Pakistan
Irrigation System Management Project
391-0467

# PAKISTAN ISM PROJECT EVALUATION: REHABILITATION AND INSTITUTIONAL STRENGTHENING COMPONENTS

ISPAN ACTIVITY NO. 604A

ISPAN REPORT NO. 2

ISPAN

RIGATION SUPPORT PROJECT FOR ASIA AND THE NEAR EAST

onsored by the U.S. Agency for International Development

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January - February, 1988

Prepared for the Water Resources Division
Office of Agriculture and Rural Development
U.S. Agency for International Development
Islamabad, Pakistan

Irrigation Support Project for Asia and Near East
Contract No. ANE-0289-C-00-7044-00, Project No. 398-0289
is sponsored by Asia and Near East Bureau
U.S. Agency for International Development
Washington, DC 20523

## EXECUTIVE SUMMARY

The essence of ISM/ISR, in concept and articulation, is sustainability. The project, jointly funded by AID and IBRD, aims to assure reliable and equitable water supplies by physically rehabilitating Pakistan's irrigation and drainage system and improving concerned institutions to enable them to sustain those improvements.

Prior to the project, a combination of factors created a crisis situation. On one hand, the completion of major link canals increased the total supply of water in the system. On the other hand, the system had deteriorated to a point where water distribution was increasingly unreliable and inequitable. Over-toppings and breaches caused damage to crops and households; and increased water supplies were captured by head-enders, while tail-enders received uncertain and irregular supplies. Throughout the system, inadequate or poorly functioning drains failed to evacuate seasonal water surpluses or raised groundwater tables.

The purpose of the project is to rehabilitate the system and establish appropriate funding levels, funding mechanisms, and operations and maintenance procedures and practices to keep the system in its improved state. Institutional and physical improvements are essential both to restore the system and maintain it; thus, the project invests in both areas.

Not surprisingly, physical improvements have been easier to undertake than institutional improvements. The PP emphasized a "systems" approach to rehabilitation, which would concentrate efforts. However, a "band-aid" approach was actually adopted, to patch up the most vulnerable parts of the system. The areas most prone to over-topping or most likely to breach, were rehabilitated, without reference to other parts of the system. This implementation approach was justified, and the effort has been successful; no known major breaches have occurred since completion of these emergency works.

Meanwhile, efforts have been undertaken to develop "yardsticks" to obtain adequate funding; to prepare O&M manuals; to establish and/or improve workshops; to introduce equipment for rehabilitation and maintenance; and to identify and respond to various management problems. Some of the results of these efforts have been mere or less visible. Nonetheless, their overall impact has been to set the stage for future initiatives, rather than to set in place viable mechanisms which are able to sustain physical and institutional improvements.

To some degree, the limited institutional impact of the project is the direct result of management deficiencies which are discussed in detail in this report. Inappropriate resources were mobilized; others were squandered, misdirected or uncoordinated. People made contributions in particular areas of interest or expertise, but there was no single project guiding force with the vision necessary to synchronize inputs and direct outputs to attain project objectives. Inherent difficulties in institutional development were exacerbated by poor communication, flights of fancy, and plain poor judgement In the end, TA consultants confused quantity for quality; AID kept fighting fires as it both initiated and reacted to accumulated insights; and the PIDs selectively responded to opportunities, burdens and inconsistencies between promises and deliveries.

Given the uneven quality of the TA, and given AID's initial limited understanding of the PIDs as institutions, the outcome has been surprisingly positive. After over four

years of the project, an observer gets a sense of arriving at the aftermath of an encounter between strangers who have struggled to establish a common ground, while each retains prerogatives. A common ground has been established, and quite firmly, but it has yet to be exploited to any degree.

The first challenge in Phase-II is to create a productive dialogue, articulating common interests and achieving a shared agenda. It is clear that many TA reports of Phase-I will merely gather dust, befitting their value. It is equally clear, however, that PIDs and AID are in better positions to identify areas in which they need assistance, to demand more practical responses, and to use them more constructively.

It is unrealistic to expect the promises of ISM-I to have been fulfilled at this stage, as they were exaggerated and over-stated and did not necessarily represent a common agenda. However, it is reasonable to expect clearer directions to have emerged, and more concrete results to have been obtained. Nonetheless, some movement is evident, and the overall results are consistent with objectives. Most importantly, the experience has confirmed the basic wisdom of project objectives, and the appropriateness of AID's decision to pursue them.

As Phase-I comes to an end, disappointments should not obscure the clarity of a sound strategy, nor should optimism obscure the fact that the overall process of physical rehabilitation and institutional development requires a commitment of at least fifteen years. AID should be prepared to signal such a commitment, and develop a timetable with the IBRD and GOP which fits the time and resources available, and clearly identifies reciprocal responsibilities and commitments, so that future phases can proceed more efficiently.

Now that the stage is set, Phase-II design should begin immediately and conclude rapidly to ensure that ISM-II implementation is fully synchronized with ISR-II under a single PC-1. The design should be based on a phased strategy, which sets overall parameters and permits specific details, such as TA requirements and equipment purchases, to be articulated during implementation. Phase-II should be designed and implemented with precise notions of short term and long-term sustainability objectives, which means establishing physical and institutional targets that emphasize O&M, as well as rehabilitation.

## Table of Contents


| | | Page |
|---|---|---|
| | Executive Summary | i |
| | Table of Contents | iii |
| | List of Tables | v |
| | Abbreviations and Acronyms | vi |
| | Currency Equivalents, Weights and Measures, Glossary | viii |
| | Introduction | 1 |
| 1. | Background | 2 |
| | 1.1 Government Policy in the Agricultural Sector | 2 |
| | 1.2 Water Resources Development | 3 |
| 2. | The Irrigation Systems Management (ISM) Project | 6 |
| | 2.1 Origin of the Rehabilitation Project | 6 |
| | 2.2 Participation of USAID | 7 |
| | 2.3 Institutional Setting | 8 |
| | 2.4 ISM Project Goal and Purpose | 10 |
| | 2.5 ISM Project Components and Implementation Plan | 10 |
| 3. | Project Components | 11 |
| | 3.1 Rehabilitation | 11 |
| | 3.2 Institutional Improvement: Management and Technical Skill Development | 17 |
| | 3.2.1 Increasing the O&M Capability of the PIDs | 17 |
| | 3.2.2 New Equipment | 19 |
| | 3.2.3 Workshop Improvements | 25 |
| | 3.2.4 Improved Design Capability | 26 |
| | 3.2.5 Management Information Systems | 30 |
| | 3.2.6 Training | 31 |
| | 3.2.7 Improving Water Management at the Federal Level | 35 |
| | 3.3 Technical Assistance | 38 |
| 4. | Policy Issues | 44 |
| | 4.1 Water Charges and Cost Recovery | 44 |
| | 4.2 Divestiture of SCARP Tubewells | 46 |
| | 4.3 O&M Financing | 47 |
| | 4.4 Hydraulic Analysis | 48 |
| | 4.5 Modernization of Management | 50 |
| 5. | Monitoring and Evaluation | 53 |
| 6. | Project Management | 57 |

7. Cross Cutting Issues 61

7.1 Sustainability 61
7.2 Impact on Women 62
7.3 Environmental Issues 62

8. Conclusions and Recommendations 63

Annexes

1. Scope of Work.
2. Actual Construction Machinery Procurement
3. Proposed List of Earthmoving and Workshop Equipment
4. Actual Workshop Equipment and Equipment Spare Parts
5. Comment on the Irrigation System Remodeling Design Process
6. Review of Activities under the Management Development Component of ISM-I
7. Fact Sheet - PRC Cheechi Contract
8. Chronology of Activities in Development of HDC
9. TOR for Monitoring and Evaluation for ISM/ISR-II
10. Lessons Learned for ISM-II
11. Annotated Logical Framework
12. Description of the Methodology Used in the Evaluation
13. Conclusions and Recommendations Matrix
14. Persons Consulted by the Evaluation Team
15. Bibliography of Documents Consulted

## List of Tables


| | | Page |
|---|---|---|
| 1-1 | Length, Discharge Capacity and Command Area of the Canal System | 5 |
| 1-2 | Discharge Capacities, Catchment Areas and Length of Surface Drains | 6 |
| 2-1 | Original ISM Project Financing, Including Proposed USAID Component | 8 |
| 2-2 | Summary of ISM Project Costs and Type of Funding | 9 |
| 3-1 | Civil Works Targets Under the ISM/ISR Project by Province | 12 |
| 3-2 | Progress of USAID Funded Canal and Drain Rehabilitation | 13 |
| 3-3 | Physical Progress of IDA Funded Rehabilitation | 13 |
| 3-4 | Physical Progress of USAID Funded Rehabilitation | 14 |
| 3-5 | Total Physical Progress of IDA and USAID Funded Rehabilitation | 15 |
| 3-6 | Summary of Equipment Procurement Under ISM | 21 |
| 3-7 | Technical Assistance Staffing Pattern by Area and Activity - April 1984 - December 1987 | 41 |

## Abbreviations and Acronyms Used

| | | |
|---|---|---|
| ac | - | Acre |
| ACE | - | Agriculture Commodities and Equipment Program |
| ACOP | - | Alluvial Canal Observation Project |
| ADB | - | Asian Development Bank |
| ADP | - | Annual Development Program |
| CADIS | - | Computer Aided Design for Irrigation Systems |
| CCA or cca | - | Canal Command Area |
| CDSS | - | Country Development Strategy Statement |
| CHOP | - | Canal Headworks Observa on Project |
| cusecs | - | Cubic feet per Second |
| DH | - | U.S. Foreign Service Officer (Direct Hire) |
| EAN | - | Economic Analysis Network Project, MINFA |
| FD | - | Finance Department |
| FCC | - | Federal Coordinating Cell |
| FFYP | - | Fifth Five-Year Plan (FY79-83) |
| FGW | - | Fresh Groundwater |
| FPC | - | Federal Project Coordinator |
| FPRB | - | Federal Project Review Board |
| FSN | - | U.S. Foreign Service National |
| GDP | - | Gross Domestic Product |
| GOP | - | Government of Pakistan |
| GOProvinces | - | Government of Provinces |
| HDC | - | Hydraulic Design Criteria |
| HDC(S) | - | Hydraulic Design Criteria (Simplified) |
| HP | - | Horsepower |
| IBRD | - | International Bank for Reconstruction and Development (World Bank) |
| IDA | - | International Development Association (World Bank) |
| IIMI | - | International Irrigation Management Institute |
| ISM | - | Irrigation Systems Management Project |
| ISM-II | - | Irrigation Systems Management Project, Phase II |
| ISRP-I | - | Irrigation Systems Rehabilitation Project, Phase I |
| ISRP-II | - | Second Irrigation Systems Rehabilitation Project, Phase II |
| Km | - | Kilometer |
| LAN | - | Local Area Network |
| M | - | Million |
| Maf | - | Million Acre Feet |
| Mcf | - | Million Cubic Feet |
| Mcm | - | Million Cubic Meters |
| Mha | - | Million Hectares |
| MINFA | - | Ministry of Food and Agriculture |
| MINWP | - | Ministry of Water and Power |
| MIS | - | Management Information System |
| Mkm | - | Million Kilometers |
| MNA | - | Member of National Assembly |
| MPA | - | Member of Provincial Assembly |
| MRs | - | Million Rupees |
| NESPAK | - | National Engineering Services, Pakistan |
| NWFP | - | North West Frontier Province |
| O&M | - | Operation and Maintenance |

| | | |
|---|---|---|
| OFWM | - | On Farm Water Management |
| PACD | - | Project Activity Completion Date P&D - Provincial Planning and Development Departments. |
| P&I | - | Planning and Investigation Division, WAPDA |
| PC | - | Provincial (Project) Coordinator |
| PC-1 | - | GOP Project Authorization Document |
| PCC | - | Project Coordination Committee |
| PERI | - | Punjab Economic Research Institute |
| PIL | - | Project Implementation Letter |
| PIO/T | - | Project Implementation Order/Technical |
| PP | - | Project Paper (USAID) |
| Ppm | - | Parts Per Million |
| PRC/Checchi | - | TA Consultants |
| PSC | - | Personal Services Contractor |
| RAP | - | Revised Action Program for Irrigated Agriculture, 1979 |
| SAR | - | Staff Appraisal Report (World Bank) |
| SCARP | - | Salinity Control and Reclamation Project |
| SDO | - | Sub-Divisional Officer |
| SDE | - | Sub-Divisional Engineer |
| SFYP | - | Sixth Five-Year Plan (FY84-88) |
| SGW | - | Saline Groundwater |
| TA | - | Technical Assistance Consultants (PRC/Checchi) |
| TDS | - | Total Dissolved Solids |
| TOR | - | Terms of Reference |
| TW | - | Tubewell |
| UNDP | - | United Nations Development Programme |
| USAID | - | U. S. Agency for International Development |
| USU | - | Utah State University |
| WAPDA | - | Water and Power Development Authority |
| WMED | - | Water Management Economics Directorate,WAPDA |
| WUA | - | Water Users Association |
| Xen | - | Executive Engineer |

## Currency Equivalents

Currency unit = Rupees (Rs)
US$1 = Rs 17
Rupee 1 = US$0.06

## Weights and Measures

| US Units | = | Metric Units |
|---|---|---|
| 1 inch (in) | = | 25.4 millimeters (mm) |
| 1 foot (ft) | = | 30.5 centimeters (cm) |
| 1 mile (mi) | = | 1.609 kilometers (km) |
| 1 acre (ac) | = | 0.405 hectares (ha) |
| 1 square mile | = | 259 ha.(sq. mi.) |
| 1 cubic foot/ | = | 0.0283 cubic meters/second (cfs) second ($m^3$/sec) |
| 1 acre foot(af) | = | 1233.5 cubic meters ($m^3$) |

## Glossary

| | | |
|---|---|---|
| beldar | - | irrigation department workman who patrols canal embankments and carries out routine maintenance |
| chak | - | lowest order of irrigation command (about 450 ac.) |
| doab | - | land area lying between the channels of two river tributaries |
| kharif | - | wet season (Mid-April to mid-October) |
| mogha | - | controlled outlet from parent canal to chak |
| rabi | - | dry season (mid-October to mid-April) |
| warabandi | - | weekly rotational schedule of irrigation deliveries to farmers |
| watercourse | - | irrigation distribution system in a chak |

## Fiscal Year

| | | | |
|---|---|---|---|
| Government of Pakistan | July 1 | - | June 30 |
| United States Government | October 1 | - | September 30 |

# INTRODUCTION

The Irrigation System Management (ISM) project consists of four discrete but interrelated components: (1) rehabilitation works; (2) institutional strengthening; (3) research and policy implementation; and (4) command water management. The project was initiated in FY83 and will be completed in FY91. Although the PACD is three years away, virtually all funds for the first two project components will have been disbursed or committed by mid-1988. The third component, research, began in 1985, and the command water management component did not become fully operational until late 1986.

A draft amendment to the Project Paper (PP) was prepared in mid 1987, focusing on rehabilitation works, institutional, management and technical skill improvement; and planning and policy implementation. It was agreed with AID Washington that an evaluation of activities during Phase I would be carried out to provide the basis for final preparation of the amendment.

The purpose of the evaluation is to review implementation progress of the project and to assess whether or not project activities are geared towards the achievement of project goals. The objectives of the evaluation are: (1) to assess progress to date in implementing the ISM project, particularly as it relates to the rehabilitation and the institutional improvement components, and (2) to review and evaluate project management issues with a view toward recommending improvement based on host government institutional capabilities and constraints. AID W noted in its review of the preliminary draft of the amendment that the evaluation should examine "what has worked and what has not, and what lessons learned are applicable to the project amendment".

The ISM project is co-financed by the International Development Association (IDA), an affiliate of the World Bank, through its Irrigation System Rehabilitation (ISR) project. The two projects are highly complimentary and incorporate the same policy agreements and project covenants. To maintain this integrated approach, USAID and the World Bank consider it essential that their respective project agreements be jointly incorporated into a single Government of Pakistan (GOP) PC-1 for FY89. Hence, timely fielding of the ISM evaluation team is critical to the overall project schedule.

The Irrigation Support Project for Asia and the Near East (ISPAN), a regional project of the Asia and Near East Bureau, AID Washington, was requested to recruit and field a team as specified in the Mission approved Scope of Work (Annex 1) through a mission buy-in. ISPAN was able to field a six-man team within about six weeks.

The evaluation team consisted of:

Jack Cave, Equipment and Workshop Specialist

W.A. Garvey, Water Resource Engineer, and Chief of Party

Ken Nobe, Economist & Institutional Specialist

Ted Schuurmans, P.E., Public Works Engineer

Larry Swarner, P.E., Operation & Maintenance Specialist

Clay Wescott, Management and Computerization Specialist

The team was assisted by S.S. Peabody III, Senior Water Management Specialist, AID/Washington (ANE TR ARD), and Anis Yousef, Senior Irrigation Engineer, World Bank Resident Mission to Pakistan. The team was also assisted by the ISM Project Officer, M. H. Qureshi, AID Policy Advisor M. I. Chishti, and AID FSN Sohail M. Malik. Sohail Sheikh was a most able and invaluable secretary and administrative assistant to the team.

## Chapter 1

## BACKGROUND

### 1.1 Government Policy in the Agricultural Sector1/

Agriculture occupies a pivotal place in Pakistan's economy. Over 50% of the population is engaged in agricultural production activities. The largest goods producing sector in Pakistan's economy is agriculture. Its contribution to the gross domestic product (GDP) decreased from 40% in FY65 to about 26% in FY85 because of more rapid growth in other sectors.

Seasonal production variations generally reflect the dominance of weather and other exogenous factors, and irrigation water availability. Yields of major crops remain well below those of some other developing countries. Even though Pakistan's climate would permit all-year cropping in most of the irrigated areas, the cropping intensity averaged only 96% for the irrigated land in FY85. Hence, there remains ample opportunity to further increase Pakistan's agricultural production.

During the last three decades, GOP's agricultural policies generally stressed large water projects, food and input subsidies, and agricultural price support. Some essential requirements for agricultural production, such as field oriented research, extension programs, water management, and operation and maintenance (O&M) of the irrigation systems were severely neglected until recently. During the Fifth Five-Year Plan (FFYP, FY79-83) steps were taken to rectify these deficiencies and these initiatives have been carried over into the Sixth Five-Year Plan (SFYP, FY84-88). Major agricultural sector strategies of these plans include:

(a) Improved availability of modern non-water inputs (fertilizer, pesticides, and improved seeds) with emphasis on privatization of distribution and sale of these inputs;

(b) Upgraded services (extension and institutional credit);

(c) Spread of farm mechanization; and

(d) Improved input of irrigation water, with emphasis on water management, systems rehabilitation, O&M and drainage of water-logged lands.

The water subsector policies pursued in the FFYP and continued in the SFYP grew out of the UNDP financed Indus Basin Study in the 1970s carried out by WAPDA for which the World Bank served as executing agency. This study's report, "Revised Action Program (RAP) for Irrigated Agriculture (May 1979)", recommended numerous policy and institutional improvements (including privatization of public tubewells in FGW areas) and placed investment priority on drainage, rehabilitation and water management.

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1/ This Chapter is drawn largely from the Staff Appraisal Report (SAR), Second Irrigation Systems Rehabilitation Project, World Bank, November 1987, Report No. 6991 PAK.

## 1.2 Water Resources Development

**Climate.** Pakistan's climate is arid to subtropical allowing year round cultivation in most irrigated areas. Annual precipitation is less than 150mm over much of the Indus plain, 1/ whereas pan evaporation varies from 1,250mm to 2,800mm, which makes irrigation a necessity for most agricultural production. Heavy rainfall does occur during some monsoon seasons causing substantial flood damage to crops and property, and loss of human lives. For example, in 1973 and 1976, floods caused damage in excess of US$1,800 M.

**Water.** The total annual surface water inflow to the Indus Plain is 185,000 million cubic meters(Mcm). The quality of this surface water is good for irrigation, with total dissolved solids (TDS) between 100 to 350 ppm. There is extensive groundwater underlying the Indus Plain with slightly less than 50% being of satisfactory quality for irrigation. Fresh groundwater (FGW) pumpage annually supplies about 42,000 Mcm for irrigation. Of the approximately 250,000 Mcm of water (including rainfall) available to the Indus Plain annually, only about 83,000 Mcm is available to crops because of unavoidable losses, poor water management, and lack of adequate storage facilities in the lower reaches of the canal delivery system.

**Indus Irrigation System.** The Indus Irrigation System (14.0 Mha cca) is the largest contiguous irrigation system in the world. It comprises the Indus River and its major tributaries, three major storage reservoirs, 29 barrages and headworks, 12 link canals, 43 canal commands and some 95,000 chaks. The total length of the canal system is about 58,500 km with watercourses, farm channels and field ditches in the chaks totaling another 1.6 Mkm.

**Canal System.** Water from the river channels is diverted by barrages and headworks into the main canals. Generally, the hierarchical canal system runs from main canals to branch canals, distributaries, and minors. Table 1-1 gives summary data on irrigation channels by Province.

Generally, canal design criteria for the Indus System have been tailored to:

(a) Fit the availability of water supplies in the river;

(b) Meet the objective of bringing crops to maturity on the largest possible area with the minimum consumption of water; and

(c) Operate with a low O&M budget and with a limited number of technical staff.

These design criteria, along with deferred maintenance and reluctance by farmers to add other production inputs because of water supply uncertainties, have resulted in low cropping intensities and low yields.

---

1/ Since over 80% of Pakistan's irrigated area is commanded by the Indus Irrigation System, unless specifically noted otherwise, reference to the irrigation program will relate to that in the Indus Plain.

Until 30 years ago the extensive groundwater resource under the Indus Plain was viewed more as a waterlogging hazard than an asset that could yield additional irrigation water. The first large scale salinity control and reclamation project (SCARP-I) was started in 1959 and involved installation of 2,069 public tubewells (TW), generally with turbine pumps, and capacities ranging from about 55 to 140 l/s. As of June 1987, WAPDA had installed about 11,000 public TWs in FGW zones and about 1,500 in saline groundwater (SGW) zones.

In part as a result of the SCARP TW experience and related financial returns achieved, farmers in the late 1950s began installing and operating small TWs (generally equipped with centrifugal pumps with capacities smaller than 55 l/sec). It is estimated that about 225,000 private TWs are in operation with a total annual pumpage of about 22,000 Mcm which exceeds by about three times public TW pumpage of 9,725 Mcm.

Table 1-1

**Length, Discharge Capacity and Command Area of the Canal System**

| | Total Length (km) | Discharge Designed Capacity (m3/sec) | CCA (Mha) |
|---|---|---|---|
| Punjab | 36700 | 7700 a/ | 8.36 |
| Sind | 18625 | 3750 | 4.93 |
| NWFP | 2300 | 220 | 0.36 |
| Baluchistan | 825 | 135 | 0.31 |
| Total | 58450 | 11805 | 13.96 |

a/ Includes link canals.
Source: "Rehabilitation of Irrigation and Flood Protection Works in Pakistan", NESPAK, October 1981 (cca adjusted on basis of RAP data).

**Drainage Facilities.** The flat topography and lack of well defined natural drainage in the Indus Plain create a surface drainage problem which has been compounded by the construction of roads, railways, floods embankments, and irrigation distribution networks that obstruct natural drainage flows. This problem is particularly severe in large areas of Sind Province where the landscape consists in part of low-lying, shallow, flat basins between the elevated Indus channels and the sea. Over the years a large network of surface drains has been constructed in Punjab's doabs and more recently in tail reaches of the Rohri and Nara canal commands in Sind. Table 1-2 gives a summary of the major characteristics of existing surface drains.

The surface and subsurface drainage systems in the irrigated areas of Pakistan are inadequate. Subsurface drainage is required for most irrigated land where the water table is less than 2.0 m deep (about 3.0 Mha).

Table 1-2

Discharge Capacities,Catchment Area and Length of Surface Drains

| Province | Discharge Designed (m3/sec) | Catchment Area (Km) | Total Length Drains (Km) |
|---|---|---|---|
| Punjab | 425 | 23390 | 6320 |
| Sind | 280 | 17390 | 5980 |
| NWFP | 95 | 2780 | 1990 |
| Baluchistan | 10 | 360 | 160 |
| Total | 810 | 44250 | 14450 |

Source: NESPAK, Ibid

## Chapter 2

## THE IRRIGATION SYSTEMS MANAGEMENT PROJECT

### 2.1 The Origin of the Rehabilitation Project

The ISM project is a USAID co-financed component of the ISR project The ISR Project was formulated in 1979-80 by the GOP and the World Bank in response to the water sub-sector needs and investment priorities adopted in the RAP. The rehabilitation needs of existing facilities included canal and surface drains.

Canals. Because of the completed Indus Basin civil works and the increasing demands for irrigation water, many canals are carrying quantities of water well in excess of their design capacities and beyond the limits of safe operation. Many canals are operating with inadequate freeboard, berms have been eroded away, inspection road widths are inadequate, outside portions of the embankments have deteriorated, sedimentation has severely reduced capacity, and many hydraulic structures need repair. Embankments and prisms are ravaged by the unauthorized crossing of people, farm animals and vehicles. Canal breaches have been frequent.

Surface Drains. The older surface drains were designed with "rule-of-thumb" criteria ranging from about 30 to 110 l/sec per square mile. The adequacy of this approach has not been satisfactory evaluated but the conventional wisdom is that systems so designed are generally inadequate. In addition, many areas are not covered by a surface drainage system. Because of inadequate maintenance, many of these drains have become clogged with sediment and weeds.

A feasibility report for a canal and drain rehabilitation project was prepared for the World Bank by National Engineering Services (Pakistan) Limited (NESPAK). The Bank' Staff Appraisal Report (SAR), completed in September 1981, described the following objectives for the ISR project:

(a) Increase agricultural production by:

  (i) providing a more reliable water supply by reducing risk of failures in the irrigation network; and

  (ii) reducing crop losses from rain flooding by improving the surface drainage system;

(b) Provide a more equitable irrigation water supply to all farmers by increasing deliveries to watercourses in the tail reaches of the minors and distributaries through a program of silt removal from selected channels;

(c) Strengthen the capability of the Provincial Irrigation Department's (PID's) O&M program so as to improve the efficiency of system operation and assure continued maintenance of the installed facilities;

(d) Serve as a Phase-I model of a larger and continuing program of a similar nature that could be replicated in future projects.

The ISR project included civil works for rehabilitation of 14,000 km of canals and 3,500 km of surface drains; construction equipment for use in rehabilitation and maintenance work; technical assistance; and training. The project was to be implemented through the PIDs but provided for a Federal Coordination Cell (FCC) in the Ministry of Water and Power to strengthen coordination of planning, and provide supervision, technical review, and quality control.

## 2.2 Participation of USAID

World Bank appraisal of the ISR project was carried out in June, 1981, during which USAID agreed to co-finance the project. ISR financing was accordingly modified as indicated in Table 2-1.

Table 2-1

**Original ISR Project Financing, Including Proposed USAID Component**
($ Million, 1981)

| Project Elements | Cost | GOP | Total External Financing IDA | AID | Total |
|---|---|---|---|---|---|
| 1. Civil Works | 59.6 | 17.2 | 28.7 | 13.7 | 42.4 |
| 2. Equipment | 28.8 | 8.6 | - | 20.2 | 20.2 |
| 3. Technical Assistance | 3.0 | - | 1.6 | 1.4 | 3.0 |
| 4. Training | 0.3 | - | - | 0.3 | 0.3 |
| 5. Supervision and and Administration | 0.1 | 0.1 | - | - | - |
| 6. Contingency | 26.3 | 7.2 | 9.7 | 9.4 | 19.1 |
| Total | 118.1 | 33.1 | 40.0 | 45.0 | 85.0 |

The USAID's ISM project was formulated in July and August of 1982, based on the findings of a project design mission, and negotiations involving the GOP and the four PIDs. The reformulated project placed greater emphasis on technical assistance and training to strengthen the capability of the PIDs to rehabilitate, operate and maintain the irrigation and drainage system.

