USAID PRE-DESIGN TEAM REPORT

ON

THE WATER MANAGEMENT AND TRAINING PROJECT PROPOSAL

FOR INDIA

BY

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NEW DELHI, INDIA

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The views expressed in this Report are those of the authors and are not necessarily those of USAID.

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Introduction

A Project Identification Document (PID), titled "Water Management and Training", was approved by the India AID Mission Director in May 1981 with a proposed life of project budget for this five-year effort of 28.5 million dollars. In subsequent discussions and in response to comments received from Government of India (GOI) and state officials, other donor agency personnel and AID/Washington staff, it was decided to utilize a pre-design team to develop a data base and to help reduce the options available for project components to manageable levels prior to bringing in a follow-up team to help USAID draft the final project paper. The pre-design team, referred to herein as the Water Management and Training (WM & T) team, consited of Messrs. K. C. Nobe, John Replogle, and Max K. Lowdermilk.

The following material presented in the WM & T team report was truly a team effort with each member contributing in his own area of specialized expertise and to the overall conceptualization of project design and implementation. Any errors of omission, misinterpretation of facts or judgmental deficiencies are the sole responsibility of the WM & T team members and the views presented herein do not necessarily reflect the agency positions in which the respective team members are regularly employed. It is our hope, however, that the material presented herein will be useful to USAID in India in the preparation of a successful project paper for the Water Mangement and Training Project.

I. Preliminary Ideas on Project Implementation

1. Project Work Plan Strategy
2. Budget Estimates and Distributions over Life of Project
3. Time Frame for Project Paper Completion
4. Timetable for Obtaining Project Approval

Annexes

1. WM & T Trip Reports, Phases I through VII

2. Summary Description of CWC Plan for National Water Resources Development and Management Institute and Team's Recommended Role and Responsibilities for a National Institute or Center for Water Resource Development and Management Within the Central Water Commission

3. Conceptualization of the Irrigation Water Management Training Needs and its Delivery System for India

4. Known Technologies and Procedures Within and Outside India with Transfer Potential

5. Summary of Lecture-Seminars Presented Before the Central Water Commission on February 9, 1982, and Before the Professional Development Workshop on "Diagnostic Analysis of Irrigation Systems" at Gambhiri Irrigation Project, Chittorgarh, Rajasthan, February 19, 198 .

6. A Proposal for Establishing an International Irrigation Water Management Institute at Colorado State University

7. Summary of IFPRI Data on Manpower Needs for Development of New Irrigation Capacity for the Period 1975-1990

8. A Proposal for an International Service for Irrigation Management

9. Questionnaire to Obtain Estimates on Number and Type of Personnel to be Trained

10. Proposed Questionnaire for Obtaining Information on Types of Irrigation Training Needs

11. Brief Outline for a Proposed Rajasthan Land and Water Management Training Center, Brief Synopsis, by R. R. Mehta, Joint Director, Agriculture, Rajasthan and Co-Coordinator of Diagnostic Analysis Workshop

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Section A

Terms of Reference

The Terms of Reference for the Water Management and Training Project pre-design team are incorporated in the New Delhi Cable #17708 sent to the Secretary of State on 9/18/81. The following Specific Terms of Reference were provided:

"A. Study the PID and other related documents available at the Mission.

B. Explore with GOI and State officials the objectives, mechanisms to be used, and inputs needed for each of the subprojects defined in the PID and others that evolved from discussions.

C. Review the Training Programs and plans of other donor agencies such as the World Bank and Ford Foundation.

D. Tour existing training facilities in Gujarat, Maharashtra, and Uttar Pradesh to determine their goals, inputs and outputs relating to areas of Water Management.

E. Considering A, B, C, and D interact with GOI and State officials in refining overall Project concept and organizational framework.

F. Develop a preliminary log frame and a detailed scope of work for the Design Team."

In addition to the above listed activities, WM & T team members made contact and acquired information from agricultural researchers, personnel at the Management Training Centers, trainee participants in the Rajasthan Diagnostic Analysis Training Workshop, other USDA TDY personnel in India, farmers, extension field staff and subject matter specialists, minor and major irrigation officials and others. In Rajasthan, one team member developed a Training Needs Survey Form which is being administered to Irrigation and Agricultural Department personnel in Rajasthan, Maharashtra, and Gujarat States. At the Rajasthan Training short course, Dr. Lowdermilk had long/informal conversations with a number of government personnel about India's water management training needs and delivery capacity He also developed and tested a Training Needs Questionnaire (See Annex 10) for use by CWC and the States to collect data in the design of the Project Paper.

Team members conducted two seminars for CWC staff and officials. One team member assisted in the Diagnostic Analysis short course for about 20 days and used this time to observe and evaluate the training and to ascertain views of the participants about training needs and how a useful WM & T Project could be developed. The WM & T Team also developed concept papers related to key components of the training project, key components for a national water management center, a case study of needed institutional reorganization at a USA land grant university to support the WM & T Project and the Asia Bureau Water Management Synthesis Project II, and other materials as referenced in this report, which can be used by the Design Team for the Project Paper. Several Annexes for the Project Paper have been prepared and others will be identified and developed by Dr. Lowdermilk before the Design Team arrives.

Section B

Summary of Team's Reconnaissance Activities

During the first few days after Nobe's arrival in Delhi, an itinerary of field visits and agency contacts was firmed up, in consultation with AID administrators and GOI Irrigation Ministry and Central Water Commission representatives. This schedule of activities was designed to carry out duty items 2 through 4 of the set of team responsibilities outlined in the Introduction section. These activities are summarized below but for a detailed report of activities, refer to Annex 1, Trip Reports: Phase I through VII.

1. Field Trips

Major field reconnaissance trips were scheduled and carried out, as follows:

1) Visits to Rajasthan and Gujarat States, Janaury 20 -23.

2) Trip to Lucknow and vicinity in Uttar Pradesh State, January 27-29.

3) Trip to Bombay, Aurangabad and Nasik in Maharashtra State, February 1-4.

The primary purpose of these field trips was to visit existing training centers and/or staff colleges, engineering and agricultural university campuses and offices of the Secretaries of Irrigation and/or Agriculture Departments directly responsible for water management training activities in Rajasthan, Gujarat, Maharashtra,

and Uttar Pradesh States. We were indeed fortunate to have Mr. R. V. Suryanarayana, Director, Central Water Commission, accompany us on each of these field visits and one or more AID administrators also participated in most of these trips.

In addition, two follow-up field visits were scheduled and later carried out:

1) Visit to the Diagnostic Analysis Short Course site at Chittorgarh, Rajasthan State (Lowdermilk, Replogle, D. R. Arora, and John Westley), February 10-12.

2) Visit to the Center for Management Analysis in Agriculture, Institute of Management at Ahmedabad, Rajasthan State (Nobe and Stains), February 16.

3) Visits by Lowdermilk with CWC observers of the D. A. Training programs and Rajasthan State observers, plus selected officials in Jaipur.

2. Agencies and Officials Contacted

A concerted effort was made to contact key personnel in GOI and state-level agencies and in key donor agencies directly involved and/or otherwise interested in India's water management training needs. Listed below are the key persons contacted, aggregated by agency affiliation. (Although we realize that some names are inadvertently omitted, we have attempted to include all those personnel and their titles for which we had a record in our voluminous field notes.

U. S. Embassy
- Mr. Harry G. Barnes, Ambassador
- Ms. Priscilla M. Boughton, Mission Director
- Dr. Richard M. Brown, Deputy Mission Director
- Mr. R. W. Nachtrieb, Chief, Office of Project Development
- Mr. John Westley, Chief, Office of Program
- Mr. William H. Janssen, Chief, Office of Agriculture and Rural Development
- Mr. Edwin D. Stains, Project Manager, Agricultural Engineer, ARD
- Mr. D. R. Arora, Engineer, (Irrigation and Water Resources)

Central Water Commission
- G. M. Vaidya, Member, (Water Resources)
- R. V. Suryanarayana, Director, (Permanent Staff)

Ministry of Irrigation (Delhi)
- C. C. Patel, Secretary
- R. K. Rao, Additional Secretary
- Mrs. P. Prakash, Joint Secretary
- S. S. Grewal, Under Secretary
- B. K. Saha, Director, Command Area Development Authority (CADA)

Narmada Control Authority (Delhi and Baroda)

M. N. Venkatesan, Chairman, (Delhi)
A. A. Pai, Chief Engineer, Project Planning Cell (Delhi)
N. Ramaswamy, Superintending Engineer, Narmada Project Canal Circle, (Baroda)

Ministry of Agriculture (Delhi)

Dr. O. P. Gautam, Director General, Indian Council of Agricultural Research, and Secretary, Department of Agriculture, Research and Education
Dr. A. M. Michael, Director, Water Technology Center, Indian Agricultural Research Institute

World Bank (Delhi)

Dr. Chris Perry, Economist
Dr. Gilbert Corey, Civil Irrigation Engineer
Mr. Sabharwal (Title unknown)

Ford Foundation (Delhi)

Dr. Lincoln Chen, Representative, (Brief introduction at Delhi Airport)
Dr. Roberto Lenton, Engineer
Dr. David Seckler, Economist, (On long-term CSU assignment in India)
Dr. Robert Chambers, Ford consultant from U. K.
Dr. Norman Collins (Dual assignment in Delhi and New York City)
L.. Marty Hanrathy, Ford Foundation's Bangladesh Office

Irrigation Department, Rajasthan State (Jaipur)

Mr. Manoharlal Mathur, Secretary, Irrigation Department
D. M. Singhvi, Officer on Special Duty (Irrigation)
C. S. Hukmani, Chief Engineer, (Irrigation)
S. R. Katariya, Superintending Engineer, (Design and Research)
Mr. Kang, Superintending Engineer, Chittorgarh

Department of Irrigation, Gujarat State (Gandhinagar)

Mr. P. A. Raj, Secretary, Irrigation Department
(Also met with seven other top staff members - names and titles not obtained
A. S. Patel, Engineer, (Anand)

Department of Agriculture, Gujarat State

R. C. Shah, Director, (Superintending Engineer), Land and Water Management Training Center at Anand
P. C. Patel, Deputy Director, Engineering Faculty, L & WM Training Center at Anand (Contact made at Chittorgarh where he was a student in the Rajasthan Diagnostic Analysis short course)

Gujarat Agricultural University Campus at Anand

Dr. P. D. Mistry, Director, Basic Science and Humanities Faculty (Meterologist)
R. A. Patel, Professor, (Entomologist)

Maharaja Sayajirao University (Baroda)
Dr. B. C. Patekh, Vice Chancellor, (Philosophy and Economics)
O. H. Patel, Professor, Dean of the Faculty of Technology and Engineering (Civil Engineer)
A. C. Pandya, Professor, currently Director of the Gujarat Energy Development Authority (Retired from the agricultural engineering faculty at Indian Institute of Technology at Kharapur; now residing in Baroda)

Department of Agriculture, Uttar Pradesh State (Lucknow)
Dr. S. C. Gupta. Assistant Director, (Farmers Soil Conservation Section) and Director, Land and Water Management Training Center located at the Rewankhera State Farm near Lucknow

Office of Agricultural Production, Uttar Pradesh State (Lucknow)
Mr. Samsha Ahmed, Commissioner
Goyal Anurag, Joint Secretary, CAD
Mrs. Sumita Kandpal, Administrator, Ramganga CA Project
Mr. Harsh Sanwal, Specialist, Area Development

Asid University of Agriculture at Kanpur
Dr. S. K. Das, Associate Professor, (Soil Conservation)
Dr. K. S. Bhatia, Associate Professor (Soils)
Dr. Banjpai, Associate Professor (Soil Conservation)
Note: Meeting was held in Lucknow as the University campus is located at Kanpur, some 80 kilometers away

Department of Irrigation, Maharashtra State
In Bombay
Mr. P. R. Gandhi, Secretary, Department of Irrigation
Mr. V. H. Darjee, Deputy Secretary, Department of Irrigation
Mr. D. M. Deshmukh, Chief Engineer, (Projects)
Note: Several other staff members attended the final meeting but names and titles were not obtained

In Aurangabad and at the Jayakwadi Project Site
Mr. H. V. Dhamdhere, Director, Water and Land Management Institute (WALMI)
Dr. S. B. Varde, Professor of Agriculture, WAIMI
Dr. S. L. Bhirdud, Senior Faculty member for Economics and Statistics
Mr. P. D. Purohit, Professor, WALMI, (discipline unspecified)
Mr. L. S. Kohil, Executive Engineer, Jayakwadi Project
Mr. N. M. Josmi, title unspecified, Jayakwadi Project
Note: Also talked at length with two farmers in the new Jayakwadi pilot project areas but names were not obtained

In Nasik
R. A. Atre, Joint Director, Maharashtra Engineering Research Institue (MERI)
N. M. Dange, Director, Engineering Staff College, MERI
T. G. Ratnaparkhi, Superintending Engineer, Central Designs Organization at MERI

Mahatma Phule Agricultural University at Rahuri

Dr. D. C. Salunkhe, Vice Chancellor
Dr. B. R. Patel, Chief Scientist, Water Management Scheme
Mr. M. M. Sawant, Head, Department of Irrigation and Drainage Engineering (Professor)

Indian Institute of Management at Ahmedabad (IMA)

Dr. V. S. Vyas, Director, IMA
Dr. Mohan Kaul, Dean, (Planning)
Dr. C. Gopinath, Chairman, Center for Management in Agriculture, IMA, (Agricultural Engineering)
Dr. Nitin Patel, Professor, (Operations Research, Systems Analysis), and Member of the Narmada Planning Group
Dr. Anil K. Gupta, (Rank unspecified), Risk and Uncertainty of Farmers' Response, Project Monitoring
Dr. A. H. Kalra, Professor, (Production Economics and Quantitative Methods)
Dr. Samir Barna, Assistant Professor, (Production Economics and Quantitative Methods)

Tamil Nadu Agricultural University (Coimbatore)

Note: Contacts at TNAU were made on behalf of the WM & T Team by Dr. William Easter, Co-Director of the CSU - University of Minnesota International Water Policy and Pricing Project, who visited that campus in regard to the IWP & P Project.

Dr. A. Venkataraman, Vice Chancellor
Dr. R. Rajagopolan, Director, Center for Rural Development
Dr. Ayasamy, Head, Department of Agricultrual Economics
Dr. Palinsami, Assistant Professor, Department of Agricultural Economics

Irrigation Personnel in Haryana State

K. B. Vig, Chief Engineer, (Lining), Haryana State Minor Irrigation (Tubewells) Corporation, Ltd., Chandighar
D. C. Garg, Superintending Engineer, World Bank Lining Project, Hassir

Miscellaneous Contacts

Informal contacts were made by WM & T team members with a large number of non-agency personnel but had views worthy of consideration relative to the WM & T project. These included the following:

Dr. Wayne Clyma, Associate Professor of Agricultural Engineering, Colorado State University, (In charge of the Rajasthan Irrigation Diagnostic Analysis short course underway during January - February)

Dr. William Easter, Professor of Agricultural Economics, University of Minnesota and Co-Director of the University of Minnesota - CSU AID-funded International Water Policy and Pricing Project. (Easter was on TDY assignment in India)

Dr. Gerry Lewis, AID Mission in Nairobi, Kenya (Visiting India to observe its Extension T & V System)

Dr. Robert Huesmann, BIFAD staff, AID/Washington (while on a visit to AID Mission in Delhi)

Dr. James Meiman, Associate Vice President for Research and Director of International Programs, Colorado State University (In India on TDY as a member of the Forestry Projects team)

Dr. A. J. Dye, Director of Asia Programs, Office of International Cooperation and Development, USDA, Washington, D.C. (Also Contract Officer's Representative for Nobe's TDY contract. Dye made a weekend stopover to visit AID Mission in Delhi.)

Ms. Kathleen McNamara, Asia Bureau, AID/Washington, D. C. (TDY in India on AID's Forestry Project Assessment Team)

Note: Comments on the PID were also provided by three Irrigation Engineers selected by CWC and currently enrolled in the CSU International School for Economic Development Studies.

3. Listing of Key Reference Materials Collected

A large quantity of reference material was collected by the WM & T team. This material has all been referenced in attached Annexes and is available in the Mission files. Trip Reports and copies have been assembled and cataloged for future use by the final Design Team for the project paper.

Listed below are selected references judged to be of particular relevance for the WM & T project design:

1) "Memorandum for Expenditure Finance for Establishment of a National Staff Training Institute, Water Resources Development and Management", Central Water Commission, New Delhi, March, 1981.

2) Draft Memo, dated 9 November, 1981, (a Proposed Memorandum of Agreement governing the Functions of the L & WM Center at Anand), 7 pp.

3) A Proposal for Establishing a Water Management Curriculum, M. S. University of Baroda, (Report by Dr. Gil Corey, Senior Water Management Specialist, USAID/Washington, D.C.), 8 May, 1981.

4) Prospectus: 1980-81, Faculty of Technology and Engineering, M. S. University of Baroda.

5) Eight Years of Postgraduate and In-Service Training in Water Management, by K. V. Paliwal, WTC Training Bulletin 1, Water Technology Centre, Indian Agricultural Research Institute, New Delhi 110011. 1979.

6) "A Proposal for an International Service for Irrigation Management" (a Commissioned paper by F. E. Schultze, P. Z. Kirpick, and R. J. H. Chambers for TAC of CGIAR), Mexico City, January 21, 1982. (Note: to be discussed and possibly acted on at a meeting in Rome in mid-February 1982).

7) "Training Programs for Better Water Management in Surface Irrigation Projects in India", T. K. Jayaraman, (pages 261-272 in an unidentified journal, undated).

Note: Dr. Jayaraman was the Area Development Commissioner of the Kadana Project, Ahmedabad, and the Director of the Training Center at Anand reported to him prior to his reassignment.

8) "Manpower Requirements for Efficient Water Development (in India)", Paper by M. N. Venkatesan, which was presented at the Afro-Asian Conference of ICID in Nigeria (Sent under cover letter from Venkatesan to Nobe, dated February 8, 1982).

9) Report presented on the occasion of the Foundation Stone Laying Ceremony of the Water Management Centre at Rehmankhera, by Mr. Vishwa Nath Pratap Singh, Chief Minister of U. P., March 8, 1981. 12 pages. (Describes the history and the field studies involved.)

10) "Detailed Syllabus for the Long-Term Course at WALMI", August 1981 - May 1982. (Topic outline by hours of instruction - typed, two pages).

11) Recommendations of the Committee for Review of Engineering Staff College, Nasik, 422002, Government of Maharashtra, Irrigation Department, January 1979. 175 pages.

12) "Water and Land Management Institute - Aurangabad", October, 1981, 14 pages. (Description of facilities, map of campus, cost estimates, organization chart and course list).
Note: This document includes detailed cost estimates for the proposed Phase 2 expansion.

13) "The IMA Bulletin", Indian Institute of Management, Ahmedabad, 1980. 47 pages.

14) "Centre for Management in Agriculture", Indian Institute of Management, Ahmedabad, undated. 4-page brochure.

15) "Land and Water Policy for India", by Mr. Vora, Sandar Patel Memorial Lectures, Government of India, 1981.

16) Training for Development, Udai Pareek, et al of the Indian Institute of Management, Ahmedabad, Kunorian Press, Conn., USA, 1978. (Lowdermilk's personal copy; with MKL).

17) "Irrigation Manpower Needs for India" in Investment and Input Requisites for Accelerating Food Production in Low Income Countries, 1975 to 1990, Research Report 10 of the International Food Policy Research Institute, September 1979 - by Peter Orom, Juan Zapata, George Aliboraho, and Shyamel Ray.

18) "Calendar of Management Programs", July 1981 - June 1982, Indian Institute of Management, Ahmedabad. A 32-page listing of programs offered at IIM for 1981-82.

19) A Ten-year Perspective , Indian Institute of Forest Management Indian Institute of Management, Ahmedabad, 1980. 63 pages.

Section C

Major Findings and Conclusions

1. Views of Agency Officials

Various agencies and contacts were asked to comment on the role of a national-level center related to water management studies and training, and on the separate roles that this center and centers at the state-level might have. This national center for water management is visualized as part of the proposed National Staff Training Institute (NSTI) which we understand has now been approved by the GOI Ministry of Irrigation and is under consideration by the Ministry of Finance.

Central Water Commission: The primary purpose of the NSTI will be to provide in-service training to CWC personnel in all its programs. There would be a separate water management section, as Phase 1.

World Bank: The view expressed here was negative toward a national-level water management training institute. Cited were the wide variability of problems that require site-specific treatments at the state level. Conversely, state-level training institutes such as the World Bank-supported WALMI Institute at Aurangabad, should be encouraged.

Ministry of Irrigation: State-level training institutes should concentrate on tubewells, overdraft of groundwater and techniques for conjunctive use of groundwater and surface supplies. Primary concern

should focus on training personnel to work in drought-prone areas. Training institutes should be kept separate from the agricultural universities, but at the same time they advised us to have discussions with the India Council for Agricultural Research (ICAR). The NSTI Water Management training functions would be to: (1) train the staffs for the state-level institutes, and (2) provide refresher courses, seminars, and information exchange for the senior executives of CWC.

Ford Foundation: Ford has invested in human capital for many years and has created a felt need for professionals for Irrigation development. Ford has a relatively small budget but continues to support numerous educational institutions and training programs in India. No undue concern was expressed toward the current move to set up numerous training institutes with various perspectives on the concept of water management because the need for retrained irrigation engineers is far in excess of probable supply.

State of Rajasthan, Department of Irrigation: No conflict between state and national training institutes are seen if both the micro and macro divisions of the training issues and problems are considered.

Agricultural University at Anand: There is definitely a need for a national-level water management center that should deal with fundamental problems of national scope while leaving it to the state centers to focus on regional and localized problems.

State of Gujarat, Department of Irrigation: State-level centers should deal with on-site problems and a national center should deal with national problems. Also, the national center should focus on issues common to all states. No time available for elaboration by the contact person.

Narmada Control Authority: If 20 or more state centers were to emerge soon, perhaps the need for a national center could be questioned. The basic question is "who needs to be trained and in what, even though all of it is generally termed 'water management'?" We must recognize the multidisciplinary nature of the training needed which is more than just engineering. As now proposed, the national center would be mostly engineering, with very little devoted to below the outlet; this was not the original intent. Ideally, a National Water Management Center (NWMC) in CWC should not be a minor part of a national staff training institute operated solely for irrigation engineers. Solving water problems at the below-canaloutput level is interdisciplinary in nature so training in such water management should include, in addition to an understanding of relevant engineering principles, (hydrology, all the way to the"farmers' fields"), such things as farm

economics, water economics, macro-economics, Extension, rural sociology, irrigation law and farmers' water rights, institution building and how to set up farmer water user organizations along with the basic soil and crop agricultural sciences. "Don't give such a training assignment to engineers as the only trainers in a NWMC because the irrigation water problem in India is a water management problem." Such training can successfully be given to professionals 30 to 35 years old who eventually would comprise new cadres in new water management departments instead of in irrigation departments. A National Water Management Center would still be useful if not overburdened with CWC engineering types and if it would truly service the state-level institutes. It could also encourage more specialized training for the "thinking groups" that develop national policy. Even this effort at the national level could benefit from inputs from India's Management Institutes such as the one at Ahmedabad which is less than 50 per cent government-controlled and therefore more flexible than CWC. "We must recognize that policy makers too must understand water management down to the farmer's field level or the cadre to be trained to work at the field level will have no upper level administrative support."

State of Maharashtra, Department of Irrigation: Such a national center would not be supported by the state-level personnel if it merely duplicated training of the WALMI style which is at the state-level and only served as an alternate training location. A National Center would be supported, should it evolve in a broad context of coordination and technical support for the state-level centers and if it can serve as a direct link to the proposed international irrigation management center and various donor agencies.

WALMI Center, Aurangabad: Four needed support areas or activities were identified for a national center role in mutual discussions between WALMI staff and the WM & T Team: (1) monitoring, (2) coordination, (3) technical support and channeling of donor funds, and (4) to serve as an information center. Included in these functions might be arranging for teacher exchange among state centers and of training the state center staffs.

Maharashtra Engineering and Research Institute, Nasik (MERI): Suggested were national center roles in teaching specialized courses (not defined), professional training for the trainers, national workshops, production of special T. V. tapes or films, adjusted for conditions likely to be encountered in India.

Indian Council for Agricultural Research: A National Center as proposed by CWC might undesirably end up duplicating the state efforts and is

likely to be dominated by CWC and the Irrigation Ministry. Suggested was that AID should help support several universities' efforts to train water managers because, in the long run, universities must produce the needed manpower. Also, ICAR could be channel for WM & T funds.

Mr. M Venkatesan: (During group discussions with Ford Foundation and WM & T team members). For developing a "thinking group", a WM Center in CWC could be of some assistance but that the interdisciplinary training needed by CWC's own staff and the top eschelon of the state agencies could be better done at one of India's management institutes, which in turn would have to be staffed up to carry out such a new responsibility in the field of water management. Carrying forward in an integrated manner will be difficult, given the continuing battle between irrigation and agriculture for control over the total program. "This is perhaps the basic reason why Finance is objecting to formation of a national WMC, feeling as they do, that water management is primarily a state-level function."

Indian Institute of Management (IMA) at Ahmedabad: IMA can serve in a support role for institution building and has capability for development of specific short courses for use in state-level or national-level training centers.

A primary role may be to add a business management orientation to the curriculum for mid-level state managers and above, including national policy workers. A secondary role would be to support CWC and states to set up water management training programs.

Assisting CWC in setting up a water management wing of the proposed National Staff Training College is a specific IMA possibility. A similar role was filled by IMA in Sri Lanka.

Summary

In general, there was a strong consensus at the state level government departments and educational institutions on what the training thrust should be and how to go about it. This was particularly true for WALMI and the Center at Anand. (See detailed Trip Reports). Also State Irrigation and Agriculture Secretaries appeared generally to have an excellent grasp of the needs of their departments and on the training objectives.

At the national-level center and among the donor agencies, however, there were many conflicting views expressed. The responses ranged from recommending a national center for training personnel from those states not having their own center (a state-like function), to a national control and funding center operating all the state centers, to a strong view that a national center is not needed at all. The review comments by the Irrigation Finance Wing to the National Center Proposal need to be studied carefully. See the Proposal and the Review Comments which are contained therein.

2. Evaluation of the Institutional Capacity for Training in India

The very nature of India's diverse training needs in the area of irrigation water management--interdisciplinary efforts ranging from seminars, to workshops, to in-service short-and-long-term courses to curriculum changes in basic degree offerings--underlines the necessity for having a large number and variety of institutions involved. For discussion purposes this preliminary evaluation of India's institutional capacity to respond to its training needs in this area of concern can be subdivided into seven components: 1) national centers, 2) state-level in-service training centers, 3) management institutes, 4) technology institutes, 5) agricultural universities, 6) engineering universities, and 7) other universities and institutes. Each of these components is discussed in turn.

(1) National Centers: The only national institution directed to agricultural research in general, but which includes some short-term training in water management, is the Water Technology Center within the Indian Agriculture Research Institute (IARC) in Delhi. Our WM & T team met briefly with Dr. A. M. Michael, the Center Director and the details of our preliminary observations are given in Annex 1 - Trip Reports - Phase I. In summary, this center has the potential for an expanded role within its already established training program to undertake many of the roles in the water management training and technology transfer arena envisioned for inclusion in the WM & T Project at the national level. This center could provide special course offerings for CWC personnel and do some of the "training the trainers" for both national and state-level institutes. It could also provide assistance to research and curriculum development efforts in India's system of agricultural universities, though its affiliation with the Indian Council of Agricultural Research (ICAR). Based on our preliminary exposure to the Water Technology Center, it appears to us that it could play a significant role in the WM & T project at the national level, even though other observers in the GOI and state-level agencies and among the donor agencies have questioned the validity of such a role. We nonetheless recommend that the design team probe this issue further before a decision is made on whether or not to include the Water Technology Center at IARC in the WM & T Project.

The options available for emerging a major water management effort in a proposed Phase I of the National Staff Training Institute of CWC are outlined in detail in Annex 2. Suffice it here to restate the broad range of activities envisioned, as follows: 1) Provide coordination and general support services for state-level in-service training centers, 2) assist in the "training the trainers" effort and provide some seminars and special short-courses for CWC staff; and 3) serve as a high-level focal point for the total water management effort and provide a direct link to the international community, via an interaction with the proposed International Service for Irrigation Management, if and when it is established (See Annex 8). Although the establishment of Phase I of the new National Staff Training Institute is about to receive GOI approval, it is still in the critical stage of its development when when its various programs remain to be specified and implemented. The WM & T Project can help CWC get this program off on a sound footing and we recommend that it be used for that purpose. Further AID interaction with CWC will be needed, however, before the details of the program effort can be specified in a WM & T Project paper.

