

ANEXO "A"

Contribuciones de la Universidad de Utah

Personal **Año Fiscal 1971**

1 Ingeniero de Riego y Drenaje
1 Ingeniero Agrícola
1 Ingeniero Consultor en Drenaje
1 Especialista en Diseño Experimental y Análisis
1 Especialista en Requerimientos de Agua y Evapotranspiración
2 Asistentes técnicos para programas de investigación.

Vehículos y Equipo

2 Vehículos

Equipo y elementos por valor no menor de US$5,000, el cual incluirá:

a) Medidor de neutrones para determinar la humedad de los suelos
b) Equipo para instalación de tuberías de acero del medidor de neutrones.
c) Unidad de rayos Gamma para determinar los parámetros físicos del suelo
d) 2 lisimetros
e) 2 totalizadores de flujo
f) 120 tensiómetros
g) 150 bloques de yeso
h) Herramientas para el mantenimiento del equipo descrito anteriormente.

ANNEX "B"

ICA Contributions

Personnel (for Santa Lucia Station)

2 Professionals
2 Agricultural Assistants
1 Administrative Assistant

(for Marconia Station)

2 Professionals
2 Agricultural Assistants
1 Administrative Assistant

INCORA through special agreement with ICA will provide:

2 Professionals
2 Field workers

Equipment

Farm machinery and other equipment necessary for land preparation, cultivating, harvesting, irrigation and other necessary work.

ANEXO "B"

Contribuciones del ICA

Personal (Estación Santa Lucía)

2 Profesionales
2 Asistentes Agrícolas
1 Asistente Administrativo

(Estación de Marconia)

2 Profesionales
2 Asistentes Agrícolas
1 Asistente Administrativo

INCORA mediante un acuerdo especial con ICA suministrará:

2 Profesionales
2 Trabajadores de campo

Equipo

Maquinaria agrícola y otros equipos necesarios para preparación de tierras, cultivos, cosechas, riego y otros trabajos.