The distribution of USAID funding among various elements of each of the three components is summarized in Table 2-2. Total USAID funding increased from $45M to $103M. The new project design incorporated three components: rehabilitation works, institutional improvements, and research. A fourth component, command water management, was added later as an amendment. The level of funding for civil works remained the same, but funding for TA was increased from $1.4M to about $29M, and funding for training was increased from $0.3M to about $11.7M. Funding for equipment increased from $20.2M to $38M, including $6M for the research component

The USAID and IDA projects were intended to be highly complementary. The IDA project emphasized the financing of civil works construction and provided local supervisory consultants, while the USAID project focused primarily on the provision of

**Table 2-2**
**Summary of ISM Project Costs and Type of Funding**
**($ 1000 1983)**

| Project Element | Total Cost | USAID Grant LC | USAID Grant FE |
|---|---|---|---|
| 1. Rehabilitation Works | | | |
| a. Commodities | 2000 | - | - |
| b. Civil Works | 13700 | 13700 | - |
| Sub-Total | 15700 | 13700 | 2000 |
| 2. Institutional | | | |
| a. Technical Assistance | 12319 | 3357 | 8962 |
| b. Training | 4273 | 955 | 3318 |
| c. Commodities | 1335 | 596 | 739 |
| Sub-Total | 17927 | 4908 | 13019 |
| 3. Research | | | |
| a. Technical Assistance | 16685 | 5008 | 11677 |
| b. Training | 7449 | 1704 | 5745 |
| c. Commodities | 994 | 593 | 401 |
| d. Other Costs | 2058 | 2058 | - |
| Sub-Total | 27186 | 9363 | 17823 |
| Contingency | 4187 | 2029 | 2158 |
| Total (ISM) | 65000 | 50000 | 35000 |
| 4. Equipment Procured under AC&E Program | 38000 | - | 38000 |
| Total | 103000 | 30000 | 73000 |

Source: ISM Project Paper, May 1983, Section V.E

equipment and workshop rehabilitation, technical assistance, and training. Both projects rely on the federal and provincial coordinating cells utilizing the same scope and approach to the civil works component. Both promote the same policy changes, and incorporate the same covenants in their respective project agreements. However, on a more substantive level, ISM shifted the focus of the project from rehabilitation and improved O&M, to rehabilitation and system redesign in the belief that new design criteria were necessary to solve canal siltation problems.

## 2.3 Institutional Setting

The ISM project design was intended to focus primarily on the problems and weaknesses of the institutions responsible for the operation and maintenance of the Indus

irrigation system. Although some elements of that system can be traced back at least to the Moghul period, the system was essentially completed during the British period. The canal system (Table 1-1) was designed and built by the PIDs established by the British.

The PIDs are engineering organizations with line responsibility for the construction, operation, and maintenance of the irrigation and drainage system down to the level of the watercourse. They each have an extensive field organization and a central secretariat with offices responsible for design, planning, equipment management, hydrology, and research. Day-to-day responsibility for carrying out construction, operation, and maintenance activities is highly decentralized. Punjab Province is divided into five zones, 20 circles, and 84 divisions that each comprise several subdivisions. Sind Province has 40 divisions under three Barrage Chief Engineers. Baluchistan has only one Chief Engineer-Irrigation and six Superintending Engineers (SE, in charge of a Circle), but 15 Divisions and 43 Subdivisions. NWFP has one Chief Engineer-Irrigation, four circles, and 16 Divisions. In the Punjab Province the head of the Division office (an XEN, Executive Engineer) is responsible for the assessment of water charges. The Revenue Department is responsible for assessing and collecting water charges in all the other provinces.

Investment in the irrigation sector since independence in 1947 has been concentrated on completing major storage projects, barrages, and link canals needed to implement the Indus Basin Project. These investments were planned, designed, and implemented at the federal level by a new agency WAPDA, whose staff was drawn from the PIDs.

There has been very little investment or involvement of the donors at the provincial level. On the contrary, the donors had created and built up WAPDA, a federal agency, by recruiting the best engineers available in the PIDs, and developed and financed the On-Farm Water Management Program in the Agriculture Departments which effectively separated the PIDs from the farmers. The ISM ISR financing is desperately needed by the PIDs but the donor interest did not appear initially to have been welcomed because of their past indifference to the problems of the PIDs.

As a consequence of the federal additions and improvements to the system, and rising demand for water, the PIDs were responsible for operating, with higher flows, an aging system that generally had not been maintained. The need to rehabilitate the system of canals and drains to insure its integrity and improve water distribution focused attention on continuing operation and maintenance, and ultimately, on the constraints faced by the PIDs. These fall into two broad categories:

(1) The PIDs have consistently received very low revenue budget allocations which had to be used for O&M as well as repair and rehabilitation. Hence, as problems with the overtaxed and aging canal and drain system mounted, O&M funds were increasingly diverted to deal with the most serious problems each year. As a consequence the system as a whole steadily deteriorated. Revenue budget allocations did not keep pace with inflation and actually declined in real terms. Budgeting and planning became increasingly unrealistic as the choice of what to do and how to do it was tailored to suit the chronic condition of dwindling and inadequate resources.

(2) Throughout the long period of severely limited financial resources, inadequate attention was given to maintaining the professional quality and standard of

the staff. Procedures were not updated or modernized, and discipline deteriorated. These conditions were to a significant extent caused by the effort to tailor standards and procedures to fit the cost of activities, such as construction and maintenance, within limited budgets. The equipment inventory was not maintained or updated to suit the growing requirements. Hence, a key component of the ISM project was to promote an appropriate institutional environment to ensure an effective O&M program by strengthening the PIDs.

## 2.4 ISM/ISR Project Goal and Purpose

The goal of the integrated ISM ISR project is to increase agricultural production and farmer income by improving the management of irrigation water resources. The primary purpose of the ISM component is to increase the capabilities of institutions involved in irrigation planning, design, research, operation and maintenance, and to assist in bringing about policy changes needed for proper irrigation water management.

## 2.5 ISM Project Components and Implementation Plan

The ISM project consisted of three components: rehabilitation works; institutional improvements, and planning, policy implementation, and research. The institution improvement component include several elements:

- Increase the operation and maintenance (O&M) capability of the PIDs in six areas

  - Procurement of new equipment
  - Workshop improvements
  - Equipment management
  - Improved design capability
  - Management training
  - Development of a management information system

- Improve water management at the Federal level by establishing a Federal Coordinating Cell

  - To coordinate and manage the rehabilitation work
  - Monitor water distribution
  - Evaluate the impact of project activities

- Provide technical assistance
- Implement a training program
- Provide commodities
- Implement computer technology

The implementation plan called for the rehabilitation works to be completed within three years of the date of the Project agreement (May 1983) in accord with the ISR project schedule, all other project activities (except the Command Water Management component) were to be completed within five years of the project agreement date. The institutional arrangement for implementation of the project was very complex and involved the new Federal Cell, Provincial Coordinators, several federal agencies, six TA teams, of which five were long-term, a supervisory consultant under the ISR project, and USAID DH, ESN, and PSC staff.

## Chapter 3

## PROJECT COMPONENTS

The ISM Project consists of four distinct but interrelated components, namely, (1) rehabilitation works, (2) institutional and technical skills improvement, (3) research and policy implementation, and (4) command water management. The assignment of the evaluating team, however, was to assess the progress made to date as it relates to the rehabilitation and the institutional improvement components.

### 3.1 Rehabilitation

Under ISM, funds were provided to carry out rehabilitation on selected canals and drains. Technical assistance was provided through four teams of expatriate and local consultants in the fields of engineering, equipment management, planning and management, and research. All of these teams were indirectly involved in the civil works component of the project, in such areas as improving rehabilitation design capability; improving provincial workshops and their ability to maintain and operate equipment; and improving the management and organizational skills within the PIDs. ISM ISR provided funds to rehabilitate about 14,000 Km of canals and re-section about 3,500 Km of surface drains, as shown in Table 3-1.

Table 3-1

**Civil Works Targets Under the ISM/ISR Project By Province**
(Km)

| Province | Canal Rehabilitation | Drain Rehabilitation | Total |
|---|---|---|---|
| Punjab | 11144 | 1157 | 12301 |
| Sind | 2476 | 2173 | 4649 |
| NWFP | 699 | 76 | 795 |
| Baluchistan | 85 | - | 85 |
| Total | 14404 | 3406 | 17810 |

Source: ISM Project Paper May, 1983

**Project Activities.** ISM ISRP was designed to finance rehabilitation of deteriorated irrigation and surface drainage systems in all four provinces. Civil works on the canals included the rehabilitation of canal banks to their original design with adequate access roads where needed and the restoration of the canal prisms to their normal section by cleaning and or full-bushing. Civil works on the surface drains included excavation of channels and the provision of inlet to the drainage channel. Guidelines and criteria were established for selecting canal and surface drains to be rehabilitated. Project guidelines emphasized rehabilitation of complete systems or subsystems and those with inequitable water delivery.

Due to the limitation of funds, and the increasing rate of canal breaches, the PIDs felt it was imperative to rehabilitate first the badly deteriorated canal sections which presented a serious threat to the delivery of water. With agreement from USAID and

the World Bank, rehabilitation efforts were concentrated on canal reaches in imminent danger of breaching and in areas where ineffective surface drainage was removing land from agricultural production. The IDA program focused primarily on canals and USAID's portion focused primarily on drainage.

**Achievements.** USAID funded work completed by the PIDs is summarized in Tables 3-2 to 3-5. The Civil works on the canals in the Punjab province consisted of outside embankment improvements only. Rehabilitation work on the canal prisms was delayed pending agreement on the hydraulic design criteria to be used for canal prism restoration. In Sind Province the canal prism of three systems were redesigned by the TA consultants and the canal prism of one canal system was redesigned by the Sind design office. The prisms of two of the four systems were rehabilitated during the closure season. The outer banks are now being rehabilitated. No field work has been done on either of the other two systems.

Table 3-2

**Progress of USAID Funded Canal and Drain Rehabilitation**
**(In Kilometers, through Dec. 31, 1987)**

| Provinces | Canals (Km) | | Drains (Km) | | Total (Km) | | |
|---|---|---|---|---|---|---|---|
| | Targ. | Prog. | Targ. | Prog. | Targ. | Prog. | % |
| Punjab | 670 | 469 | 919 | 850 | 1589 | 1319 | 83 |
| Sind | 352 | 177 | 1060 | 1017 | 1412 | 1194 | 85 |
| NWFP | 64 | 36 | 39 | 34 | 103 | 70 | 68 |
| Baluchistan | 11 | 10 | - | - | 11 | 10 | 91 |
| Total | 1097 | 692 | 2018 | 1901 | 3115 | 2593 | 83 |

Source: Project Staff

In the North West Frontier Province, four sections of canal have been rehabilitated, mainly by rock pitching. Structures crossing these canal sections have also been rehabilitated. Canals have been restored to their original design. In Baluchistan Province, only a minor amount of rehabilitation work was programed and completed. This was the restoration of two weirs and lining of a small amount of adjacent canal sections. Surface drains rehabilitated in the Punjab, Sind and North West Frontier Province were restored to their original design.

**Quality and Adequacy of Construction.** The rehabilitation of canal embankments has restored the bank to its original condition based upon the original design. The drains were restored to their original design. The design criteria for the original canals and drains is found in the Public Works Department Manual of Irrigation Practice.

Specifications for the construction of civil works were prepared by USAID and NESPAK, based upon "Specifications for Execution of Works, 1967, Vol-I, Part II Publication No. 21" published by West Pakistan Standing Rates Committee, Lahore. These specifications appear to be adequate for the civil works performed. Although

Table 3-3

**Physical Progress of IDA Funded Canal and Drain Rehabilitation**
**(Million Cubic Feet)**

| | Project Target Schemes | Actual Execution | Percent Completed |
|---|---|---|---|
| Earthwork | | | |
| Punjab | 1160 | 1125.5 | 97 |
| Sind | 850 | 826.1 | 97 |
| NWFP | 23 | 22.6 | 98 |
| Baluchistan | 57 | 56.5 | 99 |
| **Total** | 2090 | **2015.9** | **97** |
| Stonework | | | |
| NWFP | 4.2 | 2.84 | 67 |
| Baluchistan | 1.2 | 1.13 | 94 |
| **Total** | **5.4** | **3.96** | **73** |
| Concrete | | | |
| NWFP | 1.4 | 1.08 | 77 |
| Baluchistan | 0.9 | 0.59 | 65 |
| **Total** | 2.3 | **1.61** | **70** |

Source: NESPAK Progress Report, ISM Oct.- Dec. 1987.

agreement on specifications was reached prior to the start of rehabilitation, it was difficult to get the contractor to meet the specifications. The supervisory consultant, NESPAK, inspects all ISM ISR funded schemes. In addition, USAID funded ISM schemes are inspected and certified by AID ESN project engineers. Work sites are inspected periodically. Full time inspection would improve compliance with specifications.

The enforcement of specifications for rehabilitation work particularly in regard to compaction of earthwork, is a step forward and it is evident that ISM has had a beneficial impact on construction practices. Efforts to enforce these specifications must be continued. Where the Team visited rehabilitated areas or where the rehabilitation work was in progress, work generally appeared to have been completed in a satisfactory manner.

Restored canal embankments and drains can be expected to perform satisfactorily with routine day-to-day preventive maintenance and compliance with operational guidelines.

However, the Team also observed rehabilitation work which was not or had not been done in a satisfactory manner. For example, in the NWFP, stone pitching was being placed on canal embankments without proper compaction. The team was informed that mechanical compactors were not available. However, hand tamping was not being used,

Table 3-4

**Physical Progress of USAID Funded Rehabilitation**
**(Million Cubic Feet)**

| | Project Target Schemes | Actual Execution | Percent Completed |
|---|---|---|---|
| Earthwork | | | |
| Punjab | 355 | 216.7 | 61 |
| Sind | 261 | 131.3 | 50 |
| NWFP | 10 | 10.1 | 100 |
| Baluchistan | 15 | 1.1 | 7 |
| **Total** | **641** | **359.9** | **56** |
| Stonework | | | |
| NWFP | 1.7 | 0.47 | 28 |
| Baluchistan | 0.1 | 0.05 | 50 |
| **Total** | **1.8** | **0.52** | **29** |
| Concrete | | | |
| NWFP | 0.6 | 0.23 | 38 |
| Baluchistan | 0.3 | 0.31 | 100 |
| **Total** | **0.9** | **0.54** | **60** |

Source: NESPAK Progress Report, ISM Oct.- Dec. 1987.

either. The Rarwind main drain in Punjab Province was rehabilitated two years ago. It appeared that the excavated material was never dressed down and adequate bunds or dowels were not constructed on the left side of the drain to divert the water to the drain inlets. In some areas side sloughing was taking place due to the side slopes being too steep to remain stable against the sub-soil water pressure and heavy surcharge of the spoil banks.

ISM did not require the seeding or planting of grass on rehabilitated embankments. Such seeding would help stabilize banks and help prevent wind and water erosion. Specifications for future work should require seeding or sodding of new embankments.

**Operating Performance of Completed Works.** The canal rehabilitation has generally been completed in a satisfactory manner, but they will operate properly only if proper operating criteria are established and followed. The Public Works Department's Manual of Irrigation Practice (1943, revised 1963) contains good operating criteria, as well as the four general O&M manuals prepared by the TA consultants. Efficient and effective operation and management of the irrigation system is a necessary step in the implementing of a strategy aimed at improving the productivity of land and water resources.

Table 3-5

**Total Physical Progress of IDA and USAID Funded Rehabilitation (Million Cubic Feet)**

| | Project Target Schemes | Actual Execution | Percent Completed |
|---|---|---|---|
| **Earthwork** | | | |
| Punjab | 1515 | 1342.2 | 89 |
| Sind | 1111 | 957.4 | 86 |
| NWFP | 33 | 32.8 | 99 |
| Baluchistan | 72 | 57.6 | 80 |
| Total | 2731 | 2390.0 | 88 |
| **Stonework** | | | |
| NWFP | 5.9 | 3.31 | 56 |
| Baluchistan | 1.3 | 1.18 | 91 |
| Total | 7.2 | 4.49 | 62 |
| **Concrete** | | | |
| NWFP | 1.5 | 1.31 | 87 |
| Baluchistan | 1.2 | 0.90 | 75 |
| Total | 2.7 | 2.21 | 82 |

Source: NESPAK Progress Report, Oct. - Dec. 1987

**Operation and Maintenance Requirements of Completed Civil Works.** Real progress has been made in the ISM project in the recognition of the importance of preventive maintenance, but much more needs to be done. It is essential that day-to-day preventive maintenance be carried out on rehabilitated canals and drains if they are to function properly and remain in a acceptable condition. Some Executive Engineers expressed the opinion that once the embankments were rehabilitated there would be no need of maintenance for five years. Little evidence was available that the beldars, who patrol roads, canals and drains, were performing day-to-day maintenance including restoring minor dowel damage, filling rain cuts, filling chuck holes in the roadway, or removing debris from the channels. Unless this preventive maintenance is carried out on the completed rehabilitated works it will become necessary to rehabilitate the facilities again in about five years. Although some maintenance work was observed in removing reeds and brush from the drainage channels, it was apparent that a good program of preventive maintenance is not yet being carried out on rehabilitated drains. In numerous instances on the Raiwind Main Drain, water enters the drain through rain cuts rather than flowing through the masonry constructed inlets. A preventive maintenance program would have corrected these deficiencies before the approaching rainy season. Project activities, insofar as operation and maintenance is concerned, have not been geared to ensure that these rehabilitated facilities will remain in their rehabilitated state.

A good operations and maintenance program includes a telecommunication system appropriate to management requirements. The present system was established in 1905 and comprises a network of telephone and telegraph lines used to transmit vitally needed information about irrigation water. Major emphasis is given to the transmission and reception of readings from gauge stations. The gauge readings of canal levels and discharges are taken manually and recorded. Another use of the system is to transmit management and administrative directives and information between the offices of PIDs at various levels. The present system is outdated and unreliable.

Each PID should adopt a policy of modernizing and rationalizing its telecommunications system for each canal system that is redesigned and rehabilitated. Telecommunications should be quick, reliable, and have priority over-ride features in support of improved O&M activities on all rehabilitated canals. This will link gate tenders, gauge readers, maintenance supervisors, and equipment managers by effective telecommunications.

An improved transport system is needed by PID personnel if they are to perform their O&M and field and supervisory duties properly. This is particularly true for improved O&M work on rehabilitated canals. The strengthening of transport facilities for supervisory staff is a critical aspect of improved O&M.

**Utilization of Equipment.** Most of the equipment provided to the irrigation Divisions was of a large type more suited to the rehabilitation of larger canal embankments and drains. A list of equipment received under Phase-I is shown in Annex 2. Some of this equipment has been used to good advantage in the rehabilitation of drains and the outer embankments of the canals but it is generally too large for rehabilitation of smaller channels. Conversely, the two dredges provided proved to be too small for the volume of dredging required. Additional small equipment is needed to carry out a successful operation and maintenance program for the rehabilitated facilities. (see Section 3.2.2)

**Conclusions and Recommendations.** The absence of effective communications between USAID, the PIDs, NESPAK, and the TA Consultants has probably been the greatest problem in implementing the overall rehabilitation program. The lack of direction throughout the program caused it to move more slowly than was originally anticipated. Delays in preparation and approval of plans inhibited progress. Specific problems such as the lack of agreement on the hydraulic design criteria were a major obstacle to making progress in the rehabilitation of the canal prisms in Punjab Province. Difficulty was experienced in ensuring the agreed upon construction specifications were met. Insofar as O&M is concerned, it appears that the importance of a day-to-day preventive maintenance program has not been recognized or put into effect by the PIDs.

A strong preventive maintenance program which includes annual inspections must be carried out on the rehabilitated facilities if they are to remain in a fully functional condition. Additional small O&M equipment, such as farm tractors, trolleys, compactors, water tanks, and backhoes, is needed to carry out a preventive maintenance program on the rehabilitated works as well as on the un-rehabilitated canal and drainage systems. At the present time, operation and maintenance activities are not programmed or scheduled. The introduction of modern equipment makes planned maintenance more important. Discipline, supervision, and skills in basic operation and maintenance practices are lacking and this issue has not been adequately addressed in the ISM project.

Training in operation and maintenance at all levels should include seminars, short courses and on-the-job training.

### 3.2 Institutional Improvement: Management and Technical Skill Development:

The surface and subsurface drainage systems in most irrigated areas of Pakistan are inadequate. The combination of a flat topography, lack of well-developed natural surface drainage system, construction of roads, railways, flood embankments, and irrigation canals, restrict natural drainage flow. The ISM and ISR projects provided funds for re-sectioning about 3,400 Km of drains. The ISM target was 2018 Km, of which about 1,900 Km are reported as completed.

In addition to re-sectioning drains, high priority should be given to solving short-term problems such as erosion of side slopes of channels, erosion near the ditch from side flows usually at inlet structures, and erosion from spoil banks. Sloughing of side slopes is also a critical problem. Although these problems are more closely related to maintenance, they could also be design related. Because of the importance of drainage to the continued production of agricultural lands, it should receive greater emphasis. Recommendations contained in the report "Surface Drainage of Irrigated Land in Pakistan" by Glenn O. Schwab (March, 1986) should be carried out.

#### 3.2.1. Institutional Improvement: Increasing the O&M Capability of the PIDs

One of the main objectives of the ISM ISR projects was to increase the operation and maintenance capability of the PIDs in all phases of their program. It was envisioned that the institutional improvement program would support management strengthening for all personnel, including decision makers who plan multi-year programs; engineers who supervise design and construction, schedule machinery, and allocate water; and heavy equipment specialists. The major rehabilitation program undertaken by the PID was to serve as a living laboratory for institutional improvement.

**Project Activities to Increase O&M Capability.** This project component consisted of six activities which were designed to improve the O&M capability of the PIDs: (1) procurement of new equipment; (2) workshop improvement; (3) equipment management; (4) improved design capability; (5) management training program development; and (6) development of a management information system.

**Achievements.** It is difficult to measure quantitatively the degree of success in meeting the envisioned goals. Expectations originally envisioned in ISM were overly optimistic. Although beset with problems, ISM certainly has contributed to institutional improvement and provides a good foundation for continued institutional improvement during Phase-II.

**Use of Funding Yardsticks.** The PIDs have had funding yardsticks for many years. The TA consultants reviewed the PID's procedures for up-dating these yardsticks and recommended that the practice of up-dating by applying a multiplier to past yardsticks be discontinued. Yardstick quantities should be updated separately and only when they are found to be inconsistent with desired standards. Unit costs should be updated annually to reflect the general escalation of construction costs. All of the provinces have agreed that past yardsticks are inadequate and need to be revised. A good start has been made on the development of new yardsticks but additional work is required. It is expected

that the use of new yardsticks will result in more realistic cost estimate and provide a better basis for monitoring compliance with developed standards.

**Funding and Budgeting.** As a general rule, the operation and maintenance program is under-funded. Budget preparation begins with the Executive Engineer at the Division level. Budget estimates under various headings for operation and maintenance are prepared and moved upwards until a consolidated budget is prepared by the central authorities in the PID. In allocating annual funds for O&M, the Finance Development places greater reliance on budget and expenditure data of previous years than the request from the PID.

With the use of good yardsticks a consistent and reliable method of calculating and supporting budget requests could be developed. Funding for O&M is in competition with other provincial budgetary items and therefore must be fully supported and justified.

**Annual Planning and Programming.** Work plans are developed by each Executive Engineer, who computes budgetary requirements for each item of work. ISM has assisted in developing more realistic budgeting. Some progress has also been made toward computerizing maintenance yardsticks, budget preparation procedures, and monitoring of budget expenditures.

**Standards and Procedures for O&M.** Maintenance standards must be adhered to if a good program of preventive maintenance is to be carried out on an irrigation system, a workshop, or on equipment. The Public Works Department, Manual of Irrigation Practice, 1943, (Revised 1963) provides standards and procedures for operation and maintenance. These standards are not adhered to, and copies of the manual are seldom found in field offices.

**Irrigation System O&M Manuals.** The TA consultants have prepared four general manuals for the operation and maintenance of the irrigation systems:

(1) Canal Management
(2) Operation and Water Measurement
(3) Canal Embankments
(4) Canal Structures

These manuals were to be prepared in cooperation with the PIDs. However, PID personnel actually had little input because of other duties or lack of interest. The manuals cover the technical aspects of their subjects as well as some practical day-to-day aspects of maintenance. Drafts of these manuals have recently been made available to the PIDs, but they have not been thoroughly reviewed and commented upon. Because these manuals have not been printed and distributed to field personnel, they have not yet affected O&M.

In addition to the four general manuals, O&M manuals were prepared for approximately 18 subsystems which had been rehabilitated. Because of the duplicity of material, the plan for issuing general manuals covering all systems was agreed upon rather than a separate manual for each system or sub-system.

The TA consultants have prepared a report entitled "Recommendations for Improved Operation and Maintenance" (Feb. 1986) which identifies the management, transport, communications and similar studies needed to assure irrigation department

implementation of modernized O&M practices. This report contains many recommendations to improve O&M some of which have been addressed in more detail subsequently.

**Staff Development and Training.** The PID should have an on-going program of staff development, but it appears that they have not developed such a program. The TA consultants and the PSC advisor have devoted a considerable amount of time to this subject but, very little progress has been made.

Although the list of programs developed by the consultants shows approximately 30 training programs which could be of value to operating and maintenance personnel, there is little evidence that these programs have had an effect on O&M personnel in the field.

**Conclusions and Recommendations.** The four general irrigation systems O&M manuals contain much useful information. A request has been made by the TA consultants for funds to print the manuals for the PIDs to distribute to the field for review. Instead of printing now, copies should be mimeographed and sent to the field. After comments have been received and agreement reached as to their contents, the manuals should be amended, printed and issued to all concerned field offices as a supplement to the Public Works Department Manual of Irrigation Practice. Copies of the Public Works Department Manual of Irrigation Practice 1943,( revised 1963) should also be made available to all field offices.

Greater emphasis needs to be placed on developing and training O&M staff. Much of the training activity to date has been on paper rather than on production where it should be. On-the-job training should be provided along with technical formal training.

Preventive maintenance starts at the "grass roots" level. In years past, the beldars could be relied upon to do an acceptable job of carrying out a day-to-day maintenance program. Every effort should made to revive the discipline and supervision needed to restore this day-to-day preventive maintenance program. The beldars need to be given better tools and equipment to cope with the maintenance problems. Training and instructions which will give them a sense of responsibility and pride for the section of canal they maintain.

Greater emphasis needs to be placed on the inspection activity to ascertain that agreed upon specifications are met by the contractor or local work force.

The O&M management system needs to be organized to anticipate problems rather than merely respond to them.

### 3.2.2 New Equipment.

**Use of Modern Construction Equipment.** Modern construction equipment use began in Pakistan in the 1920s when some of the first large works - barrages, headworks, and canals were being constructed in the Punjab and Sind. Mechanization has grown very slowly over the years, particularly on irrigation works; manual and animal labor is used to accomplish new work, major repairs, and standard maintenance. Substantial amounts of equipment were added at various times including surplus construction equipment from large projects. There has been no organized equipment management system in the PIDs.