(2) State-Level In-Service Training Centers: Most of the WM & T team's contacts with agency personnel in India are in agreement that these kinds of centers will be the key institutions to be involved in the in-service water management training program. Eventually, all of the states with large irrigation programs are expected to have such centers. Presently, there are centers in operation in Uttar Pradesh, Maharashtra and Gujarat States and some other states are in the talking stage leading to the establishment of center, notably Rajasthan and Haryana.

The Water Management Center at the Rehmankera State Farm near Lucknow which was formally opened in March 1981, is expected to serve the in-service training needs of Uttar Pradesh State. This center, in reality, however, is only an expansion of the training programs offered at the State Soil Conservation Research and Demonstration Center which has been in existence for almost 30 years. The staff are almost totally oriented to water management problems in a soil conservation context so that while the potential is there to develop a viable on-farm water management focus, it is unlikely to be accomplished in the short run.

The WALMI training complex at Aurangabad in Maharashtra State is a spin-off from the Engineering Staff College of the Maharashtra Engineering Research Institute operated by the Irrigation Department at Nasik. It opened in temporary quarters in 1981 and constuction of permanent facilities are now underway. WALMI is viewed by the Irrigation Department to be on an equal footing with the Engineering Staff College which has already transferred all it irrigation water management courses to it. This new center has the potential for conducting the necessary kind of state-level in-service training program envisioned in the WM & T Project. But, unless its output capacity

is considerably expanded, it cannot hope to meet the total needs of the cadre of professional staff (bachelor's degree and above), let alone the even larger needs for the diploma holder group of technicians in the system. A Phase 2 expansion is in the design stage but is presently unfunded.

The Land and Water Management Training Center for Gujarat State was authorized in August 1981. Temporary facilities are in place in rented space in Anand and land for permanent facilities has been given, located adjacent to the Agricultural University campus on the outskirts of Anand. The curriculum is not yet in place but is expected to be generally patterned after the WALMI effort. It too has the potential of developing into a viable state-level center but it suffers from the same capacity limitations as WALMI. Each state institute should have a separate team to diagnose and improve systems, using careful evaluative research methods to both provide live demonstrations of what WM is and link his to training programs.

3) Indian Institute of Management: There are presently three management institutes in India that are well established and which offer university type undergraduate and graduate degree programs. Contacts made within both the Irrigation and Agriculture Ministries/Departments are wary of directly involving the management institutes in the water management training effort, even though neither group has their own internal capability to provide this critical management component of the curricula. (See Annex 3 for a detailed discussion of this issue). Only one of these institutes was visited by the WM & T team, the Institute of Management at Ahmedabad. It has a well established Center for Management in Agriculture which heretofore has focused primarily on macro issues of irrigation development and problems of the agricultural sector in general. The faculty and related research staff are extremely well trained at some of the best universities in India and abroad, and represent all of the disciplines deemed necessary to mount an effective water management training program in India. Its facilities are the best observed anywhere by the WM & T team. The faculty is anxious to participate in this new training effort but only during its initial stages of development, say for the first five years. It would focus its inputs primarily on training for administrators of irrigation delivery programs from CADA and medium irrigation project managers up through to the top irrigation administrators in the GOI. Due to the relatively small numbers of such personnel to be trained out of the total India-wide cadre to be involved, we believe that the CMA at IMA has the capability and capacity to undertake this vital component of the WM & T Project.

4) Technology Institutes: There are several Institutes of Technology in India and they are considered to be the premier institutions from

which to receive engineering degrees. None of these Institutes were visited by the WM & T team at this time, but Dr. Nobe spent a brief period as a visiting professor in the Department of Agricultural Engineering at the Institute at Kharagpur during the summer of 1980. Based on this brief exposure, it appears unlikely that the ITT's will have a viable role to play in responding to the immediate in-service water management training needs. There is a potential, however, at Kharapur at least, to eventually turn out agricultural engineering graduates with an on-farm water management capability, provided a concerted effort is made to broaden the present curriculum beyond training agricultural and food processing machinery experts currently in high demand in the private sector. Attracting the necessary interdisciplinary faculty for such an expansion will be difficult. For example, four years ago Ford Foundation provided funds to add a water resource economist to the faculty at the Institute in Kharagpur and this post is still vacant, in spite of vigorous efforts to fill it.

5) Agricultural Universities: The WM & T team is convinced that India's total training needs in water management will not be met adequately unless India's land-grant style agricultural universities become directly involved. Ultimately, degree graduates in agricultural engineering, civil engineering, agricultural economics and extension needed to staff the future water management cadre will have to come from these institutions (with the exception of the civil engineers that will be recruited from the engineering colleges). In terms of in-service training needs, they are the only likely group of institutions willing and able to take on the large training needs of the cadre of diploma holder level of engineering technicians and village level extension workers presently in the system.

The WM & T team made brief contacts with agricultural university faculty and administrators in Uttar Pradesh, Gujarat, Maharashtra and Tamil Nadu States. We note that the Mahatma Phule Agricultural University at Rahuri, Maharashtra, with 7 Agricultural Colleges, 2 Veterinary Schools, and 2 Extension Training Institutes, also has a small WM Research Project, headed by Dr. Patel. This land-grant style University is headed by Vice Chancellor Salunkhe who was at a USA land-grant university for 25 years. In Tamil Nadu, the contact was made two years ago when Dr. Nobe served briefly as a visiting professor in the Department of Economics at the Agricultural University campus at Coimbatore. In addition, this campus was visited on behalf of the WM & T team by Dr. William Easter, (Professor of Agricultural Economics, University of Minnesota), during February 1982. Response from these university personnel ranged from a "chicken and egg" stance in Uttar Pradesh (with government to make the first move by demonstrating a firm demand for water management-oriented graduates) to a "ready-to-go" stance at the universities in Maharashtra and Tamil Nadu States. The WM & T team believes that the potential is there for agricultural universities to play a key role in the WM & T Project effort but the design team needs to further investigate this potential on an all-India basis before a final decision is made in this regard.

6) Engineering Universities: The WM & T team does not fully share the optimism of many of the irrigation department personnel contacted as to the role of the engineering colleges for training the future cadre of water management personnel needed, nor do we believe that they have the proper orientation or capability to participate directly in the immediate in-service training needs. Nonetheless, it is both likely and desirable that India will continue to look to these universities for some of its irrigation engineer recruits so an effort will have to be made to assist selected institutions to broaden their curricula to include a water management option. The WM & T team visited with Professor O. H. Patel, Dean of the Faculy of Technology and Engineering at Maharaja Sayajirao University of Baroda about his efforts in that regard. We believe that his proposed new program is sound and should be encouraged.

On a previous trip to India in 1980, Dr. Nobe also visited the Bihar College of Engineering at Patna so we are therefore aware of a similar curriculum broadening effort underway there. The leading voice in that effort is Dr. T. Prasad of the Civil Engineering Department who several years ago was a Ford Foundation sponsored post-doctorate fellow at Harvard University. He has recently announced the establishment of a Water Resources Studies Program, with significant interdisciplinary components, that merits a follow-up investigation. (A Water Resources Studies Program brochure that outlines this program is available - December 1981). The WM & T team suspects that similar efforts may be underway elsewhere in India and these should be thoroughly investigated prior to finalization of the WM & T Project Paper.

7) Other Universities and Institutes: The same point made above applies equally well here. We recommend that Ford Foundation be requested to assist in a preliminary assessment of the total university and institutes' capability to assist in the water management training program. Ford personnel have a long history of working with these Indian institutions and are therefore in an excellent position to provide advice on this matter. If the team's limited knowledge of efforts already underway at Roorkee University (which recently entered into a memorandum of understanding with Colorado State University to help it add an interdisciplinary water management capability to its faculty) and at the Institute of Development Studies in Madras are any indication of future potential involvement, these "other" universities and Institutes should not be overlooked.

3. A Brief Note on Needs for Training Abroad

It is the feeling of the WM & T team that little support currently exists within either the Indian agencies concerned with irrigation or within AID for inclusion of a large training abroad component in the WM & T project. We agree in principle, particularly in regard to the in-service cadre to be trained in the near future. On the other hand,

we do feel that personnel to serve as trainers, both within the national and state-level in-service training centers, could benefit from a study period abroad. Likewise, faculty within the agricultural and engineering universities who are interested in helping expand curricula to include water management on an interdisciplinary basis could benefit from such opportunities.

We think that the training abroad component should be coordinated by the proposed national center and should be heavily skewed in favor of non-degree study tours of one year or less--such programs are available at the International School for Economic Development Studies at Colorado State University and the Water Management Institute at Utah State University. At present, six irrigation engineers selected by CWC and supported by Ford Foundation fellowships are enrolled in these programs. For the very limited number of trainees who would be supported for degree programs, there are a wide number of options available to choose from, only some of which are at USA universities. For those that would be sent to the USA, however, we strongly recommend that they go to one of the Western land-grant universities which have well established degree programs in irrigation water management on an interdisciplinary basis. We also suggest that along with the formal non-degree studies, professionals also take an intensive summer "hands-on" course in water management, plus a tour of sites in the USA and/or training centers and projects in the Philippines, Egypt, Sri Lanka, and Pakistan. We further suggest that those who come bring a real world problem to work on which will focus their studies and provide them a useful product before return. Under these programs, some individuals could benefit from in-house residence for short periods at CSU's Instructional Media Program, T. V. and Film Production Center, CSU's Video Extension on Continuing Education Center, the Bureau of Reclamation, the Soil Conservation Service, Cooperative Extension, Irrigation District offices, etc. These experiences would greatly add to other more formal learning situations. Those selected should be assured before departure for the U. S. that their sponsoring organization will utilize their knowledge upon return to India.

If degree students also are sent abroad, their thesis research should be done in India, and, if possible, they should write and defend their thesis here before the appropriate university staff.

4. General Parameters to Guide Project Design

Taking the views of various Indian and donor agency personnel into account, as well as the present and potential institutional capacity available to mount the kind and magnitude of training effort needed, it is possible to specify a set of general parameters to help guide the WM & T project design. These are as follows:

a) Prior to the arrival of the design team, AID Mission personnel should reach agreement in principle with key GOI agency administrators in regard to acceptable funding channels for various project compenents (e.g. either through CWC or ICAR, or both) and the role of a U. S. university contract support team. The AID Mission should outline a list of options from the most to the least ideal to use in any discussions to take place.

It is suggested that Mr. Venkatesan and others be used for initial discussions to outline possible strategies to pursue within a framework for negotiations.

b) Prior to the arrival of the design team, more accurate data on the number of personnel to be trained at various levels should be obtained and analyzed. It is our recommendation that CWC be asked to coordinate this data collection effort on an all-India basis. The data should be analyzed, interpreted and written up with appropriate tables to be used by the design team.

c) The success of the various in-service training efforts envisioned in the WM & T Project will require a total integration of the special studies components with the state-level training centers and cooperating universities.

Training should focus heavily on this linkage and be done primarily in a living laboratory (designated pilot areas in on-going irrigation projects) rather than using the conventional classroom lecture methods.

d) Proposed funding levels appear to be generous enough in the aggregate but it must be recognized that the pilot project areas for special studies, on which the training center efforts will be dependent, will require a disproportionate share of the total project budget. In addition, some funding for training abroad should be included but with a higher priority given to non-degree special problem solving training rather than to conventional degree programs.

e) In addition to the generally accepted components of engineering (both civil and agricultural) and agricultural sciences (including soils, crops, agricultural economics and Extension) as inputs in the training curriculum, it is absolutely essential that some business-type management and administration inputs also be included. The best available source for these inputs appears to be the Center for Management in Agriculture at the Institute for Management at Ahmedabad.

5. Key Components of the Water Management and Training Project

Figure 1 provides a tentative presentation of recommended major components of the WM & T Project. Per the PID specifications, AID support is anticipated for a national center and approximately three state-level training institutes. These should be designed with their respective roles carefully specified so that there will be mutual support rather than resulting in overlap and conflicts in objectives.

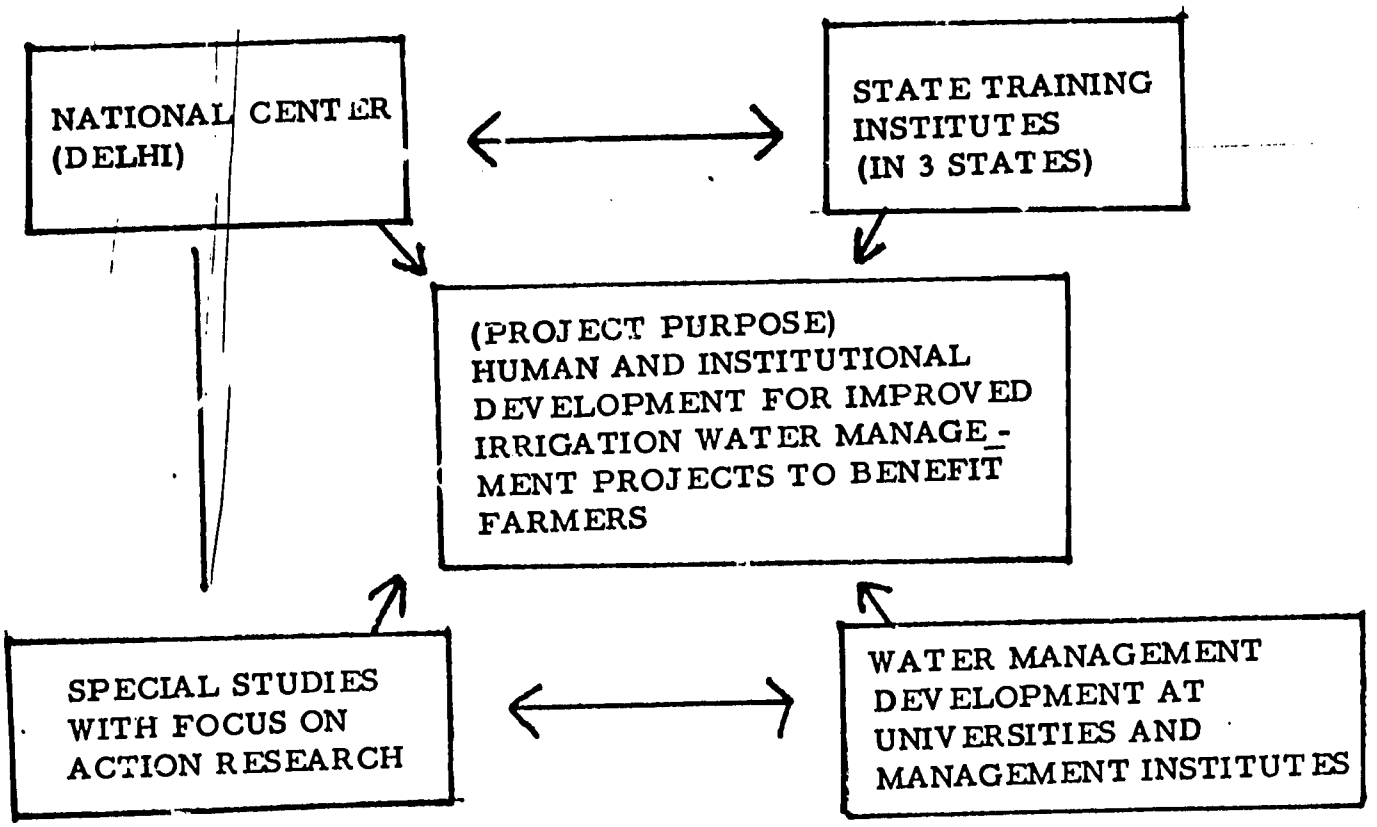
The PID also calls for a large, field-based special studies component which will focus on action-oriented applied research on priority irrigation water management problems now known in India. Some mechanism is needed for the administration of special studies which likely will be done by a number of organizations such as irrigation departments, agricultural departments, universities, and one or more management institutes.

Another key component needed for long-term institutional development is support for university degree level training especially in these disciplines needed for on-farm water management. These should include civil engineering, agricultural engineering, water resources and farm management economics, agronomy, and agricultural Extension. The degree holder output from these disciplines can certainly be employed in the CADA and other agencies involved in irrigation development and management because in the long run, the manpower needs for effective water management in India cannot be met solely through in-service training programs at the national and state-level institutes. In this regard, the project effort should start slowly and initially identify only one engineering university (e.g. M. S. University at Baroda) and one agricultural university (e.g. an agricultural university in Maharashtra or Gujarat) where there is now emerging a commitment to develop curriculum and related research in on-farm water management. Each university selected should also be assisted in developing a field-based program in a nearby irrigation command area where field experience can be gained by students and staff in a team diagnosis of a system and developing and testing solutions in a small pilot project context. It is likely that such university faculty members will be the best prospects for non-degree training programs abroad, rather than identifying large numbers of candidates from the action agencies. Ideally, a team of such university professors representing the disciplines of agricultural engineering, civil engineering, agronomy (soils-crops), agricultural economics and Extension should be sent abroad as a team for a one-year non-degree study tour.

The proposed WM & T Project cannot hope to accomodate all of India's training needs in irrigation water management. Ideally, however, this AID project can be used to demonstrate appropriate training efforts for personnel at various levels in the water delivery system. (Refer to Annex 3 for a more detailed treatment of this concept).

FIGURE 1

KEY COMPONENTS OF AN IDEALIZED WATER MANAGEMENT TRAINING AND SPECIAL STUDIES PROJECT IN INDIA



--At National Center

--At State Centers

--At Universities

--At Management Institutes

--In Irrigation Project Areas

--Engineering University

--Agricultural University

--Management Institutes

Selection of the final set of project components must necessarily be left to the design team but at this stage, a representative "package" can be offered for consideration. For example, the following components would be mutually supportive.

a. Location of three to five-man interdisciplinary team at WALMI, Aurangabad, responsible for forging a link with faculty at Mahatma Phule Agricultural University. This expatriate team should be allocated sufficient funds for special studies in a pilot project area of sufficient size to allow for a wide range of treatments. One or more of such pilot project areas could be selected from among the 13 medium-size irrigation projects that AID proposed to fund in Maharashtra State. Sub-elements of a project component in this state could also include:

   1) Funding of the proposed Phase 2 expansion of WALMI, and

   2) Provision of funding support for faculty at M. P. Agricultural University to conduct field research in nearby irrigation command areas, to implement a water management training program for diploma holder engineering technicians and village level Extension workers (a critical group that WALMI is not designed to accomodate) and to build water management courses into the curriculum for its academic degree holders.

b. Funding of an interrelated set of efforts in Gujarat State, with technical assistance to be provided from the university team to be stationed at WALMI at Aurangabad or a separate expatriate team to be located somewhere in the Ahmedabad-Anand-Baroda area. Sub-components of this package could include several or all of the following:

   1) Provision of funding support for faculty in the Gujarat Agricultural University system for some of all of the purposes listed under (a) above.

   2) Assisting M. S. University to develop a water management option in it BS degree program in general engineering (See Annex 1, Phase II).

   3) Funding a possible Phase 2 expansion of the L & WM Training Center at Anand.

   4) Providing a linkage to pilot project areas for special studies for L & WM Training Center, the Gujarat Agricultural University system, M. S. University in Baroda, and for a proposed training input for medium to high level GOI and state-level agency personnel at the Center for Management at Ahmedabad (IMA).

c. Fund the development of a short course and seminar for water management trainers at IMA, either as part of the Gujarat concentration as proposed in Item (b) or as segment of the funding support for a national-level center.

d. Given that the proposed CWC National Staff Training College will likely become a reality, fund the Phase 1 component to establish a Water Management Wing, subject to AID covenants and conditions that will put in a coordinating and support role for state-level training centers rather than letting it become a competitive program duplicating the state-level efforts. Ideally, project funding for training abroad would be left in this component of the project.

e. At a later stage in the project, provide funding and technical assistance support for development of a training center and related pilot project area in Rajasthan State.

Notes: For reasons outlined in Annex 1, Trip Report - Phase III, we do not recommend inclusion of a project component in Uttar Pradesh State in the initial project design.

Plans should be considered to conduct a DA Training Course for WALMI staff at Aurangabad and the Maharashtra Medium Irrigation key staff in late summer or early fall, 1982, to help WALMI and prepare staff for identification, selection, and implementation of sub-projects. Indian professors who have received DA Training twice along with Lowdermilk and the WMSP staff members could implement this even before the WM & T Project has final approval.

Section D

Proposed Revisions in Project Goal, Purpose and Objectives

Given our analysis of the current India situation, both individually and as a team, we recommend some modifications in the project goal, purpose, and objectives, as originally stated in the PID and related documents. These recommendations are set forth below in a series of propositions and/or specific suggestions.

1. Restate Project Goal

The goal of the project should be to build institutional capacity to help increase agricultural production, resulting in enhanced employment and incomes for rural people in India by using the mechanism of increased efficiency of irrigation water use at the on-farm level.

The general goal as stated in the PID is so broad as to be essentially meaningless and the fact that it appears in this form in almost every AID project paper with which we are familiar is no excuse to continue to use it. The point is that any single project cannot meet such a

a grandiose goal, as that specified, e. g. one that would benefit all rural people in both a welfare and an equity sense. Even within irrigation command areas, not all rural people will benefit directly from this proposed project and certainly not all who will benefit will do so in an equitable manner. But by making the project goal somewhat more specific, as recommended above, at least the log frame portion of the final project paper can set forth a more meaningful set of verifiable performance indicators.

2. Improve Project Purpose

We recommend, as a minimum, adding a follow-up statement that focuses more specifically on the on-farm element of the system, e.g. "The project purpose is to improve the utilization of irrigation water by helping the GOI and state-level government agencies in expanding their capacity to provide relevant technical assistance to farmers in their efforts to increase on-farm water use efficiencies." (This is to be followed by the rest of the statement appearing in the PID). Alternatively, the purpose of the project could simply be stated as:

> "Human and institutional development for improved irrigation water management projects to help farmers improve their levels of agricultural production and their net incomes."

We feel that it is not the purpose of this project to take responsibility for solving all of India's agricultural development problems. It is intended instead to zero in on the farm level end of its irrigation systems and given that objective, to help India develop a cadre of professionals who are adequately equipped and willing to work with farmers in using their irrigation water more efficiently. It is our belief that water will be the catalyst most likely to be effective in motivating farmers to add other risky inputs that in turn will lead to increased net farm incomes and expanded agricultural production. Many studies and long experience indicate that unless there is water control and assured supply of water, farmers seldom will take risks to invest in other inputs nor will they be motivated to change their current irrigation behavior. More reliability of supplies and improved production possibilities in irrigated areas cause farmers to recognize and value water more than any law, force, or rhetoric. If progress is made in achieving this more limited project purpose, the time and money to be invested in this project will be well spent, but without unrealistically taking on an effort to solve all the problems in the whole agricultural system in India.

3. Integrate Major Components

It will be absolutely necessary, if success of this proposed project is to be insured, to fully integrate the two major components set forth on page 7 of the PID: a) Training Programs and Professional Development and b) Pilot Study Sub-Projects. Specifically, we firmly believe that they simply cannot be successfully designed, implemented or operated as separate project components.

As viewed by our team, the primary expectation from this project will be to develop India's institutional capacity to assist farmers to more

efficiently use their irrigation water. In the final analysis, this means helping to train a cadre of water management professionals working at all levels of policy formulation, planning, design, construction and eventually operation of irrigation systems who have a clear understanding that whatever benefits will eventually come out of such projects depend on what the farmers do with the water. Since the training of water management personnel will require a "hands-on" approach, the appropriate "laboratory" is not of the type normally found at an engineering institute, an experimental station farm, or in the academically-oriented classroom set of lectures given at Indian universities. Instead, each element of the training component must be designed around a set of special field studies which are located in the chaks of on-going irrigation projects that highlight the kinds of technology and skills most easily transferable (See Annexes 4 and 5). This is the basic reason why the training and special field studies must be conceived as being totally interdependent. The key planning concepts developed by Asia TR and refined by the Missions in Asia are the ones which support this project. This project can go a long way in India to speed up the spread of water management technology which, if implemented, will complement but be far more important than the high-yielding varieties of the later 1960's and 1970's.

4. Development Framework for the Irrigation Water Management Special Studies and Training Program

There is a growing concensus among professionals involved in comprehensive water management programs that there must be a strong emphasis on action-oriented diagnostic and evaluative research studies to ascertain how systems are currently functioning in order to identify priority constraints which must be solved in the context of a living lab - the farm and command area. A Model has evolved from work in Pakistan which has been tested and refined in Egypt. This Model, called an Action Research-Development Process for Improving Irrigation Systems, now undergirds AID's Water Management Synthesis Project and training courses have been evolved, using this Model. This Model, now accepted by AID in terms of philosophy, process, and procedures, should be used for the proposed WM & T program in India and for the development of new irrigation projects. A video course has been developed which is used to teach this Model, along with field exercises and procedural manuals. Already, in the States of Gujarat and Rajasthan, there are about 40-45 professionals of four disciplines (Engineering, Agronomy, Economics, and Extension) who have successfully completed the Diagnostic Analysis phase of training.

The Model is based on several assumptions which include the following:

a. Many professionals who design, construct and operate irrigation systems do not understand sufficiently the complexities of the system.

b. Few professionals have ever had the experience of interdisciplinary team work to diagnose system problems and develop solutions to priority problems.

c. Few professionals have had any training in management of systems.

d. Few professionals have knowledge of how to monitor and evaluate complex irrigation systems.

e. Few professionals have ever worked face-to-face with farmers in the field to diagnose and solve problems.

f. Designers of projects and construction people usually have little experience and very little ground-truth empirical data to design systems that will work well for farmers.

g. Few projects have utilized the potential of farmer involvement in design, planning and implementing new projects or improving existing ones.

h. Few professionals and disciplines needed for irrigation improvement understand what comprehensive water management means.

Many studies in India indicate that these basic assumptions are sound.

The definition of Water Management which needs to be understood is as given here:

> "Water Management is defined as the manipulation of the physical, biological, economic infrastructural, legal and social factors, and the resources to achieve improved crop production and increased income for beneficiaries. Water Management means conserving soil and water resources and supplying of water in the amounts needed at the right time in the right way for optimum economic efficient crop production while conserving and maintaining the resources of soil and water for future generations of farmers."

Water Management is not merely dams, canals, water resources, policies and laws, institutions and farmers, crops and soils. It is not encompassed by Engineering, Agronomy, Economics, Law or Social organizations. It is not the domain of a single Department. Rather, it is how these resources and technical skills, hardware and software, are orchestrated or managed to provide water for plants and improved production possibilities.

Figure 2 provides a visual representation of the many inputs of an infrastructural nature, which are important to achieve water management for improved production possibilities. Note that in no country, including India, does one Department or Ministry provide all these skills, services and inputs. This indicates that irrigated agriculture and irrigation development, which is judged by the criterion of increased crop production per unit of water, is indeed a complex affair. Irrigated agriculture which provides higher quality of crops and stability of production requires broad understanding, team work, using all disciplines and professions needed and much experience by those who design, implement, and operate projects.