Much of the existing equipment is old and in need of repair, deadlined (non usable until repairs are made), or surplus (junk).

**Project Activities.** The Project Paper (PP) called for approximately $31 Million of new construction equipment, spare parts, and workshops equipment to be procured under the Agriculture Commodities and Equipment (ACE) program. ISM was to cover the cost of workshop rehabilitation, technical assistance, installation of a computerized Management Information System, (MIS), training of personnel, and general craft training. The proposed list of equipment to be procured is attached as Annex-3. The equipment on this list was to supplement the PID's existing equipment, to meet equipment requirements for the medium and larger size segments of the rehabilitation work, and to balance out the PID's equipment fleets.

ISM TA equipment specialists in consultation with AID and PID personnel made the final selection of equipment to be purchased. The equipment was ordered in 1983 and shipments were received in Pakistan from 1983 through 1986. Further equipment was ordered under IFB/PAK/CMO/86-03 and received in 1987. Additional equipment is under procurement under IFB/PAK/CMO/87-03. The total cost of construction and maintenance equipment selected, ordered, delivered and/or being procured is summarized in Table 3-6.

Table 3-6
Summary of Equipment Procurement under ISM

| Total Pieces Equipment (Pcs.) | Source of Funding | Approx. Cost ($ U.S.) | Delivered Nos. Equipment (Pcs) | Equip.under Procurement (Pcs) |
|---|---|---|---|---|
| 391 | ACE | 30223027 | 391 | 0 |
| 5 | IFB/PAK/CMO/86-02 | 395343 | 5 | 0 |
| 250 | IFB/PAK/CMO/87-03 | 4598810* | 0 | 250 |
| Total | | 35217180 | 396 | 250 |

* Includes $450,180 Spare Parts.
Source: USAID, ISM Project Files

The equipment delivered in-country has been apportioned to the various PIDs and is being used or will be used on various works under ISM/ISR funding as well as other GOP funded PID schemes. The list of equipment, purchased, delivered, or under procurement in ISM is attached to this report as Annex-2.

**Utilization and Management of Equipment.** There is controversy over the utilization of ISM/ISR equipment. A U.S. Government audit suggests that the equipment has been substantially under-utilized and is generally inappropriate for the intended project work. NESPAK's report indicates that the equipment acquired under ISM generally has been reasonably utilized based on a lower 'use base' standard, 93.5 hours per month, than the monthly hour 'use base' used by the U.S.G. auditor was 125 hours per month.

The apprarsal team feels that, in general, the new equipment and rehabilitated workshops have been under-utilized, and in some cases, equipment was not entirely

appropriate for the intended work. An assessment of this situation, however, should be mindful of the following factors:

(a) Delays in equipment delivery; the last equipment arrived in 1987, and some is still under procurement;

(b) The late start of various canal rehabilitation work schemes, particularly those funded by USAID;

(c) The long delays in the implementation and start-up of the computerized MIS. This system is still in the planning stage and probably won't be in use for six months to a year;

(d) The past dependence by the PID's on contract work done with intensive human and animal labor, supplemented with small mechanized farm machinery;

(e) The late rehabilitation of the workshops.

All of the above factors, and some not mentioned here, have made it difficult to get full utilization of the new equipment. In the future, there will have to be closer cooperation between the civil works people, in charge of the canal systems, and the mechanical people, in charge of equipment and shops. Any future procurement of equipment should be based on appropriate needs, determined from equipment use plans for proposed schemes. Additional point concerning utilization and management of equipment that should be considered include:

(a) Management System and Scheduling. The concept of a computerized MIS, which includes scheduling of equipment use, preventive maintenance, and repair, has been accepted by the PIDs. The TA contractor has trained a cadre of people to implement this system, and the PID have started active planning for the start up. The Sind PID appears to be the farthest along at the present time. Computer hardware and software remained to be acquired and turned over to the various PID, before this system can be operational.

(b) Effectiveness of Computerization. The PIDs have accepted the "MAINSAVER" software system by J. B. Systems, Inc. of California and have trained staff, but acquisition of the necessary components appear to be 6 months to a year away.

(c) Equipment Maintenance. None of the PIDs have adopted a comprehensive preventive maintenance program. Equipment is now maintained by the operators under the direction of the sub-engineers or SDOs in the field.

(d) Overhaul of Old Equipment. Very little equipment is being overhauled. It was observed in the Punjab that some diesel engines were being repaired but at a leisurely pace. In the Sind, the team observed dozer track overhaul work. A major problem undoubtedly was and is the delay of installation of repair machinery caused by late completion of the workshop rehabilitation. Most of the machinery has been installed, commissioned, and is ready to be used. Establishing an effective repair program, however, depends on scheduling equipment use.

**Appropriateness of Equipment Provided by the Project.** Some mistakes were probably made in the selection of equipment. The equipment selected was mid-size, adequate for rehabilitation of larger canals. The PID's have a large inventory of heavier equipment adequate for very large canals and flood control embankments, but presently this large equipment is in poor condition or deadlined for repair.

PID officials in the Punjab and Sind seemed generally satisfied with the equipment supplied. The Punjab was unhappy with 'Weed Cutting Boats' and small dredges. They claimed the Weed Cutting Boat was not adequate for their purposes, and that the dredges were too heavy to move in and out of medium size canals due to the great number of bridges and other canal crossing structures. Sind, to the contrary, greatly valued the 'Weed Cutting Boats', and said they could use more of them. In Sind, the Small Dredgers were felt to be too small, and in need of larger cutter heads. In both the Sind and Punjab, the Cat 225LC backhoes were highly praised for their ability to cut and remove siltation to an exact line on the inside prisms of canals and drains. It is the consensus of the Team that the bulk of the equipment furnished in most cases was appropriate.

**Impact of Equipment on the Efficiency and Effectiveness of the PID Rehabilitation Program.** Two of the important purposes served by the new equipment are to speed rehabilitation and to achieve modern construction standards and specifications, particularly earthwork compaction. The equipment both in quantity and size, may not contribute greatly to routine O&M operations. Therefore day-to-day maintenance will continue to depend on manual and animal labor.

**Impact on the Quality of Construction.** If the equipment is used properly construction quality will improve. The Team observed, that in completed sections, the quality of work was good: embankment had been brought to a proper alignment and grade, and proper compaction had been done to specifications except in NWFP where compaction was lacking. Improper compaction of earthwork is considered to be one of the largest contributing factor affecting embankment failures.

**Impact on Construction Capability.** Equipment will have a substantial impact on construction capability both in the quality and quantity of work that can be accomplished in a given time period.

In the Punjab, the Team observed work being done on the MBL (Main Branch Lower) work scheme, on the lower part of the Central Bari Doab Canal System, and which is an extremely old system in extremely poor condition that has suffered frequent overtopping and breaches. There had been tenders requested twice from local contractors with no response due to the massive quantities of earth which had to be moved from borrow pits up to 14 Km away. The PID and the LA consultant decided to do the work with modern construction equipment. The work we saw was of good quality and done in a reasonable period of time.

The team observed new equipment being used on the drain system in the Sind to good effect both in terms of quality and quantity.

It must be recognized that some of the equipment may never meet an ideal hourly/monthly/yearly 'use factor'. Nonetheless medium to heavy equipment is needed to do work on large canals and river flood control embankments periodically. When needed the work must be done quickly. The same equipment may have extended periods of idleness. The PID's are beginning to recognize that planning and equipment

management are essential for achieving cost effectiveness in use of modern equipment. The Team feels that with the proper planning of work schemes and equipment usage, they will achieve satisfactory use factors for the equipment.

**Financial and Budget Impact of Increased Reliance on Equipment.** No reliable data has been gathered to determine the cost of equipment use, or to permit a comparison between equipment and traditional labor animal intensive methods. The yardstick cost of mechanized construction may appear to be higher but other factors have to be considered when making a comparison, such as the quality and longevity of the work accomplished, speed of construction, shortage of local labor, increased unit prices charged by the local small contractors for a higher quality work. Long-term effects on O&M costs, and increased time periods between major repairs. Data on these factors must be collected before equipment use will expand very rapidly.

**Conclusions and Recommendations.** Realistic equipment cost yardsticks are not being currently used. Yardsticks based on all costs, including amortization of equipment, must be established.

A computerized management information system has been recommended and accepted by the PIDs. The acquisition of all computers and required software should be expedited by USAID as quickly as possible to enable the PIDs to implement the system.

The PIDs have a large amount of old equipment which has been recommended for repair. This program should be reconsidered after overall requirements are identified for rehabilitation, O&M, and other works. The age of this equipment should be [illegible] as well as the need to standardize spare parts. The Team recommends that the repair program be deferred until an equipment use plan is implemented.

There has been little preventive maintenance or an organized repair program for equipment in the past. An equipment preventive maintenance program should be implemented as soon as possible in conjunction with the MIS program.

Much of the equipment, both old and new, is too large for routine O&M operations. Smaller equipment for day-to-day preventive maintenance on canal and drain embankments is needed at the Sub-Division level. A list of appropriate equipment follows:

1. 50HP Farm Tractor, with three point hitch with, scraper blade attachment, and gin pole pick up attachment
2. Tractor trolley with steel box
3. Large vibratory plate compactor
4. 500 gallon water tank trailer with gasoline driven refill and discharge pump with spray bar and hose attachments
5. 'Bush Hog' mower attachment
6. Small tools

A similar list has been included in the Phase-II SAR.

A small pool of slightly larger equipment permanently assigned at the Division level would effectively supplement the Sub-Division level for major O&M work and maintenance problems.

1. Two six- to eight-ton dump trucks

2. One small wheeled loader compatible with the dump trucks

3. One 70HP grader with scarifier

4. One 1 ton vibratory roller compactor

5. One 6 ton vibratory roller compactor

6. One small dozer

7. One mobile light plant

8. Two FWD pickups or jeeps or combination thereof

9. One 2000 gallon water tanker with attachments

10. One lot of tools compatible with above

This O&M equipment program could be implemented on a trial basis on selected rehabilitated canal reaches. Data should be gathered to compare mechanized O&M with conventional labor animal intensive O&M work including the use of small contractors.

Some training for computer specialists and equipment operators has been accomplished. A comprehensive training program should be established including refresher courses, for personnel associated with stores, workshops and mechanized equipment.

In order to make the most cost effective use of all equipment in the PID fleet equipment use must be planned systematically. Private sector involvement should be explored. The MIS program can be used for systematic equipment use planning, however, the input of good and adequate data is essential.

Technical assistance has been provided in Phase-I for the development of the equipment requirements, workshops, and spare parts. This is a critical time in the start-up of the newly rehabilitated workshops. A senior construction engineer, well versed in equipment usage and shop procedure, should be assigned to assist in equipment use planning and workshop start-up in each PID. Two to three local hire construction engineers would be needed to assist, coordinate and monitor the start-up efforts. An experienced workshop superintendent and/or master mechanic has been requested to coordinate, train and monitor in two of the PID's mechanical shops. This type of technical assistance should be furnished where requested for six months to one year.

### 3.2.3 Workshop Improvements

**Project Activities.** Requirements for workshop improvement were identified by the TA consultants, USAID and the various PID organizations. Shop modifications were agreed on and replacement and additional modern machinery was ordered. (See Annex 2 and Annex 4). Machinery operators and supervisors were trained, and a computerized MIS (see Section 3.2) is being implemented.

**Achievements.** To date all remodeling is 90% completed. The machinery has been installed and is about 90% usable. The Team personally witnessed some of the new equipment being used on physical plant and equipment repairs.

There has been some criticism of the delay on the workshops completion and the start-up of the new equipment. The completion of the workshop building modifications did delay the workshops equipment installation and the start-up of that equipment; our observation is that the machinery is now basically operable. The workshops lack numerous miscellaneous items such as spare parts racks, that are needed for efficient operation. The greatest need is for a planned program for equipment repair based on equipment usage. The PID's could proceed with a equipment repair program in the interim but it will be haphazard.

**Adequacy of the Improvements, including Machinery.** The building improvements appear to be adequate for their purpose. The new machinery appears to be adequate, but some of the layout is not well organized. A shops expert should be retained to examine the present layout and recommend corrections.

**Capability to Carry Out Maintenance Functions.** The workshops in the Punjab and Sind are equipped to carry out all types of equipment repairs and major overhauls. They are capable of fabricating large parts in an emergency. The Team did observe, in the Punjab, the fabrication of pump bowls and impellers from castings, to the assembly of turbine pumping unit. In both the Punjab and Sind, the shops were fabricating barrage and control gate parts, including gate rollers and gate screw stem lifting systems. The shops will have the physical capability to carry out overall construction equipment repairs and overall physical plant mechanical repairs.

**Effectiveness of Computerized Stores Management.** The computerized stores management system (MIS) will allow efficient control, issuance, and replacement of spare parts when it is finally implemented. This in turn should greatly enhance the efficient use of the equipment by shortening repair time.

**Staff Training and Organization.** There has been general training sessions for staff and specialized training of a small number of people on the use of the MIS system. However, there appears to be no overall plan to organize the workshops and train the staff. An operation manual was prepared by the head store keeper and the accounts clerk in the Sind workshop. The manual is well prepared and consists basically of instructions for the start up of the MIS system, but it is not an overall start up and operation plan for a sophisticated shop system. Continued technical assistance will be needed to provide further training and planning assistance.

**Funding and Budget.** The TA consultant prepared budgets for start-up and initial operation of the workshop that included additional personnel in the area of management,

general staff, and skilled mechanics. The Government has not approved the additional funds or positions and it is hoped that assistance can be provided under ISM/ISR-II.

**Conclusion and Recommendations.** The workshops renovation has generally been completed in accordance with the plans. They are not yet ready for start-up and operations because of the following deficiencies:

- No storage racks for spare parts were provided. The spare parts are still in crates.
- No provision was made for handling the large spare parts for which a forklift is needed.
- Computers and software to implement the MIS system have not been provided yet and delivery is probably six months to a year away.
- There are still electrical deficiencies.
- Poor planning on equipment location and repair space

The Team recommends that experienced shop superintendents and/or master mechanics be recruited for six months to a year to monitor final renovations and planning for shops start-up and initial operations. The shop superintendent would be working in cooperation with the senior construction engineer, mentioned earlier, who would be assigned to advise and monitor the construction equipment use planning and repair. Further craft training should be implemented as required and monitored by the shop superintendent.

The Team recommends that the purchase and installation of the computers and software be expedited and further technical assistance for training and start up of the MIS system be provided.

There has been no clear cut planning or budgeting in regards to manpower or other shop costs by the PIDs. Studies and manuals have been produced and issued by the TA consultant that cover planning, management, and budgeting; these manuals have been accepted partially by the PIDs but action has not been taken by them. General workshop planning and budgeting assistance for equipment fabrication, equipment repair, and general shop operation should be included as a part of ISM-II initiated under ISM and continued during the bridging period. No repair program for old construction equipment should be scheduled until an overall equipment usage plan is developed. A repair program on selected equipment could be started for equipment that will have immediate use and could not be supplied out of the new equipment furnished, i.e. passenger vehicles.

### 3.2.4 Improved Design Capability

Improving design capability in each of the PIDs was considered an important component of the ISM project. There were two reasons: first, the canals and drains were to be restored to a safe and fully functional condition in which both water and suspended sediment are distributed equitably and proportionately; and second, it was thought that new design would reduce the cost of continuing maintenance. The PP notes

that PID maintenance problems within the canal prism are substantially due to such factors as erosion and deposition of silt due to wind, rain, and abuse of the banks by animals. It also noted that possible inaccuracies in the original design, and changes in canal flow and sediment loads may also be important causes which require design parameters to be reconsidered. The strategy to improve design capability involved three elements:

- extensive hydraulic data collection and analysis;
- development of new hydraulic design criteria based on the latest advances in alluvial channel hydraulics;
- training of PID staff and renovation of design office facilities.

**Hydraulic Data Collection.** PID staff in each division and sub-division regularly collect data on water levels near the control structures of canals within their jurisdiction in order to carry out and monitor operations. Procedures also call for annual collection of longitudinal profile and cross section data during closure. Adequate standards for collection, storage, and processing of these data are frequently not maintained. Consequently, the present data base available in the field and suitable for evaluation of canal behavior, or canal design, is considered inadequate and unreliable. WAPDA's Alluvial Channel Observation Project (ACOP) has extensive experience since 1974 in the observation of flow and sediment transport phenomena in the alluvial canals of Pakistan. They were given the assignment under ISRP of collecting sediment and morphological data to support the analysis of hydraulic conditions on problem channels (see Chap. 5 for a discussion of ACOP' additional role in monitoring). The ACOP data are reported to be reliable. The organization has done innovative and accepted work in computerized hydraulic data storage, retrieval, and analysis and appears to be very professional.

ACOP staff report that the Executive Engineers (Xens, are in charge of a Division and supervise several Sub-divisional engineers and other technicians) do not have adequately trained staff or proper facilities to collect sufficient reliable data to understand the operation and behavior of their canals on an engineering or scientific basis. The Team observed the lack of facilities for measurement and analysis of sediment, and the lack of staff and facilities for discharge measurement and preparation of rating curves (See Annex 5 for additional discussion of these issues). Hence, when problems with canal performance or safety become so acute that remedial action is required, there simply has been no basis in the field offices for deciding on a solution other than relying on the experienced judgment of the Xen and the original design drawings. (Other factors, especially lack of funds and trained staff, are equally important).

**Hydraulic Design Criteria.** An important assumption in the design of this project is that a new technique incorporating the latest advances in the technology of hydraulic design of alluvial channels was needed to minimize recurring maintenance problems and costs in rehabilitated canals. The ACOP data collected from 1983 to 1985 were used by the IA consultant to derive a new Hydraulic Design Criteria, referred to as HDC. These criteria included many more parameters to describe the sediment transport processes in the canal than had previously been used, and which more fully and elaborately integrated sediment transport capacity into the design process. The HDC could be used as a tool to

evaluate alternative strategies for improving canal performance and reducing maintenance cost including changes in operation, redesign and remodeling, as well as other options.

The HDC was developed between April, 1984 and March, 1985. The proposed use of HDC was approved by the Sind, Baluchistan, and NWFP Provinces in June of 1986 after about 15 months of discussion and review. In the Sind a team of local consultants was recruited in April, 1986, trained in the use of HDC, and began work in the Design Directorate in Hyderabad in June, 1986. Sind PID staff were subsequently assigned to this unit. The local and expatriate TA consultants designed three systems. The trained PID staff (one Deputy Director and several technicians) are presently completing their second system design. However, construction has been completed on only a portion (a single branch channel) of one system. No monitoring or evaluation data are available for HDC designed canals (see Chap 5).

The introduction of HDC has met with resistance in the Punjab PID. As a consequence, there has been no ISM financed rehabilitation work on the inside prism of any canals in the Punjab. The Punjab PID has held that they were not involved in the process of developing the criteria. They are unwilling to adopt a design criteria with which they, or any one else, have no operating experience. They do not agree that a change is needed from traditional design practices on all canals, and they disagree on technical grounds with the sediment transport relationships and the interpretation of the new data.

In June of 1987, a Special Committee appointed by the Secretary of the Punjab PID, with the participation and concurrence of the TA Consultants who developed the HDC, proposed the use of a simplified version of the HDC, referred to as HDC(S), and proposed a research program on hydraulic design technology that would, among other things compare the traditional method of design (Lacey) and the new HDC(S) in the field. USAID has not adequately responded to the Punjab proposals (as of February, 1988) although they have implicitly agreed with the proposal. This is extraordinary, since the Punjab proposals were made in response to insistence by USAID that they technically review the proposed criteria and offer suggestions where they disagreed.

**Development of Design Cells.** The third element of the strategy was to renovate the physical facilities of the design directorates or cells and develop a trained design staff. The need for renovation stems as much from the deplorable state of existing facilities as from the notion that modern facilities and working conditions, including computers, may help to make assignment to the design cell more attractive. In recent years little importance has been given to design in the PIDs. It is considered to be an unimportant and unattractive assignment by the engineers because they must give up their field assignments where they normally enjoy considerable benefits. In the British period it was said to have been the most prestigious assignment in the PID.

The Sind Central Design Directorate in Hyderabad, has been renovated and appears to be an excellent facility. A qualified Deputy Director was assigned to the Directorate in 1987, and four fresh graduates have recently also been assigned to the Directorate as part of their initial training in the PID. However, the 1988-89 budget request of the Director was not approved by the Finance Ministry on the basis that the PID had not demonstrated the need for, or value of, the expanded operations and staffing of the Design Directorate.

The proposal for renovation of design facilities at the other PIDs has been made and approved by the respective Secretaries, but no progress has been made. Computers and other equipment are not yet available. The facilities and equipment, including computers and software for using HDC(S) for canal design, have not yet been transferred to the Design Directorate of the Punjab PID. To give an indication of the importance of this issue, the Design Directorate of the Punjab PID sought access to a computer belonging to the TA consultant and has developed some software needed in other areas of their design work. The Punjab PID has also assigned a qualified Deputy Director to design duty.

Aside from the two Deputy Directors referred to above, there has been little or no development or training of professional PID staff, particularly those in the field in the Division and Sub-division offices, in the use of good design practices or in the use of the advanced HDC technology. Of course, the reasons for this are that no other staff have been assigned to the Design Directorates by the PIDs, and field staff were not a target group for design related training under the project. Technician level staff have been trained in the Sind in a variety of mundane data entry and data handling tasks related to design.

**Conclusions and Recommendations.** The project attempted to expand, modernize, and change design practice in the PIDs in one great leap from a current situation in which little or no attention was given to engineering design or analysis, to the application of a sophisticated design process using state-of-the-art technology. The focus of ISM project management was on the use of a particular methodology developed under the project that may in some respects be somewhat beyond the current state-of-the-art. Considerably more field data, observation, and analysis are needed to verify and refine the HDC technology. In the meantime, the project should have focused on the introduction and use of good engineering standards and practices for problem assessment, planning, evaluation, and design. This would have included, for example, better data collection and proper application of traditional design processes and methods. In either case, the very large and important needs for improved data, skills, and practices at the field level remain to be addressed.

The PID field staff, where engineering design and analysis are traditionally done in support of operation and maintenance, were ill-equipped to make these changes because they lacked the data and training, and because they did not believe there was a need for such a major effort. The current practice of engineering design and analysis at field level is rudimentary, relying mainly on existing design drawings, and layouts of "typical" designs by draftsmen.

The ISM TA consultant indicated that HDC and the traditional method of design, if properly applied, give essentially the same result on perhaps 75 to 80 percent of the canals. This observation suggests that the new technology is needed now for a limited number of problem systems or canals. These special design services could be provided by upgraded design cells or by the private sector.

The Central Design Office should handle the re-design of problem channels, the design of other irrigation structures as required from time to time, and provide specialized back-up and training support to the field staff in the analysis of data and design problems. The design cells should be a center of excellence within the PID for engineering design and related analytical technology. This expertise is also essential for

the proper supervision and monitoring of design services obtained from private sector consultants.

The assumption that all the responsibility for modern engineering design and analysis should be developed and centralized within upgraded design cells appears to be inappropriate and untenable. The reports and studies carried out by the TA on which the design cell proposals are based, are not objective; do not adequately address the alternatives or all needs. In short they represent little more than attempts to justify an organization which the writers thought was needed to implement HDC.

The functions and responsibilities of the design cells should not be expanded beyond those areas of expertise essential for sophisticated engineering design, adequately supported by the allied disciplines located in other cells and offices. These cells should be kept small for the foreseeable future to reduce the need for large staffing increases, to avoid seemingly insurmountable recruiting problems, and to focus training resources to ensure the timely development of expertise. Strengthening in other areas and disciplines such as surveying, data collection, and contract management should be a part of a broadly based staff development and training effort in the PIDs, not part of the expansion of a design cell.

### 3.2.5 Development of Management Information Systems

**Institutional Development.** The TA consultant's strategy was first to prepare overly-detailed feasibility studies for each province on overall computerization, with additional studies on key applications (see Annex 6). In the next stage, TA systems analysts gave computer awareness seminars to PID staff. Each province assigned staff for training, and began to seek sanction from P&D and the FD for new computer posts. Up to now, only NWFP has had even preliminary approval of such posts. Even then, there will be serious difficulties which need to be addressed in recruiting and retaining competent staff at government salary levels. The TA consultant has recommended that USAID provide bridging funds for salaries, allowances and incentives for these posts. Given USAID rules and regulations, this seems unlikely.

Another strategy followed in each PID was to carry out extensive renovations on rooms for computers before acquiring and installing them. The renovations are done to a very high standard on the grounds that computers need air conditioning, dust free conditions, and security. This need is asserted by TA consultants, but not proved in their feasibility studies. Experience in similar countries has shown that microcomputers operate nearly as well in standard government offices with fans, desert coolers, dust covers, regular floor sweeping, and other modest precautions. The approach taken by the project causes three types of problems: 1) the renovations add further delays to the introduction of computers; 2) the air conditioners will create unnecessary recurrent cost burden; and 3) the perception that office renovation is necessary to use computers will delay further computerization and encourage traditional practices of centralized control.

**Applications.** The only computer applications designed and implemented by PID staff are in the Punjab Design Cell. All others have been designed and implemented by TA consultants.

Many useful, standard packages have been introduced in the four PIDs, including an expenditure monitoring system on the progress of ISM and ISR irrigation schemes, and a system for compiling and printing annual ADP and non-recurrent budget data. One of the

most successful systems is used to select PID staff for external training opportunities in the new Training Management Cells

The most ambitious application in the planning and development stage is a versatile program called Mainsaver, which covers equipment inventory, production of work orders for maintenance, personnel, and many other management issues. Mainsaver is a potentially valuable application. Considerable resources have already gone into installing it, and there has been no serious alternative proposed for workshop and equipment management. Nonetheless, its introduction has been plagued with delays caused mainly by USAID procedures. Despite problems with the package, it is urgently needed. AID should give full support to making it operational in each of the four main workshops.

**Conclusions and Recommendations.** It is too early to judge whether the introduction of computer technology under ISM will be sustainable. Most of the computers have been installed in the PIDs for less than a year, and key applications are still under development. PID Secretaries are supportive of selective computerization, and have encouraged staff members to become users. With the exception of the Punjab Design Cell, however, PID staff are not yet able to maintain applications developed by the consultants, to develop new applications, or to manage the computer facilities effectively. Part of the problem here can be traced to the PP, which stresses how easy computers are to use, and mentions little about the difficulties of maintaining and managing them. There is a serious concern about whether computer specialists can be recruited and retained in PID headquarter-based computer cells given the minimal salary and benefits available.

Legitimate questions have been raised about the elaborate rehabilitation of computer rooms: this may promote a more centralized power structure in the PIDs, and may reduces the benefits possible from distributed processing systems. Furthermore, the way that computer-based HDC was introduced in the Punjab was a major project blunder which seriously retarded progress on canal rehabilitation.

The delays in introducing computers resulted from initial resistance by PIDs to computerization (and to many other aspects of ISM-I, particularly in the Punjab), from the time required for preparing voluminous feasibility studies on computerization for each PID, and from long holdups in procurement. The IA consultants counter that they purposely moved slowly on computerization so that PID staff would understand what they are getting rather than see it as a "black box". Yet, even at this snail's pace, the IA consultants have still only trained users, not programmers and managers. Beyond the user interface, the computers are black boxes to nearly all PID computer staff.

### 3.2.6 Training

**Project Activities.** The training function of the ISM/ISR project is summarized in the project paper as follows:

> "Develop an overall training plan, and design, organize and implement training programs, and establish an implementation plan for the in-country training activities to be arranged under the ISM Project."

In response, IA contractors pursued five major activities: 1) An inventory of training delivery capabilities in Pakistan, 2) Assessment of PID's training needs, 3)

Development of a training strategy; 4) Implementing the various training components; and 5) Planning for institutionalizing the training function.

Three different TA advisors have been in charge of the training program over the life of the project. Both the training program direction and content were significantly altered by rapid turnover of these TA training personnel and by USAID Mission intervention. This is reflected in project outputs and in the current status of the training program.

**Inventory of Training Capaoility.** The first training activity was to identify and assess the PID training capability of GOP and provincial educational institutions. TA training personnel visited all major Pakistan public training establishments and prepared a report that summarizes institutional capabilities. In addition, 16 private sector training support firms were identified. The training capacity of public institutions' for PID personnel was primarily in engineering related aspects. Training capability for technical and administrative management, particularly computer utilization, was found primarily in the private sector. Public institutions and selected private firms, as well as local staff on direct hire by the TA contractor, were used for the in-country training component.

**Assessment of PID Training Needs.** An assessment of the training needs of PID personnel began in 1985, based on discussions with senior PID administrators, and was completed for the Sind and Punjab provinces. The needs identified were heavily engineering oriented as opposed to management training and favored in-country short courses and on-the-job training. This in-country focus was substantially greater than that set forth in the project paper, which had allocated over half of the training budget for training abroad. TA management made a decision in early 1985 to discontinue the needs assessment survey, because of cost considerations and because it was felt that enough had been learned about the PIDs' training interests to develop a modified training strategy.

**Development of a Training Strategy.** A shift to a "targets of opportunity" approach in 1985 led to the development of an interim training strategy as set forth in project report 120, "Interim Plan-ISM Training Program, July 1985". While efforts continued in the training abroad component, expanded emphasis began to be given to specific subject matter, skill oriented in-country training activities. This effort, however, did not include management training of personnel. This shift to an in-country emphasis responded to one of the major recommendations given in the ISM Interim Evaluation Report. Another less visible recommendation from that evaluation report was that: "High priority should be given to the training of trainers". This provided the basis for a further shift in strategy that focused heavily on an attempt to institutionalize the in-country training function at an early date. It was to be implemented through a sub-contract with the International Irrigation Center at Utah State University (USU), under a contract signed on June 5, 1986.

While the new Trainer Training Program was in the early stages of implementation, two interventions by USAID significantly changed the momentum and direction of the overall training strategy. These were: 1) the disruption of USAID funding for the TA staff throughout 1987; and 2) a decision to re-focus the total training effort on development of eight training modules that would bear more directly on the O&M function of the ISM Project. The latter is a reflection of USAID's internal decision to refocus the training effort in anticipation of ISM-II.

**Training Program Implementation.** The results of the training implementation phase are highly visible and are fully documented in various TA reports. For example, of 113 background reports that have been published, 60 of them involve various training components. The "Annual Training Report, Fiscal Year 1987, October 1987," gives a detailed listing of personnel trained and courses offered to that date. In brief: 1) 364 training opportunities for training abroad were developed and 117 individuals were actually placed; 2) 43 in-country courses representing 79 different classes were offered a total of 153 times involving 1,782 participants; and 3) In-formal on-the-job training was given to 2,084 PID participants. In the training abroad segment, most response was to study tours and the O&M short courses offered at Utah State University.

Response to degree training opportunities abroad was far below initial expectations, with relatively little PID interest in Masters and Ph.D. degree opportunities. Of the 20 specialty areas offered in the in-country short courses, computer applications was the most visible but selected engineering oriented courses were also popular. Offerings of management courses and policy seminars received much less response. As related to the personnel training aspect of ISM, most of the aggregate contract output targets appear to have been met and in some cases were exceeded, but the "mix" was substantially different than anticipated in the project paper.

**Institutionalization of the Training Function.** Three major institutionalization efforts were carried out: 1) Establishment of training management cells in the PIDs; 2) Initiation of a Trainer Training Program under the USU sub-contract (and the related national training center proposal); and 3) Development of O&M training modules. It appears that the training management cells are sufficiently developed so that they will continue to receive support from the PID Secretaries. The Trainer Training Program is stalled, apparently due to funding constraints and erosion of support from USAID and PID administrators.

The development of training modules is well underway. Eight training modules for courses related to operation and maintenance of canals are in an advanced state of preparation. These modules are: 1) Surveying for rehabilitation, design, construction, operation, and maintenance, 2) Preparation of estimate documents; 3) Preparation of design strategy; 4) Construction specifications and methods; 5) Central administration and quality control; 6) Construction planning; 7) Operation and maintenance of canal systems: Principles and applications; and 8) Operation and maintenance of a specific canal sub-system. Modules 7 & 8 could be combined. In courses involving design, construction, operation, or maintenance should include the Public Works Department Manual of Irrigation Practice as a reference document. Future modules should include institutional and management courses. In addition, heavy enrollment in various training courses given in the past should be viewed as an indication of a level of success and those should be continued.

The prospects for long-term institutionalization are much less promising, however. This aspect is a national policy issue that lies beyond the scope or control of the ISM project. Nonetheless, at the present time, a three-man committee within the USAID Mission is working on a long-term proposal, "Career Development Program for the PID's". This proposal would encompass all PID personnel from the sub-professional staff to the top engineering echelon and envisions a 20-year time-frame. Training components would include on-the-job demonstration efforts, short-courses, formal degree options and study tours/internships abroad. The total career development package would be carried out in cooperation with both Pakistan and U.S. educational institutions. A single training

institute in Pakistan is proposed to coordinate the total program. Letters have been sent to selected U.S. institutions soliciting their interests in participation.

Apparently the USAID career development program committee believes that its proposal will be incorporated into the PP for ISM-II. The concept has been discussed within the USAID Mission and with the Additional Secretary, (Water), MINWP. However, it has not been discussed in any detail with the PID Secretaries, IDA, or the Pakistani educational institutions that would be called upon to support the in-country training components. If this approach were to be adopted, it would represent yet another change in strategy, indicating obliviousness to experience gained in implementing ISM, Phase-I, fostering unrealistic expectations and creating tremendous implementation burdens for Phase-II.

Response of the PIDs. The interim evaluation report noted slow progress in the project's training component. Much has been accomplished during the last two years, however, most of which is appreciated by the PIDs. Yet numerous PRC/Checchi project reports have identified various problems and bottlenecks to implementation. Among the more significant of these were: 1) Communication gaps and lack of timely follow-through on nominations of participants, particularly for degree training abroad; 2) Lack of incentives for participants, thereby resulting in a high level of cancellations by nominated personnel; 3) Lack of PID planning for career development and related training needs; and 4) Indifference by PIDs central administrators to long-term training institutionalization efforts, particularly in response to the single training institute proposal.

These so-called constraints are endemic in the civil service system of Pakistan and are not unique to the PIDs. PID response must be viewed relative to what is possible to attain within the system. PID response has been better than expected, given the system constraints they operate under and the short time that the ISM training effort has been underway. Noteworthy PID responses include the following: 1) Establishment of training management cells with computerized personnel records in each of the PIDs; 2) Modernizing activities and related training involving project design, hydraulic flow analysis, equipment inventories, and maintenance schedules; 3) The beginning of internally generated manpower career development and training plans; and 4) increasing support for in-country training efforts by PID Secretaries.

Conclusions and Recommendations. The project paper had exaggerated expectations for the outputs of the training components. The quantity and quality of outputs from the various training activities in the PID's must be viewed in the context of the external constraints on the professional manpower system by other departments in the government of Pakistan and the necessity to work within these constraints. The project training effort is less than three years old and was also severely constrained and/or affected by overall project related events beyond the control of the PIDs. Among these were:

(1) Turnover in the leadership for the TA training personnel with differing views on training delivery;

(2) Turnover of USAID personnel responsible for the project with differing views on training strategy;

(3) Funding disruptions and uncertainty of a long-term support base from the provincial non-development budgets;

(4) Direct intervention by USAID project personnel resulting in two major changes in direction of the training strategy; and

(5) Apparent confusion among TA and USAID administrators about fundamental differences between task oriented training and formal degree programs, relative to the needs of the PIDs.

Considering these constraints, the results were positive and in excess of what should have been expected.

One of the project weaknesses of the program has been that training in general has not been held within the PIDs. Most training required personnel to leave their posts and travel outside their provinces. The PIDs initially had no concept of why or how to establish or institutionalize a training program. All training work has been accomplished by the TAs and non-PID trainers under contract. To increase attendance in training courses, most training should take place in-country; close to participating personnel work stations, during non-peak work periods, and within one's own province.

Given the time frame of the ISM project, the training component should have given priority to short-term task oriented training. Such a program could include both in-country and abroad opportunities but the emphasis should be primarily on the in-country component. The USU and USAID Mission effort to institutionalize in-country training, tied to Pakistan's university fabric was a misdirected effort for this project. The Trainer Training Program was premature because training institutes have not been sanctioned by the GOP nor are necessary, sustainable, non-development budget funding levels assured for such an initiative. Likewise, a full-blown commitment to the proposed "Career Development Program for PIDs" proposed for Phase-II is premature.

The Team supports a shift to a training module, short course and on-the-job training approach which is in direct support of the PID functions and activities at all levels. Modules should also be developed in technical and administrative management aspects in direct support of efforts to modernize the PIDs. Short-term training and the institutionalization of training management cells within the PIDs should continue so that PID personnel can better avail themselves of various donor supported opportunities under the ISM and other projects. Limited opportunities for formal degree training abroad, as appropriate for PID conditions, should continue to be provided.

In summary, the training activities should be closely coordinated with other project components; i.e. rehabilitation, operation, maintenance, workshops, administration, finance etc. Training, whether in-country or abroad, should not be expected to precipitate operational or organizational changes to be made in the PIDs. Generally, preparation and proposed implementation of career development training programs that supersede recommended and accepted changes in the PIDs, either in operation or administrative procedures, are likely to be counter productive, particularly within the five-year time-frame of ISM, Phase-II.

### 3.2.7 Improving Irrigation Water Management at the Federal Level

**An Overview of the Federal Role.** A number of key policy makers in federal ministries are concerned with development of the agricultural sector, including the land, water and infrastructure that support this activity. Those most directly involved include

the special Agricultural Advisor to the Prime Minister, and key administrators in the ministries of Planning, Development and Commerce; Finance; Food and Agriculture (MINFA) and Water and Power (MINWP). Policy is implemented directly through the Five Year Plans and annual allocations to the development and non-development budgets of each Ministry and the Provincial Governments. Most aspects of irrigation policy and some program aspects are carried out directly by components of the federal ministries, such as WAPDA in MINWP, and others through Provincial action agencies such as the PIDs.

Major donor agencies influence Pakistan irrigation water management policies and program implementation primarily in two ways:

(1) Dialogue with key GOP policy makers about their agency development funding strategies such as the IDA's Strategy and the Country Development Strategy Statements (CDSS) of USAID,

(2) Funding of development projects which specify covenants binding on the GOP as a condition for receiving funding support, such as the co-financed ISM ISR project.

In this regard, the ISM ISR project is more of an action-oriented program for improvement of the irrigation delivery system at the provincial level, than an activity through which improved irrigation water management at the federal level can be affected. Of course, there is a very direct impact at the federal level, via the covenants imposed. Beyond that, the impact is primarily secondary and indirect through coordination of the various action programs being supported within the PID, through the project. This coordination function, and how well it works, is extremely important to USAID, however, because the ISM project is the first project in USAID's long-term funding support for agricultural development projects in Pakistan that has channeled development budget funding to the PID.

**SAR and Project Paper Specifications.** At the time IDA initiated its ISR project in 1987, the MINWP was given overall supervisory responsibility for oversight. In order to carry out the day-to-day coordination activities, a Federal Coordination Cell (FCC) was established under a Federal Project Coordinator (FPC). The FPC reports to a Chief Engineering Advisor who in turn reports to the Additional Secretary, (Water) MINWP. This organizational arrangement was specified in the USAID project paper as well and adopted upon activation of the ISM project. As a result, some duties were added to the FCC that were unique to USAID's funding and reporting procedures.

**Project Activities.** The IA consultants carried out a study of the organization, functions and budgetary staff needs of the FCC and presented their findings in a report published on December 28, 1987. The original IDA SAR report identified only eight major functions for the FCC, but the IA report identified 50 detailed activities which the FCC is now performing. The report also specified a set of conclusions which generally found that the FCC was severely under-staffed and under-budgeted to carry out all of these activities. The report listed 12 major recommendations which culminated in a recommendation that funding for the FCC should be greatly expanded for ISM ISR, Phase II. Another approach that could have been analyzed, however, would have been to reduce the list of functions of the FCC to a level which is considered by the GOP and the donor agencies to be a bare minimum necessary to carry out its coordination and accounting functions. Budget and staffing levels for that set of activities could then have been specified. The report represents an important lost opportunity.

In planning for implementation of Phase II, both the GOP and the two major donor agencies have essentially followed the latter course and such provisions for the FCC are reflected in the SAR for ISR-II. Specifically, the SAR (p.22) lists eight general coordinating functions for the FCC. The need for some expansion in its technical engineering staff and budget was recognized, but at far more modest levels than recommended in the IA consultant's report of December, 1987.

As with any new governmental organizational unit, some bottlenecks and short-falls emerged in the FCC. Among the more important of these were:

(1) A separate procurement cell as called for in the SAR and project paper for Phase-I did not materialize so this activity was performed by the FCC;

(2) Initially, at least, there was some duplication of inspection USAID-financed of civil works developed for USAID financed works because USAID regulations require inspection by USAID direct hire personnel, even though they were also inspected by NESPAK, operating as the FCC's Supervisory Consultants;

(3) There was some initial confusion and indeed resentment in the PIDs regarding the role of both the USAID funded IA staff and the NESPAK's staff funded by IDA. NESPAK in particular, and to a device the IA staff were viewed as representing federal interference since they were being funded through the FCC;

(4) Due to the press of other duties the FCC never did get directly or significantly involved in the training function or in the analysis of identified water policy issues;

(5) Time delays in getting federal level approval for individual program activities were rampant, in part because procedures required submission to the FCC while authority was vested in the Additional Secretary, (Water) of MINWP, and

(6) The FCC failed to provide adequate supervision for its responsibility to undertake economic evaluation of project impact, and as a result, this activity was not carried out effectively (see section 5).

**Conclusions and Recommendations.** The Team generally endorses the role of the FCC as specified in the SAR for ISR-II. It is clear that the specified functions reflect an attempt to remove or at least minimize the FCC deficiencies outlined above. Further streamlining of the FCC's areas of responsibility could also be considered. For example, these could include the option of decentralizing budget and supervisory responsibility for the USAID-funded IA and training components by putting them on the same provincial level focus as the civil works component. In this regard, since the ISM ISR, Phase-II will continue PID program efforts initiated under Phase-I, the more direct responsibility for these components at the PID level, the better. The FCC should concentrate on overall coordination and accountability functions, as required by the GOP and the involved donor agencies. According to the Additional Secretary, (Water) MINWP, however, the FCC is also expected to have overview responsibility for project monitoring and economic impact monitoring and to provide analysis input into the continuing dialogue on water policy issues. Technical assistance for these activities should therefore be provided in the USAID financed portion of ISM-II.

### 3.3 Technical Assistance

In accordance with the project paper, four groups of technical advisors or teams would provide assistance to USAID and the Provincial Irrigation Departments. The four teams are as follows:

(1) Equipment Management
(2) Engineering
(3) Planning and Management
(4) Research

These teams would be involved in an "advise and assist role" in the rehabilitation program and institutional strengthening of the PIDs. After further consideration, two of the teams were restructured. Research was re-identified as Engineering and Planning and Management was divided into two activities, Planning and Management, and Training. Initially, there was no provision for a Chief of Party (COP), thus teams worked independently under the ostensible coordination of an AID advisor.

The teams were to be indirectly involved in civil works design capabilities; assisting researchers in the Punjab and Sind; improving workshop capabilities in the areas of staffing and maintenance of equipment, and improving management and organizational skills within the PID. The engineering team was to assist the PIDs in implementing the canal and surface drain rehabilitation and provide training to provincial staff. The engineering advisors were to work cooperatively with a local consultant, ACOP, in assisting in canal data collection, i.e. flow and sediment information. The equipment management team was to assist in developing or updating facilities and procedures to improve the utilization and repair of equipment. The equipment management team was to assist in the preparation and implementation of necessary training programs for workshop staff and equipment operators. The planning and management team was to work with federal and provincial authorities to increase the planning and management capacity of personnel through the creation of operation and procedural manuals and the presentation of appropriate training materials.

**Project Activities.** The USAID conception of staffing of technical advisors for this project resulted in a decentralized and fragmented management structure. This approach initially resulted in staffing choices that caused confusion and isolation. After approximately 18 months, a Chief of Party was appointed, however, the overall effects were only slightly improved. In effect, the delay in restructuring management of the technical advisors caused irreparable damage to the component of the ISM project. This initial lack of direction eventually led to the perceived notion that it was important to make up for earlier delays, resulting in a profusion of hastily prepared reports. Moreover, reports lacked priorities and recommendations for phasing various stages of implementation, which obviously significantly reduced their utility.

The technical assistance contract was administered and implemented by PRC Engineering Checchi, (TA). The contract provided for 660 person months of expatriate effort and 835 person months of Pakistani effort from April 1984 to December 1987 (See Annex II). Initially, the contract did not provide for a Chief of Party, for the 20 or more TA staff that arrived in-country all at the same time. This lead to a lack of leadership and direction for the team assembled on the project. This situation continued until February, 1985. From then on, a COP has been in charge of the TA manpower.

Efforts by the TAs were separated into five groups: 1) engineering, 2) operation and maintenance, 3) construction and equipment management, 4) planning and management, 5) and training. Administrative officers, and most of the expatriate TA team members, were located in Islamabad to coordinate the sub-offices and provide coordination with USAID and the Federal Government, engineering efforts were primarily in the Punjab-Lahore sub-office, the remaining efforts were implemented through sub-offices located in each Province. The allocation of manpower indicates that the percentage of expatriate work effort was the greatest at the beginning of the project, compared to the local component. As time went on, the reverse was true such that by 1987, the local Pakistani man months of effort expended amounted to 84% of the TAs total manpower allocation.

The activities of the five groups indicate that the largest level of effort by expatriates was in engineering, followed by construction equipment and equipment management, planning and management, training, and operation and management. Pakistani manpower expanded indicates that the largest level of local effort was in planning and management, followed by construction and equipment management, training, operation and maintenance, and engineering. Table 3-7 indicates levels of effort by the technical advisors.

Table 3-7

**Location and Staffing of Technical Advisors**
**April 1984 - December 1987**
**(Man-months)**

| | Expatriate | Pakistani | Total | Percent of Total |
|---|---|---|---|---|
| **By Areas** | | | | |
| Islamabad | 222 | 271 | 493 | 35 |
| Punjab | 195 | 287 | 492 | 35 |
| Sind | 73 | 136 | 209 | 15 |
| Baluchistan | 53 | 47 | 100 | 7 |
| NWFP | 37 | 74 | 111 | 8 |
| Total | 580 | 815 | 1405 | 100 |
| **By Activity** | | | | |
| Engineering | 204 | 68 | 272 | 19 |
| Operation and Maintenance | 47 | 69 | 116 | 8 |
| Const.Equipment Management | 137 | 240 | 377 | 27 |
| Planning and Management | 135 | 249 | 384 | 27 |
| Training | 57 | 199 | 256 | 20 |
| Total | 580 | 815 | 1405 | 100 |

Source: Personal Communication and Annual Progress Reports, PRC/Checchi

Suffice it to say that a maximum of 60% of the time allocated to the TA component of the project was constructively utilized. The impact of the TAs was somewhat diluted by USAID, PID, and government procurement procedures and near the end, the impact was significantly diminished by the on-again, off-again status of the consultants contract. Nonetheless, serious doubts remain regarding the quality and appropriateness of TA personnel and of the TA team's interpretation of its role and professional responsibilities.

Activities by the technical advisors were in the development of a hydraulic design criteria, workshop upgrading and rehabilitation, new equipment utilization; preparation of training courses, establishment of information flow centers; preparation of operation and maintenance manuals, and use of computerized systems in design, budgeting, stores and equipment inventory. Some of the reports and documents completed by the TAs, and reviewed by the team, are listed in Annex 15.

**Achievements.** The development of the hydraulic design criteria (HDC) was either successful or unsuccessful, depending on the frame of mind one has when discussing the issue. The HDC has been accepted by three of the Provinces - Sind, Baluchistan, and NWFP but not without communication difficulties. In the Punjab, communication was begun in a negative manner by the TA and USAID in support of the TA. This resulted in inaction by the PIDs and the TA's for too long a time. A committee was instituted by the PID-Punjab in November 1986, in which the Chief TA advisor for HDC, was a member. This effort resulted in a methodology for simplifying or modifying the TA recommendation as an alternative approach which would be acceptable to the Punjab PID. Presently, Punjab is reviewing, comparing, and assembling data to verify and justify this approach. In the interim, the compromise approach has been included in the SAR for ISR-II.

Workshop upgrading and rehabilitation in the four Provinces, including civil works and additional machinery, is nearly complete. The staffing of the facilities in the Punjab is farther ahead than in the other Provinces. The facility in the NWFP, in actuality, is a new facility, prior workshop activities were scattered around the Province. Rehabilitation and installation of new machinery is not completed to date. Experienced equipment manufacturer expertise is required in the near future to train workshop personnel in the operation of sophisticated equipment furnished under Phase-I in all Provinces.

New construction equipment utilization has not proceeded as quickly as was intended in the PP. Training in proper operation and maintenance of canal systems would enhance use of the supplied equipment. The TAs have not developed programs for proper preventative, normal, or project maintenance. Until such a program is put into practice, use of equipment furnished would be nothing more than an exercise in equipment operation.

Training modules and manuals have been written and implemented in varying degrees. Other reports address the establishment and staffing of training cells and/or suggest various training courses for selected personnel. (See Sub-Section 3.2.6 for further discussion on training.) This may be the opportunity to make comments on the importance of physical location of technical advisor offices within the PIDs in each Province. It is imperative for any advisor to have facilities within the PID.

Communication, availability of personnel, problem identification and resolution, and response are all enhanced if the PIDs have close access to the TAs and vise versa. Under ISM-I, whenever the advisors were located some distance from PID offices, communication efforts were reduced or failed completely, the experience in Punjab was a case in point.

Operation and maintenance manuals have been completed. Poor communication, resulting in misinterpretation and lack of input by field personnel has held up final printing and distribution. The comments above regarding communication are the very cause of this delay.

Use of computer and software programs has probably generated the most positive interest within the PIDs, but, the need for a computer cell was translated into an exaggerated design. Proposed cells have a tendency to centralize or create a special cadre of personnel that is unnecessary at the present time. The activity of computer use in HDC, budgeting, stores and equipment inventory, equipment work orders, and administrative management is a good beginning. However the potential, efficient use, and implementation of available programs and equipment has just begun. The need is waiting to be responded to. But such development is dependant on other aspects of department activities in canal operation, engineering design, canal maintenance, inventories, budgeting, personnel administration, and equipment maintenance.

**Response of PIDs.** The PIDs responded with acceptance, reluctance, or rejection, varying in degree from province to province and subject to subject. The establishment of computer cells and computer use was very successful. Interest was not only created but sustained as well in all Provinces. Training of staff at all levels was well accepted. Political, procedural, and cultural constraints limited foreign country training, but in-country training proved to be more acceptable, therefore much more successful. Information flow centers are in the process of being implemented, but at a slow pace. The centers as proposed initially appear to be too elaborate and cumbersome for the PID organizations as they are presently organized. The establishment of standards for operation and maintenance for planning and budgeting are probably the most successful. Though additional work should be carried out, the concept is well accepted by the Irrigation, Planning and Development, and Finance Department. The upgrading and rehabilitation of workshops, along with procurement of additional machine equipment and tools, has generated a positive response by the PIDs. Partly because of communication difficulties, the review, inputs, and acceptance of operation and maintenance manuals has been slow. The study products are presently being reviewed by the PIDs. However, it is unlikely that comments will be forthcoming in time to revise the manuals, incorporating those comments, and print them before the completion of ISM-I.

The acceptance of the hydraulic design criteria (HDC) is another matter. The attitude of each Province is different, both in understanding and acceptance. The HDC is, in general terms, accepted by the PIDs in the Sind, Baluchistan, and North West Frontier Provinces. It is and has been used in the Sind on a number of rehabilitation projects. Though the NWFP PID has accepted the HDC, their hydraulic considerations are different than those of the Punjab and Sind PID. The NWFP PID now uses Manning's formula and indications are that the Province has had no major problems in the design or re-evaluation of its canals and ditches, using that formula. The Punjab PID is a different story. Poor communication with that PID design cell and its Research Institute created a battle field of discussion and resulted in unnecessary delays in program implementation.

**Conclusions and Recommendations.** The TAs have indicated that they have completed over 260 reports, not all of which have been accepted or approved by the PIDs or USAID. Some of these are in fact redundant because the same basic reports are issued individually for each Province. The number of reports addressing different subject matter might amount to some 80 reports or less.

Implementation of the procedures or suggestions generated in these reports is another matter. The scope of work in the USAID project paper was too ambitious; therefore, limited implementation might be expected. In addition, there is little evidence of quality control of products generated by the TA. Work products are over-statements of the subject matter, an attitude of reports for report-sake seemed to have prevailed. Responsibility for quality control lies also with USAID. USAID staff did not review work products early enough in the project on in sufficient detail to communicate the lack of quality in reports being issued by the TA.

Most reports have been published near the end of the project and confuse the PID organizations who are responsible to implement them. Some reports are so lengthy, complex, and detailed that the PIDs have a difficult time determining where they should begin. Others are just poorly written, making it impossible to determine just what is being recommended and why. Too many reports are aimed at ideal recommendations without a stepping or phased approach. In other words, there is little in the way of prioritized strategy for implementation. In addition, there are no indications of sensitivity to the kinds and levels of decisions to be made or type of difficulties which would be encountered by the PIDs in implementing these reports. Many reports indicate confusion over objectives--to analyze, to advocate or to act--raising false hopes, and reflecting questionable interpretations of the professional responsibility of advisors. Moreover, few, if any, of the studies seriously suggest alternative approaches on the achievement of short term versus long term objectives. Emphasis on engineering resulted in a decreased level of activity in other component efforts. Though the overall levels of accomplishment in training were good, the activities in operation and maintenance were sorely neglected.

Practical implementation of recommendations made by the TA to the PIDs, and sustaining those improvements, should be of paramount importance. A number of suggestions follow:

(1) The acceptance and use of operation and maintenance manuals for preventative, normal, and project maintenance should be given top priority;

(2) There should be continued use of computerized systems; implement programs started; begin new programs slowly (consider projects requested by the PIDs); and continue training in the use of computer programing and operation,

(3) In-country training should be increased with training modules presented in each Province;

(4) There should be continued TA assistance in the use of HDC or improvements therein;

(5) Implement suggested institutional changes slowly, keeping practicality and sustainability as priority goals;

(6) Involve the federal, PIDs, and other units, government or private, in work efforts. This would improve communication and accomplishment of goals and successes in completing assigned tasks;

(7) Generate documents which suggest a strategy for implementation, taking into account sustainability and budget restraints of the PIDs. One suggestion might be a stepped implementation without specific time phasing;

(8) Improve communication efforts between the local units of government and USAID staff, especially with its technical advisors;

(9) Each Province PID should have full time technical advisory staff available to it. Advisor offices should be located within the PID offices to facilitate better communication and interest between all parties.