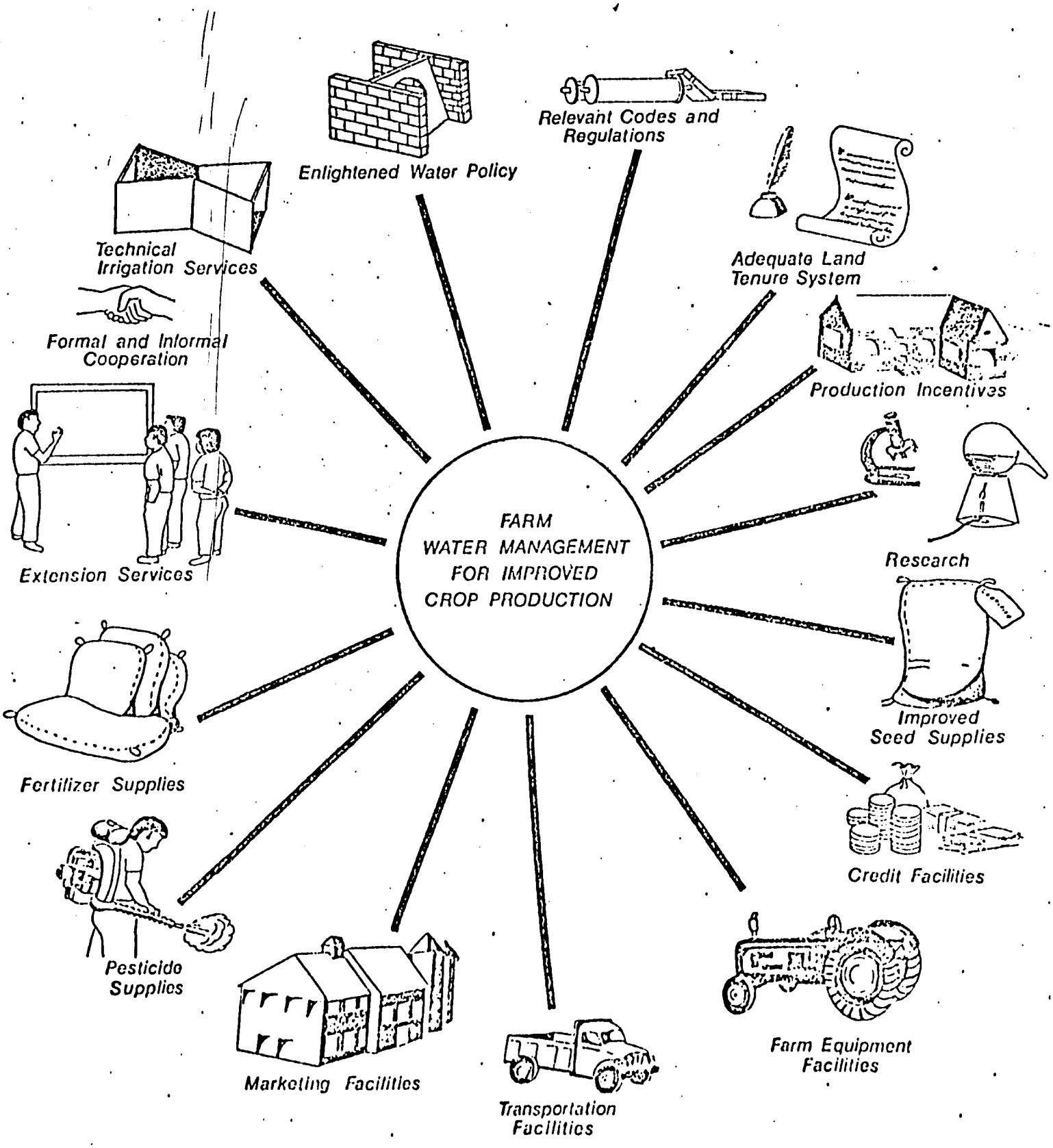


Figure 2 Institutional infrastructure linkages at the farm level to provide improved production possibilities

With this complexity in mind, Figure 3 shows an outline of the four phases and the essential concepts needed to implement successful training projects and programs. This model has evolved over a 10-year period in AID projects and is now accepted in whole or part by water management specialists around the world. The proposed International Center, FAO, the World Bank and others are now advocating this type or a similar approach.

As Figure 3 indicates, there are four phases, each of which has relevance for training programs and special studies.

First, diagnostic analysis of an irrigation system is done by an interdisciplinary team with farmer involvement to understand the system and to identify those physical, biological and socio-economic components which are not functioning to meet the system goals. The priority constraints are established in terms of the criteria discussed previously. This is the type of training and special studies done recently in Gujarat and Rajasthan States. The professionals and participants like the approach, learn rapidly and now can be used to train others in India. Note that training and data collection go hand-in-hand.

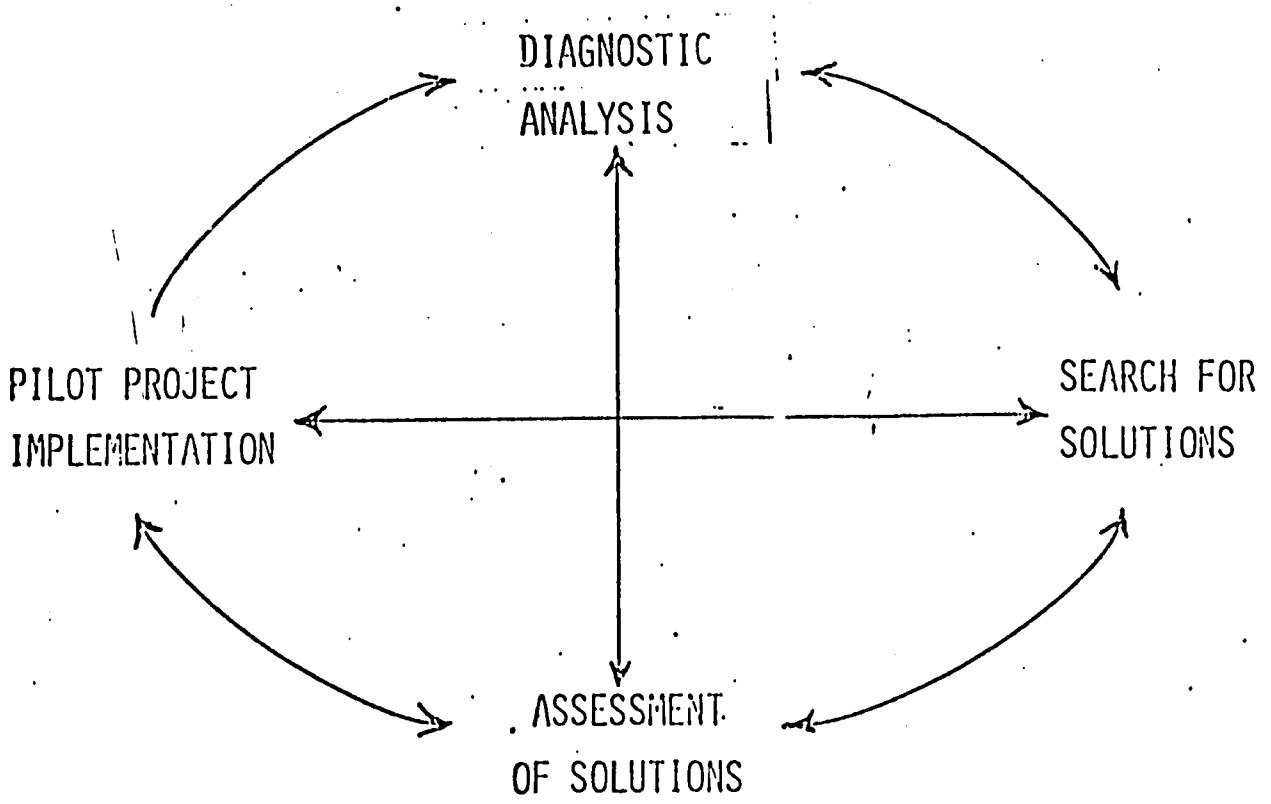
Second, there is a search for practical solutions by the same team made up of an engineer, agronomist, economist, and an Extension professional. An in-depth investigation is made of these priority problems and solutions are worked out on-farm with farmers as cooperators. Those solutions which are cost effective, highly visible, and acceptable by farmers are selected, demonstrated, and refined. In India, every project, sub-project and CAD program needs a place where a team can learn by doing how to improve one or more chaks completely. These complete demonstrations developed and evaluated over one or more crop seasons would provide a visible demonstration of what water management really is. You can't just talk or lecture water management; it has to be done and made visible to farmers, trainers and officers.

Third, the same team makes an assessment of each solution that is made to ensure farmer acceptance, and to identify what complementary inputs are required. Careful analysis of costs and benefits, externalities, and institutional infrastructure needs are conducted. The alternative packages evolved are presented to the appropriate agency for policy decisions about implementation.

Fourth, there is the phase of program diffusion or project implementation over a large area by a government. This is taking place now in several countries of the region with good results. This is the phase where training centers are needed to provide large numbers of professionals. This requires many types of levels of training to meet a country's needs. The training, however, of both a discipline-subject matter nature and interdisciplinary training, must be relevant and done on real systems under farm conditions in order to be effective.

Figure 3

A RESEARCH PROCESS
IMPROVING IRRIGATION SYSTEMS



KEY CONCEPTS

1. SYSTEMS APPROACH
2. INTERDISCIPLINARY RESEARCH
3. ON-FARM CLIENT FOCUS
4. MANAGEMENT ORIENTED
5. ACTION RESEARCH

ESSENTIAL COMPONENTS

1. CLIENT INVOLVEMENT
2. COMMUNICATION
3. TEAM COLLABORATION
4. TRAINING
5. INSTITUTIONAL BUILDING
6. MONITORING AND EVALUATION

The key concepts and essential components which guide this process are also shown in Figure 3. The nature of the systems Indian professionals deal with require a systems approach. The action research and the development components of the Model bring together an interdisciplinary team quite unlike most academic institutions in the world who must solve real system problems. The training and the research then is not done in the lecture halls, a lab or on a research farm, but on-farm and in chaks, involving the farmer himself under real and complex conditions. The total approach is management-oriented because the focus is on helping the real manager at the farm level as well as the professionals who operate the large system.

The research is applied and evaluative and not designed to produce only reports or journal articles. The Model then places great stress on involving the client in the total process from the beginning.

Note in Figure 4 the centrality of the farmer decision maker and the farm focus in the Model. Ways and means have been evolved to improve communications and collaboration among the team members, with farmers, and between farmers and officials. Training in India and elsewhere is a critical need and it ranges from training officials, technicians, managers, Extension managers, and farmers. The International Food Research Institute estimates that by the year 1990 about $247 million is needed in Asia to train professionals, technicians, and Extension workers in Water Management only for the new systems being developed. If, however, we include all the people on existing systems who need training in Asia alone, the cost is estimated at about $317 million.

In India, according to our estimates, those needing training by 1985 are roughly 150,000 or more, including those at all levels from the senior professionals, CAD personnel, staff in existing systems, and technical and Extension staff. By 1990 there will be an additional need of an estimated 200,000 to be trained, so India must start now at every level, using a national center, state centers, management institutes, and universities to provide the staff needed.

To achieve the targets India has set and to meet the criteria of successful projects listed below, India cannot afford to neglect any longer an institutional approach for training critically needed staff. If Water Management on irrigation projects is to be cost effective, it will have to meet the following criteria which undergird the meaning of Water Management.

- Improved control and reliability of water supplies to farmers
- Improved equity in distribution of water
- Improved productivity of water
- Improved maintenance of soil and water resources
- Improved maintenance of improvements and operation of the farm sub-systems by the farmers themselves
- Improved cost recovery of projects by increased involvement and contributions by farmers themselves.

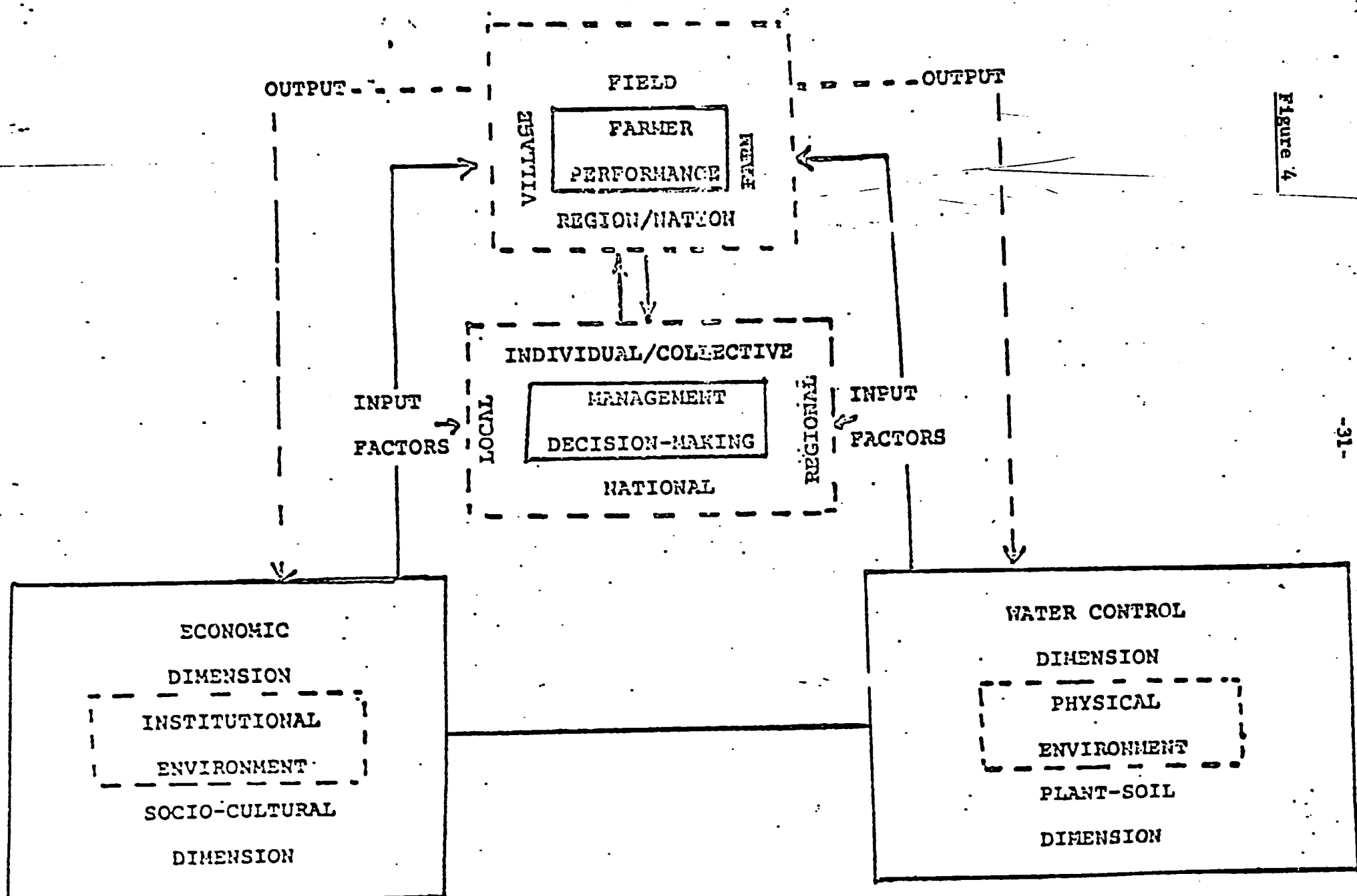


Figure 4

Conceptual Framework of
Factors Influencing
Farmer Decision Making

5. Retitle Project: e.g. On-Farm Water Management Studies and Training (OWMS & T)

In general, the concept of water management as understood by many concerned India government and university personnel is slightly different from that visualized by the WM & T team, and as set forth above in section A. As viewed in India by most observers within the government, the concept encompasses the total irrigation water delivery system which in itself is a valid concept only if there is agreement of just what "management" means in this context. But, as put into practice here in India, there is a primary focus on upper watershed treatment to minimize erosion, dams and canal construction, and delivery of water down to the canal outlets which focuses only on the hydraulic aspects of management, not including budget and people management. There is now an increasing recognition as well that more attention must be paid to water delivery and use below the public outlets, including drainage of excess water, and, with particular attention to be given to problems of farmers who use the water to increase output of plant material, and hopefully, to increase net incomes.

The key point we wish to make is that there is a tendency to view irrigation systems in India from the top down, e.g. starting in the upper watershed and progressing downward through the system, but, unfortunately, stopping at the point where water leaves the government-operated canals via the outlets into the watercourses or field channels that serve small groups of farmers. An alternative approach is to reverse this sequence.

Specifically, the new approach is to start in the farmers' fields and work upward through the system; conceptually this approach encompasses the total system as well but places major emphasis on that segment below the canal outlets from which benefits must come. Since the old approach is so engrained here in India and has heretofore so totally ignored that vital segment below the canal outlets, we think that this project should deliberately focus extra attention on the below canal outlet portion--hence, the recommendation that the title of the project should be changed as outlined above. If this suggestion is not acceptable, then as a minimum, we suggest that the "irrigation" be inserted in the title in lieu of "on-farm".

Irrigation Water Management Studies and Training is also an optimal title. Some of the studies will deal with dam and reservoir problems, ground-water investigations, systems for information, total system modeling, and systems analysis. However, the on-farm first focus should be the approach because of its present neglect and the fact that a focus on the productive end of the system will serve as a barometer of system efficiency.

Section - E

Desired Organizational Mechanisms and Necessary Project Support Linkages

1. AID Project Linkage with GOI and State-Level Agencies and the International Community

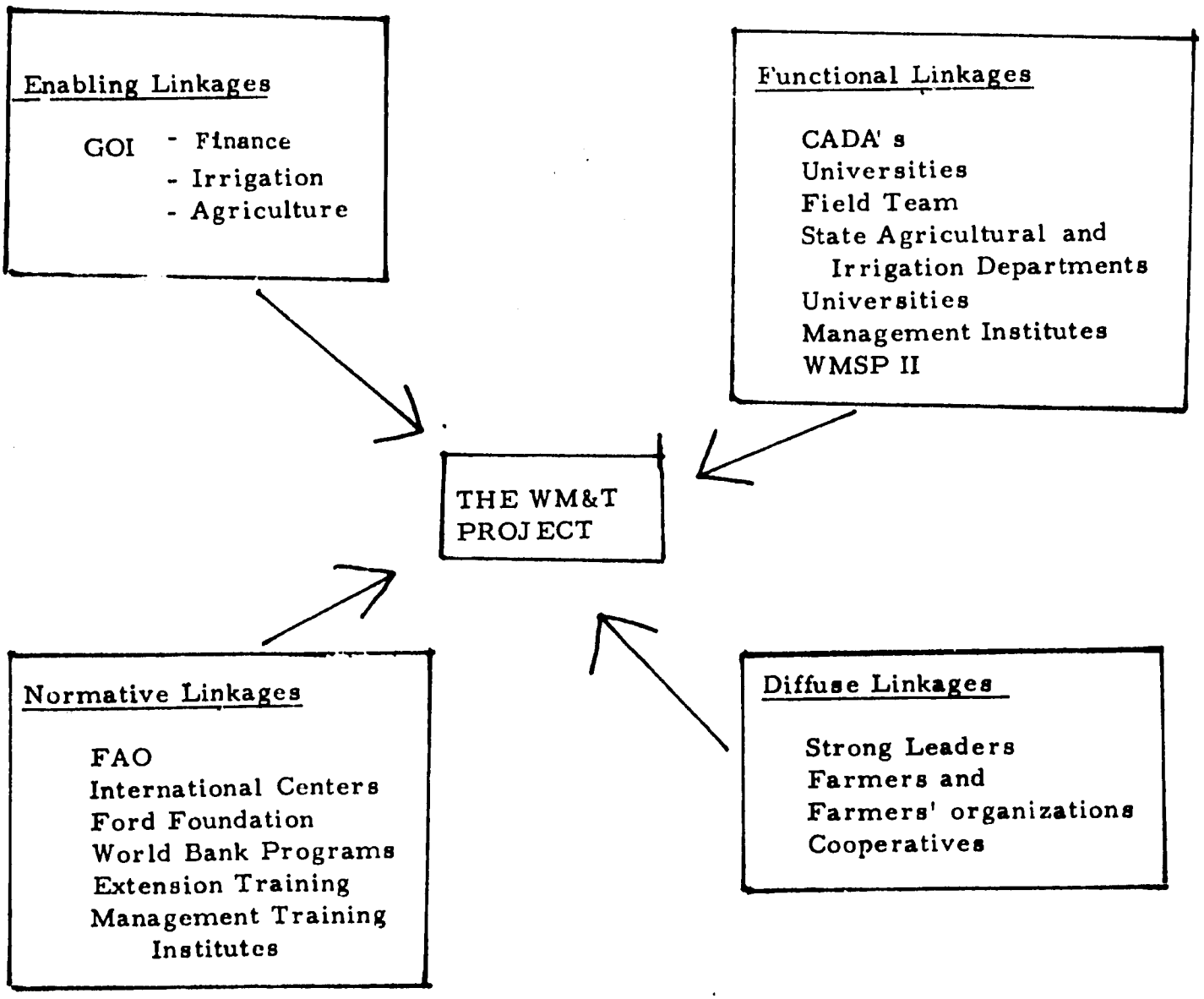
New projects must be designed ins such a manner that there are strong institutional linkages which will support and sustain the project and lead to a firm institutionalization of the project's purpose within the system. This innovative project needs strong enabling linkages for gaining the necessary high level commitments at the policy level, mandates for operation, and funds to support activities. The project also needs strong functional linkages with those organizations which will provide essential inputs and those which will utilize the project outputs. Also the project will need normative linkages with a number of organizations in India which share the purpose of the project and have similar values or norms. Finally another set of linkages, more diffuse than the others, that will be needed over time is with strong leaders of public opinion and organizations that believe in and will support the project's end goals. Figure 5 provides a tentative framework showing key organizational mechanisms and linkages of the type recommended for the WM & T Project. The mechanics of these proposed set of linkages will be discussed in turn.

As to enabling linkages, in the GOI and in the States, there now appears to be a strong commitment by key administrators to this project. These include the Economic Affairs Division, the CWC of the Irrigation Ministry, and top level Irrigation Department leaders in the States. But a similarly strong commitment of the Ministry of Agriculture personnel from the Minister of Agriculture to the Director of ICAR and corresponding support from state-level Agriculture Departments will also be required but is not yet fully evident. In Rajasthan, where a Senior Superintending Engineer and a Joint Director of Agriculture were Co-Coordinators of the Diagnostic Analysis Workshop, sponsored by the Mission, there is a good environment for this close collaboration for a Center. Given the unique nature of this project, a workable mechanism for handling funds for action research or special studies is sorely needed and may well require a joint effort of the Ministries of Irrigation and Agriculture.

Secondly, as to functional linkages, there is a need to work out carefully which outside organizations can or should provide inputs to the project. For example, such inputs may include Mission staff for overall administrative control, a contractual technical manager who monitors the activities in the field, and a small field team of experts from a USA university to provide technical support and guidance for the "hands-on" training and special field studies. And, if this university team were to be located in Maharashtra State, say at WALMI, Aurangabad, it could also assist in the implementation and monitoring of the Medium Irrigation Projects to be assisted by USAID in the near future.

FIGURE - 5

Possible Organizational Mechanisms and Linkages to Implement and Support the Project



The WMSP II Project could also be used to assist and support the WM & T Project through "training the trainers", and providing training materials, technical and procedural manuals, video and audio-visual materials, special overseas short-term training efforts, technology transfer and by other means. This linkage would be particularly beneficial because it would tie the WM & T Project to sources of the leading expertise in the water management field throughout the international community.

Strong linkages are also needed with Indian universities and institutions, CADA's, Agricultural and Irrigation organizations, and other institutions which either produce trained personnel or utilize them in their programs. The universities, and possibly one or more management institutes, should be closely linked because they will be involved in training and in special field research which will feed back into the training efforts at the national and state-level centers and also will provide valuable data for system improvements.

Linkages of this project with international efforts - normative linkages - are essential. Linkages need to be developed to the forthcoming International Water Management Research and Training Center (See Annex 8), FAO, UNDP, and similar organizations, such as the Center in Israel, to keep in touch with progress on water management improvements, especially in training and research efforts, on a worldwide basis. In terms of institutional linkages to the international community directly here in India, there is a need to forge strong and long-term linkages with Ford Foundation and World Bank programs. These organizations have already laid much of the foundation and developed contacts for international interaction which can serve the WM & T Project extremely well.

There are many organizations in India as well with similar goals and purposes in regard to the importance of training. Linkages with them can help to maintain a positive environment for this project. These may include Extension training efforts, research efforts, and management and other major training efforts such as in forestry and rural development programs. At a minimum, such groups should know about this Porject which seeks to build both human and instiutional capacity for India not unlike the goals of their own organizations.

Finally, there is a desired set of diffuse linkages to include interaction with and support of strong leaders in forming public opinion, farmer organizations, and government policy and planning officials who can indirectly help support the Project's aims. If made fully aware of the Project, there will be many individuals and groups in India who will willingly support the purpose and objectives of the Project.

This framework for forging four sets of organizational linkages for a project, as outlined above, was used successfully in a neighboring country to India during the 1970's in evolving a national water management program which is now fully institutionalized there. Institutions were carefully selected which could be strengthened. An inventory was made of all the enabling, functional, normative, and diffuse linkages required. By design, several strategies were used to build up and maintain the desired linkages over a long period of time. Project documentation and reports were prepared for both technical and non-technical audiences and sent to a network of supporting individuals and organizations on a regular basis.

Training programs must start in the field with trainees working together in interdisciplinary teams to evaluate and improve small water delivery systems. This "bottom-up" approach, plus the "top-down" approach for building organizational support mechanisms can be successfully combined to achieve desired institutional changes. For in-service training to be effective, this action, hands-on, management-oriented approach requires a living field laboratory as essential. Few people learn much about actual implementation of water management improvements if this knowledge is offered only in lectures. Therefore, the field studies and related field training exercises must be a fully integrated and large part of the total training effort envisioned in the WM & T Project.

If the proper mechanisms are evolved and the right types of support linkages are developed, this WM & T Project can support a successful large-scale, comprehensive training effort. This task is only surpassed by the challenge, and the payoffs in a few years can be substantial. Development of human capital, as Theodore Schultz has argued for over half a century, is still one of the best means for institutional change. As Schultz, Ruttan and many others have shown, time and time again, the payoffs of applied research and training are much higher than any other forms of investment. Therefore, we believe that this WM & T Project can provide a viable means for AID assistance to India for successfully increasing its food production capacity by serving as the catalyst for convincing farmers to accept the risks of adding a total package of production inputs, once they are assured of a reliable water supply and know how to use it efficiently.

2. U. S. University Support Base for the Project

Our WM & T team has approached the technical support question for the WM & T Project components envisioned as being beyond the internal support capabilities of AID's manpower resources. The India AID Mission is not unique in this regard; mounting large scale irrigation water management projects by AID Missions in Sri Lanka, Pakistan, Egypt, and elsewhere were all faced with the same dilemma. Particularly in Pakistan and Egypt, an acceptable solution was found by contracting with U. S. land-grant universities with demonstrated expertise in irrigation management to supply in-country interdisciplinary teams, supported by back-up research, training and coordination cadres on the home university campuses. We strongly recommend that the AID Mission in India also utilize this mechanism for obtaining the necessary personnel for delivering technical support inputs for its WM & T Project.

Due to the presence of large irrigation components in the agricultural sectors in the Western states of the U.S.A., these states have strongly supported the development of teaching, research and extension expertise in irrigation water management in their land-grant universities. During the past two decades or more, some of these faculties have been active participants in international irrigation development and water management as well, thereby gaining additional expertise that is particularly relevant to this WM & T Project in India. It is for this reason that we recommend that India AID Mission look to the Western universities for the U.S. for its technical assistance manpower needs for this project.

Based on successful past and present endeavors, there are several options available to choose from. Among these are: 1) contracting with a single university (Colorado State University and the highly successful Pakistan On-Farm Water Management Project of the 1960's and 1970's), 2) contracting with the Consortium for International Development (CID) which uses a lead university approach (CID/CSU Lead University contract for the Egypt Water Use Project), and 3) a co-university team effort approach (CSU/Utah State's Water Management Synthesis Project that operates on a world-wide basis).

It must be recognized that these past projects came on line in a sequential manner and were at far lower levels of effort than the huge and long-term efforts now on the drawing boards, not only in India but also in Pakistan, Sri Lanka, Thailand, the Philippines and elsewhere. In our opinion, therefore, we do not think it likely that a single Western university, or even CID as a whole, can successfully service all of the present and emerging irrigation water development and management projects of AID and other donor agencies if they continue to operate under all these ad hoc ways of the past. Therefore these universities cannot be relied upon to meet Missions' manpower needs unless they begin to make internal adjustments that will

now demonstrate to AID and other clientele donor groups and host country that they are finally making the necessary commitments to serving internatinal irrigation water management personnel needs in adequate numbers and on a long-term sustainable basis.

In looking to the university community for its technical support manpower requirements, we recommend that India AID Mission despense with the farce of competitive bidding since anyone even vaguely aware of the comparative advantage of the Western state universities for these kinds of projects can predict the outcome with near 100% certainty. In lieu thereof, we recommend that the Mission assess the relative degrees of commitment that the possible individual Western universities, and/or combinations thereof, are willing to make for serving this WM & T Project and other similar projects in countries noted above on a long-term sustainable basis. Since two of our WM & T team members have been closely associated with Colorado State University in past and present irrigation water management projects, we have developed a model of the kind of university commitment and internal structure that we think the Mission should insit on when seeking its university input for the WM & T Project--using CSU as a case study. For details thereto, refer to Annex 6.

3. AID Collaboration with other Donor Agencies in India

It must be clearly recognized by the proponents of the WM & T Project that USAID is coming rather late on the scene in terms of donor agencies' concern about the need for irrigation water management training in India. Ford Foundation has been in the business of developing institutional capacity in this area of endeavor for over two decades and in recent years, World Bank has recognized the need for such efforts when awarding loans for the construction of major irrigation projects, E.g. in Gujarat and Maharashtra States. It will therefore behove USAID to give due credit for these prior efforts and to solicit further collaboration along these lines. We firnly believe that the orders of magnitude in the training needs area are so large that there is ample room for all three donor agencies to be involved and that a coordinated effort will be more productive than individual efforts which could lead to duplication and conflicts of interests. Suggestions for the kinds of USAID collaboration with these other donor agencies are given below.

a. Collaboration with Ford Foundation

Ford Foundation has been involved in training for development in Extension, community development, population health, irrigation, and in many other areas in India since the 1950's. In recent years, Ford Foundation, through numerous workshops, grants, scholarships, fellowships, and other means has been involved in professional development related to irrigation professionals. Ford Foundation has been a pioneer, a catalyst, and a promoter of training. They have established significant creditability with officials at every level which will be invaluable for the proposed USAID Water Management Training Project.

USAID should collaborate with Ford to build upon and expand the efforts already initiated. This collaboration should include joint efforts where feasible, loan of personnel for special activities, and close cooperation in design, implementation, and evaluation of training and special studies activities. Ford Foundation, with its excellent record of graduate level training effort should be encouraged to continue that focus as well as offering workshops which help change attitudes, increase knowledge, and help bring about institutional change. Ford Foundation looks to AID for further building up of institutional capacity in WM training on a large scale which they cannot do due to lack of resources required.

b. Collaboration with World Bank

In terms of irrigation water management improvement, AID and World Bank have collaborated closely in Washington and many host countries in project identification, development, appraisal, evaluation and training. In several countries, the Bank and AID are jointly funding irrigation projects. The Bank uses AID and its Title XII universities for technical assistance. These relationships for the most part have been productive but there must be a continuous process of building and strengthening these linkages.

In India, fortunately, excellent collaborative efforts are already evolving. In water management training and special action research, in particular, there are many opportunities for close cooperation. With USAID's staff always in India and their ability to locate teams of expatriates in-country, there is a comparative advantage for USAID in accomplishing many activities in irrigation management training and in technology transfer efforts. For example, the World Bank sponsored Water and Land Management Institute in Aurangabad, the Water and Land Training Center in Anand, and other centers need help in improving their programs and expanding their efforts. AID, through its Title XII universities and its forthcoming WMSP II Project, will have much expertise available for training and assistance to training. In terms of technology transfer, AID and World Bank staff need to work closely together. Also, in efforts to promote institutional change and policy formation, both USAID and World Bank staff need to continue their support efforts.

Present dialogue can be exchanged for very short-term activities. joint seminars and workshops implemented, and the second phase of special projects can be worked out jointly. The World Bank needs AID's contributions to training because AID has resident staff, a source of expertise and much experience in both human and institutional development.

c. Collaboration with FAO and Other Organizations Concerned

AID and Missions have collaborated closely with FAO's activities in water management. They have jointly sponsored expert consultations, developed materials, and shared materials and personnel over the last few years. This type of collaboration needs to continue. In the field, the Mission and FAO personnel should continue to seek ways to cooperate more closely and coordinate their efforts in this regard.

d. A Concluding Comment

AID, through its WMSP II, is planning several regional workshops, training activities, and other activities in India over the next 5 years, Ford, World Bank and FAO staff should be involved in these efforts. In the WM & T Project and related efforts, USAID will be involved in helping to build up the capacity of India to train professional staff at the Center and in the States, special action research, strengthening universities, etc. Some of the local World Bank, Ford and AID staff should participate in many of these training programs to gain additional expertise and experience which are needed.

Section F

Recommendations for Composition of and Scope of Work for the Design Team

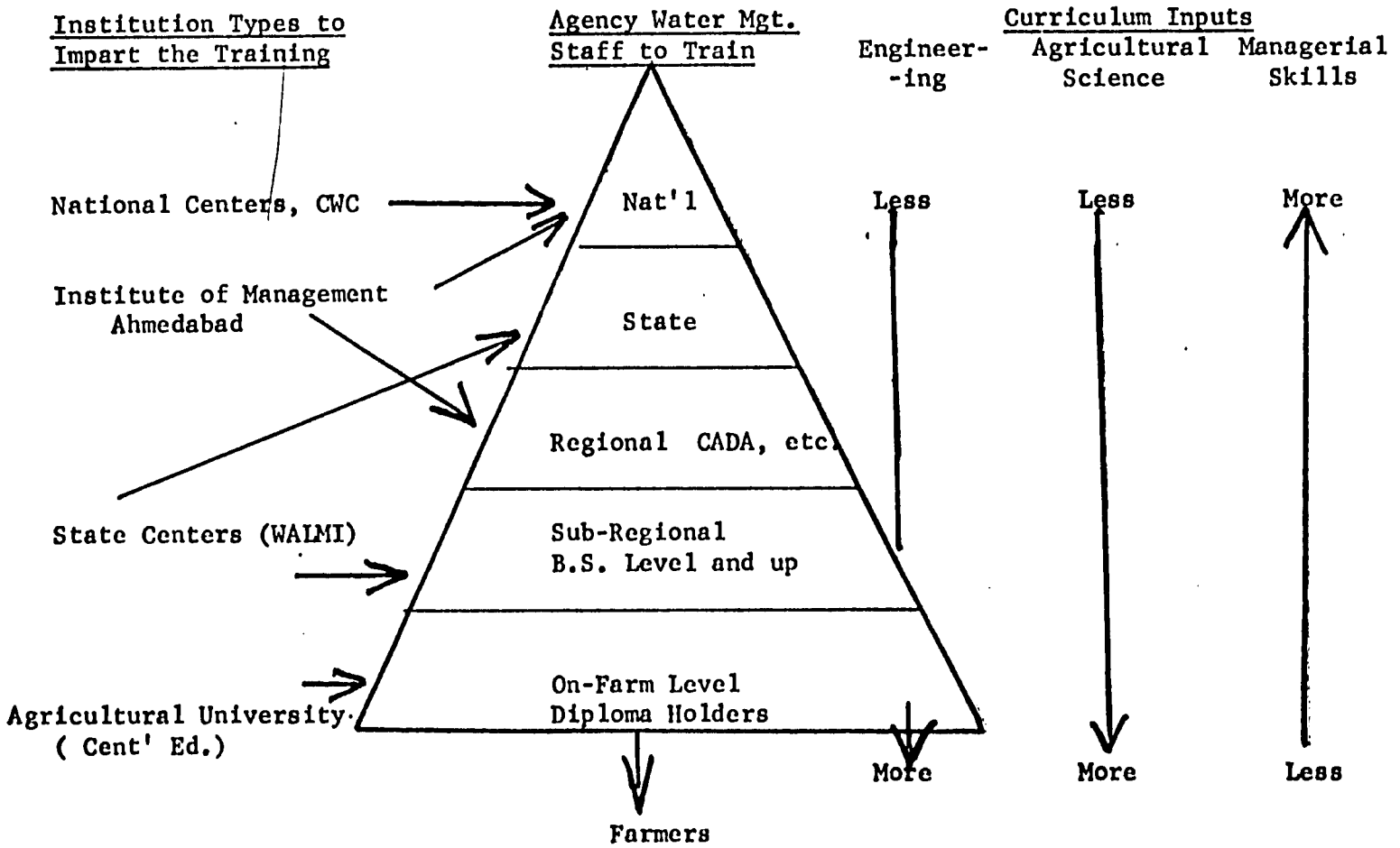
1. Conceptual Framework of the Project

A detailed conceptualization of the irrigation water management training needs and its delivery system for India is presented in Annex 3 so only a brief treatment thereofwill be presented in this section. The point of departure for designing this project will be to obtain accurate

estimates of the number of personnel to be trained by category levels within the system (See Annexes 3 and 7). Next in sequence is the need to determine what kind of skills to be imparted and this in turn naturally leads one to concern with what kind of institution can best do the training in each professional/administrative level of the system. In summary, an adequate response to the following set of questions:

(1) Who shall be trained?
(2) In what numbers?
(3) In what kind of skills?
(4) What institutions can best do the training?

Schematically, the interrelationships of these four basic issues can be shown as follows:



Not shown on this diagram, however, is the location of an expatriate interdisciplinary team of three to five persons who should be housed with one of the WALMI type state centers and the location of a general coordinator in Delhi. Also not shown is the location of pilot project sites for special studies and demonstrations for use by trainees and as examples for farmers. The pilot project sites should be in on-going

irrigation project command areas and will need to be linked in one way or another with the various kinds of training institutions to be involved. Providing a mechanism for establishing these linkages will be one of the primary functions of the expatriate team. Finally, given the nature of the small but important training abroad component, it cannot be shown in this schematic diagram.

2. Team Composition and Professional Qualification of Nominees

The PID identified the following staff resources required for the design team for the project paper: "an irrigation engineer, water management specialist, training specialist, water resources systems specialist, irrigation agronomist and economist." We believe that it will be more important to have team members who are already totally familiar with the desired type of water management processes, business management principles and training methods than the necessity to have all the PID-specified disciplines involved. Secondly, it would be highly desirable for the team members to have had prior experience in India or similar experience elsewhere abroad with these kinds of irrigation systems. Finally, it must be recognized that because of the need to have the team in-country as a group during the total but rather short period envisioned, it may become necessary to make some compromises in the selection of team members.

Assuming, however, that the first two conditions can be met and that no compromises will become necessary, we recommend the following persons as the ideal design team:

Dr. Max Lowdermilk - Team Leader (Water Management & Extension Specialist)
Dr. Dean Peterson - (Agricultural Engineer)
Dr. Melvin Skold - (Agricultural Economist)
Dr. R. K. Sampath - (Economist, Business Management & Training Specialist).

To this group to be brought in from the USA, we recommend the addition of three consultants already employed in India with other donor agencies:

Dr. Gilbert Corey - World Bank (Agricultural Engineer)
Dr. David Seckler - Ford Foundation (Economist)
Dr. Roberto Lenton - (Engineer).

It is our understanding that Dr. Corey may likely be available for essentially full-time work with the team for up to a month and that Messrs. Seckler and Lenton will be available for part-time consulting inputs to the degree that their busy schedules will permit.

Brief resumes of the professional qualifications of the team members recommended to be brought in from the USA are as follows:

Max Lowdermilk: Received his undergraduate degree at Duke University and later interrupted a 12-year tour of duty in Pakistan to return to Cornell University for a Ph.D. Degree in Extension with a speciali-

zation as well in agricultural economics and soils of the Tropics. In Pakistan, he was involved in a series of farm level development efforts, directed a major Extension program and then served as a member of the CSU field team for the On-Farm Water Management Project. He has served on the planning and coordination committee for the Egypt Water Use Project and was heavily involved in the Water Management and Synthesis Project. At the present time, he is a water management specialist with the Asia Bureau of AID/Washington, D.C. while on leave from his faculty position in the Department of Sociology at Colorado State University.

Dean Peterson: Is an Irrigation Engineer with a stronginternational reputation who is already well known to AID. He has been a faculty member at Colorado State University and a faculty member, department head and dean at Utah State University. Following his retirement form USU, he served as Chief of the Technical Assistance Bureau of AID in Washington, D.C. Following his retirement from that post, he was in the India Mission in Delhi on a personal services contract for over two years. He returned to the States only last December. He was heavily involved in the development of the PID for the Water Management and Training Project.

Melvin Skold: Obtained his undergraduate degree at Colorado State University and his graduate degrees in Economics at Iowa State University, specializing in agricultural production and water resource economics. He spent an extended period of time in the Economic Research Service of the U. S. Department of Agriculture, both as a Western Region Leader and later on, a duty assignment in Washington, D.C. He is presently a tenured Professor of Economics at Colorado State University. He was a member of the on-campus support staff of the Pakistan On-Farm Water Management Project and is presently a member of the planning and coordination committee for the Egypt Water Use Project; this latter assignment has been taking him to Egypt on TDY assignments on the average of twice a year. He is presently considering spending his forthcoming one-year sabbatic leave in Rome at the invitation of FAO to work with their irrigation development specialists.

R. K. Sampath: Received his undergraduate and graduate degrees at Universities in India; he then spent two years as a post-doctorate fellow at Harvard University where he specialized in water resource economics and systems analysis. He previously was employed as a program officer and training coordinator for the Ford Foundation Office in Delhi. He is presently an Associate Professor of Economics and Co-Director of the International School for Economics Development Studies at Colorado State University. He has already made plans to spend the coming summer in India developing materials for a macro study of investment in irrigation in India since Independence as part of the AID-funded International Water Policy and Pricing Project. While in India on short-term TDY, he will be spending some time as an Honorary Visiting Fellow at the Madras Institute of Development Studies on the invitation of Director Kurien and also plans to spend some time working with Director Gopinath of the Center for Management in Agriculture at the Institute of Management at Ahmedabad; he and Dr. Gopinath were Fellows together at Harvard.

The qualifications of the proposed participants from Ford Foundation and World Bank are well known to Mission personnel so will not be restated herein.

As noted above, schedule conflicts may well occur that will make it impossible to bring in all of the desired team members during the in-country period as specified to complete the Project paper. Therefore we offer the following list of possible substitutes, all of whom have the kinds of training and experience that will be needed. These are:

Team Leader: No substitute recommended.
Schedule the time in-country so Dr. Lowdermilk will be available.

Agricultural Engineer or Engineer Alternatives:

Dr. Doral Kemper (Former Chief of Party, Pakistan On-Farm Water Management Project)

Dr. Gil Levine (Soon to retire from Cornell University)

Dr. E. V. Richardson (Director, Egypt Water Use Project), CSU

Dr. Jack Keller (Co-Director, W.M.S.Project, Utah State)

Agricultural Economics:

Dr. Robert Young (Co-Director, International Water Management and Pricing Project), CSU

Dr. William Easter (Co-Director, International Water Management and Pricing Project), CSU

Dr. Edward Sparling (Participant in Pakistan, Egypt, and International Water Policy and Pricing Projects), CSU

Dr. Jerry Eckert (Former team member, Pakistan On-Farm Water Management Project)

Dr. Sam Johnson, III (Former team member, Pakistan On-Farm Water Management Project and now Associate Professor, Department of Agricultural Economics, University of Illinois)

Management and Training Specialist:

Dr. James Francis (Professor of Business Management), CSU

Other Disciplines:

Dr. John Reuss (Soil Scientist, former member of the Pakistan On-Farm Water Management Project, Professor of Agronomy, CSU; on assignment in CID Office, Tucson, Arizona.

3. Scope of Work and Specific Duties of Team Members [1/]

a. Scope of Work

The design team is expected to assist USAID,GOI and concerned States in determining the scope and nature of AID assistance to an integrated program of training and pilot-level research designed to improve water management, culminating in the preparation of a Project paper.

The team will be required to work closely with GOI and State officials and the AID project manager in evolving the various elements of the project design. The PID visualizes that the goal of increased agricultural production, rural incomes and employment will be served by improved utilization of irrigation water - the Project's purpose.

The Project concept assumes that increased numbers of better trained personnel and better systems-level information - project outputs - will result in improved utilization of irrigation water. As instruments (sub-projects) for achieving the project's purpose, a national staff training institute, two or more staff training institutes at state-level, development of academic programs and curricula at one or more engineering and/or agricultural universities and implementation of pilot-level field studies of critical problems are visualized. The team, working closely with GOI and State officials and USAID staff, will develop a detailed description of the project, setting forth what is to be done, who is responsible, what support will be required, by whom and how it will be provided.

The degree of success of the Project is highly dependent upon the effectiveness of the organizational and administrative arrangements for the project generally and for the sub-projects, the linkages in place or to be developed to utilize outputs of trained people and information, and the priority, technical content and design of the sub-projects themselves. With Indian counterparts, the team shall review and make recommendations on these issues and on a plan for implementation. In addition, the team will be required to develop a financial plan insuring the integrity of the sub-projects and to examine and assess the economic and social impacts of the Project and sub-projects.

It is expected that the bulk of sub-project design will be complete by the time the final Project paper is drafted; however, some flexibility to add new critical activities or revise activities over time as experience is gained is desirable; therefore, a definite procedure for making these changes must be agreed upon and included in the project paper.

1/ The WM & T team is indebted to Dr. Dean Peterson who drafted a preliminary version of this section of the report. We generally concurred in its content and are presenting it herein with only minor modifications.

The activities to be supported under this Project are only part of India's program to improve irrigation water untilization through training and research, unilaterally by GOI or the States and with other bilateral and multilateral support. Under active consideration for CGIAR (Consultative Group for International Agricultural Research) support is an international water management research and training center. For the current draft proposal, see Annex 8. The team shall assess the coherence of the WM & T Project with all of these programs, with the Mission's portfolio in the irrigation sector and with its strategy as set forth in its current (FY 84) Country Development Strategy Statement (CDSS).

The final product of the team will be a draft of the Project paper to be presented to USAID prior to the team's departure from India. It will provide essential chapters in final form which will support the Project paper. Circulation of the draft Project paper will be restricted to GOI and concerned Indian State officials until after the Project paper has been formally acted upon by AID and the GOI. Final revisions and additions will be provided by the Mission before submission for review by AID/Washington.

To meet this schedule will require that the Mission, CWC and the States provide the data requested which must be analyzed and summarized in a usable form. Also one senior team member should arrive 2-3 weeks prior to the rest of the team for critical negotiations. One team member should remain behind a week or more to complete any section of the draft Project paper not completed due to the lack of data and information to be collected, analyzed, and tabulated by CWC, the States, and the Mission.

Before the team arrives, key contacts should be made with the Ministry of Agriculture, the Director General of ICAR, to gain their views.

Both at the Center and in the States, the assessment of training needs should be done by a good balance of Agriculture and Irrigation officers.

Key appointments should be well planned for members of the team. A strategy which could be used is for some of the team members who know India and Indian colleagues to travel individually to make contacts where appropriate. At each place there should be group meetings as well as individual for al and informal meetings.

The Mission will give high priority on finding a suitable working environment with easy access to typing, xeroxing, transportation, and other facilities. The team members should be housed in one place or one floor in a suitable hotel with air-conditioning.

b. Specific Duties of the Team as a Whole.

(1) The team, as a whole or individually, as designated by the team leader, shall examine, analyze and fully describe the various components of the overall Project and of each of the sub-projects, or where similar sub-projects are involved, one or more examples of each, giving attention to the validity, feasibility and implementation requirements relating to but not restricted to the following issues:

(a) Concept

(1) goals and objectives
(2) outputs to be realized
(3) alternative approaches
(4) justification

(b) Organization

(1) organizational objectives and constraints
(2) alternative options
(3) description
(4) responsibilities

(c) Methodology

(1) description
(2) technical soundness - scientific methodology, curriculum, entrance requirements
(3) alternative approaches
(4) additional design requirements
(5) special training needs

(d) Physical Resources

(1) description of those available and planned
(2) adequacy
(3) responsibility for providing physical resources
(4) imported equipment needs

(e) Personnel Resources

(1) need and availability
(2) plans for acquisition and training

(f) Technological Support

(1) exchange of scientific personnel for training
(2) consultancies; indigenous and international

(g) Relationship to Other Programs

(1) other sub-project components
(2) other similar unilateral or bilateral or multilateral programs
(3) related indigenous programs such as irrigation project design, construction and rehabilitation, command area development, extension and production support programs, etc.

(h) Impact

(1) linkages and institutions to be used and their effectiveness and availability
(2) beneficiaries, direct and indirect
(3) economic and social impacts

(i) Work Plan and Budget

(1) identify critical steps for implementation and develop time schedules for their accomplishment
(2) agree upon detailed budget.

(j) Criteria for AID Support

State any specific criteria relating to features of the overall project or sub-projects believed to be essential to achieving the project outputs and establishing the goal linkages as set forth in the PID and as may be further agreed upon during the design study period.

The foregoing list of tasks is not necessarily the prescribed outline for the team's report (although it may serve as a guide). For example, Item (j), may need to be addressed as well under several of the other items. Nor is the list necessarily complete. Other important issues identified by GOI or State officials, the team or Mission may be added at the discretion of the team leader.

(2) In preparing its design, the team should keep in mind the project concept as routinely outlined in a logical framework. The team, with USAID assistance, shall fully develop the logical framework following the general concept stated in the PID Section "Project Goals and Purpose". Particular attention shall be given to:

(a) Institutional linkages for translating project outputs into achievement of the project's purpose.

(b) Methodology, organization and work plans for achieving project and sub-project outputs.

(c) Identifying the critical inputs, including the appropriate disciplinary backgrounds and training of personnel responsible for existing sub-projects.

(3) The project should be designed to "learn as it goes"; thus, provision will be made for both internal and external monitoring and evaluation and a process described and responsibility fixed for judging, amending and revising project and sub-project plans in order to increase effectiveness during the project's life.

(4) The team, with Indian officials and with USAID staff advice and assistance, shall prepare detailed plans for implementation and evaluation of the project.

c. Individual Duties of Team Members

(1) Project Leader

The project leader ideally will be the water management specialist but either the economist or irrigation engineer can be substituted, if necessary. He will be responsible for providing overall leadership and organizing the work of the team, for insuring that adequate attention is given to the integrative features of the project such as institutional linkages, interdisciplinary approaches, etc., for preparing the Project paper outline, assigning the various tasks to team members, developing work schedules and for completion of the draft of the Project paper.

(2) Other Team Members

The disciplinary makeup of the team was based on consideration of the various technical areas which need to be integrated into project and sub-project design. Each team member will be responsible for insuring that proper consideration is given to mobilizing the most effective technological approaches available in his field of expertise and experience.

d. Minimum Qualifications Desired of Team Members

(1) Team Leader

The team leader shall be a senior water management specialist (or economist or agricultural engineer) with extensive professional experience in irrigation and with at least some relevant experience in India or other LDC's with similar irrigation problems. He shall have had significant experience with the design and management of a multi-disciplinary project, preferably in irrigation and/or water resources fields. Because of the training, pilot-level research and practical application aspects of the project, a combination of academic, research and applied professional experience is highly desirable, as is familiarity with AID project design processes and AID procedures. The team leader should hold a Ph.D. or equivalent degree, have gained a significant level of professional recognition in his field and as a technical generalist, and with a minimum of 15 years of professional experience.

(2) Irrigation Engineers

A Ph.D. in civil or agricultural engineering, with a minimum of 10 years experience in irrigation and 15 years total in water resources is expected. Experience may include academic teaching or research with not less than four years equivalent consulting experience, preferably in India or as a minimum, in other LDC's with similar irrigation problems.

(3) Irrigation Water Management Specialist
(See Team Leader, Item #1, above)

(4) Economist
Ph.D. and 15 years experience in agricultural economics, with a significant period of overseas experience in irrigation and related agricultural development projects is expected. Development or resource economics expertise may be substituted if incumbent has had significant applied experience in the agricultural sector.

(5) Training Specialist
Ph.D. level academic qualifications in economics, agricultural economics, agricultural education, Extension, or a business management speciality. Not less than 10 years professional experience with not less than 5 years direct experience in curriculum development, development of training courses, instructional modules, training aids, etc. or five years experience in administration of training programs in agriculture or related agricultural development fields.

4. Further Investigations Needed

Within the time frame that the WM & T team members were in India, it was not possible to collect and/or develop all of the information and data base that the design team will need to prepare a Project paper. In order to best utilize the time of this team when it arrives in Inida, the following investigations should have been completed: 1) Dissagregated estimates of the number and type of water management personnel who will need training; 2) Information on curriculum content obtained from Irrigation and Agriculture Department staff who are engaged in on-farm management and/or the administration of such effort; and 3) A judgment on the interest, capability and quality of universities and institutes in India that could be utilized in the training function. These data needs are discussed briefly in turn.

a. Number and Type of Personnel to Train

We believe that this kind of information should be collected India-wide from Irrigation Departments, Agriculture Departments, CADs and the like. Further, we believe that the Central Water Commission would be the best agency to coordinate this data collection effort. A questionnaire for this survey has been developed and shown in Annex 9.

b. Views of Irrigation and Agriculture Staff on Types of Training Needed

If we truly believe that farmers should be involved in government decision making on the amount and timing of their irrigation water deliveries, channel layouts and the like, then we must also obtain an input on what the curriculum for water management training should include, obtained directly from the staff of Irrigation Departments and

Agriculture Departments. Initially, we think that this kind of information should be obtained from the States of Gujarat, Maharashtra, and Rajasthan where AID is presently getting involved in irrigation development efforts and where various kinds of training are already underway. Given the foregoing rationale, we think that USAID should coordinate this survey effort. A questionnaire for the survey has been developed and is given in Annex 10.

One of the WM & T pre-design team members was also one of the trainers in the Rajasthan Irrigation Diagnostic Short Course, completed in February 1982. As such he had an opportunity to field test the questionnaire given in Annex 10. Time constraints did not permit us to totally summarize the data recieved from 29 course participants and observers but it is clear from a preliminary screening of these data that such people have valid ideas for curriculum input that should be used as a direct input into the WM & T Project design. (See Table 1, 2 and 3). Also, this test run provides some hard data with which to disprove the conventional wisdom within the Mission that a team of U. S. university expatriates to work with the project would not be welcomed at a field location in India. Of the 25 persons in the sample who responded to a question in this regard, 92.4 % would favor the presence of a U. S. university expatriate team at a state-level in-service training center, 4.3 % did not favor this and 4.3 % were undecided. (See Table 4).

5. Follow Up Visits and Contacts to be Made by the Design Team

a. Central Government

(1) Mr. C. C. Patel and key CWC Members
(2) Director General ICAR and Staff
(3) Water Technology Center - Dr. A. M. Michael
(4) Ministry of Agriculture - Secretary, Director, etc.
(5) Mr. S. R. Upadhyaya, Joint Director of Extension

b. Donor Agencies in Delhi

(1) World Bank - Dr. Corey and others
(2) Ford Foundation - Drs. Lenton, Seckler, an Chambers

c. Rajasthan

(1) Mr. D. M. Singhvi (who can plan a meeting for Irrigation and Agriculture officials)
(2) Director of Agriculture and Mr. R. R. Mehta, Joint Director
(3) Mr. Tomar, Director of the Adaptive Research Centre, Chittorgarh
(4) Agricultural College Staff selected by Mr. R. R. Mehta at Udaipur

d. Maharashtra

(1) Mr. P. R. Ghandi, Secretary of Irrigation and key Staff - Bombay (Utilize heavily as he knows and understands water management)
(2) Mr. Dhamdhere, Director of Water and Land Institute, Aurangabad

(3) Irrigation Staff College and Research Center, Nasik
(4) Vice Chancellor Salunkhe and selected Staff from Agricultural Engineering, Economics, Extension, Agronomy, and Water Management Research Project at Rahuri, the Mahatma Phule Agricultural University

e. Gujarat

(1) Dr. O. H. Patel, Dean of Faculty of Technology and Engineering at Maharaja Sayajirao University of Baroda (Dr. Patel and key officials)
(2) Director R. C. Shah, Water Management Training Center, Anand
(3) Agricultural College, Anand
(4) Rural Management Training Institute, Anand
(5) Indian Institute of Management, Ahmedabad, and selected Staff (Dr. Anil K. Gupta, Dr. Nitin Patel, Dr. V. N. Asopa, Dr. G. R. Shown, and Professor S. P. Seethovonan).

f. Other Key Places/People

Mr. M. N. Venkatesan, Former Member of CWC, now Chairman of the Narmada Control Authority

Note: He is a key individual to depend upon in sorting out the art of the possible in negotiations and in planning the Project. Consider utilizing his services as a working member of the PP team.

TABLE 1 PARTICIPANT'S VIEWS OF RELEVANCE OF DIAGNOSTIC ANALYSIS TRAINING FOR VARIOUS WATER MANAGEMENT PERSONNEL (WORKSHOP AT CHATOORGARH, RAJASTHAN, JANUARY 19 - FEBRUARY 20, 1982)

"Would You Recommend Diagnostic Analysis Types of Professional Development For ------?"