## Chapter 4

## POLICY ISSUES

GOP dialogue and efforts to update its irrigation water policy gained considerable momentum with the release of RAP in 1979. From that date onward, all IDA and related USAID funded irrigation projects have required GOP adherence to a series of water policy covenants. These covenants reflect an attempt to encourage the GOP to take action to remove the gap between revenue collections via water charges and the O&M budget allocations that will be necessary to sustain Pakistan's rehabilitated canal delivery system. In response, GOP adopted a policy objective of attaining full recovery of O&M expenditures in all provinces by the early 1990's. A review by IDA administrators in March 1985, however, showed that due to the present political sensitivity to imposing significantly higher water rates or additional taxes (primarily due to the imposition of Usher tax in 1983), the GOP would not be able to attain the covenant targets within the time-frame specified. Changes in the existing covenants as they would relate to ISM ISR-II, primarily as a result of changing the formula used to determine irrigation system O&M costs and a new time-table for privatization of public tubewells in fresh ground water (FGW) zones, were based in part on results of the Phase-I ISM ISR program activities.

The ISM project paper highlighted specific water policy issues addressed by IDA covenants (pp.24-25) as follows: (1) Water charges, (2) SCARP transition study (Divestiture of SCARP tubewells in FGW zones); (3) O&M financing procedures (revised "Yardstick"), and (4) Maintenance of Canal Freeboard (which provided the basis for the HDC effort). Although not specifically stated as a project covenant, there was an overall policy objective to improve equity in water deliveries. Finally, a concern for the PID's ability to sustain the system after rehabilitation through adequate O&M was translated into a major project component referred to as "modernizing the operation and management of the PIDs". These six major activities, designed to update GOP and provincial water policies and related action programs, were addressed in ISM ISR. A 1985 PRC report, An Evaluation of Existing Irrigation Water Pricing Policy in Pakistan (PRC Cheechi, Nov, 1985) captured this policy focus as follows:

> 'Aside from technical and management improvements in O&M, this essentially calls for, (i) an improvement in the cost recovery situation through an increase in water charges, (ii) technical revision of the "yardstick model" to make it an effective tool for budgeting procedures, and (iii) elimination of 'financial leakages' from the revenue collection system "(p.vii)

### 4.1 Water Charges and Cost Recovery

**IDA/USAID Project Covenants.** Following the release of WAPDA's RAP report in 1979, IDA began to impose strict covenants on cost recovery for O&M in all the water projects it financed in Pakistan. In cases of co-financed projects such as ISM/ISR, these covenants were also adopted by USAID. Specifically, the covenants required the GOP to "recover through water charges, or other appropriate financial arrangements, the full O&M costs of the irrigation systems" (SAR, phase-II, p.30). The specified dates for reaching full recovery ranged from June 30, 1988 for Sind to June 30, 1992 for Baluchistan.

**Project Activities.** Since cost recovery is a national policy issue, ISM project activity with its major action programs at the PID level was only indirectly related to this matter. Several research reports were released by the TA consultants, however, that analyzed the issues involved. Among the conclusions provided were

(1) Farmers spend only a small portion of their income from irrigated crop production for water charges so they do have the capacity to pay higher water charges;

(2) Government subsidies to irrigation are substantial and increasing with a disproportionate share going to farmers served by moghas at the heads of the minors and by farmers at the heads of watercourses served by the moghas (the equity issue);

(3) The current "low" water charges are a major cause of inefficient irrigation water use;

(4) O&M subsidies are placing a heavy strain on the provincial non-development budgets and they are increasing at a faster rate than increases in water charge revenues (which are also increasing);

(5) Leakages, defined as the difference between levied water charges based on actual cropping patterns and the amounts actually collected, based on artificial cropping patterns as reported, are substantial. (An analysis of 1981 data showed that "collectable" revenues constituted about 79 percent and 54 percent of canal O&M costs in the Punjab and Sind provinces, respectively.); and

(6) Adoption of differentiated water rates, i.e. among head and tail end moghas, would have only a modest redistribution effect on farm income but would significantly increase the total water fees that could be collected.

**GOP and Donor Agency Response.** Data analyzed by IDA in March, 1987, indicated that full recovery of O&M by the provinces could not be met by the specified target dates. Estimated recovery levels as of 1987, were as follows: NWFP 20%, Baluchistan 28%, Sind 48%, and Punjab 60%. This analysis also showed that if the cost of SCARP tubewells were fully removed in fresh water zones, the gap between recovery levels and O&M budget allocations would be substantially reduced in Sind and NWFP Provinces and practically eliminated in the Punjab.

Considerable confusion resulted from inclusion of the phrase "other appropriate financial arrangements" in the project covenants. The GOP maintained that, with inclusion of certain fees for agricultural services, total collections were meeting the full recovery requirements. IDA disagreed and has since revised the formula for determining O&M cost to remove the confusion. IDA limited the revenue component to fees charged for irrigation water, and also added a provision that SCARP wells in FGW zones be rapidly divested - generally within an 8-year time period. The GOP has accepted these conditions except for some new schemes funded by ADB.

The GOP has also agreed to initiate a study designed to improve collections. When recommended reforms are implemented, GOP has agreed that any remaining shortfall is to be covered by increasing the water rates charged to farmers.

As to attempts to reduce collection "leakages", a high level government commission has recently recommended that a series of flat rate charges be instituted, which decline as one moves from the head to the tail moghas. It was reported to the Team that a trial of this proposal will be carried out in the Punjab.

Finally, WAPDA has been directed to institute a flat rate charge for power charges to irrigators, which is expected to stimulate development of private tubewells, particularly in the FGW zones of the SCARPs. It is apparent that a number of the GOP water policy changes already implemented, agreed to and/or under consideration were based in part on the ISM TA consultant studies of water rates and cost recovery issues.

### 4.2 Divestiture of SCARP Tubewells

**IDA/USAID Project Covenants.** The original IDA covenants, subsequently adopted by USAID, required the GOP to identify a SCARP transition area in SCARP I in which it would investigate the feasibility of full divestiture of public tubewells in the FGW zones of the SCARPs. Of some 12,500 large (2 to 5 cusec) SCARP wells, about 11,000 are in the fresh ground water zones. They are a major cause of rapidly escalating O&M costs, due to high energy, maintenance and replacement costs. According to the project paper, this study was to be completed by July 1, 1983 but due to unforeseen delays, it is still continuing.

**Project Activities.** TA consultants ceased work in this area after 1986, when Dr. Aslam Chaudhry (who was primarily responsible for the earlier water policy background studies) transferred to the EAN policy research project in the Ministry of Food and Agriculture (MINFA). Very recently, however, following the emergence of the proposed new covenants related to SCARP tubewells divestiture during Phase II, a special study of the issue was initiated by MINFA under the EAN project. This study, conducted by a TDY consultant, Dr. Robert Young, and Dr. Aslam Chaudhry, is still underway but their preliminary results have already attracted considerable interest within the GOP and the donor agencies. Among other findings, they concluded that:

(1) Private farm groups organized as farmer water user associations (WUAs) are not interested in taking over SCARP wells, due to financial and managerial constraints;

(2) Individual farmers are replacing SCARP wells with small fractional TWs (less than 1 cusec), but serious increases in groundwater levels may result if the time lag is too long; and

(3) In economic terms, when marginal cost considerations are taken into account, the cost of pumping with diesel engines is becoming competitive with electrical pumping costs.

The latter is a significant finding because it had been assumed that private tubewell installation in many areas would have to await expansion of the WAPDA electrical network. Other important observations emanating from this on-going study include:

(1) Given the sunk cost investment in SCARP wells, they should be allowed to "die a natural death" rather than closing them down prematurely;

(2) Although donor agencies and GOP policy makers have stated that they think WAPDA can play an important role in future irrigation water management, field level managers in the provinces are not very optimistic about this role;

(3) The on-going SCARP-I transition project has not been able to demonstrate that the IDA's desired replacement mode (turning wells over to WUAs) is a viable concept; and

(4) Given a concern about GOP's future capability to respond to a high water table problem that could materialize, consideration should be given to "moth balling" some SCARP wells in FGW zones rather than simply removing them.

Further analysis of these issues seems worthwhile and should therefore be given consideration in designing Phase-II of the ISM/ISR project.

The SCARP I transition study has not yet been completed but preliminary findings indicate that;

(1) Farmers are replacing SCARP wells in the study area and the rate of replacement with small individual wells is increasing;

(2) No WUAs have been formed to date to physically take over SCARP wells; and

(3) The ratio of new diesel powered to electrical powered wells is about 1:3.

Without direct IDA involvement in the transition study, it appears that the monitoring of progress has been quite lax and no economic evaluation of that effort is presently being made. This is clearly a major deficiency in the on-going SCARP tubewell transition study that should be rectified in the design of ISM/ISR, Phase-II.

**GOP and Donor Agency Response.** Following the IDA study (March, 1987) of the lack of progress by the PIDs in meeting the O&M cost recovery targets, there has been a continuing IDA dialogue with GOP administrators on speeding up the SCARP tubewell divestiture effort. Of the six covenants related to the O&M subsidy removal policy issue specified in the SAR for ISM/ISR, phase-II, four of them deal with public tubewells in FGW zones. There is widespread PID resistance to the proposed 8-year time-table and the IDA expectation that these SCARP wells would be taken over by WUAs. The PIDs position, particularly in the Punjab, is that specification of the time-table and the manner of divestiture should await the results of the SCARP transition study. Preliminary results from that study and the companion study by the EAN project in MINFA indicate that revisions in the IDA proposed covenants may indeed be warranted. Further, they underscore the need for proceeding with more systematic monitoring of progress and for conducting institutional and economic impact studies. In this regard, IDA is considering funding a follow-up institutional study and PERI has been asked to conduct an economic study, with ISM/ISR phase II funding.

## 4.3 O&M Financing

**IDA/USAID Project Covenants.** The ISM/ISR Phase-I project covenants included a requirement for increased O&M budget allocations to the PIDs. The funding targets are given in Table 4-1.

Table 4-1

**Allocation of Funds To O&M by the Provincial Governments**

| | FY-83 | FY-84 | FY-85 | FY-86 | FY-87 |
|---|---|---|---|---|---|
| MRs (in constant FY-81 Rs) | 793.5 | 882.5 | 971.5 | 1034.5 | 1037.5 |
| MRs (Current Rs) | 877.7 | 1056.6 | 1203.3 | 1323.5 | 1374.5 |

**Source:** SAR, ISR-II Report No. PAK 6991, World Bank, Nov. 1987.

During ISM/ISR, these O&M allocation targets for "operation of the PID irrigation system" included O&M costs for irrigation, flood control and surface drainage facilities, and related administrative costs but excluded the O&M cost of public tubewells. For the future, the formula components will be limited to O&M costs for canal systems, subsurface saline drainage, and related administrative costs.

Project Activities. One of the major activities of the TA contractor was to work with the PID's in modernizing the "yardsticks" used to formulate budget requests (see Section 3.2.1). The PIDs have generally endorsed these changes as reported in the review drafts of the TA reports on this matter. In Baluchistan and NWFP, however, the PIDs have requested inclusion of costs that are unique to their conditions. Publication of the final reports is pending, because the final review comments of the PIDs have not yet been received by the TA consultants.

Response of GOP and Provincial Governments. The GOP agreed to the initial O&M funding covenants and made corresponding increased allocations to the provincial governments. The four Provinces in turn have allocated funding for irrigation system O&M which has been in excess of covenant targets during each year of the project life. Specifically, the increases have been over 15% annually during the last five years.

Except for Baluchistan and NWFP, as noted above, the PIDs have generally accepted the revised funding yardsticks developed by the TA consultants and these appear to have the endorsement of the P&D departments as well. Budget allocations are made by the provincial Finance Departments, however, and it remains to be seen if they will accept these new yardsticks. In any case, however, the GOP will be required to adhere to an overall O&M covenant for ISM/ISR, Phase-II, which is stated as follows in the SAR:

> "Assurance would be obtained from all four Provinces that the current level of O&M funding for the surface irrigation and subsurface saline drainage facilities would be maintained in real terms..."

### 4.4 Hydraulic Analysis

The basic approaches to the design of unlined alluvial canals were developed from studies of Pakistan's canals; initially by Kennedy in the late 19th century, culminating with the work of Lacy in the mid 1930s. Lacy's relationships and approach were adopted by the Central Board of Irrigation in 1934. Lacy's method was used to design the major

canals built since that time, and was adopted for the Phase I link canals in 1962, after a thorough study of the literature.

Research on the behavior of unlined alluvial channels has continued in Pakistan and elsewhere in the world in an effort to improve design methodology. The Canal Headworks Observation Program (CHOP) in support of the link canal projects was started in 1961, and expanded to other areas of the country under the Alluvial Channels Observation Project (ACOP) in 1974. The efforts to collect additional data and develop specific new design methodologies under the ISM project should therefor be seen as a continuation of a long scientific and engineering tradition in Pakistan.

There were a number of specific ISM project concerns that stimulated these efforts as well:

- since completion of the storage and link canal components of the Indus Basin Project, many of the canals carry discharges higher than the original design capacity;

- funding had not kept pace with requirements for adequate maintenance, particularly preventive maintenance; as a consequence canal embankments and structures deteriorated, and accumulating sediments in the canal prism reduced performance and freeboard, there were frequent breaches and increasingly inequitable water distribution as watercourses in the head reaches benefited from higher water levels; and

- Pakistan's canals must carry a huge suspended sediment load that varies greatly throughout the year; for canal rehabilitation to be cost effective the canal sections should be modified only where needed to provide required flow and sediment carrying capacity, sediment transport capacity is therefore a critical factor in design and traditional practices, such as Lacey, did not explicitly account for this factor.

**Project Activities.** As outlined in Section 3.2.4, the ISM project TA consultants developed new hydraulic design criteria (HDC) between April, 1984, and February, 1986, using ACOP data and several international data sets. The chronology of this development is presented in Annex 8. The results were presented in a series of technical reports. The design methodology was also presented in the form of a computer aided design package (software) called CADIS.

**Response of the PIDs.** The HDC was seen by the PIDs as very advanced and sophisticated technology. It did not use or develop new hydraulic concepts or even relationships that had not already appeared in the technical literature, but it did represent a major change for the PID staff, one that they were ill equipped to make. The PIDs were not involved in the development of HDC and did not believe at the outset that a new design methodolows was needed. Hence it took a long time for their technical experts to review the work and understand what was being proposed. A major factor in this was that there was no field experience or data available to directly demonstrate or evaluate the efficacy of the new design criteria. Moreover, since it was produced by outsiders, it was initially met with mistrust and rejection.

The Sind, Baluchistan, and NWFP PIDs accepted the new HDC in 1986 and it was in use in the Design Directorate of the Sind PID by June of 1986. Four canal systems have been designed in the Sind and a fifth is nearly completed. It should be noted that the

use of traditional methods of design were least effective on the Sind canals and the limited Indus areas of Baluchistan. Entirely different methods are used for many of the NWFP canals because of the coarse gravely bad materials and steeper slopes.

After an additional period of about one year (i.e., by June 1987) to consider a number of technical alternatives to HDC, the Punjab PID proposed that an alternative procedure, referred to as HDC Simplified or HDC(s), be used for ISM/ISR rehabilitation design in the Punjab, and that a research program be initiated to further refine the methods. The TA Consultant who developed the HDC participated in the evaluation and concurred in the findings of the technical sub-committee that produced the final proposal.

**Conclusions and Recommendations.** Project activities have established the basis in each province for improved design methods and, to the extent possible, improved canal designs. But the process used was damaging and destructive to the project. Activities which have far reaching consequences within the PIDs must in the future be developed with the closest collaboration. Collaboration is essential to the institutional strengthening component of ISM.

Adoption of the HDC methodology will have serious implications for PID staffing and training. At present the HDC technology is most effectively applied by trained specialists whose background and experience in hydraulic engineering is much more extensive than most PID engineering staff. Complete system design will be required for a limited number of systems, hence the specialized design cells do not need to be large. Nevertheless, recruiting even a limited number of staff will be very difficult.

A more serious concern related to staffing and training is the capability for data collection, engineering evaluation of canal performance and operating criteria, identification of problems and formulation of solutions, and preparing maintenance plans (see Annex 5 for a discussion of problems in several of these areas). These functions are normally the responsibilities of the field offices of the PIDs. The staff of these offices are ill-equipped for these duties because they lack facilities such as transport and specialized equipment, and adequate training in essential areas such as surveying, water measurement, operation, canal design, and maintenance. Since there is no internal continuing training program in the PIDs, except for a limited capability in the Punjab, upgrading the capability of the engineering staff of the PIDs is a major challenge for the second phase of ISM (see section 5.2.6).

### 4.5 Modernization of Management

Pakistan's Sixth Five Year Plan (1983-88) highlights the importance of management improvements to enhance productivity and effectiveness. Such improvements were the purpose of the ISM Project "...to increase the capabilities of institutions involved in irrigation system planning, design, research, operation and maintenance...". This hasn't happened.

**Project Activities and Problems.** There have been lots of reports written, civil works installed, and computer centers physically established, but few sustainable management improvements (see Annex 6). The PIDs argue that it is very difficult to change procedures--you must negotiate with federal government, etc. Yet such is not always the case. If the TA consultants had management specialists assigned to the PIDs,

who were told not to write reports but to make things happen, and if USAID came up with more flexible procedures, then something could be done.

Largely because of internal ISM management problems (see Chapter 6), the project achieved minimal productive policy dialogue on key management issues. The actual policy dialogue that took place was often bitterly adversarial and counterproductive.

The heated debate over HDC centered on arcane, technical points on the surface, but was actually the PID management proving to the TA consultants, AID, the FCC, and other interested parties that they were still technically in command of the department. The PID was raising an important, provincial-level policy issue: 80% of the canals were not problem channels and didn't need HDC for their redesign. Work on these should have gone ahead while the issue of the remaining 20% was being settled. Since this was not done, canal rehabilitation in the Punjab under the project has fallen far short of original plans. Within the last year, there has been progress. The Design Cell now has a full-time director and deputy, some very useful computer-aided design work is going on, and the heat of the HDC debate has subsided. Yet had the HDC activity been better managed, the changes might have taken place faster, with fewer delays in civil works rehabilitation.

There have been other modest, management improvements, particularly in Sind, which in general has been more receptive than Punjab to the project. The reason for the greater receptiveness may be that the TA approach in Sind was superior since consultants worked inside the PID office.

**Conclusions and Recommendations.** The Planning and Management team was the TA input dealing explicitly with management issues. Its approach was to formulate eight proposals on management improvements for the four provinces. The proposals are meant to sketch out an ideal scenario for the PIDs (see section 3.2.1). These studies contain useful ideas and data, but are not practical catalysts for action because:

(1) The reports themselves and the recommendations within each of them are not prioritized.

(2) Four of the eight innovations depend on USAID agreeing to provide bridging funds for salaries, allowances and incentives to government staff, which seems highly improbable.

A related issue is to what extent management improvements have overcome the limitations on the PIDs stemming from existing service rules, incentives, and traditional modes of behavior. Management improvements have taken hold in three types of cases:

(1) When unusually dedicated managers take an interest, eg. the CAD work of the deputy director of the Design Cell, Punjab PID.

(2) When managers find that management improvements serve their own interests.

(3) When improvements have a neutral effect on managers' interests, and are vigorously pursued by the TA consultants and USAID. For example, limited progress has been made on funding yardsticks for O&M because they are suitable for budgeting, but not for monitoring. By contrast, attempts by the project to develop

detailed costing of what particular jobs should cost have failed, since these could be used to highlight the lack of cost-effectiveness of contracted work.

## Chapter 5

## MONITORING AND EVALUATION

**Project Paper Specifications.** Hydraulic monitoring was called for in the project paper to provide empirical data for the development of new design criteria, and to provide data for estimating the project impact on the equity of water delivery. Evaluation, as defined for this review, refers specifically to estimating the project's economic impact by monitoring the physical output parameters of the project effort. The project paper, however, did not clearly differentiate between this function and one of merely specifying the mechanics and timing for a series of project reviews (progress evaluations). For example, while the project paper does mention some of the parameters to be monitored for economic impact evaluation (section F.1.b./p.96) considerable more detail is given on the mechanics for carrying out periodic project reviews (pp 97-99). Very little guidance is given on the specifications for economic impact evaluation anywhere in the project paper. It is important to recognize this constraint at the outset as it goes a long way to explain why so little usable results were accomplished in the area of project economic impact analysis.

Responsibility for project monitoring and (economic) evaluation was assigned to the Federal Coordination Cell. The project paper specified that two units within WAPDA--ACOP and WMED P&I--would be responsible for "collecting and analyzing data for design and evaluation purposes under the ISM ISR project." The ACOP and WMED activities were funded by IBRD and the study area was limited to IDA-financed program impacts. No provisions were made within the ISM project for the IA contractor to provide technical assistance to WMED in developing methodology for its assignments, to provide advice on collecting data and analyzing the results. The project paper stated that "WMED will receive additional assistance from the long-term consultants to be provided under the OFWM Project." However, there is no evidence that such assistance was sought or available.

It should be noted that the project paper did call for a standard economic evaluation of the project. However, the wording cast doubts about what was being prescribed beyond merely measuring project progress. Specifically, the project paper stated:

> "The availability of production impact data for project areas before, during, and at the end of the project will facilitate an evaluation of the progress achieved in meeting the overall goal of the project".

The project paper failed to note, however, that even if such data had been obtained, translation into net farm income and related economic impacts would still have been necessary in order to carry out a complete economic evaluation of project impacts. While it was clearly stated in the project paper that the assignment of overall economic impact analysis was the responsibility of the Office of the Federal Coordinator, this assignment was eventually delegated to the WMED. By the time this WMED assignment was funded, however, the EPC had decided that it was too late to carry out a baseline survey of project impact areas because the rehabilitation work was already underway. As a result, WMED was given an impossible assignment and this should have been apparent to IDA and USAID administrators responsible for the ISM ISR projects at that time.

**Project Activities: ACOP.** Two specific assignments were given to ACOP: (1) to carry out an evaluation of project impact on water supply and equity, based on a comparison data obtained from monitoring after rehabilitation with base-line data; and (2)

to monitor problem channels to identify the sources of problems, with particular emphasis on sediment, so as to provide a data base for the HDC development effort

In practice, only one-third of the identified problem channels were monitored and baseline data for these channels were collected for only one year (for both kharif and rabi seasons). Data were compiled for 128 systems over a three-year period. These data were computerized and provided to the IA Consultant for use in developing the HDC. Follow-up surveys have not been carried out to date, due to the long delay in rehabilitation of channels.

ACOP collected baseline data on 324 non-problem channels on which rehabilitation work was to be carried out. For these, a follow-up survey was carried out and the results compared with the baseline data. Since this portion of the monitoring effort was also not started until after the first 18 months of the project, however, some baseline data obtained from the PIDs was used in the analysis. ACOP did not provide separate analyses for rehabilitation work completed with USAID and IDA funds.

ACOP found from an analysis of its data that average discharges increased by about 39% at the head of the rehabilitated channels. Discharges also increased throughout the downstream sections of these channels, but the rate of increase declined as one moves toward the tail of the channels. As to impact on equity, ACOP concluded that some 30-to-35% of the middle and lower reaches were benefitted, but at less than the level that had been expected. Another major finding by ACOP was that many moghas currently deliver water far in excess of design discharge, particularly in the upper reaches of minors. Some moghas exceeded this level by up to 170 percent. The ACOP engineers noted that the less than expected improvement in equity was primarily due to the fact that the moghas were not remodeled as part of the rehabilitation work in the channels for which they had obtained sample data. In their view, one of the important lessons learned from this exercise is that if higher equity in water distribution is to be achieved, the moghas will have to be recalibrated during the rehabilitation activity.

**Project Activities: WMED.** WMED was directed to carry out agronomic-economic impact data collection and analysis for the ISM ISR project. This work was not started until 1985. Initially, WMED was given only one year to complete its assignment and this constraint was reflected in its workplan. Since rehabilitation work was already underway, the ICC decision that a baseline survey would not be carried out was accepted as given by WMED (and USAID). In lieu thereof, a modified "with and without" approach to data collection and analysis was adopted by WMED. In this approach, a sample of 24 watercourses was selected: six sample systems in areas not in the project and six in areas being affected by rehabilitation. One watercourse at the head and one at the tail was selected in each of these 12 sample areas. Finally, 15 farms were selected in each of the 24 watercourses in the sample. For these, standard agro-economic data were collected from farm operators using the interview method. In addition, data on discharges for 70 mogha outlets, including those for the 24 watercourses in the sample, were obtained from the PIDs as input data. None of the similar discharge data being collected by ACOP was used by WMED in its analysis.

WMED issued its first report in August 1985. It covered 44 rehabilitated schemes but no data on pre-project conditions was included. A second report, covering 10 schemes, and for which the modified "with and without" project conditions were compared, was issued in May 1986. This report noted some improvement in irrigation supplies, slightly skewed to the tail of the system, and some preliminary indications of

increased crop production. A third report, covering 41 distributaries and minors of the Muzaffargarh canal system in the Punjab was released in August 1987. According to this report, "significant increases in water supplies occurred in watercourses in the tail sections." WMED's final report is in rough draft form, but WMED administrators stated that they have no remaining project funds to publish it.

WMED concluded that water supplies to the water courses increased in both the "with" and "without" project samples but the greatest increases were in the "with" sections. These conclusions were based on comparison with original design specifications. However, discharges in these sample moghas were not measured at the start of the data collection period. Based on the ACOP study, however, there is a strong basis for assuming that such discharges were already above the design levels so that actual increases due to the project cannot be determined. WMED did not find significant increases in yields but did document significant increases in cropping intensities; thus, increases in total agricultural output were indicated. These agronomic indicators have not yet been fully analyzed to determine the increases in net farm incomes, and resultant estimates of project economic impact. Nor are there plans to do so because the draft of WMED's final report does not include such an analysis. To do so would not provide reliable information in any case because of the database and methodology employed. Consequently, it should not even be done. No estimates were made of the project impact on employment. The WMED personnel stressed that the time frame was too short to expect significant increases in farm-level benefits and that even those that may be accruing could not be measured because there was no applicable baseline data available. They also pointed out that impact of private tubewells in the sample areas was significant, but not separable under the study methodology employed.

**Response by the GOP and Donor Agencies.** There is ample evidence of an increasing awareness by key policy makers in the GOP and in the P&D departments at the provincial level that projects such as ISM/ISR should be subjected to comprehensive economic impact analysis. The primary reasons cited for this interest are rapidly increasing deficits in the non-development budget and, in particular, the large gap between water rate collections and budget allocations for O&M of the irrigation delivery system. There is also a realization that the impact data and analysis for ISM/ISR was grossly inadequate. The view of IDA representatives on this matter are reflected in the SAR for Phase-II:

> "The ISRP-I evaluation reports prepared by consultants were generally inadequate. The primary problem faced by the consultants was that ISRP-I works were scattered, which made it difficult to isolate their economic impact from that of the rest of the system."

USAID staff in the Mission and in Washington have also expressed concern about the inadequacy of the economic impact evaluation efforts carried out for ISM/ISR. As a result of this new awareness by concerned policy makers in the GOP and the donor agencies, provisions are being made in plans of work for Phase-II to remedy this deficiency.

**Conclusions and Recommendations.** The hydraulic monitoring and analysis work conducted by ACOP met the stated project paper objectives and produced generally high quality results. The hydraulic data collection should therefore be continued, and work started immediately to do the follow-up surveys on the rehabilitated segments. In

addition, the data base for improved hydraulic design criteria needs to be greatly expanded (to cover more adequately seasonal variations, and to increase the sample size). Over the longer term, such work should be taken over by the PIDs as part of their routine O&M activities. ACOP should be relied upon during the transition phase, however, both for data collection and for training of PID personnel in the techniques employed.