(Number of Participants Reporting is 29)

Type Personnel	Yes	Perhaps	No	Don't Know	No Reponse
	PERCENTAGES				
1. CAD Field Staff	86	7	0	3.5	3.5
2. All Irrigation Dept. Personnel	76	14	7	0	3.5
3. All New Eng. Graduates Entering Irrigation Depts.	60	24	16	0	0
4. Extension Staff Involved in CAD Programs	79	14	3.5	3.5	0
5. Agronomists Involved in CAD Programs	90	7	0	3.5	0
6. Economists Involved in CAD Programs	76	21	0	3.5	0
7. Officers with Similar Positions to Yours	83	3.5	7	3.5	3.5

TABLE 2 PARTICIPANT'S VIEWS OF THE IMPORTANCE OF SHORT 1-TO-4 DAY WORKSHOPS FOR TOP LEVEL OFFICIALS ON SYSTEMATIC INTERDISCIPLINARY APPROACHES TO DIAGNOSE AND IMPROVE FARM IRRIGATION SYSTEMS

"Would You Recommend Short 1-to-4 Day Workshops for Top Level Officials to Understand the Systematic Approach to Understanding How to Diagnose and Improve Farm Irrigation Systems?"

(Twenty Nine Participants)

Type Personnel	Yes	Perhaps	No	Don't Know	No Response
	PERCENTAGES				
1. Policy Makers at National Level	83	14	0	0	3.5
2. CWC Members	76	17	0	0	7
3. CAD Commissioners	93	7	0	0	0
4. Secretaries, Chief Engineers, Supt. Engineers-Irrigation	76	17	3.5	0	0
5. Directors of Agriculture	93	7	0	0	0

TABLE 3 ANAND/GUJARAT STATE PARTICIPANT'S VIEWS OF RELEVANCE OF DIAGNOSTIC ANALYSIS TRAINING FOR VARIOUS WATER MANAGEMENT PERSONNEL (WORKSHOP AT ANAND, GUJARAT, FEBRUARY 16 - MARCH 14, 1982)

"Would You Recommend Diagnostic Analysis Types of Professional Development For------?"

Type Personnel	Yes	Perhaps	No	Don't Know
		PERCENTAGES		
1. CAD Field Staff (n=16)	94	0	0	6
2. All Irrigation Dept. Personnel (n=16)	56	19	19	6
3. All New Engineering Graduates Entering Irrigation Depts. (n=16)	73	20	0	7
4. Extension Staff Involved in CAD Programs (n=16)	87	13	0	0
5. Agronomists Involved in CAD Programs (n=15)	87	7	6	0
6. Economists Involved in CAD Programs (n=15)	75	19	6	0
7. Officers with Similar Positions to Yours (n=15)	60	13	27	0

Table - 4

Participants' Responses to the Question

"Would you be for or against a small interdisciplinary expatriate Team of 3 to 4 professionals such as the Diagnostic Analysis Training being being located in India for a few years to provide assistance and support.in Development or strengthening Training Centers for Water Management and Special On-Farm action research studies?

*Participants	Total Number	Percentage Reporting		
		For	Against	Undecided
	23	92.4	4.3	4.3

*Participants included:

Irrigation Engineer (12) - Exec. Engineer (7) Asst. Engineers (3), Supt. Engineer(1), Project Officer CAD (1)

Agriculture (11) - SMS Agronomy (3), Asst. Agronomy (2),

Additional DAO (1), Joint Director (1) Training Officer Extension (1); Deputy Director Econ (1) ; (Economists (3)

Section G

Outline for the Project Paper and the Preliminary Log Frame

PART I. SUMMARY AND RECOMMENDATIONS

A. RECOMMENDATIONS

B. SUMMARY DESCRIPTION

1. General
2. Statement of Problem
3. Project Components
4. Project Activities
5. Project Goal and Purpose
6. Project Expectations and Output
7. Feasibility
8. Alternative Approaches
9. Monitoring and Evaluation
10. Organizational Arrangements

(a) Organizations Involved
(b) Organizational Linkages

1/ Inside India
2/ Outside India
3/ WMSP II

C. RESOLUTIONS OF ISSUES RAISED BY APAC REVIEW OF PID

D. MISSION SUPPORT OF PROJECT

1. Grant Component
2. Loan Component
3. GOI Component

PART II. PROJECT BACKGROUND AND DETAILED DESCRIPTION

A. BACKGROUND AND BASIC CONCEPTS

B. JUSTIFICATIONS

C. DETAILED PROJECT DESCRIPTION

1. Project Concept
2. Project Goal and Purpose
3. Project Outputs
4. Project Inputs
5. Project Linkages/Assumptions
6. Key Components and Relationships
7. Description of Project Components

PART III. PROJECT ANALYSIS

A. TECHNICAL ANALYSIS

1. Project Mechanism and Components (Example Only)

   (a) Types of Training Needed
   (b) Quantity and Quality of Training
   (c) Special Water Management Studies

      1/ Dams and Reservoirs
      2/ Canals
      3/ Minors
      4/ Systems Analysis
      5/ Information Systems
      6/ Control Structures
      7/ Rotation Systems
      8/ Outlets to Farm

         a/ Control Structures
         b/ Conveyance Losses
         c/ Lining Techniques
         d/ Channel Cross Sections
         e/ Topography
         f/ Land Leveling
         g/ Irrigation Practices
         h/ Irrigation Efficiencies

      9/ Monitoring Evaluation

      10/ Ground Water

         a/ Conjunctive use
         b/ Water logging
         c/ Salinity
         d/ Drainage Control

      11/ Water Use Practices
      12/ Water Codes

2. Impact on Primary Audience
3. Impact on Secondary Audience at the Farm Level
4. Initial Environmental Analysis
5. Relevant Experience at AID with Similar Projects

B. SOCIAL ANALYSIS

(See Section in WMSP II Project Paper)

C. ECONOMIC ANALYSIS

(See Section in WMSP II Project Paper)

D. FINANCIAL ANALYSIS

E. ORGANIZATIONAL ANALYSIS

PART IV. ADMINISTRATIVE ARRANGEMENTS

A. ANALYSIS OF ADMINISTRATIVE ARRANGEMENTS

1. National Level
2. State Levels

B. IMPLEMENTATION PLAN

1. National Level
2. State Levels

C. EVALUATION

PART V. COVENANTS AND AGREEMENTS BETWEEN AID AND GOI

PART VI. SCOPE OF WORK

PART VII. LOGICAL FRAMEWORK

PART VIII. TECHNICAL SUPPORT CHAPTERS

Chapter 1 Evaluation of Irrigation Practice Seminars (1956-1970) on Indian Water Management Developments

Chapter 2 Evaluations of Gujarat and Rajasthan Diagnostic Analysis Professional Development Programs by the Water Management Synthesis Project (Gujarat, 1981; Rajasthan, 1982)

Chapter 3 Evaluation of Potential for Institutional Change of Participating Organizations (MKL will do)

Chapter 4 Support Services to Project by AID/Science and Technology Bureau, WMSP II Project

Chapter 5 Asia Bureau Expert Team Evaluation of India's Training and Special Studies Needs (1980) (WM Synthesis Team Report on Training)

Chapter 6 Water Management Curriculum of M.S. University of Baroda, by Gil Corey, USAID/Washington, May 8, 1981

Chapter 7 Brief Description of CWC Plan for National Water Resources Development and Management Institute (In Team paper, Annex 2)

Chapter 8 Relative Cost of Hardware and Software, including Training, from World Bank and USAID Projects in Asia and India
(India to be added)

Chapter 9 Known Technologies and Procedures Within and Outside of India With Transfer Potential
(In Team Paper, Annex 4)

Chapter 10 Minor and Major Irrigation Officials of Gujarat and Rajasthan on Professional Development Needs

Chapter 11 Analysis of Data on Number of Potential Trainees to be Provided by CWC

Chapter 12 Summary of Findings of Irrigation Needs Assessment by Agriculture and Irrigation Officials in Gujarat, Maharashtra, and Rajasthan
(Survey Data)

Chapter 13 Effectiveness of Operation of Irrigation Projects Visited by Expert Team in 1980

PRELIMINARY LOGICAL FRAMEWORK OF GOALS, PURPOSES & OUTPUTS

Irrigation Water Management Training and Action Research Project

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions (For achieving Goal)
Program or Sector Goal: To improve India's capability - increased agriculture production and higher farm incomes.	Measures of Goal Achievement: Implementation of new design procedures for projects, new technologies, monitoring and evaluation Cadres, trainers, institutionalized training programs, improved projects, more area irrigated in projects, higher returns.	On-going monitoring evaluation studies by CWC, States and special studies project evaluation plus monitoring through LOP by WMSP II experts.	1. GOI will continue to place high priority on irrigation. 2. CWC will continue to work toward a separate professional Cadre by WM Development and O&M Field Staff. 3. That Irrigation and Agriculture ministries work close together at project level and state level. 4. That a contractor and a team of experts are allowed to help implement the project.
Project Purpose: To strengthen India's institutional and develop human capital which will increase India's capability to design, implement and operate effective irrigation systems which will improve the economic efficiency of irrigation water uses.	End of Project Status: 1. Host country has adopted and continuing training at established centers. 2. WM concept and professional development widely accepted . 3. Universities beginning to include WM in curricula.		Important Assumptions for Achieving Purpose: 1. Adequate commitment of GOI for training and provision of incentives for training and professional careers in WM and O&M. 2. Host country continues to give highest priority to improved WM by changing policies, codes, and developing, monitoring, and evaluating systems for projects to assure improved operation of Irrigation projects to provide water control, improved timing, more equity and more level as a final measure of irrigation project success.

	End of Project Status: (Contd.) 4. New design and implementation procedures for monitoring and evaluation accepted for irrigation improvement. 5. More effective programs established.		Important Assumptions (For achieving Goal) (Contd) 3. That all training programs are linked with special field research which diagnoses problems and develops solutions on-farm. 4. That all training has a primary hands-on field-oriented management focus with the Command Areas and farms as Living Laboratories.
·its: rained manpower for better understanding, design, implementation, operation, monitoring and evaluation of irrigation Water Management Projects. 1. A National Center which focuses on WM training. 2. 3 or more State Centers. 3. 2 or more universities with a WM curriculum focus. 4. Special studies or action oriented evaluative research to diagnose and solve problems.	Magnitude of Outputs: 1. One National Center with ____ professionals trained. 2. 3 State Centers with ____professionals trained. 3. 2 or more university with full-fledged courses in WM at BSc level and graduate programs. 4. Professional development on-going for all staff. 5. Technology transfer as a built-in component of India's irrigation development.		Assumptions for Achieving Outputs: 1. Quality host country trainers and levels of training programs are selected . 2. Trained personnel will utilize skills gained in their organizations. 3. Long-term AID commitment to institutional development, human resource development, and technology transfer. 4. WMSP II supports and assists this project by special studies, training materials, transfer network and TA as needed.

Outputs: (Contd.)

5. Rapid appraisal, monitoring and evaluation methodologies developed and adapted.

6. Greater understanding by host countries of importance of on-farm WM.

7. Network of Indian professionals who form a special professional Cadre.

8. Hardware and software interface on irrigation projects accepted widely.

9. Special demonstration of a whole package of improvements on all projects and subprojects funded by AID.

10. Trained Professionals.
    a) At Center
    b) In States
    c) Universities
    d) Extension
    e) Management Institutes

11. Special studies reports & procedural manuals for technology transfer.

12. Training materials

13. Audio-visual and films Production Unit at Center

Section H

Proposed Covenants and Conditions

The WM & T team feels that there is a need to establish a number of covenants and conditions for the WM & T Project, mutually agreed upon by the donor organization (USAID) and the host country (GOI). This will require some skillful negotiations and educational efforts. We feel, however, that the environment is positive for creating the conditions needed for successful projects.

Activities by Ford, World Bank, and the Mission over the last few years have created much interaction, openness, and change in old-established attitudes. The WMSP Irrigation team efforts to study issues and strategies, the two successful Diagnostic Analysis Training Workshops, and both formal and informal contacts with key officials at the national level and in the States have collectively created an environment that is now ready to yield results. Our team was impressed with the openness, frankness, and candid questioning attitude of officials at all levels, project managers, professional staff, extension workers and technicians relative to water management training for improvement of irrigation systems for increased productivity.

The suggested list of covenants and conditions below is not complete and should be viewed only as suggestive. There are several options open for negotiations. We have not included the usual conventional conditions of AID relative to procurement, repayment of loans, etc. since these can be added later.

1. Recommended Covenants and Conditions for Consideration by GOI

   a. That the Phase I component of the National Staff Training Institute to be funded be limited to irrigation water management with a primary focus on on-farm aspects.

   b. That the roles of the National and State Centers be designed so as not to be in conflict or duplicative in nature.

   c. That the National Center be designed to coordinate, support, and strengthen State-level institutes.

   d. That the National Center and State institutes have a permanent staff of the best professionals available both as administrators and trainers and that the training team be interdisciplinary.

   e. That the GOI provide priority commitment to water management training, which is "hands-on" and field-oriented, and to special studies that are primarily action-oriented to meet high priority irrigation needs in India.

(1) That the GOI and States will finalize or move toward creating a professional Cadre for operation, maintenance and rehabilitation of irrigation systems separate from a design and construction Cadre.

(2) That the training program be interdisciplinary as well as discipline-based and that the program be available to key personnel from both Irrigation and Agriculture Ministries/ Departments.

(3) That efforts will continue by CWC and the States to find an improved management mode for CAD programs where essential services and personnel are more carefully coordinated into a Cadre of professionals.

(4) That faculty staff of training centers be carefully selected and provided with incentives and status similar to that given to faculty at India's premier management institutes.

f. That a council be established for the National Center on which all organizations are represented who play a role in efforts to improve irrigation efficiencies for increased productivity of water.

g. That all components of the Water Management Training Project be "linked" and that the GOI provides the vehicle through which the AID Project Officer can work effectively.

h. That a contract technical coordinator selected by the Mission and GOI reside in New Delhi and be housed in CWC or appropriate GOI Ministry or organization.

i. That CWC have a Member for Water Management (Training and Special Studies) so as to give visibility, stature and administrative support for water management training efforts.

j. That the CWC will help create close collaboration among all donor agencies involved in training for water management and to link with all international efforts.

k. That the National Center be involved in identification, development, and dissemination of technical materials, procedural guides, and training materials to support training efforts throughout India.

l. That CWC utilize the centrally-funded AID Science and Technology Bureau's Water Management Synthesis Project II to support efforts in training, technology transfer, and in special studies as needed.

m. That CWC develop an interdisciplinary team to monitor and evaluate training activities in the States and for its own training activities and special studies.

n. That criteria be developed for identification of special study needs, selection of organizations to implement studies, and the means to monitor and evaluate these studies in pilot-project areas.

2. Thoughts about Covenants/Agreements for Contractor

a. That a top level USA Title XII consortium, utilizing one or two lead universities with demonstrated expertise and long experience with water management with all relevant discipline espertise, be selected for a special MOU or other appropriate mechanism to assist with the project.

b. That the universities concerned organize in such a way to provide the services contracted for in a timely and efficient manner.

c. That the contractor utilize an experienced interdisciplinary team approach with top senior faculty and mature experienced research associates.

d. That the consortium mechanism with the lead universities provide a mechanism for short and mid-term non-degree special studies as well as longer term highly-specialized studies where needed.

e. That the mechanism utilized is committed to the philosophy, principles and procedures of AID's WMSP II and that they be closely linked in supportive roles to meet the urgent needs of the project.

Section I

Preliminary Ideas on Project Implementation

1. Project Work Plan Strategy

As discussed in earlier sections of this report, our team recommends six major components for inclusion in the WM & T Project. These are:

(1) Assistance to CWC during Phase I of their proposed National Staff Training Institute during which time a Water Management Center would be implemented.

(2) Assistance to the Center for Management in Agriculture in the Institute of Management at Ahmedabad.

(3) Assistance to two or more State-level in-service training centers.

(4) Provision of a three-to-five person expatriate team from a U.S. Western land-grant university.

(5) Development of a series of special studies in pilot-project areas, particularly in Maharashtra State, but later also in Gujarat State and elsewhere.

(6) Technical assistance to selected universities for curriculum development, field-level research and training of the technician cadre currently employed in the Irrigation and Agriculture Departments.

We propose that AID fund one or more activities in each of these program area rather than concentrating on only a few of them. The strategy proposed is to provide concrete examples of what is needed at each program delivery level which can then serve as a demonstration effect for the whole system. We definitely recommend the use of an expatriate team from a U.S. land-grant university to assist AID in servicing these components, with an overall coordinator to be located in Delhi and the remaining members of the team to be located in the field, preferably at the WALMI campus at Aurangabad.

Finally, we recommend that the total project effort be started at a modest level and to build it gradually until about the mid-term of the project. The key elements in this strategy, along with a schematic distribution of project budget, are shown in Figure 6.

2. Project Budget and its Distribution

It is of course not possible at this time to develop a total budget estimate for the Project or to suggest its distribution over the life of the project. Rather than presenting figures that later could conceivably be used without further analysis, we prefer simply to indicate the general allocation stream that will likely be needed, again as shown in Figure 6.

3. Estimated Time Frame for Project Paper Completion

April 1	Agreement and organization of TDY Team Members
April 20	Team Members review relevant materials before arrival, e.g. WM & T Team Report, etc.
May 1	Team arrives in India
May 3 - 4	Team orientation by USAID Mission and top level GOI officials
May 3	Team provided with documents available at Mission
May 4 - 5	Team provided with a synthesis and analysis of data collected by CWC and State governments-careful study by team

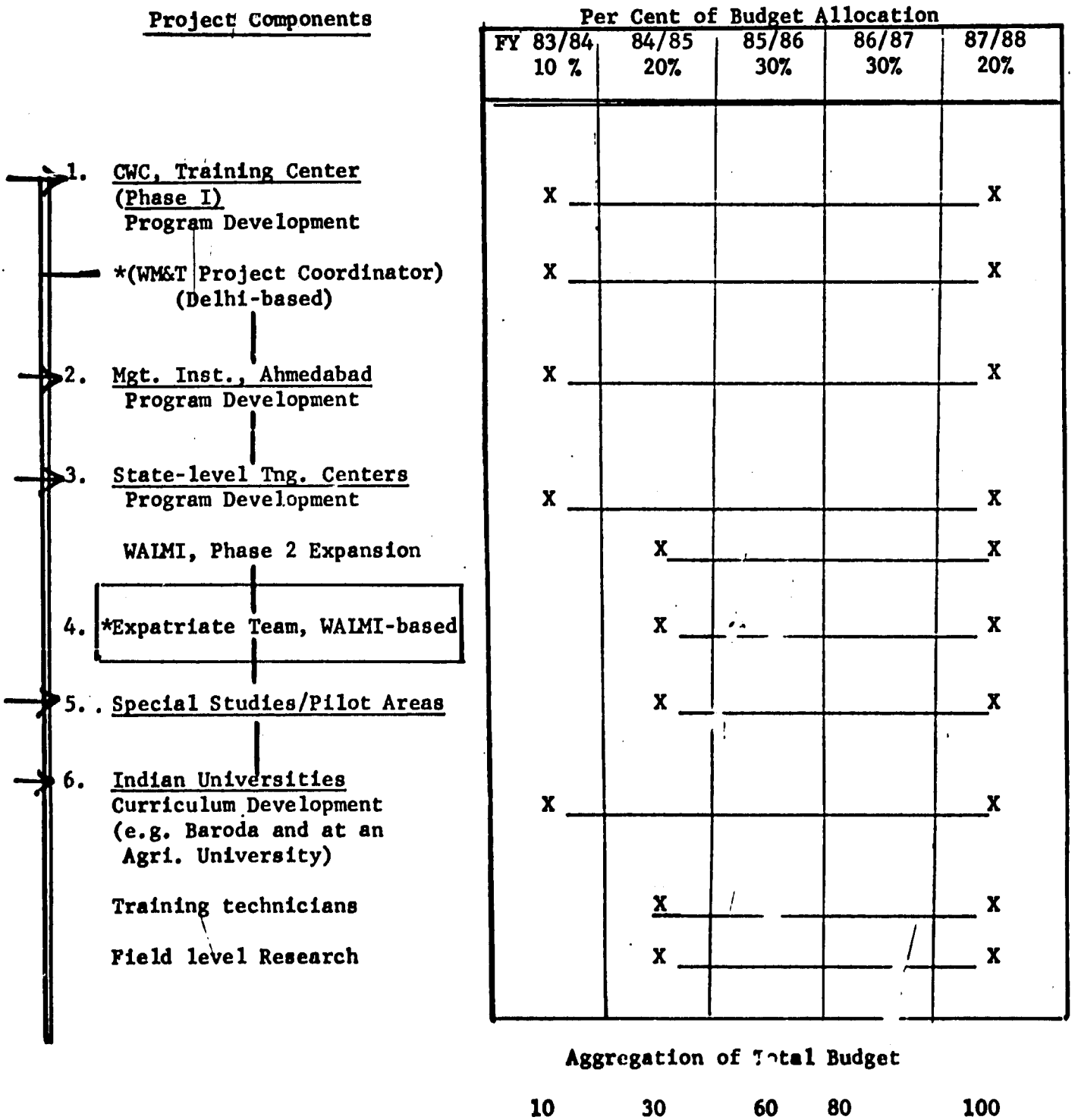
May 6	Team Members plan for detailed investigation
May 10 - 20	Central Government - Peterson
May 10 - 15	Visits to States and organizations concerned by individual Team Members unless otherwise needed
May 17 - 18	Working session with AID and CWC officials to provide findings
May 17 - 22	Preparation of the draft PP
May 24 - 31	Revisions of draft PP and TDY Team return to the USA

4. Timetable for Obtaining Project Approval

June 1 -15, 1982	Review of draft PP by USAID and GOI officials
June 30, 1982	Approval of PP by USAID and GOI
July 4, 1982	Project Paper submitted to Washington
July 15, 1982	Review of PP by Asia PD, Desk and TR
July 22, 1982	APAC Review of PP
August 1, 1982	Approval sought by
August 1-30, 1982	Final Revision and Resolution of key issues by
September 1, 1982	Project signed.

Figure 6

Schematic Distribution of Budget over Life of Project



Annex-2

SUMMARY DESCRIPTION OF CWC PLAN FOR NATIONAL WATER RESOURCES DEVELOPMENT AND MANAGEMENT INSTITUTE AND TEAM'S RECOMMENDED

ROLE AND RESPONSIBILITIES FOR A NATIONAL INSTITUTE OR CENTER FOR WATER RESOURCE DEVELOPMENT AND MANAGEMENT WITHIN THE CENTRAL WATER COMMISSION

There is presently much debate in Central Government and in the States as to the role and function of a national center for water management. Concern is being expressed in the Finance Wing of the Ministry of Irrigation about the size and cost of the proposed project as well as on the need for a National Center, given the conventional wisdom that Irrigation is solely a State subject of concern.

The CWC proposal now under review is designed only for the professional development of Engineers and has included irrigation water management as only one component, to be implemented as Phase I. 1/ The proposed curricula includes primarily physical engineering content, along with some agronomy and soils input but little if any related to the software sciences such as economics, management or public administration is included. There is yet little known about the actual field training to be included or a recognition of the difficulty for a Center to be located in or near New Delhi to include this vital component. Presently there is no arrangement for professionals other than engineers to participate, either as trainers or participants.

The proposal calls for starting small and supplementing a small core staff with outside lecturers. Such an arrangement appears to be somewhat ad hoc and will make it difficult to build a strong permanent center over time. While the proposal discusses the need for interdisciplinary training, it is difficult to see how this can be done without an interdisciplinary staff and participants from various disciplines learning and working together in field-level appraisal situations.

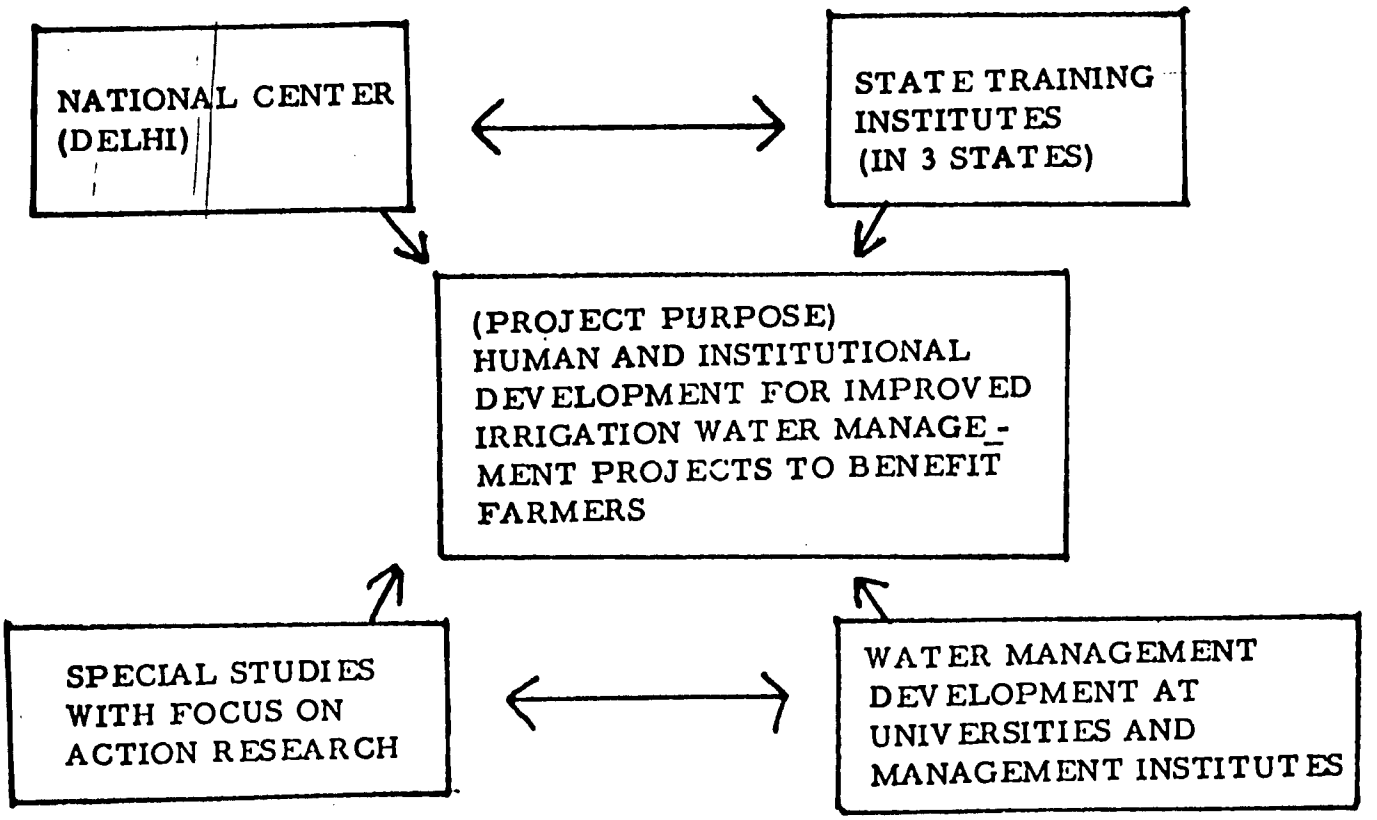
The proposal does call for a council to guide the Institute as a Board, to be made up of senior professionals from CWC, CGWB, Finance, Ministry of Irrigation, representatives from the States, and a representative from the Ministry of Agriculture (ICAR). But, it is evident that the Center as presently proposed is primarily for the professional development of engineers, and thus there is insufficient emphasis placed on problems and responses for that vital portion that starts at the canal outlet and ends in the farmers' fields. This is not to imply that it is not needed but there is also a need to provide training in water management to the other disciplines required to implement comprehensive, multi-faceted water management projects, e.g. crop and soil specialists, economists, and the like.

Based upon experience in Egypt and Pakistan, there appears to be a need for a national or central Institute to do the following things:

1/ "Memorandum for Expenditure Finance for Establishment of a National Staff Training Institute", Water Resources Development and Management, Central Water Commission, New Delhi, March, 1981.

FIGURE 2

KEY COMPONENTS OF AN IDEALIZED WATER MANAGEMENT TRAINING AND SPECIAL STUDIES PROJECT IN INDIA



--At National Center

--At State Centers

--At Universities

--At Management Institutes

--In Irrigation Project Areas

--Engineering University

--Agricultural University

--Management Institute (Ahmedabad)

1) To provide high level commitment, status, and support for training efforts throughout the country in on-farm water management.

2) To focus on collecting, developing, and disseminating of special training materials, technical manuals, and transfer of technologies and new innovations in training.

3) To coordinate, monitor, and evaluate all water management training activities to be carried out at state-level training institutes and/or universities.

4) To provide linkages between all ministries, departments, and organizations concerned with irrigation/water management training in India and with the proposed International Center.

5) To operate as a mechanism for the acquisition and channeling of funds.