As to the data collection effort for economic impact analysis, there is general agreement that this effort was a disaster. Therefore, some further observations are in order:

(1) It was naive to assume that an evaluation unit (WMED) in WAPDA developed to study micro-economic conditions for on-farm water management programs would be technically capable to take on the macro-analysis focus of the ISM/ISR evaluation, particularly when no adequate provisions were made for TA advisors services.

(2) The rationale given by IDA in the SAR for Phase-II to the effect that no economic evaluation could be made because of the scattered completed works, is only partially correct. For example, it is known that no breaches have occurred to date in the rehabilitated canal reaches, whereas this was a common occurrence throughout the system before the project. Therefore, for such scattered works, reasonably good estimates could have been made of the economic damages thus averted and these data could then have been used as a proxy for benefits attributable to the project.

(3) Some rehabilitation works were not scattered. In such cases, project impacts on acreage in cultivation, cropping patterns, intensities, etc. are physically observable and thus could have been subjected to an economic evaluation. For example, drainage works rehabilitated in the Lower Sind, right bank, and near Faisalabad in the Punjab, fall into this category.

(4) Even though the WMED work did not start until 1985, a baseline survey of land areas to be affected by subsequent rehabilitation works could still have been selected and baseline surveys done there at that time. Especially since Phase-II was already under serious consideration by then.

(5) The sample areas selected by WMED could have been limited to a sub-sample of systems for which ACOP was already collecting hydraulic data. Had this been done, the preliminary study results on increased water deliveries and improvement in equity of delivery could have been strengthened, instead two sets of conflicting results are now available with no way to reconcile the differences.

The bottom line is that review of the failed evaluation effort during Phase-I is useful only in terms of lessons learned for Phase-II. Above all, the impact evaluation for Phase-II should focus on total project impact, no artificial disaggregation should be allowed between components funded by IDA and USAID. In this regard, the evaluation team endorses the proposed revised approach for monitoring and evaluation set forth in the SAR for Phase-II. For additional terms of reference material to assist in implementing that effort, see the attached Annex 9.

## Chapter 6

## PROJECT MANAGEMENT

Some of the ISM technical assistance has been useful, but the overall effort has suffered from the lack of planning, direction, and quality control, particularly during the first half of the project. Team members worked in isolation from the PIDs and each other, showed poor judgement, and continually demonstrated a lack of sensitivity to the organizational subtleties of the PIDs. In the second half, the TA consultants have mobilized capable Pakistani specialists who have done some productive work. However, quality control is still uneven, the project's disastrous beginning has hampered attempts to salvage the TA operation.

The problem stems in part from the original design of TA for ISM, which was to operate with several teams without an overall team leader. The intent had been that a PSC project management advisor would coordinate the four project components: rehabilitation work, institutional improvement, planning, policy implementation, and research; and command water management. This was then reinterpreted in the case of contracting to mean that the project management advisor would coordinate the TA teams focusing on engineering, equipment, training, and planning and management. This was untenable, so after 15 months of their contract, the TA consultants were finally authorized to appoint a COP. Overall, the TA teams lacked coherence, direction, and good judgement during the initial stages.

There were other problems of project design. The design was flawed by the high-risk strategy of creating new government entities (the FCC, PCCs, and FPRB) defined as critical to project success. The TA effort was divided into substantive areas, where it should have focused efforts geographically within the four PIDs. The PP shows no awareness of the complex incentives and subtle arrangements within to the current operations and structure of the PIDs. For these and other reasons, the PIDs resisted the project from the start, and began efforts to undermine key project tasks.

There were also leadership and project management problems at the USAID Mission. It failed to anticipate the management needs of the project, insisted on an unmanageable organizational arrangement, and contracted with a TA group in whom they had little confidence.

An ambitious, integrated, politically sensitive project such as ISM requires outstanding project leadership supported through a clear-cut chain of command. Yet the project never had an adequate leadership structure. A PSC project management advisor acted as administrative coordinator of the technical inputs, and troubleshooter, but too frequently assumed direct administrative responsibility for individual components. This arrangement particularly compromised the role of the Project Officer when an FSN assumed the position. The contractor's initial COP came too late and left too soon to truly lead, and wasn't given a mandate by USAID to do so. All of the above problems should have been evident during the mid-term evaluation, but were not adequately addressed.

This management misdirection has come to a head in the last year. During that time USAID and GOP have explored ways to create a TA bridging mechanism to continue until the start of ISM-II, without reaching a final agreement. As contract periods came and passed, USAID and the GOP appeared to have changed strategies from canceling ISM-II, to hiring an inexperienced 8(A) contractor as a bridge to ISM-II, to extending

the existing TA contract without providing adequate resources to implement recommendations.

Meanwhile, the TA consultants have released a multitude of reports and some advisors have started to gain the confidence and raise expectations of the PIDs. At the same time, however, in anticipation of the expiration of the contract and subsequent extensions, the TA consultants have terminated and rehired staff three times, losing people in the process, as well as momentum. Also, the backlog of FHCs and PIO/Ts at USAID has grown, giving the PIDs the impression of an unresponsive agency.

Such a mismanaged project was a singularly unsuitable vehicle to use to improve the management of the PIDs. Problems were studied rather than solved and the studies themselves became greater barriers to change than the original problems under study. Project inputs focused on technical questions, while many of the more serious institutional and political problems were not addressed. Recommendations were overly complicated and grandiose, with too little input from the PIDs.

The TA consultants have reported that they delivered over 260 reports. Most of these were not specified as deliverables in their "advise and assist" contract. There is little evidence that these reports are read by PID staff, or that any of the institutional changes called for in the reports are being implemented. Indeed, the reports surely discourage implementation since they are so numerous; and their recommendations are lengthy and complex; and they failed to prioritize their implementation. Thus, the PIDs cannot use the reports to guide planning or implementation, even if they accept the report conclusions.

The reports are not strategic. How is the reader (PID Secretary, Chief Engineer or USAID) to know what to do first? How are the recommendations in the various reports contingent on each other, and what is the critical path to be followed?

Take the example of the Budget Modernization Report. Although one can find some useful information scattered through it, it is not a useful management tool because:

(1) It was completed in July, 1987, more than three years after the start of the TA consultant's contract. The consultant was asked to propose a 2-year program, yet the report proposed a 4-year program costing $3 million, without containing a viable workplan or implementation schedule.

(2) The overall purpose, plan and recommended outcome is not clear, and would have been better stated in a two-page memorandum.

(3) The ambitious design of the program shows poor judgement. For example, a proposed module producing Halqa-based demand statements (800,000 for the Lahore Division alone) on a LAN system would push the limits of most government bodies in the US, and would be ludicrous to try in a PID at this stage.

(4) The overall conclusion (p.11) is that Punjab and Sind have nearly achieved full funding of O&M, and will achieve full funding within the next 2 to 3 years. Yet the Chief Engineer, Hyderabad told us current funding covered only 60% of needed O&M. The discrepancy results from the standard of O&M under consideration. Punjab and Sind have nearly achieved full funding of O&M at the present standard. However, this standard is not acceptable, as evidenced by the need for canal and

drain rehabilitation. By not recognizing this distinction, the recommendations of the consultant's report are questionable.

The procedures being followed for printing and planned release of the reports are also suspect. For example, the consultant requested funds to print 2000 copies of the O&M manual for $170,000. When AID questioned the price, it dropped to $70,000. With further questioning, it was discovered that the PIDs had not yet seen, much less approved, the final draft. When the PIDs requested hundreds of copies of the manual, the TA interpreted this to be approval. In reality, the PIDs claim they want copies to pass to their staff for discussion, so that a final draft can be prepared.

The TA effort had particular difficulties in the Punjab. For example, the Punjab Secretary says he has been trying for a long time to computerize data on crop revenue; nothing has been produced by the computer cell, yet lots of work has been done on data collection. The TA consultant said that the problem is bad data - the PID has only data on revenue estimates; the FD has data on receipts, but not in comparable form. It is unfortunate that the computer cell could not have produced something, even with bad data to serve as a demonstration. This could have been an opportunity for the PID to work with the FD, which could build good will when approaching them for full-funded O&M budgets or more sanctioned staff for PID.

Indeed, the problems with this component are symptomatic of the broader TA problems on this project. Initially, the Secretary asked for a system to monitor revenue billing and crop estimation. A feasibility report prepared by a local consultant interpreted his request as a call for a much broader system comparing assessments with billings and collections. They recommended a separate feasibility study on this application, the cost of hardware alone for which may exceed 3 million rupees. Yet there is no reason why the Secretary could not have had his assessment system developed by existing staff on one of the PCs he already has. This would serve his immediate needs, and provide a pilot to help the department learn to develop and use this type of application. If further expansion was needed, consistent with the feasibility report identified above, additional modules could be added to the assessment system.

The delays in computer equipment procurement point out another, symptomatic TA problem. Both TA and local consultant studies provide detailed justifications and organizational plans for all applications. These studies are far more detailed than necessary, or contain the wrong details for decision makers. The staffing plans are ambitious and unrealistic. Up to now, six months after the final report was released, the Punjab PID has not requested a staffing from the Finance Department.

Both the TA consultants and USAID have consistently demonstrated ad hoc project management style. Procurement is done piecemeal, requiring many different PILs and multiple delays. For example, the NWFP workshop was designed by NESPAK prior to the start of ISM. Design specifications were reviewed by two TA consultants and used as the basis for initial procurement requests. Before this was even processed, other basic requirements were identified by another local consultant, reviewed by TA consultants and forwarded to USAID. However, it appears that no action was taken until about 18 months later, when the TA advisor in Peshawar developed a third set of requirements, including seemingly basic items like shelves for spares. (Spares had been ordered in the previous phases, but are still in shipping crates because no provision had been made for shelving them.) This became the basis for another PIL.

Too many management related activities of ISM reflect technical incompetence, or carelessness, on one hand, and inefficiency or unresponsiveness, on the other hand, neither of which enhance efforts to strengthen the PIDs. Over the last year, USAID has reorganized its water resources unit, changing roles as well as personnel. The transition has been difficult, and is not complete, but the new arrangement should overcome many of the previous problems.

## Chapter 7

## CROSS-CUTTING ISSUES

### 7.1 Sustainability

The essence of ISM/ISR, in concept and articulation, is sustainability. The project aims to assure reliable and equitable water supplies by physically rehabilitating Pakistan's irrigation and drainage system and strengthening concerned institutions to enable them to sustain those improvements.

Prior to the project, a combination of factors created a crisis situation. On one hand, the completion of major link canals increased the total supply of water in the system. On the other hand, the system had deteriorated to a point where water distribution was increasingly unreliable and inequitable. Over-toppings and breaches caused damage to crops and households; and increased water supplies were captured by head-enders, while tail-enders received uncertain and irregular supplies. Meanwhile, the PIDs, the responsible institutions, were debilitated by the creation of WAPDA, on one hand, which drew off much of their most capable staff; and by the advent of the On-Farm Water Management Program, in MINFA, which has reduced PID-farmer contacts.

The purpose of the project is to rehabilitate the system and establish appropriate funding levels, funding mechanisms, and operations and maintenance procedures and practices to keep the system in its improved state. Institutional and physical improvements are essential to restore the system and maintain it, thus the project invests in both areas.

Not surprisingly, physical improvements have been easier to undertake than institutional improvements. The PP emphasized a "systems" approach to rehabilitation, which would concentrate efforts. However, a "band-aid" approach was actually adopted, to patch up the most vulnerable parts of the system. The areas most prone to over-topping or breaching were rehabilitated first, without reference to other parts of the system. This implementation approach was justified, and the effort has been successful; no major breaches have occurred since completion of the major emergency works.

Meanwhile, activities were undertaken to address other issues related to sustainability. "Yardsticks" were developed to help PIDs prepare and defend budget requests, and thereby obtain adequate funding for O&M; O&M manuals were prepared to assist in reasserting maintenance standards and practices; workshops were established or improved to enable the PIDs to take care of equipment properly; additional equipment was introduced to be used for rehabilitation and maintenance; and various management problems were identified and studied.

Some of these efforts have produced visible results, but others have not. In general, their overall impact has been to set the stage for future initiatives, rather than to establish viable mechanisms to sustain physical or institutional improvements.

It would be unrealistic to expect ISM to have fulfilled many of the promises articulated in the PP, which were clearly exaggerated. Nonetheless, project implementation has suffered from a multitude of management problems which has led to frequent confusion. The most obvious example is the single minded attempt to impose HDC on the PIDs, delaying other useful initiatives. On the institutional strengthening side, too many management reports were prepared which posited unrealistic, idealized scenarios and attempted to recommend ways to realize them. These reports generated

false expectations and misunderstandings, which themselves became the subject for debate, rather than generating useful discussions which could lead to practical responses to real problems. Other examples could be cited of implementation problems which seemed to reflect a loss of direction.

Nonetheless, project results have been consistent with overall objectives and have set a useful framework for future efforts. To continue this process, ISM-II must clearly maintain its focus on the issue of sustainability, which means establishing physical and institutional targets that emphasize O&M, as well as rehabilitation.

### 7.2 Impact on Women

The PP made no pretensions regarding its potential impact on women. No special initiatives were proposed, and no specific benefits were expected to accrue to women except as members of beneficiary households. The assessment was reasonable, and remains so.

An interesting potential opportunity for women has arisen during project implementation, however. When it became obvious that it would be difficult to recruit capable PID staff to work in the up-graded design cells, AID recommended hiring women for these positions. It was argued that women engineering graduates were available, were likely to be more qualified than their male cohorts, and would be content to stay in the offices, as they would not be able to work in the field. The TA consultants began a demonstration by hiring two women in the Sind and Punjab, in the hope that they would ultimately be absorbed by the PIDs. On one hand, the demonstration was successful: these recruits were capable and earned the professional respect of their counterparts, where they existed. On the other hand, the pilot was short-lived, as the women all ultimately resigned to take other jobs.

Unfortunately, it is not clear that the overall strategy is sound. It is not likely that the PIDs will be able to develop stable design cells by hiring women, because capable women are no more interested in these positions than their male colleagues, under existing arrangements. By the same token, if design work is farmed out to new provincial firms, as has been suggested, it is unlikely that these firms would make any special effort to recruit women, unless they are related to PID or other officials.

Consequently, this experiment may have run its course. USAID is encouraged to pursue this initiative wherever possible and practical, but it should not be viewed with great expectations as a definitive vehicle to achieve two objectives: to upgrade the status of women and strengthen the PID design cells.

### 7.3 Environmental Impact

The project has already had beneficial environmental impact to the extent that canal rehabilitation has reduced the frequency and magnitude of flooding due to canal breaches and over-topping and drain rehabilitation has reduced flooding and quickened the evacuation of rainwater.

These, and other environmental benefits are as expected, and consistent with project objectives. There are no indications that undesirable environmental effects have resulted from the project, nor are any anticipated.

## Chapter 8

## CONCLUSIONS AND RECOMMENDATIONS

The ISM/ISR Project is a timely and appropriate initiative in the irrigation sector and vital to Pakistan's economy. USAID's ISM effort has been plagued by major management problems, which have hindered overall progress and sometimes resulted in strained working relations with the PIDs and other donors. Nonetheless, the original concept remains valid and should continue to be a high priority for USAID.

The team has identified many problems, virtually all of which were already familiar to the PIDs, IBRD and USAID. It is reassuring to note that each party has taken steps to resolve many of the problems, but the process is not yet complete. The team has identified many accomplishments of the project, but feels frustrated by the fact that monitoring and evaluation were not taken seriously. Thus, it is not possible to substantiate some impressions and judgments as firmly as needed.

The team unequivocally supports the Mission's intent to prepare the project amendment for a second phase, closely synchronized with ISR-II. ISM and ISR must be included in the same PC-1 in order to ensure that Government accepts the common approach to technical criteria, rehabilitation works, and institutional strengthening being jointly developed by USAID and the World Bank.

### Rehabilitation Works

#### Conclusions

- The project carried out primarily rehabilitation of critical portions of canals and drains rather than systems as called for in the PP. This was a reasonable approach during the first stage of the project.

- The quality of civil works was generally good but uneven; it did improve over the course of the project.

- The progress of civil works was in general slow, but it was also held up due to design controversies.

- Rehabilitation was to be the basis for institutional strengthening and improvement of O&M, but this did not occur.

#### Recommendations

- Future rehabilitation work should follow a system concept, and be carried out in accordance with the procedures and criteria for determination of a planning and design approach to subsystem rehabilitation, contained in Annex 2 of the current SAR for ISR-II, and as may be further elaborated in the project amendment.

- Future rehabilitation work should include a construction and equipment use plan, as appropriate, which should be reviewed by an experienced construction engineer.

-- The frequency of inspection of civil works being rehabilitated should be increased to ensure that all specifications are adhered to.

-- Maintenance of civil works rehabilitated under ISM should be monitored closely as a part of the institutionalization and improvement of O&M capability components.

## Improving O&M

### Conclusions

-- The project produced a large number of reports concerned with O&M; however, these were drafted too late in the project and therefore have had little or no impact on field practices to date.

-- O&M funding has been significantly increased by the Provincial Governments, more than required by project agreements.

-- The PID have responded to the development of new yardsticks; they are actively working on their improvement, and have used them, or plan to use them, for budgeting.

-- There is little evidence of maintenance planning or programming essential to more cost effective O&M; in the field there is little evidence of an increased understanding of the need for regular preventive maintenance, or how to organize and carry it out.

### Recommendations

-- Full funding of O&M should be achieved, or continued where it is now being achieved.

-- Future efforts should be focused on training PID field staff in planning and carrying out cost-effective and acceptable maintenance plans and activities directly related to yardsticks and budgets. These yardsticks and plans should be made the basis for monitoring maintenance performance and benefits.

-- The draft O&M manual should be distributed to all field offices for review, edited as appropriate, and redistributed in sufficient numbers to be used in the field by all staff.

-- Data on cost and performance of equipment used for maintenance should be generated in the field to compare mechanized and traditional practices, and to provide a basis for equipment yardsticks, equipment selection, and planning for mechanized maintenance.

## Equipment

### Conclusions

-- Equipment selection and utilization has been adequate on the whole, particularly in the present institutional context.

-- Equipment procurement should have included smaller equipment to support the rehabilitation and maintenance of minor canals and drains.

-- Equipment utilization increased during the course of the project.

-- The project did not establish nor institutionalize an adequate planning process for equipment selection and utilization.

**Recommendations**

-- Prior to further large scale procurement, trial sets of medium and small scale equipment for maintenance should be procured for use at division and sub-division level respectively, and accompanied by appropriate training in equipment planning and use.

-- The MAINSAVER system should be used to assist in improving equipment utilization planning.

-- Additional equipment and spares, other than trial equipment, should not be procured, nor should old equipment be repaired or rehabilitated, until adequate equipment inventories and utilization plans are prepared.

**Workshop Improvements**

**Conclusions**

-- The physical facility portion of workshop improvements were carried out satisfactorily on the whole, but plans were incomplete and procuring missing items has been exceedingly slow; the equipment repair capability of the workshops is not yet functional.

-- Achievements will be lost quickly if critically needed TA, training, and facilities are not provided immediately.

**Recommendations**

-- As quickly as possible USAID should contract under ISM for the technical assistance needed to complete the workshops and make them fully functional. This includes the following:

  -- Identify, procure, and install missing plant, equipment, and machinery;

  -- Establish a program for workshop operation; and

  -- Train shop and supervisory personnel;

## Improving Design Capability

### Conclusions

- An improved design capability has been established in Sind and Punjab Provinces.

- New hydraulic design criteria developed by the project has been adopted by the Sind, Baluchistan, and NWFP PIDs, and an acceptable alternative design criteria has been proposed by the Punjab PID.

- Plans developed by the project for integrated central design cells were unrealistic and exaggerated vis-a-vis the needs, staffing, and funding capacity of the PIDs.

- Single-minded insistence on the adoption of project developed design criteria (HDC), out of proportion to its importance and impact, unnecessarily delayed civil works, and seriously hindered efforts for institutional strengthening in other areas.

### Recommendations

- USAID should complete the minimum improvements required to establish functional design cells and enable them to take on their assigned tasks. Improvements would include installation of all equipment, installation of required furniture for computers and related equipment, and renovation of rooms including upgrading electrical fixtures and painting where necessary.

- USAID should not encourage expansion of the roles and responsibility of the design cells to encompass those of other existing directorates or organizations in the PID.

- USAID should establish standards for the preparation of schemes for funding under ISM which require adequate problem assessment and technical planning and design suited to the difficulty or impact of the problem, or the cost of rehabilitation. This includes engineering analysis of existing canal performance or function, and identification of solutions to maintenance problems, through proper use of suitable engineering methodology and appropriate and reliable data, and in the case of problem channels, the use of agreed on hydraulic design criteria.

## Modernizing PID Management

### Conclusions

- The project introduced several successful innovations including the Training and Management Cells, and the computerization of key tasks such as preparation of non-development budgets and ADPs, facility inventories, and project monitoring.

- The project did not develop an overall strategy or sense of how to improve management within the PIDs.

-- The project focused on a few ad hoc areas identified as needed by PID management; however, implementation of even these modest improvements was slowed by preparation of lengthy reports that lacked clarity, proposed programs with requirements beyond the capability of the PIDs to implement them, and lacked priorities and practical plans for implementation.

-- The project did not adequately deal with the need to introduce the capability to carry out improved planning and management of O&M.

Recommendations

-- AID should insure that adequate local TA is available to sustain and support on-going and planned computerization initiatives.

-- Future efforts to modernize PID management should be articulated and implemented in close collaboration with PID staff.

## Training

### Conclusions

-- The aggregate results of the training activities are positive when measured in terms of the number of people who received training, which exceeded project targets, and considering present institutional constraints.

-- The establishment of Training & Management Cells was an important innovation that has PID support, and has been demonstrated as effective in increasing the capability of the PIDs to take advantage of training opportunities.

-- Training in certain areas, for example in computers, equipment, and workshops, was not coordinated with and frequently preceded installation of equipment and the setting up of an institutional framework, and therefore was of minimal value.

-- Differences between what USAID and the PIDs thought was needed in the educational and training components was never satisfactorily resolved; as a consequence there was no consistent strategy on which there was common agreement.

-- Groundwork for expanded and successful training has been laid by the project despite repeated AID intervention and consequent shifts in strategy and lack of overall consensus, the PIDs now have a keen interest in training, particularly in-country, in-service training, tailored to their individual needs and offered within each province.

### Recommendations

-- Future training efforts should focus primarily on in-country and in-service training of PID staff at all levels through programs developed in close collaboration with the PIDs, and expressly tailored to meet the individual needs of each Province.

-- Future support should also provide a limited amount of formal degree training, supervised study tours, and short courses abroad, tailored to individual PID responses and absorptive capability.

-- Flexibility and adaptability to the evolution of PID staff training needs should be the hallmark of future training program design and management under ISM.

-- Skill training should be coordinated with any prerequisite such as equipment installation, construction or renovation of facilities, or institutional adjustments.

-- The long term interests of the PIDs requires significant upgrading of technical education. Activities to support this development should be designed and carried out separately from the ISM training program aimed at in-service PID staff development.

-- Institutionalization of training in the PIDs should be continued by developing the Training and Management Cells in each PID as the primary focus for organizing and managing training. This will require the development of specific competence in these skill areas.

## Improving Water Management at the Federal Level

### Conclusions

-- The structure of the FCC to coordinate and monitor funding among the Provinces was appropriate.

-- The FCC took responsibility for too many detailed aspects of the project, especially in the institutional strengthening areas, that are not the concern of Federal policy makers; as a consequence it became a bottleneck in the implementation of matters in which the Provinces are competent to lead, decide and administer.

-- The FCC had responsibility for monitoring and evaluation but did not effectively carry this out.

-- The FCC did not assume its intended role to provide information and analysis as input to a continuing high level policy dialogue on water policy issues of concern to the project.

### Recommendations

-- The role of FCC should be limited to the following:

  -- Coordination of monitoring and evaluation activities;

  -- Monitoring the use of project funds, the progress of civil works, and interfacing with donor agencies,

  -- Contributing to an effective policy dialogue concerning project covenants;

- In conjunction with the donor agencies and the Provincial PID Secretaries, approve annual workplans and broad budget allocations whose detailed implementation should be made the responsibility of the Provincial Secretaries.

- The FCC should carry out its responsibility for coordination of monitoring and evaluation which is to be implemented by the Provincial P&Ds under ISM/ISR-II. It should be provided resources for required TA, and assisted and advised by the ISM PSC responsible for policy, monitoring, and evaluation.

- In order to carry out its policy role, the FCC should be provided financial resources and TA advisors as appropriate to be used to commission and carry out studies to support effective and broad water policy dialogue at the Federal and Provincial levels.

## Technical Assistance

### Conclusions

- The original conception of the TA staffing pattern by USAID involved a fragmented and decentralized management structure based on USAID coordination of diverse technical inputs, and in its implementation was plagued by unfortunate staffing choices by the TA Consultants and USAID. These staffing problems promoted confusion, mistrust, and isolation; some problems were resolved by appointment of a COP, but the overall effects, especially the low level of dialogue and collaboration with the PIDs were not overcome.

- Late in the project, a perceived need to make up for lost time and to show concrete progress led to a focus on deliverables; the results was that a large number of reports were produced in a short time near the end of the TA contract; these reports generally lacked priorities and practical plans for implementation.

- Consultants had considerable positive impact in some areas but these impacts were diluted by slow procurement and USAID response, and the on-again, off-again status of the consultant's contract extension; useful outputs included;

  - The O&M manuals prepared by the TA consultants were acceptable but need detailed review in the field, and editing.

  - The training modules and short courses were acceptable but too narrowly conceived

  - Contribution of the TA consultant to the physical aspects of equipment and workshops such as facilities, the MAINSAVER software, and installation of equipment was acceptable.

  - Useful computer programs were developed and implemented, and users trained.

-- Consultant's research on the development of a new hydraulic design criteria was innovative and constitutes a major contribution to the state-of-the-art but was done largely in isolation of the PIDs.

-- Consultant's policy studies in cost recovery and funding of O&M were effective and contributed to policy dialogue.

-- Consultants work on O&M budgeting yardsticks, though deficient in substance, was effective in creating interest on the part of the PIDs in a more modern approach to O&M budgeting.

-- Consultants were innovative in the employment of women professionals and in the use of private firms in computerization and training.

**Recommendations**

-- A bridging mechanism is required to maintain momentum in priority areas until Phase-II is fully operational. The bridging would provide supervision of selected local consultants in five specific areas: equipment, workshops, design, computerization and management information systems, and training. It should also compile, organize, and disseminate relevant data and reports generated in the course of ISM. Design may require a special focus because completion of the design for the first year's rehabilitation program is a condition of credit effectiveness.

-- TA will be required for the bridging period. Every effort should be made to mobilize the COP and four Provincial Advisors by the end of the third or fourth quarter of 1988 in which case only short-term expatriate TA will be required in the interim to supervise selected local consultants and assist PID staff. If a longer bridging period is foreseen a resident expatriate advisor would also be needed for the bridging period.

-- Future focus on the TA effort should be "advise and assist". Deliverables should be kept simple, directly responsive to tasks, and identified in close collaboration with the individual PIDs.

-- Phase-II TA should consist of a long term advisor based in each Province. Each provincial advisor should be broadly experienced, assigned to the PID as counterpart to the Provincial coordinator, and report to the Secretary PID. The Provincial Advisor would supervise a team of local consultants geared to respond to individual PID needs, and be assisted by short-term or long-term expatriate technical assistance as needed.