6) To conduct special studies which feed into training which state institutes are not equipped to do and make these data available. (Examples: Evaluation of CAD organizations, WM manpower needs, etc.).

7) To conduct special training for CWC personnel and others in the form of workshops, seminars, and special courses.

Discussions in the States with personnel at training centers, Irrigation Department offices, and at universities about the role of a National Center in CWC revealed the following ideas:

1) Develop a center which will be an apex organization which will provide support services to State training centers but in a coordination sense rather than in a control sense.

2) Have a National Center that will not attempt to duplicate what the States will do in their training centers.

3) Use a National Center to develop strong linkages with support organizations in India and outside of India to assure systematic transfer of technologies and new ideas related to Water Management and training in Water Management (WM).

4) Allow the National Center to be a model for other training centers in terms of having an interdisciplinary focus, development of a systems understanding to irrigation, advocation of a management-oriented approach to irrigation, and the integration of software with hardware approaches, with major emphasis on the on-farm (below canal outlet) components.

5) Utilize outside international expertise, where available, to assist in "training the trainers" and to provide other support assistance as needed.

Utilizing these ideas, it was possible to develop a preliminary framework for a Water Management Wing of a National Center which would have four major functions, as shown in Figure 1. These are: 1) Special Training; 2) Support Services for State Training Institutes; 3) Special Studies; and 4) Technology Transfer.

I. Special Training

This training would be for CWC staff, key researchers and administrators from Irrigation and Agriculture Ministries, senior State professionals from Agriculture and Irrigation Departments, and selected University staff from both Engineering and Agricultural Universities. The specific course content needs for various training components should be finalized only after a thorough study of the priority needs of the staff, based on a careful job analysis. Unless there is high-level commitment that those who receive training will actually utilize the new skills, e.g. be assigned to duties that tuilize the new expertise, thi.. training effort will result in questionable impact and a waste of scarce resources.

II. Support Services for State Training Institutes

A National Center could provide valuable technical assistance to the State training institutes in the form of curricula development, training materials, development of training aids, evaluation of training programs, channeling funds for training, exchange of trainers, and maintaining key linkages, both inside and outside of India, for training.

For example, this National Center could access an AID/Washington, D.C. centrally-funded Water Management Synthesis Project which is designed to help strengthen water management training programs world-wide. This Project has developed non-country specific training materials, technical manuals, procedural manuals, teaching aids (films, videos, slide sets, etc.) for use in this new filed of Water Management. FAO, IRRI, and other donor organizations also provide some assistance in this specialization that can be funneled through the National Center.

III. Special Studies

A National Center could also conduct special studies of the type not to be undertaken by State institutes but which would support and help to improve their training efforts. These could include: monitoring and evaluating of projects, using interdisciplinary teams which serve a dual purpose. One is to improve projects and another is to provide useful data for training. The Center could focus on special studies to improve CAD's performance and CAD management. Also this Center could evaluate state-level training programs, provide teams to do project appraisals, study ways to improve irrigation information systems, and provide information on water law, water user associations, and other sujects which provide data for policy analysis and program action decisions.

IV. Technology Transfer

World -wide, the technologies are known for more effective irrigation development and water use but there is no systematic vehicle., either within countries or world-wide, to transfer this technology. Within India, each project and each State program operates almost as a case separate from other projects and State programs. There are therefore likely many technologies and procedures within this vast nation which need to be known, tested and adopted elsewhere. Even in neighboring countries, there are technologies which may be useful to India. There are organizations such as AID and FAO which have plans to build an international information network and to evolve more efficient means to transfer technologies. A National Center needs to be linked to all these related efforts and also to play a major role in promoting national and regional workshops, study/observation tours, development and dissemination of technical and procedural manuals, planning guides, and publication of relevant reports, news letters and the like.

Annex - 3

CONCEPTUALIZATION OF THE IRRIGATION WATER MANAGEMENT TRAINING NEEDS AND ITS DELIVERY SYSTEM FOR INDIA

Background

In recent years, there has been a growing awareness among Indian administrators, professional agency personnel and farmers that in order to make significant progress in efforts to increase agricultural output, ways must be found to increase the efficiency and productivity of irrigation water at the on-farm level. Heretofore, professional personnel primarily employed in the Irrigation Ministry and respective state level Irrigation Departments, who are trained primarily in civil engineering, have only been concerned with the water delivery system above the canal outlets. Delivery of water at the water-course level and its eventual use in farmers' fields have been considered the farmers' responsibility. These end users have traditionally been given technical assistance from the Ministry of Agriculture and the respective state level Agriculture Departments, supported through research at land-grant type agricultural universities and Institutes and by cadres of Extension personnel. At the farmer's level of contact, however, such Extension assistance has been almost totally on a single-item basis, e.g. plant protection, improved seed varieties, fertilizer, etc. but there is presently no overall Extension component packaged as on-farm water management advice.

Given the above listed separate lines of agency responsibility and the type of training of the respective professional staffs involved, it should be readily apparent that appropriate technology and better methods of on-farm water use are not effectively reaching the Indian farmer irrigators at the present time. Within this context of present reality, Indian government administrators and concerned personnel from the major international donor agencies have now reached agreement in principle that an intensive training effort to upgrade the professional skills of personnel in Irrigation and Agriculture Departments in the area of irrigation water management is now of the highest order of priority. The urgency of this effort was recently highlighted in the new 20 Point Program for the current 5 Year Plan reiterated by the Prime Minister (January 1982) in which improving India's irrigation efficiency was given priority number one.

Although some mechanisms for training a cadre of skilled personnel in the area of on-farm water management are already underway, e.g. World Bank supported state-level training centers at Aurangabad (WALMI) and at Anand, it is deemed necessary to view the training needs in total perspective. Such a perspective must necessarily range upward from engineering technicians and Extension workers in direct contact with farmers, to CADA and major irrigation project administrators, and finally up to national level personnel in the Ministries of Irrigation and Agriculture. In taking such an overview, there are key questions to answer, as follows:

1) Who shall be trained?
2) In what numbers?
3) In what kind of skills?
4) Who can best do the training?

These questions are addressed briefly in turn.

Who Shall be Trained?

At the outset, it would be desirable to consider the proposition that all government agency personnel in the chain of command who have a direct role in the irrigation water delivery system--from the watersheds above the major dams, down through the canal system, into the water courses and eventually ending in individual farmers' fields, must have the kind of professional skills appropriate to whatever level of responsibility each of them has in the system. A corollary to this basic proposition is that, regardless of the kind of specific skills each professional needs to engage effectively in his primary activity, each of them should also have an overall understanding of the total irrigation system, not just detailed knowledge of that component of the system with which he is presently directly concerned. Up to now, little understanding of the system component below the canal outlets is apparent among either Irrigation Engineers or Agricultural Extension specialists.

The short-run training needs focus directly on the total group of professional personnel already on the job--an in-service training effort which, as will be shown below, is of a major order of magnitude. For the longer term, it must be recognized, however, that an interdisciplinary focus on irrigation system management must be included in the university curricula of the engineering and agricultural universities whose graduates form the manpower pool from which government agencies concerned with irrigation systems will be recruiting their personnel replacements. Smaller numbers of the latter group of trained personnel will be needed on an annual basis. But, it must be recognized at the outset that considerable lead time is necessarily involved in developing this part of the training system because of the slow rate at which curriculum changes can be incorporated into the on-going university delivery systems.

The final point to make in regard to "who shall be trained" is that ultimately, it is the farmers who need these kinds of water management skills and unverstanding. All of the professional manpower requirements for agency personnel referenced above are dwarfed by the magnitude of the number of farmers involved in irrigating fields. Unless the agency personnel receive the appropriate training first, there is not likely to be much adoption of improved irrigation water management technology and skills at the farmer level. Nor will they undertake the risks involved in adding enough other high cost modern inputs until reliable water deliveries are insured.

In What Numbers?

Estimates of the number of professionals in need of appropriate irrigation management training here ranged from 30,000 to 50,000, (not including personnel at the irrigation technician and agricultural diploma holder levels) but in our view, there is serious question as to their reliability. Ultimately, the magnitude of the training needs should be based on estimates obtained from agency administrators at

the various levels involved in the system. Therefore, the WMT team has designed a questionnaire to be coordinated through CWC so that such data can be available for use by the appraisal team when it arrives in Delhi.

For the purpose of this effort at overall conceptualization, however, estimates to the year 1985 prepared by M. N. Venkatesan and presented in a recent professional paper will suffice. 1/ His approach in developing these estimates assumed that the smallest units to be managed independently would average 5 million ha. There are presently 60 million total ha under irrigation and another 15 million are scheduled for development during the current 5-Year Plan. 2/ In total then, there would be 15 such units of 5 million ha each by 1985. Including both technicians and professional level managers, a total manpower requirement of 171,794 was estimated per unit. Of this total, however, only 8,933 would be assistant manager level and above. 3/ To this direct manpower requirement, he added 250 persons for monitoring and 25 for auditing, or a total of 9,208 per unit. 4/ Then, since there are 15 such units to staff, the total estimated professional manpower requirements at the assistant manager level and above is 138,120 to 1985.

It is worthy of note that this total estimate is two to three times as large as estimates made previously by Indian administrators and donor agency personnel. This wide variation in available estimates points to the critical need for getting more accurate estimates, preferably from the various administrative levels involved, per steps taken to have the CWC coordinate this data collection effort. At this point in time, it is impossible to tell at what level the final estimates will fall so suffice it now to merely say that extremely large numbers of professional personnel will be in need of training, over and above the even larger training needs for diploma holder support personnel.

In What Kind of Skills?

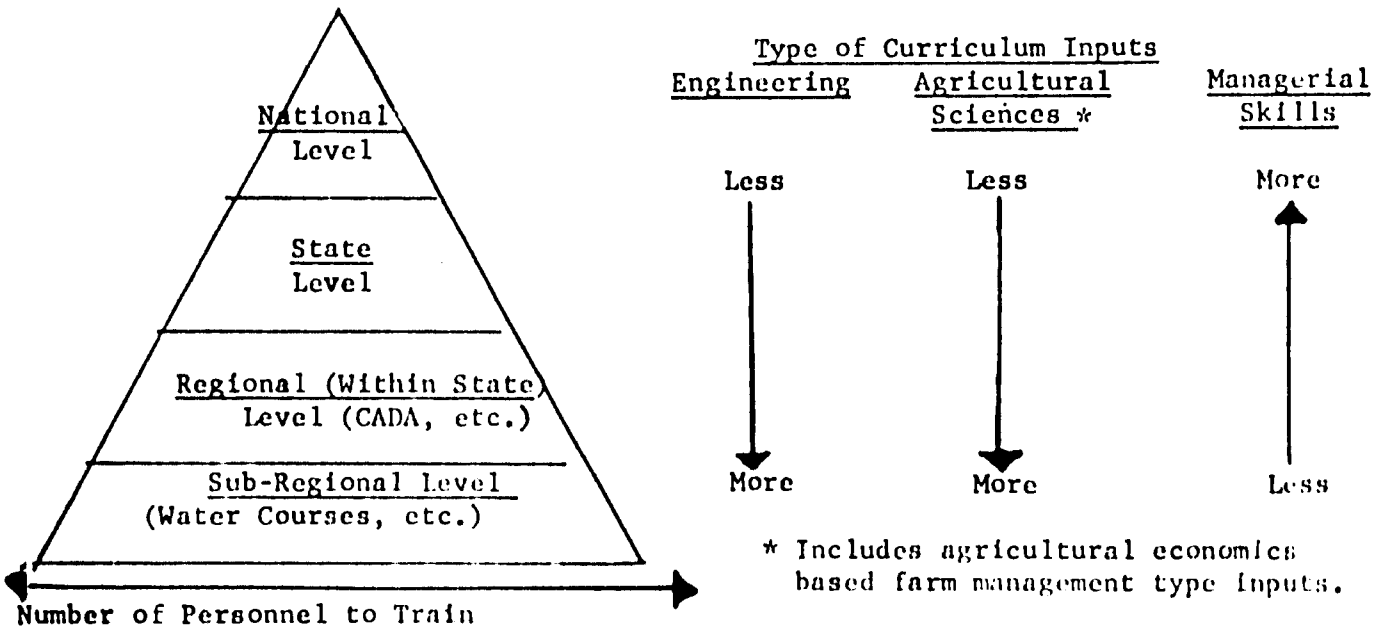
The basic approach to training agency personnel in water management for irrigation begins with a diagnostic analysis of water use problems in the farmers' fields, carried out by an interdisciplinary team. The mechanics of this approach are explained in a paper detailing the Pakistan experience of the CSU On-Farm Water Management Project during the 1970's which our WMT feels is extremely relevant to the India

1/ M. N. Venkatesan, "Manpower Requirements for Efficient Water Management", Paper presented at the Afro-Asian Conference, I.C.I.D., Nigeria, 1981.
2/ Ibid. p.2
3/ Ibid. p.15
4/ Ibid. p.17

situation as well. [1/] The three basic kinds of subject matter involved are engineering, agricultural scinces, and a third area of expertise broadly labeled "management". At the lowest level of involvement by professional agency staff, the training inputs are covered via participation of the following team members, identified by discipline: engineering, agronomy, economics and sociology (or Extension).

As the training needs are defined for involved professional personnel at higher levels in the system, however, the element of management skills shifts from the narrower focus of farm management as a basic element of the agricultural economics and sociology disciplines to that of program and personnel management in the vein of the kind of training provided in Harvard and elsewhere in MBA programs; therefore, a skill input of this type, more likely to be found in such places as the Inidan Management Institutes, becomes a necessary ingredient. Finally, as one visualizes the kinds and mix of skills needed as we move up through the administrative hierarchy, one finds less and less a need for detailed skills in engineering (which the personnel involved there already have in any case) and in the agricultural sciences but with increasing proportions of basic management skills. For personnel at all levels, the need remains for an understanding of the total irrigation delivery system, beginning at the farmer's field and moving upward to include the canal delivery system and the total watershed above the storage reservoirs.

It should be apparent from the above discussion that the curriculum mix for the clientele groups at different administrative levels will necessarily have to change as we move upward through the system, and with smaller and smaller groups involved at each successive level. This kind of mix change can be schematically shown as follows:



* Includes agricultural economics based farm management type inputs.

1/ Max. K. Lowdermilk, Wayne Clyma and Alan C. Early, "Physical and Socio-Economic Dynamics of Irrigation in Pakistan", Proceedings: Specialty Conference on Legal, Institution and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management, ASCE, Blacksburg, Virginia, July 26 1979. pp. 827-843.

Who Can Best Do the Training?

There is presently no consideration being given to the diploma level technician water management training needs at any of the state WAIMI type training centers now underway. Yet, since it is these engineering aides and field level Extension workers who have the most direct contact with the farmers, this component of a total training needs program is extremely critical. Given the large numbers involved, it does not appear likely that the state level training centers could accommodate them, even if physical facilities could be adequately expanded. It therefore appears that the continuing education and Extension type short courses presently offered in other subjects at some of the agricultural universities could be utilized to meet this need. It must be recognized, however, that given the present departmentalized and specialized nature of such university programs, a concentrated program of training these trainers from among existing faculty would have to precede any major efforts of the universities to pick up this large training component. This component will involve some training abroad.

As presently structured, the state level training centers are best equipped to handle the regional level training needs, such as the junior engineers of the Irrigation Departments and the Extension contact agents of the Agriculture Departments. While the centers at Aurangabad and Anand have organized so as to have interdisciplinary faculty inputs, the older training center near Lucknow is still heavily focused on programs that utilize its existing expertise in soil conservation. All of the existing and proposed centers will require a heavier curriculum input of field demonstration and problem solving which in turn will necessitate a linkage with pilot field areas for conducting special studies. The degree to which the training centers can be linked with agricultural universities in their immediate vicinity will likely depend on whether the center directors report through either the Irrigation or Agriculture Departments. Since the curriculum at the state level centers will have a heavy agricultural economics input, there is no apparent need for an additional direct input of the "managerial skills" component that is envisioned to be increasingly critical in training programs for personnel at higher levels in the administrative chain.

The so-called state level top administrators are identified in the above diagram as the point at which the managerial skills input becomes critical, although in practice, key regional level administrators, such as project managers and CAD directors, should also have this kind of training. And, it goes without saying that the key administrators at the national level in both the Irrigation and Agriculture Ministries should be included. In this level, it will be particularly critical for the administrators who came up through the technical route, such as in CWC, but will also be useful for Indian Administrative Service personnel who have heretofore had no specialized training for administering irrigation water management programs. Ideally, such training via seminars, workshops and short-to-medium term study programs should be offered through one or more

of the Indian Institutes of Management who have deomonstrated expertise in this area of endeavor. The IMA at Ahmedabad, through its Center for Management in Agriculture is best equipped to take on this responsibility, and since there will be a relatively smaller number of trainees involved, it could probably handle the total workload. In addition, it could provide a useful function as an input for "training the trainers", both for the state level training institutes and the water management wing of the proposed national staff training college in CWC.

Under present plans, the water management unit of the CWC national staff training college sits at the top of the apex. As we view its most useful functions, however, they fall more in the coordination and support role for state level training centers than in major direct involvement in training efforts, per se. Since it would not be tied to a representative field study or pilot program area, and since the IMA at Ahmedabad has greater demonstrated expertise in imparting managerial skills, it is difficult to see a direct training role in either of these two areas for CWC's institute. We do see, however, a role of providing selected short courses in specialized subjects, and workshops and seminars for CWC.

Implications for AID's Water Management and Training Project

It was not our intent in providing the foregoing material that it would enable AID to move directly into the design of an ideal water management training program for India. There are simply too many options to consider, ranging from concentrating its support only at the CWC level, to a broad range of program support at all levels in the system. The intent was rather to provide an overall conceptualization of the problem, identification of key questions to answer, and a raising of awareness to the political framework in which a water management training program in India will necessarily evolve.

K. C. Kobo
WM&T Team

Annex - 4 Known Technologies and Procedures Within and Outside India with Transfer Potential

Introduction

A recently printed volume, entitled " Design and Operation of Farm Irrigation Systems", Edited by M. E. Jensen, American Society of Agricultural Engineers, Monograph Number 3, in a series published by ASAE, 2950 Niles Road, P. O. Box 410, St. Joseph, MI, 49085, December, 1980, provides a convenient point of departure for the summary presented in this Annex, even though its thrust is for U. S. Irrigated Agriculture.

Irrigation technology has advanced significantly during the past two decades but most existing projects and on-farm systems have not improved proportionally since their original inception. Scientifically, we seem to know what to do, but despite many decades of irrigation research, the most pressing need for improving the overall effectiveness of irrigation is still on-farm water management. Of course, on-farm water management cannot be divorced from the complete irrigation system, nor should it be, since the water delivery policies of the irrigation departments bear heavily on the effective and economical use of water, labor, energy, and capital investment on the farm. It even limits the crops that can be considered.

Irrigation Delivery Scheduling Policies

Ideally, the farm-water delivery policy must be compatible with the distribution system on the farm. In India, this has generally required adaptation of the on-farm systems to what is, in effect, an existing system (whether it is built yet or not) because the "existing" system is construction-incentive oriented with plaudits measured in length of canal completed. Some day soon, as water resources reach their practical limits, the emphasis must turn to production per unit of water. At that time, much interest will probably be generated on ideal matching of delivery minors and majors to on-farm distribution requirements.

At that time the rigid schedules that deliver water in fixed volumes at fixed intervals with little regard to weather or crops will be upgraded to more flexible schedules, even the modified-demand systems, considered the practical ideal in more developed countries. However, to function, the modified-demand systems require widespread and thorough on-farm water management knowledge by the farm owners-operators in the system. Even then, the canal operators must be ready to make best-choice decisions on how to "break-cadence" of demand requests that will naturally accumulate a few days after a rainstorm. These types of decisions, incorporating canal capacities, cropping patterns, probability analyses, and weather sequences, are well suited to modern computer modeling and will be a management tool for the canal system operations and maintenance staffs.

Meanwhile, in India, the rigid rotation system (warabunde) appears to be the first step toward more effective on-farm water management. The reasons for this conclusion are not really complex. They stem from an unanticipated evolution of the irrigation construction procedure. Initially the water supplies were captured (dams), then canal mains were started and distributary canals added, etc. Meanwhile, the dams were filling and the water supply was over-abundant for the small area then serviced. These upper-end farmers were thus allowed, even encouraged, to take the water at extremely inefficient quantities - the lakes must be emptied. Thus. low efficiency was learned and irrigation methods established that now border on dependency. These early users appear to have established an unintended "water-right", as first beneficial users, that has continued even though the remaining canals have since been constructed. These remaining canals seldom have the anticipated design flow in them. This is a psychological problem entwined in economics, sociology, and education. The rotation system may have to be announced and imposed, but simultaneously, these upper-end farmers must be convinced and shown by demonstration, that their previous water-wasting practices were actually leaching expensive fertilizers, causing drainage problems, and in general, depressing their yields.

Level Basin Irrigation

Much of India appears to have enough natural rainfall and deliverable irrigation water to mature one, and in most cases, two cycles of some economically viable crop per year. Technologies that can enhance the irrigation components are those that hold natural rainfall on the fields. Systems that are in use and are visualized to expand, are precision-leveled basins and level contour furrows. Both allow maximum vertical infiltration and minimum runoff, but also, if precision-leveled, drain well enough when weather extremes produce very large rainfalls.

Basic level-basin design criteria are listed in the aforementioned reference. Basin size is a function of infiltration rate and water supply rate. For example, if the final intake rate of a wetted field (infiltration is very rapid at first, then slows to a nearly constant rate after a short, but soil-specific time) is at 0.1 inch per hour, and the water supply is 1 cfs, then a four-inch application on one acre would take four hours, and the theoretical difference in infiltrated water from beginning edge to basin end would be the advance time difference. This advance time is a complex function of infiltration rate and crop cover, but in the worst case, it is usually no more than 30% more than the application time, or 5 to 6 hours, and for small basins with relatively deep applications, it will be much less than the application time. (Simple consideration of scaling effects would indicate that a four-inch application with four cfs on four acres would most likely compare with a one-inch application with one cfs on one acre). Thus it can be shown that the worst case situation of 0.5 inch infiltration difference in 4.0 inches is an application efficiency

(uniformity measure) of about 87% and any real differences will be caused by field-leveling problems.

Advantages and limitations: High application efficiency can be obtained with little labor. Basin irrigation can be used efficiently by inexperienced irrigators who need to be able to tell time intervals, read a number scale on a flow measuring device, and calculate or table-look-up a time-on interval. If water delivery is uniform from delivery to delivery, this reduces to determining the time interval from basin to basin. Basins are usually precision-leveled with laser-controlled equipment, and the leveled basins may be as large as 40 acres, with no specific limit on how small they can be. Indian applications would tend to small sizes. Laser-controlled equipment has expanded in use to Africa and Spain and could possibly be employed as project-owned equipment in India. The possibility of using it with compact earth-moving equipment makes it attractive for small, sub-acre sized plots despite its high-capital investment of about $15,000 per system, plus the tractor and scraper equipment. Other methods are also available for small plots--water leveling, standard surveying processes, etc., and are suited to labor-intensive situations.

Many different kinds of crops can be grown in sequence without major changes in design layout or operating procedures. There is no runoff, there is little deep percolation, if no excess water is applied, and maximum use of rainfall is possible. Leaching, when required, is easy and can be done without changing either the layout or operation method.

Accurate land leveling is essential to within about $\pm$ 1.0 inch. This does not refer to tillage marks but to general, large islands or ponds that would be 1 inch above or below the rest of the field. Adequate basin ridge height and integrity may be difficult to maintain in sandy soils, or crack-prone soils, or where extensive rodent or crayfish activity is present. If the system is poorly managed (over-irrigated), prolonged ponding and crop scalding can occur. In hot weather, total inundation times should be limited to 8 to 12 hours in fields that have a history of fungus infestations (Pythium). Uniform soils are also a basic requirement.

Design efficiencies should not be less than 80%. Efficiencies in excess of 90% are often practical. This may be compared to sloping furrow irrigation, where frequently half or two-thirds of the water applied exits as surface runoff, making the field efficiency very low; or to sprinkler efficiencies, which are normally quoted at 70% to 80% application efficiency under good conditions. Of course, sprinklers can be effectively applied where sand and clays appear in the same fields, or where the field slopes cannot be readily altered due to underlying rock formations, etc.

Flow Metering

One other requirement for level basins is that of measuring the applied volume. The new styles of flumes available are simple to install, flexible in design and rugged enough to require minimum maintenance. Like any flow meter, they should be installed by experienced technicians or engineers, or at least constructed under close supervision of an experienced person. They were especially designed for third world use, but are finding their primary applications in the United States. Installations in Sri Lanka, Spain, Mexico, Australia, Canada, New Zealand, and India have been reported. They would seem well-suited to Indian conditions for retrofitting main canals, minors, and farm outlets.

Trickle Irrigation

Drip or trickle irrigation is the newest of all commercial methods of water application. It is described as the frequent, slow application of water to soils through mechanical means or devices called emitters or applicators, located at selected points along a water delivery tube or lines. These lines may be placed on the ground (usual) or buried. The emitted water moves in the soil system mainly be the process of unsaturated flow.

Advantages: Initially, many claims for trickle irrigation compared to conventional methods were made. Several of the currentl recognized advantages are:

a) Application of water at slow rates around trees improves water penetration in some problem soils

b) If small areas around trees are wetted, general soil surface evaporation is reduced and the extra-dry soil between trees could then absorb more rainfall

c) Further savings of water result for young trees if the wetted area is appropriately reduced

d) Weed growth is reduced because of the limited soil surface that is wetted

e) Limited soil wetting aids in scheduling cultural operations and in utilizing labor

f) Fertilizers can be injected with the water supply

g) Considerable evidence supported the concept that water availability to plants enhanced plant growth and yield

h) Frequent or daily applications of water kept the salts in the soil water more dilute and leached to the outer limits of the wetting pattern, making the use of saline water practical.

Drip or trickle irrigation is not suited to every agricultural crop, specific sites or objectives. It is used for a variety of crops, climates, and soils such as almonds, grapes, citrus fruit, stone fruit, avocados, walnuts, pistachios, olives, pecans, apples, pears, figs, vegetable crops, nursery plants, berries, tropical fruit, sugar cane, and others.

Disadvantages: Several problems are associated with trickle irrigation. The causes of clogging are attributed to physical, chemical and biological factors. Clogging greatly reduces emitter uniformity and crop damage frequently occurs before it is detected. (New infrared sensing equipment reduces this risk of damage by permitting early detection). Improved filtration and chemical treatment of the water (acid and chlorine are used) can reduce clogging problems. Rodents and other animals frequently damage the tubing. For crops of high density, the pipe quantities may be uneconomical. Excess salts accumulate at the soil surface and toward the fringes of the wetted area. Rain may leach harmful amounts of these salts into the root zone. Drip irrigation thus should continue even during rain.

High level technology and hardware support are necessary to successfully use trickle systems. This technology and support has traditionally been supplied by the equipment manufacturers. Since there is a product to sell, it has had more commercial effort and backing than the contractor-construction operations common to surface systems. The success of individual schemes have large / been due to the success of the grower-supplier relationship and now adept both are in developing successful management schemes tailored to the particular case.

In most third world applications (North Yemen), entire plantation style operations have been attempted, the equipment and technology imported and varied success experienced.

It is doubtful if India should venture into this method at this time. If economic analysis should show a strong possible market for crops such as strawberries, the use of drip irrigation with its potential for extremely high yields on small areas should then be considered. However, even two hectares of drip irrigated strawberries can be a maintenance, management, labor, and marketing nightmare.

Sprinklers

In rolling lands, and where infiltration rates are so spatially varied that surface irrigation is highly inefficient, sprinkler systems are commonly recommended. Besides a clear water supply, pump pressure and trained maintenance personnel are usually needed. Fixed, or permanently-placedsprinklers, common to household yards and some stateside gardens and parks, usually produce low distribution efficiencies. Movable sprinklers are slightly better, depending on how they are handled. The Center-Pivot and Lateral-Move systems provide the most uniform field distributions among the various sprinkler methods because the sprinkler "cones" that form with fixed systems become sprinkler "ridges" when they move, and this improves uniformity.

These mechanically-moved sprinklers, however, are best suited for field sizes on the order of 40 acres to 160 acres, although larger and smaller sizes of fields are in service. The Center-Pivot system, unlike the linear mover, irrigates the inscribed circle on the square-shaped fields, resulting in unirrigated corner areas. Expensive mechanical solutions are sold to reduce this unirrigated area. Where land is more plentiful than water, the corners are ignored.

The major advantage of such systems is the "built-in" water management. The sprinklers are normally designed for a particular cropping system, soil and climate. The owner-operator is handed a "turn-key" system with few management options besides "on" and "off". The training requirements of this may reduce to one plant-ater specialist for thousands of acres, but the mechanical and maintenance training, and the hardware support, including wells, or surface-water treatment facilities and power plants, may be formidable in an otherwise non-mechanized environment. One unofficial report from Lybia in the late 1970's stated that in one new remote area, 500 miles from a supply port city, 104 center-pivot systems were installed, but only 7 were able to operate at the time of the observation. (Dr. Grant Richardson, Arizona State University, Department of Agriculture). Thus, hardware support problems in remote areas can be severe.

The small holdings in India mitigate against using the center-pivot systems by private sector farmers. However, it could be visualized that with some property realignments, a centrally-located well and an area where water is covering 75% or less of the land anyway, a large center-pivot might be operated by an irrigation department or local cooperative which would make the "on-off" decisions and employ the technicians for maintenance. The complex problems of site selection for such operations are much more acute for previously farmed areas than on raw, unsettled lands, which may extremely limit opportunities for applications in India.

Fixed, or solid-set systems, even with the usual low efficiencies, may be a technology that can be applied in special situations. Rocky sloping fields are prime candidates. Again proper sprinkler type and spacing can improve performance, and essentially provide water management down to the "on-off" operation, once installed. As in all, hardware intensive systems, vandalism, and animal damage must be considered.

Thermal - Infrared

All masses and biological systems at temperature above absolute zero emit radiation in the Thermal Infrared portion of the electro-magnetic spectrum for which instruments are now commercially available to detect remotely. The common configuration is that of a "space-age" gun that has a detection angle of only a few degrees. (Visualize the conical angle of the full moon which is one-half degree).

This instrument used in conjuction with the conventional soil auger would extend the effective working range of trained water management specialists. With it, he could quickly assess the problems of water distribution within fields, since the dry, hot areas show up very early, days before ordinary visual signs are present. The present ability of the irrigation system to respondto this new capability is limited unless tube wells are present. In the case of a well, it can quickly outline the portion of the field needing direct attention and avoid overwatering again the original overwatered areas.

This technology is supportable in remote areas since no field repair is possible on the rugged, solid-state devices anyway. They should be provided in quantity to irrigation evaluation study groups who would use them initially to assess system effectiveness and field application efficiencies. This can be done by quickly scanning a field as it begins to dry out after an irrigation or rainstorm, and following the drying pattern for a few days. This should basically point out the water distribution pattern on that field for the previous irrigation, or irrigations.

Computer-Scheduling Techniques and Models

The next decade may see the computer technology that is presently in place in some U. S. Irrigation Districts, transferred to Indian conditions. A typical example is the 100,000 ha Salt River Project that operates a modified-demand scheduling system whereby the farmer calls in his requested flow size and requested duration with the expectation of getting notified response as early as 24 hours later but not more than 48 hours later. To accumulate these orders, place them in a computer, and work out the flow hydraulics for timed delivery, requires four technicians for part of each day. For Indian conditions, the number of such orders for the many small farms will be nearly overwhelming and also would require a sophisticated telephone system. This may, however, be brought into manageable proportions with a leader that places the local group order and receives the confirmation.

It should be pointed out that such rater or volume deliveries require canal flow metering and monitoring. In existing operating systems, minor adjustments in flow quantities to offset known seepage losses are "cranked" into the hydraulics of the system.

Seepage Control

The physical layout of most irrigation systems is such that water captured in a lake or dam must be delivered to the field to be used. Losses from the delivery canals and from the fields is infrequently recovered by that irrigation system although it may serve as a supply to the next downstream system, or escapes to the ocean. These losses then, reduce the area thatcan be serviced, or reduce the quality of service to the area. A sometimes more important problem is that caused by the lost water itself. It can appear as stream flow (probably the least damaging), or cause high water tables

and swampy, saline conditions (usually the most damaging).

While the problems of seepage are site-specific, most can be anticipated. For example, when the dam to field efficiency is less than 50%, the huge quantities of non-consumptive use flow can be expected to raise water tables to the swamp-producing levels. When these losses are less than say 20%, natural internal drainage can often suffice. Canal lining has been long recommended for seepage control. Evaluation of its relative effectiveness has been somewhat spotty, with the general conclusion that any lining helps considerably, but collecting accurate verification data on seepage after lining installation is somewhat difficult because of the small differences between usually large flow values.

Lining of canals in India will probably proceed much as it has in the U. S. which has been described cynically as "--decided to line the canal, so then proceeded to collect data to prove that it leaked--", meaning that while the project may indeed be technically necessary or desirable, it is seldom technically inspired.

In non-freezing climates, such as India, many lining techniques are available. Even brick or block linings, not feasible in the U. S. because it is labor intensive, competes well in India with concrete linings, particularly in cement-short areas. Pneumatically applied mortar or shotcrete is sometimes used for canal linings; repairing old linings, or connecting structures to linings. Since the equipment ordinarily will not pass particles larger than 5 mm, shotcrete requires more cement in the mix than ordinary concrete. The resulting lining is usually made thinner than concrete which precludes its wide use in cold climates. It may, however, not be suited to applications in India in the near future because of the relatively remote locations of some irrigation systems. In these cases, definite third-world design strategies are probably in order. This means that canals and structures are over-designed to a guaranteed failsafe level because remedial steps and maintenance is highly unlikely. This becomes both an economic and an institutional consideration. India has the technical expertise, that under the right conditions, will be applied to maintenance and design-correction operations.

The technical aspects of a large canal operation and maintenance are already better understood by a much higher percentage of the people involved than by those involved in the on-farm operations. The largest volume of canal losses are reported to actually be from the large number of small on-farm canals.

Our own observations of several canals that were considered as "on-farm" or "beyond the outlet" indicated that in the observed cases, about 50% of that diverted reached the intended plot. The other 50% would probably reappear as a drainage problem.

Where high water tables have presently developed, an irrigation and drainage opportunity may exist. In many parts of the world, where

the water table supply is not too saline, it has been tapped by wells and used to irrigate off-season crops, or to supplement an unreliable surface water source. Where pump power can be supported, this drainage scheme solves two problems, and may produce the temporary crop production that will then finance permanent efficient surface irrigation techniques that will greatly reduce future drainage problems.

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Annex - 5

SUMMARY OF LECTURE-SEMINARS

Presented Before the Central Water Commission on February 9, 1982
and
Before the Professional Development Workshop on "Diagnostic Analysis of Irrigation Systems" at Gambhiri Irrigation Project, Chittorgarh, Rajasthan, February 19, 1982

Originally contacted by the World Bank concerning his availability for a seminar on Flow-Measuring Flumes, Dr. Replogle subsequently addressed an assemblage of Engineers from various projects throughout India and from the World Bank, using a lecture room at the Central Water Commission. The substance of the presentation which consisted of 50 photographic slides was as described below.

A style of trapezoidal, broad-crested weir, particularly suited for slipformed canals can inexpensively and accurately measure irrigation flows. The weirs are really long-throated flumes with the throat contracted from the bottom only. They differ from the classical, historical broad-crested weirs in that they have a sloping approach ramp, instead of a blunt vertical wall, and the cross-sectional shape may be any desired form, usually trapezoidal or rectangular, as opposed to rectangular, only in most of the historical cases (2).

These flumes are called long-throated because the contraction length is about twice the maximum flow depth, causing the flow lines to be nearly parallel as they pass through the flume throat. The cross-sectional shapes of the throat and the approach channel can be almost any regular geometric pattern--rectangular, triangular, trapezoidal, circular, parabolic, or complex. The approach channel may be any of these shapes and the throat may be any other. Of course, the throat must be of lesser flow area than the approach channel to effect the necessary hydraulic control and cause "critical flow" on which all flume-theory and weir-theory depend. Also, if the approach channel and the throat are of different shapes, a warped-surface transition will be necessary between the two. This transition in all cases should converge the flow lines no faster than about 18 degrees (about a 3:1 slope from the centerline of flow) to avoid overly large shock waves in the throat. Bottom sill contractions can be somewhat steeper without shock waves.

Constructed with these rather liberal requirements, long-throated flumes have been successfully computer-modeled to give reliable calibrations for all shapes to within $\pm$ 2 percent for a high-to-low-flow-range ratio varying from about 35:1 for rectangular shapes to about 350:1 for triangular shapes. Boundary layer development, caused by wall friction and velocity distributions in channel flows, are incorporated into the model to obtain the relatively high accuracy as verified by numerous laboratory measurements by Replogle and by limited check measurements at the U.S. Bureau

of Reclamation, Denver, Colorado, and the Salt River Project, Phoenix, Arizona.

Simplified field techniques have greatly decreased the skill requirements of field construction yet permit accurate determination of individual discharge rating, restoring intended accuracy in spite of most field construction anomalies (5, 12).

An important aspect of flumes is the high submergence limits (50-95%) that can be tolerated as compared with sharp-crested weirs (0%).. (Submergence limit is defined as that depth of downstream water at which the real discharge deviates by 1% from that indicated from the observed discharge). This translates into the minimum required drop in water surface for the measuring device in the canal system (4, 11).

The broad-crested weir styles, mentioned previously as being particularly suited to canal use, require the least absolute head loss of all other flume shapes and are nearly ideal for retro-fitting into old canal systems where increases in upstream water surfaces must be kept to a minumum. Representative minimum head losses are about 1 cm for the smallest flume in use (4.5 liters per second) and about 15 cm for the largest in service (85 cubic meters per second).

The liberal construction tolerances place major emphasis on making the raised sill portion (throat). level, prescribed (or at least determining) the sill width, and on careful mounting and referencing of the flume gauge. Analysis shows that the error in discharge is almost proportional to the error in sill width, but may be about twice the error that may exist in locating the gauge zero (8).

The high accuracy and low cost of these styles of long-throated devices make them highly desirable for measuring flows in slip-formed canals. The basic shape conforms to the canal which is used as part of the flume structure. The photographic reproduction of the attached figure sheet shows a broad-crested weir style of flume satisfactorily operating at near the submergence limit, with a head loss in the canal of less than 4 cm while measuring approximately 400 liters per second. The drawing on the attached sheet shows details for installing this style. Calibration Tables are provided for a selection of pre-computed sizes so that the casual, or non-technical user , need not learn the computer procedures. The Tables are not presented here, but may be found in the appended references (10, 11, 12).

The broad-crested weir styles are usually constructed without exit ramps in the small sizes where the sill is 0.5 meters, or less, high

and are usually made of solid concrete. In the very large sizes where the sill may exceed one meter, the sill may be of compacted earth which is then covered by a canal-lining procedure. In this case, a mild-sloping exit ramp of about 6:1 is recommended for structural reasons, construction ease, and high-head recovery, permitting higher submergence ratios than obtainable without the exit ramp (Example: 93% with ramp, 85% without ramp) (4).

The above points were made with the aid of photographic slidds of field installations and flume styles. Also introduced were small furrow-measuring sizes made of sheet metal that are being used by U. S. researchers at the U. S. Water Conservation Laboratory, the Snake River Conservation Research Center, the U. S. Salinity Laboratory, the Soil Conservation Service, and three Western universities (USU, WSU, and USCD). They are particularly adapted for quick installation and ease of reading, so that large numbers of furrow flows can be monitored for better evaluation of field application efficiencies.

Similar points and a discussion were presented to the study course group at Chittorgarh under the lecture title of "Fourth-Generation Flume Developments". The thrust of the presentation moved from the Venturi flumes of the early 1900's, to the short-throated flumes, Parshall, Cutthroat, Short-throated Trapezoidal of Robinson (2), the early long-throated styles that were partly mathematically modeled, Ackers and Harrison, (1) to the general solutions and computer-rated styles of today (5,7,8,9,10,11,12) which were designated the fourth generation flumes.

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FIG. 9.2 Type FBIM flume is near the submergence limit due to added friction of downstream vegetation, but is functioning well.

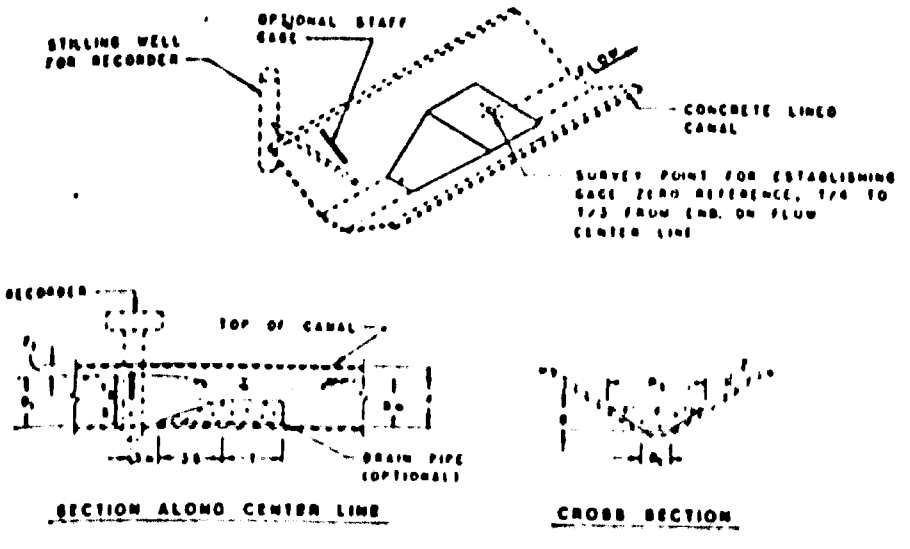


FIG. 9.3 Profile and cross-section of a long-throated flume, broad-crested weir style.

Annex - 6

A PROPOSAL FOR ESTABLISHING AN INTERNATIONAL IRRIGATION WATER MANAGEMENT INSTITUTE AT COLORADO STATE UNIVERSITY

Background

Colorado State University has been engaged in international development programs and projects since the mid-1950 s. These efforts have ranged from institution building (Asian Institute of Technology in Thailand and the Peshawar University effort in Pakistan), to irrigation water management projects (Pakistan, Egypt), agricultural sector analysis and planning (Lesotho) agricultural credit (dominican Republic, Honduras), establishment of a veternary program (Kenya). farming systems (The Gambia) and many other smaller and/or short-term technical assistance efforts throughout Asia, the Middle East Africa and Latin America. Irrigation projects have been one of CSU 's major inputs throughout its long period of involvement in international technical assistance programs. And, given the exceedingly large projected expansion of irrigation development via new project construction and upgrading of existing projects with funding and technical assistance from the Agency for International Development (AID) and other donor agencies, it is likely that CSU can continue to assist in such programs for a long time into the future. CSU participation will not be automatic, however, because AID and other donor agencies will necessarily have to be assured of long-term continuity

for the technical expertise from the university community that they wish to employ. Therefore, it is now time that CSU make a strong commitment to this program area that will be convincing to both the kind of faculty that will be involved and to the donor agency personnel responsible for obtaining U.S. university involvement.

Over the years, CSU has utilized many different kinds of contracting mechanisms for delivering its technical expertise to AID including institutional and personal service contracts with AID in Washington and with individual country missions, cooperative agreements with AID/Washington, PASA type arrangements through the U.S. Department of Agriculture, host country contracts, and lead university contracts with the Consortium for International Development (CID). All of these prior efforts have one thing in common--they were on a project by project basis and as a result academic departments and colleges at CSU view these efforts as temporary and unrelated so that they have refused to adequately staff such efforts on a long-term basis with sufficient numbers of tenure-track faculty. Specifically, CSU administrators still view involvement in international development programs as a temporary measure, even though we have now been in the business for over a quarter of a century. Given the magnitude of technical assistance that AID and other donor agencies expect to draw from the university community in the water management area alone (let alone

a large number of related programs), CSU simply must begin to make long-term commitments to this area of concern if it wishes to continue to be actively involved.

AID is well aware of the dilemma that CSU and other agricultural universities have faced in the past because of the risk and uncertainty involved in staffing development projects on an ad hoc basis. Recently, AID has introduced a number of mechanisms designed to obtain university involvement in development efforts on a long term basis with a minimum of risk and uncertainty, including but not necessarily limited to collaborative agreements, technical service to missions (TSMs), dual career-track faculty appointments and the new Memorandum of Understanding (MOUs). In my opinion, the MOU mechanism offers CSU the best option for developing a long-term commitment in one of its greatest areas of recognized expertise - on-farm water management - that will in turn attract enough donor funding to sustain this effort and allow CSU to attract and retain the necessary number and type of faculty to service it. It is within this context that this proposal for establishing an International Irrigation Water Management Institute at CSU is being put forward at this time.

Rationale for Establishing the Institute

CSU has recently been invited by AID and BIFAD to become one of the first three U.S. universities with which to enter into a Memorandum of

Understanding(MOU). Acceptance of the MOU by CSU in itself will demonstrate an institutional commitment heretofore absent because of the cost-sharing for faculty positions required in this vehicle. But, in my opinion, this will not be sufficient, either from the viewpoint of AID of from that of a large number of interested CSU faculty, unless the MOU is focussed on a large functional area for which there is demonstrated demand within AID and unless there is established at the same time an administrative mechanism within which CSU can deliver its services. Therefore, I propose that CSU's MOU be devoted entirely to emerging a high level of visibility and university commitment to the important and growing area of irrigation water management and the establishment of the IIWM Institute to administer it.

As is well known within the donor community, CSU is already involved in three separate projects in this area of specialization - 1) Egypt Water Use Project, 2) Water Management Synthesis Project, and 3) International Water Policy and Pricing Project - and, of course these were preceeded by the long-term highly successful On-Farm Water Management Project in Pakistan. In addition, CSU (former and present) faculty are involved in helping AID develop project papers for major new water management projects in India, Pakistan and Sri Lanka. These projects, due to clearly articulated host country needs and by deliberate AID design, will be an inter-

disciplinary in nature that will require an integrated team effort approach. All three of the traditional university faculty responsibilities - teaching, research and Extension (service) will be involved with much more emphasis on the training and Extenstion aspects than has been the case in CSU projects heretofore.

The faculty manpower requirements from specific disciplines are already well known. Although some inputs will be needed from a wide range of disciplines, (usually for short-term assignments) almost all of the long-term requirements will be for faculty and mature graduate students from the Departments of Agricultural Engineering, Civil Engineering, Agronomy, Economics, and Sociology. And, given the on-farm nature of the special field studies and training support components, the CSU personnel to be involved must have expertise and a strong commitment to applied rather than basic research, non-degree rather than degree training, and above all, an Extension orientation that truly reaches down to the farmer level. Due to the somewhat non-academic nature of these manpower requirements, and the uncertainty and risk associated with staffing development projects in the past, department chairman and college deans are not likely to respond positively to the expanded faculty needs in these areas under the present administrative arrangements at CSU. As a result,

individual project directors will continue to compete for the scarce faculty resources now available. And, AID is becoming increasingly aware that, given their projected large and increasing demands for such faculty inputs, CSU simply will not be able to deliver the necessary inputs on a sustainable long-term basis under the present ad hoc arrangements. Therefore, now is the time for some innovative organizational changes to respond to the above listed set of adverse circumstances.

An MOU at CSU focussed on irrigation water management can serve as the mechanism for significantly reducing the uncertainty level for department chairman and college deans who will ultimately be responsible for setting up and staffing thefaculty positions needed in this program. And, if an Institute is established to which the cost-shared positions envisioned in the MOU mechanism are assigned for administrative control, planning for faculty needs for the program needs as a whole will minimize the unproductive competition among individual project directors for these resources. And for interested faculty who desire to work in agricultural development with a concentration in irrigation management on a long-term basis, the combined effects of a functionally oriented MOU and the proposed Institute will greatly reduce their uncertainty levels and facilitate their necessary progression toward tenure and promotion. Finally but nonetheless equally important, adoption of these organizational changes would clearly demonstrate

to AID and other donor agencies that CSU is making the necessary high-level commitment to insure that their manpower needs from the university community can be insured on a long term sustainable basis. I am firmly convinced that unless CSU agrees to make such a commitment, AID and other donor agencies will simply have to look elsewhere for their university inputs in the water management arena - the stakes are much too high for them to risk the failure that reliance on a university chosing to continue to operate under the ad hoc arrangements of the past would imply.

The funding levels for international work in water management in the forseeable future are exceedingly large. For AID alone, ignoring for the moment other donor agency needs, funding for projects in which CSU is and/or should be involved because of its unique expertise, is conservatively estimated at 75 millinn dollars. The breakdown of projects likely to be involved is as follows: Egypt (15.2 mil.), WMS II (12.5), IWPP (1 3), India (25 0) Pakistan (15.0) and others e.g., Sri Lanka, etc (6.3). It should be readily apparent, therefore, that direct CSU involvement in these water management projects would easily exceed the budget and faculty requirements of all other CSU international projects by several orders of magnitude Isn't it critical therefore, for CSU to now make a convincing committment to this important and rapidly growing area of specialization in the international development arena? The Institute proposal, combined with a water management functional

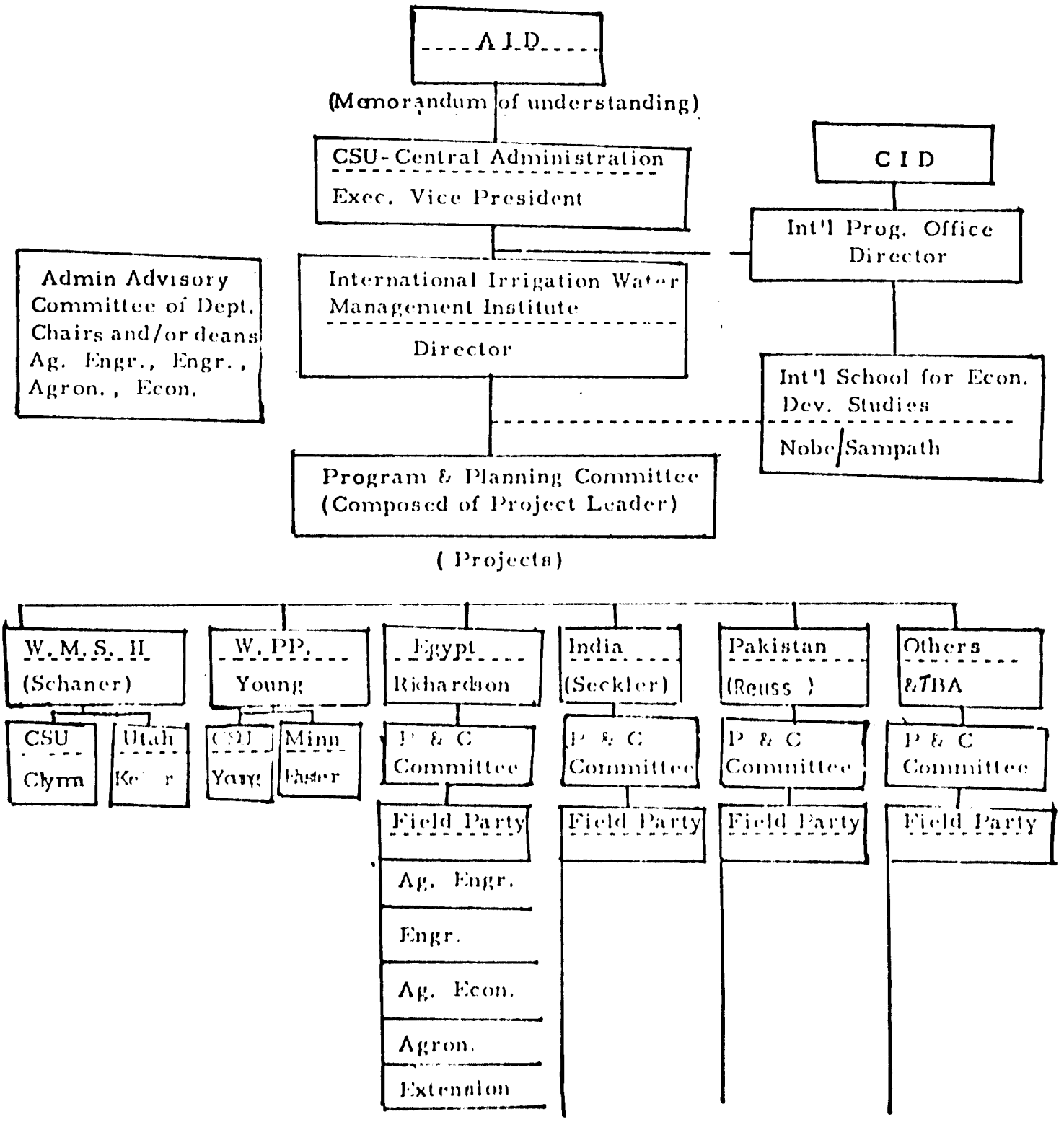
focus in the new CSU MOU, would be an ideal mechanism to accomplish this.

Proposed Organizational Structure for the Institute

A suggested administrative structure for a new International Irrigation Water Management Institute at CSU is given in Figure 1. This mechanism, as proposed, has several unique features designed to give high visibility and functionality to CSU's international water management programs but without limiting its efforts in other areas of the international arena (It is not the purpose of this proposal to deal with CSU's total present and potential interests in the international arena although I personally believe that a sharpening of focus for CSU's overall involvement in such activities is long overdue.)

Note first of all that the creation of the Institute and its reporting directly to the Executive Vice President would give it high visability and clearly demonstrate CSU's commitment to this area of endeavor As result, AID and the other donor agencies interested in irrigation water management (e.g. World Bank, FAO, UNDP, Ford Rockfeller, the proposed worldwide Irrigation Management Service, and the like) could look to the Institute Director as their university contact point. This would be highly desirable because it would greatly increase the efficiency and reduce the time involved in contract negotiations and project and program planning that is presently the case when they deal with CSU administrators and faculty for whom water management is only a part-time activity. It is for this reason that three units at CSU that would

Figure - 1 A Proposed International Irrigation Management Institute at Colorado State University: Organizational Chart



be involved but who have other important university duties as well are set outside on the line authority chain of command for the Institute. These are: 1) The Office of International Programs, 2) An Administrative Policy Advisory Committee (composed of Department Chairman and/or Deans representing the major disciplines to be involved), and 3) the International School for Economic Development Studies.

Reporting to the Institute Director would be a Program and Planning Committee on which all the directors of individual water management projects to be included under the Institute would automatically hold membership. This unit would be a vital link for planning long-term faculty support needs. Each project director in turn would have his own planning and coordination committee, composed of senior faculty from each of the disciplines involved, building on the success which the Egypt and Gambia projects have had with this approach. Individual faculty would continue to hold rank and appointments in their home departments in the same manner as faculty now servicing the other institutes at CSU.

The second unique feature of this institute's organizational structure is that the faculty positions to be funded on a cost-share basis under the MOU would be under the administrative control of the Institute Director. He in turn could negotiate much more effectively with individual department chairmen and college deans for necessary faculty inputs because such positions would remain in specified academic units only as long as the faculty input

was delivered. Thus, if such units in turn would take their commitment to this area of specialization seriously, such inputs could certainly be viewed with long run security in the same light as positions now funded from resident instruction, Experiment Station and Extension. (It is my firm belief that this lack of security for tenure-track positions has been the primary reason that department chairman and college deans have not supported CSU's efforts in international development with the same degree of enthusiasm that they have accorded to resident instruction, Experiment Station Research and Extension.) But even so, such administrators would not necessarily have the confidence in this arrangement that will be needed unless the Director in turn reports directly to central administration in the same context as the line administrators for these other university programs.

Concluding Comments:

The MOU mechanism now being offered to CSU was designed to provide AID a way to insure long-term university involvement in their programs. If properly formulated, it can achieve the objective envisioned. CSU has a unique opportunity through this mechanism to make a firm commitment to its major international program, one in which it has already established its expertise within AID and the rest of the donor community. The proposed Institute, supported by a functionally oriented MOU focussed on irrigation water management, is the ideal mechanism for this purpose at this point in time.

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Annex 7

SUMMARY OF IFPRI DATA ON MANPOWER NEEDS FOR DEVELOPMENT OF NEW IRRIGATION CAPACITY FOR THE PERIOD 1975-1990

This projected estimate for India is based on a growth rate of new irrigation area of 17,511,000 hectares or 2.84 per cent for the 1975-1990 period. Between 1964-74, the actual growth rate was 2.46 per cent. By 1990 the estimated new irrigated area is 69,000,000 hectares which is an increase of 27,336,000 hectares over the 1975 year total. Roughly 79 per cent of this new area is estimated to be for food production with an estimated 2.5 tons/ hectare of primarily rice and wheat.