-- Phase-II Ta should also provide a Chief of Party (COP) based in Islamabad assigned to provide an interface for the provincial advisors with AID, IBRD, and the FCC. The COP would report to the Additional Secretary-Water, Ministry of Water and Power and serve as counterpart to the Federal Project Coordinator. The COP would also administer local consultant contracts, provide quality control, recruit and schedule short term TA, and supervise long term technical assistance.

## Policy Issues

### Conclusions

-- Project activities had only an indirect impact on important policy issues in the project, which include cost recovery, privatization of SCARP tubewells, and funding for O&M.

-- Project studies contributed to policy dialogue but there was not a sustained effort at follow-up by AID or the FCC.

### Recommendations

-- USAID should take the initiative in areas of concern to ISM, as set forth in the PP, to collect data and carry out studies that are required for effective policy analysis critical to sound policy evaluation and decision making by GOP.

-- USAID should initiate the formation of a technical work group to deal with the mobilization and utilization of data and analysis to support higher level policy dialogue. Membership should include concerned donors and government agencies.

## Monitoring and Evaluation

### Conclusions

-- The monitoring and evaluation function was funded through ISR but was also an explicit part of the ISM project and hence an equal responsibility of AID management; the few project activities undertaken were ineffective, ill-timed, and in some instances not well conceived. The final WMED report should not be published because the methodology used in the study was faulty and led to inaccurate data and analysis.

-- Nonetheless, at both Federal and PID levels there presently seems to be an awareness of the need for a well conceived monitoring and evaluation program, including timely baseline studies.

### Recommendations

-- The monitoring and evaluation program should be:

  -- Continuous, not simply short studies made pre-and immediately post-project implementation.

  -- Simple, straight forward, and clearly designed to use recognizable physical and economic parameters for which there is an established methodology and capability to collect the data.

-- The PID should be trained to properly collect the physical input data concerned with water deliveries to the moghas, and an outside consultant should collect the physical and economic data concerned with agro-economic response, including employment generation.

-- A preliminary Terms of Reference (TOR) for the monitoring and evaluation program should be adopted for the ISM project amendment. It is attached as Annex-5. This material is consistent with the monitoring and evaluation section of the Phase-II SAR.

-- A process of annual maintenance view of rehabilitated works, similar to the five-year inspection required by the PID Manual of Irrigation Practice, should be implemented in conjunction with PID field staff to assist in the preparation of maintenance plans, budgeting, and monitoring of maintenance cost and effectiveness.

## AID Project Management

### Conclusions

-- The PIDs were not effectively brought into the planning and conceptualization of the work programs.

-- Management was ineffective in translating the broad and very general ideas in the PP into an effective project management plan. Management focus was narrow and inconsistent resulting in repeated changes in direction, and shifts in responsibility and assignment within USAID, and between USAID and the Consultants.

-- Conceptualization of a number of the project components in terms of strategy and work plan was lacking or inadequate, as a consequence some activities and details became inappropriately important, leading to unnecessary delay in implementation of USAID - financed civil works rehabilitation.

-- Effective and regular communication at the provincial level, particularly with the PID Secretaries, which is critical for project success, was not developed.

-- USAID management did not recognize the magnitude of the opportunity or the challenges presented by this project, did not mobilize sufficient and adequately qualified manpower, and did not have an appropriate management structure to deal with a project of this complexity.

-- Instead of delegating authority to the TA Consultant and assuming a role of oversight and conceptualization, USAID focused on detailed supervision of the consultant, using internal consultants, which created confusion. In the end there were "too many and too few" in charge.

-- There was too great a gap between USAID Mission management and USAID project management; information flows and feedback needed for good management awareness and decision making were lacking.

### Recommendations

-- USAID and IBRD should view ISM and ISR as a single integrated project, rather than as two parallel projects.

- USAID should develop a follow-up project with a broad strategic framework, realistic expectations, and flexibility sufficient to adapt the approach and resources within the project time frame.

- USAID project management role should concentrate on guidance of the conceptual workplan, the broad allocation of resources, policy dialogue, and monitoring and evaluation. Within this framework, the TA consultant should be given adequate authority and resources to carry out the workplan.

- USAID must provide adequate technical and administrative oversight by senior management with appropriate feedback mechanisms.

- USAID should provide the ISM project an experienced full time DH project officer, along with a complementary FSN team incorporating engineering and management expertise.

- USAID should hire a PSC (perhaps a JCC) to be responsible for the policy, monitoring, and evaluation components of the ISM/ISR project. The person must be given the authority to make appropriate contacts in government and supplied with adequate resources to commission studies as needed for data collection and analysis.

## PROGRAM DESCRIPTION/STATEMENT OF WORK

### I. Activity to be Evaluated:

| | |
|---|---|
| Project Title: | Irrigation Systems Management |
| Project Number: | 391-0467 |
| USAID Funding: | Grant $90 million |
| IBRD/IDA Funding: | $86.5 million (Irrigation Systems Rehabilitation) |
| LOP Dates: | FY 1983 - FY 1991 |
| PACD: | 15 February 1991 |

### II. Purpose of the Evaluation:

The ISM Project consists of four discrete but interrelated components: (1) rehabilitation works, (2) institutional and technical skill improvement, (3) research and policy implementation, and (4) command water management. Although the PACD is three years away, virtually all funds for the first two project components will have been disbursed or committed by mid-1988. The purpose of the evaluation is to review implementation progress of the project to assess whether or not project activities are geared towards the achievement of project goals. The evaluation will point out those project initiatives which may not be consistent with project goals and determine causes of the inconsistency.

### III. Background:

The Irrigation Systems Management (ISM) Project and its IBRD/IDA co-financed Irrigation Systems Rehabilitation (ISR) Project were designed to assist the Government of Pakistan (GOP) and its four Provincial Irrigation Departments (PIDs) to rehabilitate the nation's deteriorated surface irrigation and drainage systems and to improve the GOP's institutional capacity to operate and maintain the systems. The project (including both donors) provided funds to rehabilitate approximately thirty percent of Pakistan's surface canals and drains and to improve federal and provincial capability to plan, design and undertake research, and operate and maintain the country's irrigation systems so that reliable and equitable water supplies are available to the irrigated agriculture sector.

The USAID-assisted ISM project is intimately linked to the IBRD's $86.5 million ISR project. In fact, the implementation of the ISR project is dependent on AID support. While the IBRD project focuses almost exclusively on rehabilitation works, the AID project addresses, in addition, water and institutional policies and practices through reform, directed planning and research programs, and action programs to implement policy reforms. The AID project also takes the first steps toward the long-term goal of integrating water, land and farmer resources, known as

the Command Water Management (CWM) concept. The World Bank and USAID project agreements both contain the same covenants which are aimed at ensuring that adequate financing of operation and maintenance (O&M) costs are available to prevent the deterioration of rehabilitated canals and drains.

The AID project consists of four distinct but complementary and interrelated components:

Component 1. Rehabilitation Works

At the conclusion of this component of the project (FY 1988), ISM will have: (a) rehabilitated and helped to maintain about 14,000 km of surface canals and about 3500 km of surface drains for improving equity in water distribution and reliability of irrigation supplies; and, (b) strengthened its human and physical resources and management operations to plan and design civil works activities and effectively operate and maintain the entire system.

Component 2. Institutional Improvement: Management and Technical Skill Development

Institutional improvement has taken place at both the provincial (PID) and federal levels. To increase the productivity of PIDs to operate and maintain the entire system, ISM: (a) provided $40 million in new earthmoving and workshop equipment and spare parts; (b) upgraded six PID maintenance workshops; (c) introduced improved controls to enable PIDs to better manage and operate machinery for preventive maintenance of civil works; (d) increased system design capacity to reduce continuing maintenance demands; and, (e) provided substantial in-country and overseas training opportunities. To increase the productivity of federal level bodies, specifically the Ministry of Water and Power and the Water and Power Development Authority (WAPDA) to coordinate both water policies and storage supplies, ISM: (a) established a Federal Coordinating Cell (FCC) to ensure effective implementation, coordination and supervision of the ISM project; and (b) expanded a water management computer modeling system in WAPDA to monitor total water supplies and scheduled distribution.

Component 3. Planning, Policy Implementation and Research

The objectives of this component are to: (a) strengthen the capacity of the PIDs to engage in the planning process for future projects in the water sector and to continue, with WAPDA, the transformation of policy guidelines into action programs; and (b) strengthen existing critical research programs in areas of water management both within and outside the Indus system by improving the capability of scientists and institutions to conduct research which will lead to better utilization of irrigation water in Pakistan. As this component of the project has been

operational for only two years, it is expected that this project evaluation will give minimal attention to the ISM/Research agenda itself. Rather, the evaluation will focus on whether the research component is responding to the overall needs of the other ISM components providing data to assist in future planning and decision-making related to system operation.

Component 4. Command Water Management

The CWM component is intended to integrate the management of irrigation water at all levels within canal commands by coordinating the work of the PID and the Directorates of On-Farm Water Management and Agricultural Extension with the Water User Association. The objectives of this pilot effort are to: (a) substantially increase agricultural production in selected pilot areas through improved water management; (b) develop water management techniques and programs which can be replicated throughout the country; (c) test feasibility of an institution to reduce inequities in actual water deliveries by encouraging farmer participation; and, (d) build within the provincial agencies of irrigation and agriculture a continuing capability for planning, implementing and operating integrated programs for irrigated agriculture. This component of the ISM project has been operational for three years with substantial funding still remaining. CWM is not included in the extension phase of the project.

IV. Statement of Work:

A. Objectives: The objectives of this evaluation are: (1) to assess progress to date in implementing the ISM project, particularly as it relates to the rehabilitation and the institutional improvement components; and, (2) to review and evaluate project management issues with a view toward recommending improvements based on host government institutional capabilities and constraints. The evaluation will require that the team examine the planned targets, outputs and activities, the nature of administrative arrangements, the existing capabilities of the implementing agencies, the performance of the TA contractors and the planned implementation schedule, and to make recommendations regarding the possible need for changes wherever required.

B. Scope of Work: Specifically the evaluation team shall respond to the following questions:

1. Rehabilitation Works (canals, drains, and related structures).

(a) What role has the canal and drain rehabilitation program of the ISM project played in enhancing provincial irrigation department (PID) capability to efficiently plan, design, operate and maintain the irrigation systems and to what extent has the program contributed to improved water management, increased reliability, and improved water distribution equity?

(b) Have all the rehabilitated facilities been brought to a condition in which only routine and periodic maintenance and compliance with operating guidelines are required to achieve sustained system performance targets?

(c) Have the project activities been appropriately and adequately geared to ensure that the facilities once rehabilitated will be kept in a rehabilitated state? This relates to the project activities such as development of full-funding O&M yardsticks, preparation of O&M manuals for the systems or sub-systems to be rehabilitated, and provision of training to the PIDs' staff.

2. The Institutional strengthening component of the ISM project included a number of activities intended to strengthen and develop the capability of the PIDs to carry out the rehabilitation program, and a sustained and improved O&M program.

(a) What has been the impact of equipment provided to the PIDs? Are the project initiatives in respect of equipment utilization, maintenance, and scheduling appropriate? Are the workshops adequately upgraded and equipped to take care of equipment maintenance requirements?

(b) Have the training activities under the ISM project been responsive to the training needs of the agencies involved in planning, design and implementation of water sector projects in Pakistan? How effective have been the project training initiatives in institutionalizing training within WAPDA and PIDs?

(c) Management and Organization: Has the approach to management development taken under ISM been effective in increasing the capacity of the PIDs to plan, program, execute and manage a continuing rehabilitation and O&M program? Activities in the ISM project intended to increase the management capacity of the PIDs to carry out the O&M program included development of O&M manuals, procurement of new equipment, workshop improvements, improved systems for equipment management, improved design capability, management training, and development of management information systems. The concept of key performance indicators, computerized tracking of equipment and spare parts and computerized project scheduling were all introduced. Review progress in each of these areas and identify the causes of any shortfalls, and lessons learned from the approaches taken. To what extent has ISM project been successful in overcoming the limitations that existing service rules, incentives, and traditional modes of behavior and responsibility place on innovation and management improvement in the PID organizations?

(d) Operations: Activities under the ISM project dealt with a limited number of the functional areas of responsibility within the PID organization. Is there evidence of responsiveness within the PID organization? Is the PID as presently organized and operating capable of operating and maintaining a modern-day irrigation system?

3. The ISM project sought to deal with several major policy issues. Several of these issues have been mentioned previously in this SOW under discussions of rehabilitation works and institutional strengthening. The topics have been broadened and recast here as "policy issues" since the resolution of each question is beyond the scope of the PID and will require guidance from the senior-most levels of the GOP.

(a) The funding of operation and maintenance: What initiatives have been taken under the ISM project to bring about policy changes to fully fund the operation and maintenance of irrigation and drainage facilities and how effective have these initiatives been?

(b) Cost recovery: The ISM and the IBRD/IDA-funded projects included covenants establishing dates by which the GOP agreed to recover the full O&M costs of the irrigation systems through water charges or "other appropriate financial arrangements." Although the date for the first province to meet this covenant has not yet arrived (June 30, 1988), to what extent is the GOP moving in this direction? Is there any likelihood of the covenant being met? Is it feasible? Have water charges been increased sufficiently? What progress has been made in the GOP's effort to privatize tubewells and how has ISM-I encouraged this movement?

(c) Equity: A major purpose of irrigation system rehabilitation is to improve water delivery, particularly to the tail-enders. To what extent have the rehabilitated systems met this purpose? Has ISM-funded canal design work moved the PIDs in this direction?

(d) Hydraulic Analysis: System rehabilitation was never intended to be restricted exclusively to canal and drain cleaning. Different canal regimens and sediment deposition required, in some cases, system redesign. Have the introduction of new hydraulic criteria and analytical tools been accepted by the PIDs? Will these changes necessitate changes in PID staffing and training?

(e) Modernization of Management: Addressing the concerns of O&M funding, cost recovery, equity and system redesign require GOP/AID dialogue on how these concerns may be institutionalized. Has the ISM project supported this effort?

4. Additional Concerns: This scope of work attempts to evaluate the output and development results of the ISM project. It is expected that the information gathered from the evaluation will serve as a guide to the design of phase II of the project. The team will provide specific recommendations regarding the need to continue selected elements of the ISM project. The recommendations will be drafted as an appendix which will be kept apart from the body of the evaluation itself. (A draft proposal for ISM phase II will be available for evaluation team's review.)

C. Approach:

1. In Pakistan, the evaluation team will review data, reports and other records of activities carried out under the ISM project. The Team will interview USAID Mission, contractor, GOP and GOProvincial personnel involved in the project to document their experiences and views.

2. The team will visit as many canal and drain systems that have been rehabilitated under the ISM project as is practical during the period the team is in the field. The team will visit PID central and field offices, and as feasible, will meet with representatives of long-running, technically related project teams such as the U.S. Bureau of Reclamation, Harza Engineering Co., and ISM contractors such as PRC/Checchi, ARD Inc., and the University of Idaho.

3. The team will be responsible for its own administrative and logistical support including securing the clerical assistance for the report. The Mission is prepared to assist the team with in-country travel arrangements and staff house accommodations while in Islamabad and in the field.

4. The team will work a six-day week.

5. Prior to initiating activities in Pakistan, the evaluation team will conduct a team planning workshop that will include an in-depth briefing by World Bank and AID/W staff on the Pakistan irrigation system, the ISM and ISF projects, and plan for the next phase. At this workshop the following background material will be provided:

(a) ISM project paper dated May 1983
(b) March 1985 ISM Evaluation
(c) March 19786 Drainage Study
(d) ISM-II summary cable dated 26 October 87
(e) AID/W cable in reply to (d) dated 19 November 1987
(f) Hydraulic Design Criteria for Remodelling of Alluvail Canals inPakistan -- June, 1986
(g) An Evaluation of Existing Irrigation Water Pricing Policy in Pakistan -- November, 1985
(h) Water Charges and Farmers Repayment Capacity in Punjab Province -- May, 1986
(i) Evaluation of Alternative Hydraulic Design Procedures -- March, 1987
(j) Operation and Maintenance Manual Rehabilitated Canals General Instruction (VER 1) -- March 1987
(k) Full Funding Budget, Sind -- December, 1986
(l) Technical Criteria for Rehabilitation of Canal Systems in Pakistan -- November, 1986
(m) Recommendations for Improved Operation and Maintenance of Rehabilitated Canal Systems -- February, 1987

The above list is illustrative. The evaluation team may also like to review other reports prepared during the implementation of the ISM project by long-term TA team and other consultants.

6. Schedule of the Evaluation Team:

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>_____________________________________________________________________________>
>              January                    >              February               >
>_____________Week Beginning______________>_____Week Beginning_____________>
>4        >11        >18        >25        >1        >8        >15       >22       >
>         >          >          >          >         >         >         >         >
>         >          >          >          >         >         >         >         >
>         >XXXXXXXX>            >          >         >         >         >         >
>         >Mobilization        >          >         >         >         >         >
>         >          >--Initiate fieldwork           >         >         >         >
>         >          >          >          >         >         >         >.Review >
>         >Team      >          >          >         >         >         > of Draft
>         >Planning>            >          >         >         >         > Report >
>         >Workshop>            >          >         >         .Drafting >.Briefing
>         >in        >          >          >         >         of Mission> of USAID
>         >Washing->            >          >         >         Report    > and GOP>
>         >ton (as >            >          >         >         >         >         >
>         >feasible)            >          >         >         >         >         >
>         >          >          >          >         >         >_________________>
>         >          >          >          >         >         >XXXXXXXX>XXXXXXXX>
>         >          >          >          >         >         >         >         >
>         >          >_____________________________________________>         >         >
>         >          >_____________Engineer - Team Leader_____________>         >         >
>         >          >          >          >         >         >         >         >
>         >          >_____________________________>         >         >         >         >
>         >          >__Equipment Specialist__>         >         >         >         >
>         >          >          >          >         >         >         >         >
>         >          >_____________________________________>         >         >         >
>         >          >_____________Economist_____________>         >         >         >
>         >          >          >          >         >         >         >         >
>         >          >_____________________________________________>         >         >
>         >          >_____________O&M  Specialist_____________>         >         >
>         >          >          >          >         >         >         >         >
>         >          >_____________________________________________>         >         >
>         >          >__Public Administration Specialist__>         >         >         >
>         >          >          >          >         >         >         >         >
>         >          >_____________________>         >         >         >         >
>         >          >__Social  Scientist__>         >         >         >         >
>         >          >          >          >         >         >         >         >
>         >          >          >          >_____________________>         >         >
>         >          >          >          >__ANE Representative__>         >         >
>         >          >          >          >         >         >         >         >
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7. Work in Pakistan will be initiated by a meeting in Islamabad with USAID staff to review and finalize the scope of work for the team, the plan of operation, logistics and scheduling during the evaluation, and the outline of the evaluation mission report.

V. Cross-cutting Evaluation Issues:

The following questions should also be briefly addressed by the evaluation team. These questions are general to all AID mid-term and final project evaluations:

1. Sustainability:
(a) Which benefits are likely to be sustained after AID funding ends?
(b) What has been the performance of the project planning and management unit to date and should it be continued? If not, what alternatives modes should be pursued if any?

2. Women and development: How has the project had an effect on women?

3. Environmental impact: To what degree have environmental questions been an issue?

4. Lessons learned:
(a) What specific lessons have been learned which can be applied toward the redesigning of the project?
(b) What have been the positive/negative effects of the project?

VI. Composition of The Evaluation Team:

1. Engineer with experience in water resources management, planning, strengthening irrigation water development and management organizations. This individual will also serve as the team leader.

2. O&M Specialist in irrigation operation and maintenance with extensive experience in planning and programming annual O&M work plans, management of O&M organizations, and supervision of O&M field work, including construction and inspection.

3. Equipment and Workshop Specialist with extensive experience in the utilization, scheduling and management of equipment pools for irrigation and drainage system maintenance, and in the management of workshops to service their equipment pools.

4. Economist with extensive experience in project formulation and economic evaluation, and financial and economic analysis of irrigated farm operation in the developing world.

5. Public administration specialist with experience in organi-ational development and strengthening and management development.

6. Social scientist with experience in project evaluation, farmer participation in large-scale surface irrigation systems, cost recovery and equity issues and irrigation water management.

7. ANE Bureau's Senior Water Management Specialist, as bureau representative and additional institutional specialist.

NOTE: Positions 8-12 are advisory positions.

8. USAID Project Officer (FSN) for the ISM Rehabilitation and Institutional Improvement component.

9,10. Senior engineering staff member (SE or above) from the Punjab and the Sind PID (two persons) whose experience has included field construction and control officer management and technical functions.

OR

9,10. Secretary, Irrigation and Power, Government of Punjab and Government of Sind (or two senior staff as described above to be seconded to the Mission).

11. A representative of the World Bank Mission.

12. A senior Pakistani specialist in management and management development with experience in consulting, training and research.

VII. Reporting Requirements:

A. Format of the Report:

The contractor will prepare a written report in conformance with ANE Bureau Evaluation guidance. ANE/DP/E will provide the evaluation team with the necessary documentation. The report includes the following sections:

1. Table of Contents
2. Map(s)
3. Acronyms and Abbreviations
4. A.I.D. Evaluation Summary (Part II)
5. Basic Project Identification Data Sheet
6. Executive Summary (not to exceed three pages)
7. Body of the Report (not to exceed 75 pages) will have a brief description of the country context in which the project was develop and implemented, project history, sections for each project compone evalu ted, and findings upon which the conclusions and recommendations are based.

8. Appendices - These should include at a minimum:
   (a) Evaluation Scope of Work;
   (b) Annotated Logical Framework;
   (c) Description of the methodology used in the evaluation;
   (d) Findings/Conclusions/Recommendations Matrix;
   (e) Bibliography of documents consulted; and,
   (f) A report comprising evalaution team's analysis, views and recommendations on ISM-II as stated in Section IV.4. above.

B. Submission of Report:

The team will prepare a draft final report and provide 15 copies to USAID/Pakistan for a review by the Mission for the debriefing. The Team Leader will give an oral presentation of the major findings, conclusions and recommendations to the Mission and governmental officials prior to departure.

The Team Leader will submit 50 copies of the final report to the Mission Evaluation Officer, c/o Program Office for distribution within the Mission, appropriate Pakistani officials, and AID/W.

# IRRIGATION SYSTEMS MANAGEMENT PROJECT

## ACTUAL
## CONSTRUCTION EQUIPMENT PROCUREMENT

**Note:** All Equipment and parts listed were purchased under the Agriculture Commodities and Equipment Program (ACL)

| No. | Item | Qty. | P (*) | S | N | B | Manufacturers | $ Cost | Status |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Bulldozer 200 HP | 1 | 1 | | | | Caterpillar | 131616 | Arr.1983 |
| 2. | Draglines 2.5cyd. | 2 | 2 | | | | Bucyrus Erie | 706786 | Arr.1984 |
| 3. | Draglines 1.5cyd. | 8 | 8 | | | | American Hst | 1768779 | Arr.1984 |
| 4. | Dragline 0.75cyd. | 7 | 6 | 1 | | | Kohring | 1180683 | Arr.1984 |
| 5. | Backhoe 0.75cyd. | 6 | 2 | 2 | 2 | | Caterpillar | 1106764 | Arr.1984 |
| 6. | Excavator T/Boom | 3 | 2 | | 1 | | Gradall | 582683 | Arr.1984 |
| 7. | Compactor SP 6 ton | 7 | 5 | 1 | 1 | | Bros | 397789 | Arr.1984 |
| 8. | Compactor SP 1 ton | 30 | 15 | 10 | 2 | 3 | Ingersoll Rand | 262969 | Arr.1984 |
| 9. | Comp.Hand Vib.Plt. | 110 | 36 | 60 | 8 | 6 | Ingersoll Rand | 457309 | Arr.1984 |
| 10. | Dump Truck 10 ton | 24 | 16 | 8 | | | Mach Trucks | 1878249 | Arr.1984 |
| 11. | Dump Truck 8 ton | 8 | 4 | 4 | | | Intl.Harvtr. | 357313 | Arr.1984 |
| 12. | L.Bed Trilr.50 ton | 2 | 2 | | | | Mack Trucks | 315884 | Arr.1984 |
| 13. | L.Bed Trilr 35 ton | 1 | 1 | | | | Mack Trucks | 140181 | Arr.1984 |
| 14. | F.Bed Truck 8 ton | 4 | 4 | | | | Int'l.Harvtr | 161754 | Arr.1984 |
| 15. | Wtr.Truck 2500 Glns | 5 | 4 | 1 | | | " " | 322561 | Arr.1984 |
| 16. | Fuel Tck 2500 Glns | 3 | 2 | 1 | | | " " | 181102 | Arr.1984 |
| 17. | Fuel Trilr.600 Glns | 4 | 4 | | | | Dredge Mstr. | 32366 | Arr.1984 |
| 18. | Lubrication Trucks | 6 | 2 | 2 | 2 | | Int'l Harvtr. | 379376 | Arr.1984 |
| 19. | Dredges Small | 6 | 2 | 4 | | | Mudcat | 696416 | Arr.1984 |
| 20. | Weed Cutting Boat | 5 | 3 | 2 | | | Dredges Master | 144607 | Arr.1984 |
| 21. | Cabl.Tool Wl.Drill | 1 | 1 | | | | Bucyrus Erie | 434652 | Arr.1984 |
| 22. | Generator Set 50W | 4 | 2 | 2 | | | Caterpillar | 86769 | Arr.1984 |
| 23. | Mobile Light Plant | 7 | 5 | 2 | | | Amida | 98870 | Arr.1984 |
| 24. | Mobile Crane 35 ton | 1 | 1 | | | | Koehring | 238445 | Arr.1986 |
| 25. | Excavator T/Boom | 2 | 2 | | | | Hnry.Jhn.Gradl. | 494896 | Arr.1986 |
| 26 | Backhoe 0.75(40"Tr) | 4 | 4 | | | | Caterpillar | 642961 | Arr.1986 |
| 27. | Dump Truck 8 ton | 9 | 5 | 4 | | | Int'l Harvtr. | 408321 | Arr.1986 |
| 28. | Wtr.Truck 2500 Glns | 8 | 4 | 4 | | | " " | 531648 | Arr.1986 |
| 29. | Fuel Tck 2500 Glns | 4 | 4 | | | | " " | 269900 | Arr.1986 |
| 30. | Lubrication Trucks | 6 | 4 | 2 | | | " " | 400437 | Arr.1986 |
| 31 | Mobile Light Plnt | 4 | 4 | | | | Amida | 55420 | Arr.1986 |
| 32 | Excavator T/Boom | 3 | 3 | | | | Transcontinental | 542671 | Arr.1986 |
| 33. | L.Bed.Trilr.70 ton | 2 | | 2 | | | IMAX (Badger) | 96614 | Arr.1986 |
| 34 | Backhoe 0.75cyd. | 6 | 6 | | | | Eager Beaver Caterpillar | 939754 | Arr.1986 |
| 35 | Cat Bckhos Bkt/Stks | 3 | 1 | 1 | 1 | | " " | 44193 | Arr.1986 |
| 36. | Cat Bckhos Bkt/Prts | 3 | 1 | 1 | 1 | | " " | 17538 | Arr.1986 |

| No. | Item | Qty. | P (*) | S | N | B | Manufacturers | $ Cost | Status |
|---|---|---|---|---|---|---|---|---|---|
| A. | Dozer 140HP | 13 | 6 | 2 | 1 | 4 | JICase | 773776 | Arr.1986 |
| B. | Bozer 70HP | 16 | 15 | 1 | | | John Deere | 430992 | Arr.1986 |
| C. | Scraper 10cyd. | 22 | 6 | 16 | | | Dresser Idust. | 1764235 | Arr.1986 |
| D | Frnt.E.Lodr.2.5cyd | 4 | 2 | 2 | | | JICase | 195842 | Arr.1986 |
| E. | Motors Graders 150 | 2 | 2 | | | | John Deere | 123501 | Arr.1986 |
| F. | Dozer 300HP | 11 | 11 | | | | Dresser Idust. | 1729610 | Arr.1986 |
| G. | Scraper 20cyds. | 5 | 5 | | | | Caterpillar | 687250 | Arr.1986 |
| H. | Draglines 2.5cyds | 5 | 5 | | | | FM/Link Belt | 1472916 | Arr.1986 |
| I. | Amphibious Bck.ho. | 4 | 4 | | | | Caterpillar | 699800 | Arr.1986 |
| | Sub-Total | 391 | | | | | | 30223027 | |
| | IFB/Pak/CMO/86-02 | | | | | | | | |
| 1. | Frnt.E.Ldrs.1.5cyd | 2 | | 2 | | | JICase | 108711 | Arr.1987 |
| 2. | Excavator T/Boom | 1 | | 1 | | | Little.Gnt. Crn.& Shovel | 185516 | Arr.1987 |
| 3. | Loader Backhoe | 1 | | 1 | | | JICase | 57787 | Arr.1987 |
| 4. | Air Compressor | 1 | | 1 | | | Ingersol Rand | 43329 | Dec.1987 |
| | Sub-Total | 5 | | | | | | 395343 | |
| 2 | IFB/Pak/CMO/87-03 | | | | | | | | |
| 1. | Hyd.Bckho.3-4cyd. | 13 | 5 | 8 | | | Remnded/Rehab. | | |
| 2. | Crawler Tractor Bulldozer 75HP | 8 | 8 | | | | JICase | 288960 | Under |
| | | | | | | | | 17456@ | Procment. |
| 3. | Wtr.Truck 2500 Gls. | 1 | 1 | | | | Smth.Tank & | 69149 | " " |
| | | | | | | | Eqpt.Co. | 3929@ | " " |
| 4. | Fuel Trk.2500 Gls. | 1 | 1 | | | | " " | 65909 | " " |
| | | | | | | | | 5783@ | " " |
| 5. | Motor Graders 150 HP | 1 | 1 | | | | John Deere | 80621 | " " |
| | | | | | | | | 11436@ | " " |
| 6. | Draglines 0.75cyd | 10 | 10 | | | | Little Giant | 1734265 | " " |
| | | | | | | | Crane & Shovel | 117571@ | " " |
| 7. | Low Bed Tractor-Trailer 50 Ton | 3 | 1 | 2 | | | Mack Trk.Inc. | 466932 | " " |
| | | | | | | | " " | 43563@ | " " |
| 8 | Low Bed Tractor Trailer 35 Ton | 2 | 2 | | | | " " | 291530 | " " |
| | | | | | | | | 27470@ | " " |
| | | | | | | | | 70' '00 | " " |
| | Compactor 2 Ton Vibratory | 28 | 16 | 8 | 2 | 2 | Eqpt.Co | 199722@ | " " |
| | Compactor 2 Ton (CWM) | | | | | | | 118800 | " " |
| 10. | Rough Terrain Crane | 1 | | 1 | | | Link Belt | 134830 | " " |
| | | | | | | | Const. | 15683@ | " " |

| No. | Item | Qty. | P (*) | S | N | B | Manufacturers | $ Cost | Status | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11. | Integral Loader/ Backhoe 75HP RT | 3 | | 3 | | | Jlcase | 134734 | " | " |
| | Sub-total Spare Parts | | | | | | | 10567@ | " | " |
| | Sub-total Equipment | | | | | | | 450180 | | |
| | | | | | | | | 4098630 | | |
| | Sub-Total | 250 | | | | | | 4548810 | | |
| | Total | 646 | | | | | | 35617360 | | |