Also IFPRI estimates that India had 6,720,000 million acres needing major improvements and 10,080,000 needing minor improvements in 1975. Those estimates adjusted for 1982 are much higher, probably doub · the 1975 figure.

The manpower needed only to develop and operate the new systems is estimated as technicians (21,098), Extension workers (17,511), and professional staff (4,378), or a total of about 42,987 individuals. This does not include personnel needed for rehabilitation and improvement of existing systems.

At a cost of $3000 for training a technician, $5000 for an Extension worker, and $10,000 for a professional, the estimated training costs are provided below only for manpower for newly equipped areas.

Type of Worker	Number Needed 1975-1990	Total Cost ($1000)
Technicians	21,098	$63,294
Extension Workers	17,511	$87,555
Professionals	4,378	$43,780
TOTALS	42,977	$194,629

Some estimate that with the increase in CAD programs and rehabilitation of major and minor schemes, plus small scheme developments, the number of individuals to be trained in new approaches to WM improvement, research, and operations and maintenance (management) is on the order of double or triple the needs for trained manpower for new areas.

There is the growing perception among planners and officials that all new professional entrants to irrigation require some training plus existing staff. Added to this is the need to train subject matter specialists, and Extension workers need special training in water use technologies and practices to improve the productivity of farmers.

Current investments in irrigation development in India ; is on the order of $2.5 billion per year as India attempts to add about 2.5 million hectares of new irrigated area per year. The total estimated capital investment by 1990 for only major improvements ($3,716,200) and minor improvements ($2,388,900) is about $5 billion (dollars).

New irrigation capacity alone by 1990 is estimated by IFPRI to add 35,205,000 metric tons of food production in wheat equivalent per year. Major improvements should add 8,198,000 metric tons and minor improvements should add 7,799,000 million tons per year.

An Added Note:

These IFPRI estimates provide an overall perspective of both the magnitude of the task in developing skilled manpower and the expected benefits if systems are designed and operated at a reasonably good level. It should be noted, however, that the cost per trainee figures are likly to be on the high side as they appear to include more formal degree training and training abroad than visualized in the Water Management and Training Project. On the other hand, this Project which will emphasize a "hands-on" approach, supported by farm level special study areas will have a correspondingly higher cost item for these special studies than was likely taken into account in the IFPRI estimates. It is the latter component, however, that will make the training project successful and so therefore must be funded to the level deemed necessary.

Source: "Investment and Input Requirements for Accelerating Food Production in Low-Income Countries by 1990", by Peter Orman, Juan Zopote, George Aliborwho, Shyamal Raj, Research Report 10, International Food Policy Research Institute, Washington, D.C., September, 1979.

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2/23/82

Annex 8

Annex 8

A PROPOSAL FOR AN INTERNATIONAL SERVICE FOR IRRIGATION MANAGEMENT

The Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR) has commissioned a 3-person Study Team to report on irrigation management research and training. Its terms of reference include investigating current research and training, identifying gaps and needs, and if appropriate, proposing action. Countries visited include Pakistan, India, the Philippines, Sudan, Senegal, Mexico, France, the United Kingdom, and the USA. Besides national departments and agencies, the Study Team has also consulted representatives of the World Bank, the Asian Development Bank, the Inter American Development Bank, FAO, UNDP, USAID, ODA, ICID, the Ford Foundation, the Rockefeller Foundation, IRRI, ICRISAT, and numerous individuals. The proposals which follow have been developed through these discussions, but are the responsibility of the Study Team alone, serving in their individual capacities.

The importance of irrigation and drainage is indicated by its current scale and production, by projected increases and investment, and by its social significance. Of over 200 million hectares irrigated in the world, over 70 percent are in 22 developing countries, India alone having some 60 million hectares under command. It has been estimated that in Asia, investment in new irrigation in the next decade will be of the order of $75 to $100 billion. Sri Lanka, India and Mexico are among the countries projecting a doubling of irrigated area by the end of the century. Moreover, irrigation has enormous social significance - raising incomes, employment and wages, reducing risk, restraining migration to overcrowded towns, and with mixed benefits and disbenefits through its effects on productivity (negative with waterlogging and salinity), on nutrition, and on health.

Severe deficiencies are, however, widely reported in irrigation management. These arise from inadequate planning (with narrow objectives, lack of realism, and neglect of non-irrigation aspects), from defects in design (neglecting requirements for flexible operation, on farm development, and drainage), and especially deficiencies in operation and maintenance (including farmers' participation, the distribution of water, and financing maintenance). Good irrigation management requires a multi-disciplinary approach, but specialisation leads away from this. In particular, civil engineering training and professional rewards value construction and neglect and undervalue the vital activities of operation.

To improve irrigation management is a national responsibility. Three principles underlie an effective approach: analysis of whole systems, not just of parts; a practical, field orientation; and the application of already known physical technologies. Seven key activities can be identified:

i. appraisal for improvement of existing systems.

ii. action research on existing systems (whole or part) to identify, test and replicate improvements.

iii. improved operation of existing systems based on either appraisals, existing knowledge stemming from action research, or additional planning and design.

iv. improved planning and design for future irrigation systems.

v. information systems for monitoring, communication, control and evaluation.

vi. institutional development, including management of irrigation organizations, responsibilities for water distribution, farmers' participation, and national irrigation management institutions.

vii. training, with curricula and methods focusing on and deriving from the above.

Major attention is proposed to action research as a vehicle, mechanism and spur for other activities. Action research involves appraisal, the identification of interventions, benchmark studies, and then experimental treatments with monitoring. It will often involve collaboration of an action team (the project management) and a research team (a separate group, often from another institution). The benefits from good action research in the Philippines, Pakistan and elsewhere have been high, and the methods deserve rapid development and dissemination.

To promote and support these priority activities, the Study Team recommends an International Service for Irrigation Management (ISFIM). This Service would not replace national, bilateral or other multilateral initiatives, but it would complement these in the following ways:

- By raising, in each country, the status of professional interest in irrigation management

- By supporting activities in irrigation management through encouragement, promotion (including partial funding in some cases), catalysis, and facilitating collaboration between disciplines and agencies

- By assisting in identifying, analysing and developing methods for key activities including the appraisal of existing systems, the conduct of action research, and the management of water distribution on main systems

- By transferring and exchanging information, especially among developing countries with similar problems

- By, through the foregoing activities, promoting confidence among decision makers, both national and international, that irrigation management problems are being adequately addressed.

The support of ISFIM to national activities would be both indirect and direct. Indirect support includes an information network, and a network to link together existing action research, and workshops and seminars. Direct involvement and support would include variously funded action research, and staff support for national institutes of irrigation management and for regional training. Indirect support would be relatively quick and easy to mount, requiring a minimum of reconnaissance and negotiation, and is strongly recommended. But in itself it is unlikely to achieve the desired impact. Direct support is therefore recommended to countries that request it.

The Study Team proposes that a country's involvement can be at a number of different levels, according to whether it participates in an information and/or action research network, whether funds or staff are provided for action research, and whether a national institute or regional training are supported.

Seven possible degrees of involvement are in the attached chart. For a particular country, the degree of involvement would be largely according to the desires of the country, subject however to negotiation and agreement with ISFIM. The degree of involvement could also increase and develop over time.

To carry out its tasks, ISFIM would have a small inter-disciplinary "core staff" of some 8 - 12 professionals plus a field staff which would be built up gradually, depending on agreements reached with a number of participating countries. The core staff would be on a travel status during about a third of their time.

The headquarters of ISFIM would consist of offices only without any further physical facilities, in which respect it differs from the existing centres of the CGIAR system (except for ISNAR, IBPGR, and IFPRI). This is so since action research would be carried out on actual irrigation systems on areas varying in extent but often between 1,000 and 20,000 hectares.

The Governing Board of ISFIM would include: (a) representatives of the principal donor organisations; (b) representatives of leading irrigation developing countries, and (c) professionals in their personal capacity who have had pertinent experience in planning, research, training or operation of irrigation systems. Since the Governing Board might have as many as 20 members, it would not be feasible for it to meet more than once a year. It might therefore be advisable to have a Program Committee of say 6 members made up of persons as under (c). It might be possible for these persons to serve both on the Governing Board and the Program Committee.

Owing to starting difficulties and the time needed for staff recruitment, substantive activities by the end of year 1 would be limited to level I (please see table) and perhaps level II, with preliminary explorations of other levels. By the end of year 2, a reasonable target would be substantive progress at either level V, VI, or VII in 3 to 5 countries.

With respect to costs, the Study Team has estimated a requirement in 1982 dollars of about $1,600,000 for year 1 and $3,200,000 for year 2. Costs after year 2 have to be somewhat speculative at this point since much depends on the response of the first five countries involved, on requests for assistance by additional countries, and on the extent and character of funding from bilateral and multilateral donors for related activities. It should be noted that some of such funding would very likely be stimulated through the work of ISFIM.

The best current guess is that the level of funding for ISFIM needed in year 3 and subsequent years would be about $5 million (in 1982 dollars).

Drafted by the Study Team, Mexico City, 21.1.82.
F.E. Schulze
P.Z. Kirpich
R.J.H. Chambers

Table 1

Possible Levels of Involvement of a Country with ISFIM.

		I	II	III	IV	V	VI	VII
Indirect	(Information networks, (seminars, workshops., (etc.	X	X	X	X	X	X	X
	((Action research in (network		X	X	X	X	X	X
	(Action research partially (funded			X	X			
	((Training partially funded				X	X	X	X
Direct	((Action research partially (funded plus ISFIM staff in (residence					X	X	X
	((Regional training						X	X
	((Support for national (irrigation management (center							X
	ISFIM staff visits	-	X	X	X	X	X	X
	ISFIM staff In residence	-	-	0-1	0-1	1-2	1-3	2-4

Annex 9

QUESTIONNAIRE TO OBTAIN ESTIMATES ON NUMBER AND TYPE OF PERSONNEL TO BE TRAINED

(Estimated Number)

ITEM	RAJASTHAN	GUJARAT	MAHARA--SHTRA	UTTAR PRADESH	MADHYA PRADESH	INDIA
1. Irrigation Potential (CCA)						
a) Created up to 1980-81						
b) Proposed by end of 6th Five Year Plan						
c) Proposed by end of 7th Five Year Plan						
d) Proposed by the end of the year 2000						
e) Number of projec s:						
i) Completed up o 1980-81						
- Major						
- Medium						
- Minor						
ii) Under construction						
- Major						
- Medium						
- Minor						
iii) Planned up to yr. 2000						
- Major						
- Medium						
- Minor						
2. CAD program - operational						
a) Major						
b) Medium						
c) CCA coverage						
i) Major						
ii) Medium						
3. Personnel involved in CAD operating projects						
a) CAD Administration:						
i) Commissioners/ Administrators						
ii) Deputy Administrators						
b) Engineering (Civil/Agril)						
i) Senior level Engineers (SE and above)						
ii) Mid-level Engineers (XEN and AE)						
iii) Junior level Engineers (Deputy Engrs.)						
iv) Technicians						

QUESTIONNAIRE TO OBTAIN ESTIMATES ON NUMBER AND TYPE OF PERSONNEL TO BE TRAINED

(Estimated Number)

ITEM	RAJASTHAN	GUJARAT	MAHARA--SHTRA	UTTAR PRADESH	MADHYA PRADESH	INDIA
c) Agriculture						
i) Soil conservation field units						
- Jt./Deputy Directors						
- Asst. Directors or equal						
- Overseers/tracers						
ii) Extension						
- Jt./Deputy Directors						
- Subject matter specialists						
- VLW's etc.						
iii) Agronomists						
iv) Soil Scientists						
v) Economists						
4. Personnel involved in non-CAD irrigation projects						
a) State level						
i) Irrigation Department						
- Secretary						
- Chief Engineers						
- Superintending Engrs.						
- Executive Engineers						
- Asst. Engineers/ Deputy Engineers						
- Technicians						
ii) Agriculture Department						
- Jt. Directors						
- Deputy Directors						
- Subject matter specialists						
- Extension specialists						
b) Regional project construction level						
i) Irrigation Department: Project construction						
- Addl. Chief Engineers						
- Supdg. Engineers						
- Executive Engineers						
- Asst. Engrs/Deputy Engrs.						
- Technicians						
Operation&Maintenance						
- Addl. Chief Engineers						
- Supdg. Engineers						
- Executive Engineers						
- Asst. Engr/Deputy Engrs.						
- Technicians						

QUESTIONNAIRE TO OBTAIN ESTIMATES ON NUMBER AND TYPE OF PERSONNEL TO BE TRAINED

(Estimated Number)

ITEM	RAJASTHAN	GUJARAT	MAHARA-SHTRA	UTTAR PRADESH	MADHYA PRADESH	INDIA
ii) Agriculture Department						
- Jt. Directors						
- Deputy Directors						
- Subject matter specialists						
- Extension specialists						
1. Jt. Directors						
2. Deputy Directors						
3. Sub. matter specialists						
4. VLW's						
5. CWC Professionals						
a) Members						
b) Chief Engineers						
c) Directors						
d) Deputy Directors						
e) Asst. Directors						
f) Technicians						
g) Irrigation Research Institutes						
i) Directors						
ii) Deputy Directors						
iii) Assistant Directors						
iv) Technicians						
6. Universities						
a) Training of Civil Engrs.						
i) Bachelor's level						
ii) Master's level						
iii) Doctorate level						
b) Training of Agricultural Engineers						
i) Bachelor's level						
ii) Master's level						
iii) Doctorate level						
c) Training in Agriculture						
i) Bachelor's level						
ii) Master's level						
iii) Doctorate level						
7. Estimated number to be trained per year at National Centre by type of course						
a) Professor's induction course (1 year)						
b) Mid-level course (6-8 weeks)						

QUESTIONNAIRE TO OBTAIN ESTIMATES ON NUMBER AND TYPE OF PERSONNEL TO BE TRAINED

(Estimated Number)

ITEM	RAJASTHAN	GUJARAT	MAHARA-SHTRA	UTTAR PRADESH	MADHYA PRADESH	INDIA
i) Superintending Engrs.						
ii) Executive Engineers						
iii) CAWB						
iv) State GW organizations						
v) Agronomists						
c) Management Development Course (3-4 weeks)						
i) Members						
ii) Chief/Addl. Chief Engrs.						
iii) Superintending Engrs.						
d) Training of trainers at State level institutes						
i) Engineers						
ii) Agronomists						
iii) Soil conservation personnel						
8. Overseas Training by type of training per year						
a) Non-degree specialized (1 year)						
b) Intensive specialized (6 months)						
c) Intensive specialized (3 months)						
d) Short-term "Hands-on" Intensive training (4-6 weeks)						
e) Study/Observation Training Tours						
f) Professional Workshops/ Conferences						
g) Graduate Degree specialized						
i) Masters						
ii) Doctorate						

Annex 10

Proposed Questionnaire for Obtaining Information on Types of Irrigation Training Needs

INFORMATION ABOUT IRRIGATION MANAGEMENT TRAINING NEEDS IN INDIA

PURPOSE

As is becoming well-known in India, Irrigation Water Management is a new interdisciplinary subject of deep interest around the world. The identification of Training needs has just begun in most countries. India, with one of the largest irrigated areas in the world, has the great challenge of providing skilled manpower needs for new projects, rehabilitation programs for old projects, and for operation and maintenance of existing systems.

Several special training institutions are being developed in the States and a Water Resources Development and Management Center as Phase 1 of a National Staff Training Institute in the National Water Commission has now been approved. Exsiting Institutes, Research Centers and Universities are becoming interested in "hands-on" field-level training and applied action research in irrigation water management.

USAID and the Government of India are now developing a project paper for an India-wide project to provide assistance in training and for special action research studies. We need your views and information about this proposed project. We will utilize your views in the design of the project.

Please take time to answer this questionnaire to the best of your ability. Please return the completed form to Mr. Edwin D. Stains, USAID, by 15 April, 1982. No information will be used or reported which reveals the name of the person who provided the information. Be frank and provide us with your best judgments. Thank you very much for the valuable information you can provide.

Present Position in Your Department

Position and Department _____

Years of Total Service there _____

Highest level of Academic Training attained _____

Places of Academic Training (College level) _____

Non- Academic Training:

Formal _____

Tours _____

Other _____

Plans for further Professional Development

(1) Academic _____

(2) Non-Academic Short Courses _____

(3) Other _____

A. INFORMATION ABOUT A NATIONAL CENTER

There is a current proposal for a National Center for Water Resources Development and Management. The following questions are related to that proposed Center.

1. The National Center should provide training for: (Check only one)

a) Only Senior Officials in Irrigation Departments _____

b) Only Senior Professionals or New Entrants to Irrigation Department _____

c) Only Senior Officials in Ministries of Irrigation and Agriculture to be involved in Irrigated Agriculture _____

d) Only Key Professionals from all Departments and disciplines involved in Irrigation developments _____

e) Other _____

_____

_____

Explain your choice: _____

_____

_____

_____

_____

2. The National Center should be under the:
(Check only one)

a) Central Water Commission _____ _____

b) Some other Unit of the Ministry of Irrigation _____

c) Under the Ministry of Agriculture _____

d) Under some Joint Committee of the Ministries of Agriculture and Irrigation _____

e) Other _____

_____

Explain your choice: _____

_____

_____

_____

3. The National Center should be designed to provide the following types of Training.
(Check only one)

a) Long-term (6-12 months) of technical training _____

b) Short-term (1 week to 2 months) courses of technical training _____

c) Short courses on technical or management-oriented studies _____

d) Other _____

_____

_____

Explain your choice briefly: _____

_____

_____

_____

_____ _____

4. Methods of Training: (Please rank these in order of value 1 is high; 9 is lowest)

a) Lectures _____

b) Discussion _____

c) Case Studies _____

d) Audio Visuals (Video, films, etc.) _____

e) Demonstrations _____

f) Field-oriented (Field trips, observation tours, field studies, etc.) _____

g) Laboratory _____

h) Other _____

i) Combinations of all the above activities _____

5. Types of Training: (Check one)

a) Single subject matter discipline training (Civil Eng., Management, etc.) _____

b) Interdisciplinary Team training in technical areas which combine some discipline training with Team training in how to analyze irrigation systems and develop solutions to problems _____

6. What disciplines need special subject matter training?

_____

_____

_____

_____

_____

7. What types of non-discipline training is needed?
(Example: Management/Systems Analysis)

_____

_____

_____

_____

8. Types of Overseas Studies needed: (Please rank; 1 is high, 7 lowest)

a) Observation tours in other Countries _____

b) Short intensive "hands-on" practical interdisciplinary Water Management Training (4-6 weeks) _____

c) Short-term (4-6 weeks) in highly technical, specialized subject area. _____

d) One year non-degree academic training with focus on Water Management _____

e) M.Sc. or Ph.D. level academic training in interdisciplinary Water Resource Management _____

f) M.Sc. or Ph.D. level academic training in a highly specialized technical subject area _____

g) Technical speciality in Irrigation or Agriculture _____

h) Other _____

_____

9. Selection of Core Training Staff for National Center should be taken from the following:

(Please rank with 1 highest; 6 lowest)

a) Senior professional staff from Irrigation and Agriculture Ministries _____

b) Highest qualified staff from any place in India _____

c) Highly qualified staff from Research Institutes _____

d) Highly qualified University staff _____

e) All of the above _____

f) None of the above (Other) Please describe _____

_____

10. Training of Trainers: (Check only one below)

a) All training staff should have special training in use of best teaching philosophies or methods _____

b) All training staff should have special training in Comprehensive Diagnostic Analysis of Irrigation Systems _____

c) No extra training needs to be provided _____

d) Discipline Trainers need update in their subject matter areas. _____

e) Other _____

_____

_____

11. Major Role of the National Center: (Check only one)

a) Training CWC Staff _____

b) Training Senior Irrigation Staff in States _____

c) Training Senior Irrigation staff or Agricultural Staff involved in State Irrigation Projects

d) Training of Trainers for State Training Institutes and providing support for State Institutes

e) All of the above

f) None of the above (Other; Write in).

12. What other roles are appropriate?

13. Would you please specify the ways a National Center could assist and support Water Management Training efforts in the States? (May include: training the trainers, transfer of technology from around the world, collection and development of training materials, etc. Describe below).

B. TRAINING NEEDS IN THE STATES

1. Please describe the specific types of training in Water Management needed in the States to develop new projects or improve the operation of existing projects.

2. Policy Commitment for Using Trainers

What official arrangements should be made to assure that trained personnel are used for the jobs for which they receive training?

3. How can this high level of commitment be ensured?

4. Which of the following types of training are most needed for Command Area Development: (Check One)

a) Strictly technical discipline training in key subject. _____

b) Strictly technical training of an interdisciplinary nature. _____

c) Discipline oriented field training in Team Diagnostic Analysis, development of solutions and project implementation _____

5. Please describe your present positon in terms of job activities which you are expected to perform.

6. What specific types of further professional Water Management training would you like to have? Please specify in terms of subject areas you feel you need further training in to be a better professional.
(Remember that professional development is a life-long process).

_____

_____

_____

_____

_____

7. Please specify:

a) The number of trainers needed for a State Training Center (Number)_____

b) The disciplines needed for faculty in a State Training Center _____,_____

_____,_____

c) The professional qualifications of these staff members in terms of experience and academic training should be:

_____

_____

C. SPECIAL STUDIES NEEDED IN WATER MANAGEMENT

(In terms of the types of applied research needs to improve irrigated agriculture, please answer the following questions).

1. Special types of action research needed? (Rank with 1 as highest; 11 as lowest)

a) System evaluation such as diagnostic analysis by Team _____

b) Ground water hydrology_____

c) Crop water requirements consumptive use _____

d) Soil fertility studies_____

e) Water logging and salinity _____

f) Institutional constraints _____

g) Conjunctive use of ground and surface water _____

h) Soil-water-plant relationship _____

i) Farm Management Economics studies _____

j) Extension studies _____

k) Ways to involve Farmers _____

2. What organizations or an organization at the National and State levels do you think is best for allocating funds, receiving proposals, monitoring/evaluating of special studies? (List one)

a) National Level _____

b) State Level _____

(Explain your answer below)

_____

_____

_____

_____

_____

D. EDUCATIONAL NEEDS

1. What new course would you like to see in the following Departments of Universities related to Water Management which would help prepare future generations of graduates with improved skills, knowledge and attitudes about Irrigation Water Management? (Please list by academic departments).

a) Civil Engineering

_____

_____

b) Agricultural Engineering

_____

_____

c) Agronomy, Soils

_____

d) Economics/Agricultural Economics

e) Agricultural Extension

f) Rural Sociology

g) Business Management

h) Other

2. Do you think there should be a special interdisciplinary set of courses in graduate schools in India for Water Resource Management? Why or Why Not?

3. What role, if any, could the Management Institutes (Example: those at Ahmedabad, Bombay, Bangalore, etc.) play in special workshops/ training which would help improve the management of irrigation projects.

E. TECHNICAL ASSISTANCE

Would you be for or against a small interdisciplinary expatriate Team of 3-4 Professionals, such as the Diagnostic Analysis Trainers, being located in India for a few years to provide assistance and support in developing or strengthening Training Centers for Water Management and special On-Farm Action Research Studies?

Check One:

For_____ Against_____ Undecided _____

If you are Against, briefly explain why in the space below.

_____

_____

_____

If you are For such a Team, explain why and suggest where it should be best located and what the primary job responsibilities of the Team members should be.

_____

_____

_____

F. LOCATION OF STATE TRAINING CENTERS

1. Should the State Training Centers be located on or near an on-going Irrigation Project, at a major city, or near a University or Institute?

Check One:

Project Area_____ City_____ University_____

Explain your answer.

_____

_____

_____

2. Where would be the best place to establish a State Training Center?

(Check one below)

a) Rajasthan _____
b) Maharashtra _____
c) Gujarat _____
d) Maydha[illegible]desh_____

Annex - 11 Annex -11

Brief Outline for a Proposed Rajasthan

LAND AND WATER MANAGEMENT TRAINING CENTER

BRIEF SYNOPSIS

By

R.R. Mehta, Jt. Director - Agriculture, Rajasthan
Co-coordinator of Diagnostic Analysis Workshop

Note:

A brief outline has been worked out; it will be completed in detail after the finalization of the scheme, it s contents as per approval of GOI/ GOR as the case may be.

Objective

With increase in the energy rates and fertilizer's cost the water management has become of the prime importance in the irrigator's minds. Our country is the oldest, where irrigation is practised since centuries. However, more and more stress has been rightly given to the development of irrigation. But less emphasis was given on the utilization of irrigation potential created, which is equally important to achieve the maximum production and efficient utilization of the water. More and more emphasis will have to be given for the regulated water supply at the field levels and at the critical stages of the various crops.

For efficient operation and management of the irrigation projects, special efforts are required to train the personnel engaged on operation, maintenance and utilization of the irrigation systems with a view to achieve better water use management and to attain higher productivity from irrigated agriculture. To meet this requirement the "Land and water management in service training" has been proposed for the irrigation and concerning agriculture authorities.

2.	Trainees	Senior and Junior level officers of Irrigation Department and the Agriculture officers of the concerning command areas.
3.	Duration	For Senior Officers the period may vary from 2 - 3 weeks. For Junior level officers the training period may be of 4 weeks.
4.	Training Venue	If possible it may be good canal irrigation farm and/or at project site as the case may be.
5.	Trainers	Engineers/Agronomists and Soil Specialists and Extension specialists . (May be selected from various depts) Must be post Graduate in the subject and must have good knowledge or irrigation and land management.
6.	Training	For the best management of the training, it should be based on the (i) Sound technology (ii) Good management and (iii) Supported by good applied field Research and Development.
6.1	Practical training and training aids	(i) Live modules for various irrigation systems on the farm. (ii) Live modules of drainage system on the farms. (iii) Various important crops. (iv) Various systems of irrigation to different types of crops. (v) Size of irrigation fields depending on the type of soils. (vi) Various types of canal/water courses field channels etc. (vii) A complete meterological unit. (viii) Various measures of controlling water systems. (ix) Various instruments for measuring quantities of water, etc. (x) A small laboratory for working out the field capacity, wilting points, permanent wilting points,

quality of soils, water, infiltration rates of various soils,etc.

(xi) Weed controlling measures in canals , distributaries, water courses,field channels etc. (By mechanical, chemical and manual method)

(xii) Field preparations of various types of soils and their water requirements depending on the field capacity.

(xiii) Equipment needed for working out capacities of canal, distributaries, water courses field channels and field losses.

6.2 Theoretical/ Practical — The following are the important topics which may be dealt in the classes and fields both.

6.2 (1) Soils: (in Brief)

(a) Type of soils (Prevalent in the state)

(b) Characteristics of various soils (Chemical and physical).

(c) Irrigability classification of various soils.

(d) Salinity and alkalinity development, it's control.

(e) Drainage system in different soils.

(f) Field preparation in various soils in irrigation.

(g) Crops in relation to various types of soils.

6.2 (2) Crops:

(a) Important crops of the state in relation to climate soil and irrigation.

(b) Characteristics of all the crops in relation to growing period and with major emphasis on the water requirement in relation to the maximum productivity.

(c) Correlation of irrigation and yields (For emphasizing the timely irrigation at a critical stage of the crop.

6.2 (3) Weed Control:

(a) Field weed control, important weeds, their control measures, losses incurred etc.

(b) Canal weed control:
(i) Important characteristics of aquatic weeds, their growth cycle in details
(ii) Control measures in tanks, canals, branches, etc. (By mechanical, chemical and manual.).
(iii) Hazards of not controlling the weeds.

6.2 (4) Climate:
(a) Components of weather and their importance in relation to crop growth and water requirement.
(b) Rainfall in relation to growing period of various crops and their water requirements.
(c) Working out of water requirements of various crops by using climatological data.

6.2 (5) Irrigation:
(a) Various systems
(b) Methods of irrigation
(c) Type of irrigation in relation to various crops, fruit plants, trees, etc.
(d) Types of channels and their efficiency in relation to quantities of water and soils.
(e) Types of canals and their efficiency in relation to quantity of water and area of the command.
(f) Drainage systems in relation to soil their depth and permeability
(g) Warabandi system
(h) Maintenance of canals
(i) Reduction of water losses in conveyance.
(j) Difficulties faced in adopting irrigation
(k) Conjunctive use of ground and surface water.
(l) Sedimentation of reservoirs
(m) Silting of irrigation channels and its control measures.
(n) Cheap methods of reducing losses in conveyance system.
(o) Maintenance of various structures on canals
(p) Practical field studies for working out losses (A case study) and their remedies in different irrigation commands.