(*) P=Punjab, S=Sind, N=NWFP, B=Baluchistan
@ Spare Parts

# PROPOSED
# AGRICULTURAL COMMODITIES AND EQUIPMENT PROGRAM (391-0468)
# LIST OF EARTHMOVING AND WORKSHOP EQUIPMENT FOR USE IN ISM PROJECT

**Note: Exact Numbers of each specific type of equipment not given in Project Paper**

## A. EARTHMOVING & ANCILLARY EQUIPMENT

1. Bulldozer, 200 HP
2. Bulldozer, 140 HP
3. Bulldozer, 75 HP
4. Scraper, Elevating 8-11 cu.yd.
5. Dragline, 2.5 cu.yd
6. Dragline, 1.5 cu.yd
7. Dragline, 0.75 cu.yd
8. Backhoe, 0.75 cu.yd.
9. Excavator Telescopic Boom, 0.75 cu.yd.
10. Compactor, Self Propelled, 6 ton
11. Compactor, Sheep foot, Towed
12. Compactor, Self Propelled, 1 ton
13. Compactor, Hand Vibratory Plate
14. Compactor, Self Propelled, 4 ton
15. Dump Truck, 10 ton
16. Dump Truck, 8 ton
17. Front End Loader, 2.5 cu.yd.
18. Low Bed Tractor Trailer, 50 ton
19. Low Bed Tractor Trailer, 35 ton
20. Flat Bed Truck, 5 ton
21. Water Truck, 2500 U.S.Gallons
22. Fuel Truck, 2500, U.S.Gallons
23. Fuel Trailer, 600 U.S.Gallons
24. Lubrication Truck
25. Dredge
26. Mobile Crane, 35 ton
27. Weed Cutting Boat, 12 HP
28. Cable Tool Water Well Driller
29. Generating Set, 50 KW
30. Mobile Light Plant, 10 KW
31. Ditch Cleaning Machine
32. Spare Parts for Items 1-31 and for Existing Equipment

## B. WORKSHOP EQUIPMENT

### a. GENERAL SHOP

1. Floor Crane, 4 ton
2. Sprocket and Bearing Puller
3. Hydraulic Jack 50 ton
4. Hydraulic Jack 35 ton
5. Red Devil 110 lbs. Hammers, High Torque Air Wrenches, and Heavy Duty Sanders
6. Lift Hydraulic, 10 ton
7. Electric Welding Plant, 400 Amp.
8. Mobile Welding Unit, Arc and Gas, Diesel
9. Overhead Crane 20 ft. Span, 8 ton Chain Hoist
10. Air Compressor, 350 cfm., Trailer Mounted
11. Air Compressor, 150 cfm.
12. Cabinet Benches, Vices
13. Track Press

### b. MACHINE SHOP

1. Shaper, 36" Pass
2. Mill (Knee Type)
3. Planner, 10 ft. (Travelling Bed)
4. Surface Grinder
5. Tool Grinder
6. Drill Press, Column 3/4"
7. Power Hack Saw
8. Pedestal Grinder, 12" Stone
9. Crankshaft Build-up Machine
10. Precision Instruments
11. Wrenches: Master Mechanic Set, Heavy Duty
12. Electric Hand Drill, 3/4"
13. Crankshaft Grinder
14. Floor Crane, 2000 lbs.
15. Radial Drill 24"
16. Lathe, 14 ft., 12" Swing
17. Lathe, 8 ft., 17" Swing
18. Lathe, 6 ft., 12" Swing with Tapper Attachment
19. Lathe, 4 ft., 8" Swing
20. Spot Welder
21. Radial Drill, 24"
22. Benches, Cabinets, Vices
23. Precision Tooling and Supplies
24. Floor Crane, 2000 lbs.

c. **MOBILE SHOP**

1. Lathe/Mill Combination
2. Injector Tester
3. Hydraulic Hose Machine
4. Hose Assembly Machine
5. Bench Drill Press
6. Owatana Pullers
7. Wrenches, Mechanic Set
8. Hydraulic Jack, 25 ton
9. Winch (Front Power Take Off)
10. Tripod
11. Bench Grinder
12. Hydraulic Tester
13. Gasoline-Electric Starter

d. **ENGINE OVERHAUL SHOP**

1. Engine Stand
2. Valve Refacer
3. Valve Seat Grinder
4. Head Shop Valve
5. Portable Cylinder Boring Machine, 5-1/4" X 14"
6. Owatana Liner Pullers
7. Injector Tester
8. Injector Pump Calibrator, 8 Cylinder
9. Mobile Shop Crane, 5 ton
10. Engine Tune-up Kit
11. Battery Charger, 60 Amp.
12. Allison Transmission Tools
13. Hoist, 20 ton Tripod
14. Electric Drill, 3/4"
15. Impact Wrenches
16. High Pressure Steam Cleaner
17. Honing Machine
18. Laping Machine
19. Mechanic Tools, English-Metric
20. Electric Test Stand, Alt., Gen.
21. Engine Analyzer
22. Impact Wrenches
23. Benches, Cabinets, Vices
24. Pin Press
25. Air-Compressor, 150 cfm

e. **HYDRAULIC SHOP**

1. Hydraulic Test Pump 600 psi
2. Hydraulic Cleaning Unit
3. Owatana Cylinder Pulling Unit
4. Hose Assembly Machine
5. Hose Cutting Machine

6. Cleaning Tank
7. Tools

f. **BRAKE SHOP**

1. Mobile Crane, 4 ton
2. Compressor (Air), Electric, 150 cfm
3. Brake Drum Lathe
4. Disc Brake Lathe, 16" Diameter
5. Brake Shoe Grinder
6. Owatana Puller
7. Tool Kit (Wrenches)
8. Tire Remover
9. Tire Rim Remover
10. Benches, Cabinets, Vices.

# ACTUAL WORKSHOP MACHINERY & EQUIPMENT SPARE PARTS PROCUREMENT

| Sr. No. | Description | Qty. | Tot. Provinces 1/ B | N | S | P | $ Cost |
|---|---|---|---|---|---|---|---|
| | **General Shop** | | | | | | |
| AA1 | Mobile Shop Crane, 4 Ton | 5 | 1 | 1 | 1 | 2 | 5775 |
| AA2 | Sprocket, Bearing Puller | 4 | 1 | 1 | 1 | 1 | 32251 |
| AA3 | Hydraulic Jack 50 Ton | 5 | | 1 | 1 | 3 | 2352 |
| AA4 | Hydraulic Jack 30 Ton | 5 | 1 | 1 | 3 | | 1291 |
| AA5a | Red Devil 110 Lbs HMR | 5 | 1 | 1 | 3 | | 935 |
| AA5b | High Torque Air Wrench | 5 | 1 | 1 | 3 | | 3390 |
| AA5c | Heavy Duty Air Sander | 5 | 1 | 1 | 3 | | 1880 |
| AA6 | Lift Hydraulic 10 Ton | 4 | 1 | 1 | 1 | | 21300 |
| AA7 | Electric Welder | 3 | | 1 | 1 | 1 | 7788 |
| AA8 | Mobile Welding Plant | 4 | | 1 | 1 | 2 | 24934 |
| AA9 | Bridge Crane 8 Ton | 3 | 1 | 1 | 1 | | 44590 |
| AA10 | Air Compressor 130 cfm | 4 | 1 | 1 | 2 | | 22144 |
| AA11 | | | | | | | |
| AA12 | Track Press | 2 | 1 | 1 | | | 96775 |
| AA13 | Air Compressor,300-350 cfm | 2 | 1 | 1 | | | 38671 |
| | **Sub-Total** | **56** | | | | | **269266** |
| | Machine Shop | | | | | | |
| BB1 | Shaper-18 inch Stroke | 2 | | 1 | 1 | | 85604 |
| BB2 | Milling Machine | 4 | | 1 | 1 | 2 | 64004 |
| BB3 | Planner 10 Feet | 2 | | | 1 | 1 | 801204 |
| BB4 | Surface Grinder | 4 | | 1 | 1 | 2 | 59456 |
| BB5 | Tool Cutter Grinder | 4 | | 1 | 1 | 2 | 40895 |
| BB6 | Drill Press Floor Model | 3 | | | 1 | 2 | 4056 |
| BB7 | Metal Cutting Band Saw | 6 | 1 | 1 | 1 | 3 | 10894 |
| BB8 | Pedestal Grinder | 3 | | 1 | 1 | 1 | 4230 |
| BB9 | Crnk.Shaft Rebuildup Mach. | 5 | | 1 | 1 | 3 | 142550 |
| BB10 | Precision Instrument | 5 | | 1 | 1 | 3 | 28410 |
| BB11 | Electric Drill 3/4 Inch | 3 | | | 1 | 2 | 1060 |
| BB12 | Mobile Shop Crane | 4 | | 1 | 1 | 2 | 2195 |
| BB13 | Master Machine Tool | 7 | 1 | 1 | 2 | 3 | 54492 |
| BB14 | Radial Drill 24 Inch | 3 | 1 | 1 | 1 | | 273737 |
| BB15 | Lathe 12 Inch Swing | 9 | 1 | 1 | 1 | 6 | 270252 |
| BB16 | Lathe 17 Inch Swing | 8 | | 1 | 1 | 6 | 168078 |
| BB17 | Lathe 12 Inch Swing | 2 | | 1 | 1 | | 26558 |

| Sr. No. | Description | Qty. | Tot. B | Provinces 1/ N | S | P | $ Cost |
|---|---|---|---|---|---|---|---|
| BB18 | Lathe 8 Inch Swing | 3 | | 2 | 1 | | 4424 |
| BB19 | Spot Welder | 2 | | 1 | 1 | | 913 |
| BB22 | Electric Drill 1 Inch | 1 | | | 1 | | 689 |
| BB23 | Electric Dril 1/2" | 1 | | | 1 | | 98 |
| | Sub-Total | 81 | | | | | 2043799 |
| | **Mobile Shop** | | | | | | |
| CC1 | Lathe/Mill Combination | 4 | | 1 | 2 | 1 | 7880 |
| CC2 | Nozzle Tester | 4 | 1 | 2 | 1 | 1 | 3806 |
| CC3 | Hose Cutting Machine | 4 | | 1 | 2 | 1 | 23413 |
| CC4 | Hose Assembly Machine | 4 | | 1 | 2 | 1 | 94733 |
| CC5 | Drill Press Bench Model | 4 | | 1 | 2 | 1 | 4921 |
| CC6 | Puller Set | 4 | | 1 | 2 | 1 | 7611 |
| CC7 | Wrench Mechanic Set | 4 | | 1 | 2 | 1 | 1373 |
| CC8 | Hydraulic Jack, 30 Ton | 4 | | 1 | 2 | 1 | 1393 |
| CC10 | Hydraulic Tester | 4 | | 1 | 2 | 1 | 7372 |
| CC12 | Gasoline Electric Starter | 4 | | 1 | 2 | 1 | 9300 |
| CC13 | Mobile Welding Plant | 4 | | 1 | 2 | 1 | 26870 |
| CC14 | Mobile Shop Van/Truck | 4 | | 1 | 2 | 1 | 21960 |
| CC15 | Sprocket Bearing Puller | 3 | | 1 | 2 | | 29349 |
| | Sub-Total | 51 | | | | | 249981 |
| | **Engine Overhaul Shop** | | | | | | |
| DD1 | Engine Stand | 3 | | 1 | 2 | | 9086 |
| DD2 | Valve Refacer | 4 | | 1 | 1 | 2 | 54001 |
| DD3 | Head Shop | 4 | | 1 | 1 | 2 | 46299 |
| DD4 | Cylinder Boring Machine | 4 | | 1 | 1 | 2 | 35730 |
| DD5 | Cylinder Sleeve Puller | 6 | | 1 | 1 | 4 | 8751 |
| DD6 | Nozzle Tester | 5 | | 1 | 1 | 3 | 16582 |
| DD7 | Injector Pump Calibrator | 5 | | 1 | 1 | 3 | 243777 |
| DD8 | Mobile Shop Crane, 4 Ton | 4 | | 1 | 1 | 2 | 4534 |
| DD9 | Engine Tune up Kit | 6 | | 1 | 2 | 3 | 9547 |
| DD10 | Battery Charger | 7 | 2 | 2 | 3 | | 1820 |
| DD11 | Gantr Crane Hoist | 1 | | | | 1 | 3699 |
| DD12 | Electric Drill | 4 | | | 1 | 3 | 1744 |
| DD13 | Impact Wrenches | 5 | | 1 | 1 | 3 | 3470 |
| DD14 | Allison Transmission Tools | 4 | | 1 | 1 | 2 | 10180 |
| DD15 | Power Spray Washer | 5 | | 1 | 2 | 1 | 73375 |
| DD16 | Cylinder Hone Set | 1 | | 1 | | | 424 |
| DD17 | Surface Grinder | 1 | | | 1 | | 19955 |
| DD18 | Electric Test Bench | 2 | | 1 | 1 | | 41680 |
| DD19 | Hydr.Shop Press,50 Ton | 1 | | 1 | | | 1836 |
| DD20 | Engine Analyzer | 4 | | 1 | 1 | 2 | 6369 |

| Sr. No. | Description | Qty. | Tot. B | Provinces 1/ N | S | P | $ Cost |
|---|---|---|---|---|---|---|---|
| DD21 | Mechanic Tools Eng.Metric | 1 | 1 | | | | 9213 |
| DD22 | Local | | | | | | |
| DD23 | Air compressor 130 cfm | 2 | 1 | 1 | | | 11068 |
| DD24 | Crank Shaft Grinding Mach. | 1 | 1 | | | | 82503 |
| DD25 | Magtic.Particle Insp.Eqpt. | 3 | | 1 | 2 | | 13749 |
| DD26 | Rod Aligner Borng.Mach. | 3 | | 1 | 2 | | 35187 |
| DD27 | Sprocket, Bearing Puller | 1 | | 1 | | | 8086 |
| DD28 | Dynomometer | 1 | | 1 | | | 32905 |
| | Sub-Total | 88 | | | | | 719570 |
| | Hydraulic Shop | | | | | | |
| EE1 | Hydraulic Test Bench Pump | 5 | 1 | 1 | 2 | 1 | 4448 |
| EE2 | Hydraulic Cleaning Unit | 5 | 1 | 1 | 3 | | 17142 |
| EE3 | Puller Set | 6 | 1 | 1 | 1 | 3 | 12708 |
| EE4 | Hose Assembly Machine | 6 | 1 | 1 | 1 | 3 | 106146 |
| EE5 | Hose Testing Machine | 6 | 1 | 1 | 1 | 3 | 25387 |
| EE6 | Cleaning Tank | 6 | 1 | 1 | 1 | 3 | 67929 |
| EE7 | Tooling | 6 | 1 | 1 | 1 | 3 | 9654 |
| EE8 | Mobile Shop Crane | 2 | 1 | 1 | | | 1092 |
| | Sub-Total | 42 | | | | | 249954 |
| | Brake Shop | | | | | | |
| FF1 | Mobile Shop Crane 4 Ton | 4 | 1 | 1 | 2 | | 4448 |
| FF2 | Aircompressor 130 cfm | 6 | 1 | 1 | 1 | 3 | 33204 |
| FF3 | Brake Service Machine | 6 | 1 | 1 | 1 | 3 | 26057 |
| FF4 | Puller Set | 6 | 1 | 1 | 1 | 3 | 6112 |
| FF5 | Tool Kit | 7 | 1 | 1 | 2 | 3 | 12988 |
| FF6 | Tire Rim Remover | 7 | 1 | 1 | 2 | 3 | 42602 |
| | Sub-Total | 36 | | | | | 125911 |
| | Total Quantities | 354 | | | | | 7315962 |

# SPARE PARTS PROCUREMENT

| Sr. No. | Description | Tot. Qty. | Provinces 1/ B | N | S | P | $ Cost |
|---|---|---|---|---|---|---|---|
| BA | Parts for Cate. | Lot | x | | | | 17643 |
| BB | Parts for Fiat | " | x | | | | 69373 |
| BC | Parts for Fiat | " | x | | | | 84874 |
| NA | Parts for Fiat | " | | x | | | 60490 |
| NB | Parts for D-8 | " | | x | | | 32053 |
| NC | Hydraulic Excavator | " | | x | | | 15284 |
| ND | Part for URSU | " | | x | | | 20423 |
| NE | Injector Pump | " | | x | | | 2467 |
| PA | Parts for D-8 | " | | | | x | 83235 |
| PB | Wabco Scraper | " | | | | x | 88645 |
| PBA | Wabco 229 G Scraper | " | | | | x | 299702 |
| PC | Ingersoll Rand Compactor | " | | | | x | 28424 |
| PD | Galion Motors | " | | | | x | 28574 |
| PE | D-375 Caterpillar | " | | | | x | 16047 |
| PF | P&H Dragline | " | | | | x | 317751 |
| PG | D-326 Caterpillar | " | | | | x | 9963 |
| PH | P&H Excavator | " | | | | x | 113292 |
| PI | 38 R.B. Excavator | " | | | | x | 121374 |
| PJ | Paxman Diesel Engine | " | | | | x | 61779 |
| PK | G.M. Engine | " | | | | x | 18739 |
| PL | P&H Dragline | " | | | | x | 359446 |
| SA | Summitomo Link Belt | " | | | x | | 11122 |
| SB | Galion Motor Grader | " | | | x | | 8560 |
| SC | Wabco Motorised Scraper | " | | | x | | 104560 |
| SE | Caterpillar D8 Dozer | " | | | x | | 11275 |
| SF | Caterpillar D8 Tractor | " | | | x | | 342703 |

**Total Spare Parts $ 2327798**

1/ B=Baluchistan, N=NWFP, S=Sind, P=Punjab

## Comments on the Irrigation System Remodelling Design Process 1/

After working on remodelling design for a year one develops opinions on what seem to be deficiencies in the process. It is understandable that to get a new design process underway that emphasis would be placed on the more directly visible aspects such as design offices, equipment and design personnel but this is only part of the process and in terms of sequence in the design process the part that could be developed in the later phases. The major deficiency appears to be an inadequate appreciation of the initial phases of the design process, obtaining adequate and accurate field data required for design, and the lead time required to accomplish these phases. The redesign can be no better than the quality of this field data. It is hoped that the following comments will be of use in formulating plans to strengthen the complete design process.

1 Much of the data being gathered by ACOP is not presently usable for CADIS rehabilitation design. Most of the deficiency is in the number of samples and the shortness of the period of sampling. It will probably take 3 or 4 years of intermittent year round sampling to develop a sediment inflow pattern that would be reasonably representative for a canal system. Five sediment concentrations each were taken on the Warah and Shahdadkot Branches from February 19 to 23, 1986. At that time of year the flow in the Indus is close to minimum and the diversions to the North West Canal [illegible] average about 37% of design discharge; it is hardly surprising that concentrations for these two canals look ridiculously low. The number of sediment samples on the other Sind canal system is equally deficient: Hala had four, Amerji had four, and Almani had six. This is not a criticism of ACOP sampling quality which admittedly I am not qualified to judge but it is a warning that a long term consistent year round sampling program will have to be undertaken before parameters that are worth using in the CADIS (Computer Aided Design of Irrigation Systems) analysis are available.

If there is a lack of commitment to do this sampling or if the need for redesign is so urgent that the necessary lead time is not available the possibility of developing design parameters from data that is in existence should be investigated. The Indus River Commission Records and publications like the 1979 report on Remodelling of Rohri Canal Based on ACOP Data indicate that there may be quite a bit of information on sediment and bed sampling available.

A few talks with ACOP and a short literature search should indicate if there is sufficient data that this is a viable approach. While all the data presently being accumulated by ACOP is valuable only three of the parameters D50 bed material, D90 bed material and sediment concentration input are actually used in the CADIS program modelling. One envisions irrigated area maps for the three parameters with isometric lines showing values recommended for use for design.

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1/ As attached to End of Tour Report of W.R. Stoneman, Irrigation Design Engineer, PRC/Cheechi, March 20, 1987, Hyderabad, Sind Province, Pakistan.

While admittedly this may not be the most desirable approach it would give more consistent design parameters and would buy time required to obtain additional sampling. The five to six sediment concentration samples available at this time for most individual irrigation systems in the Sind can be terribly misleading.

If much of the sampling that is presently performed by ACOP is to be done by PID, this program should be instituted and pursued as vigorously as possible. Not only is there the lead time to set up field laboratories and train PID personnel in sampling and lab techniques, there is also the lead time required to sample, analyze and publish results for several reasons to obtain the backlog of data that will allow the selection of sensible parameters to be used for design.

2. Accurate surveys of existing field conditions are vital for redesign. Some of the survey information received from the PID appear to be of dubious quality. The most glaring inconsistency is WWL's that are unbelievably flat. This can only be explained as survey errors or the survey being made at a low discharge with the water surface checked up at cross regulators by reducing gate openings. If the latter is the explanation, depth of flow in the prism is also suspect since most times it is obtained from measurement from the water surface. Survey inconsistencies either require the designer to return the work to the field for correction or make his best guess as to the correction. Both courses of action waste time and give questionable results.

The following are recommended for design surveys:

a. For design and later construction surveys, reestablish the canal system horizontal and vertical control network and install permanent benchmarks so no place on the system is more than 2 miles from a permanent benchmark.

b. All surveys should be completed within as short a period as practical to give as complete a picture as possible of conditions at one point in time.

c. Surveys particularly for WWL and depth of flow should only be made when the flow in the system is close to design discharge. For some systems like the North West Canal this means surveys must be scheduled to be accomplished between about June 10th and the end of August. Efforts should be made to get as many discharge readings as possible during the survey period.

d. The reported practice of taking water surface readings above and below existing cross regulators and assuming that the intervening water surface is a straight line between the two points should be discouraged. As a minimum the water surface elevation should also be checked adjacent to permanent benchmarks (see a. above - check WS at not more than 2 mile intervals).

e. More complete documentation of surveys is necessary. As a minimum dates when surveyed, state of canal flow when surveyed (discharge), weather conditions, names of the personnel in the survey party and the survey equipment used should be noted.

f. A representative of the design office, who has been trained in survey data required for design, should be stationed in the field to monitor progress, check work and explain requirements to field personnel when design surveys are in progress.

The above recommendations assume that adequate personnel, budget, transportation and survey equipment are available or will be made available to do the work. It has been suggested that a special survey unit should be formed to do the design surveys. Such a unit would be on a system on a temporary basis and would never have the intimate knowledge of the system that permanent field personnel have developed. While a special survey unit might supplement the survey effort they should work for the permanent survey personnel who will be responsible for continuing maintenance of the survey network and future operation and maintenance surveys.

3. CADIS applications do not lend themselves well to less than system wide investigations. If only the main conveyance part of the system is analyzed one can not consider lowering the water surface since off taking distributaries, minors and outlets may be thrown out of command. Reducing the amount of sediment to be transported in the main conveyance part of the system can not be considered alone because the effect will be carried over into offtaking distributaries and minors. These constraints severely limit the improvements that it is practical to investigate. It is more rewarding to have the data to look at a system as a whole.

A further reason for looking at the complete system is that the smaller canals are many times those in most need of remodelling. For the systems investigated to date the most serious deficiency in hydraulic head for supplying watercourses occurs in minors toward the tails of the systems. Part of the reason for this appears to be that watercourse slopes used in the original design were optimistically flat. Since watercourse sections are small, relatively steep hydraulic slopes, often on the order of 1 to 2,500 to 4,000, are required to produce a reasonable flow velocity. When watercourse are allowed to steepen to get reasonable velocities the water surface at the outlet raises resulting in "hard flow" conditions from the minor.

4. Irrigation design and particularly remodelling design requires on site inspection by the designers to field check and visually evaluate conditions that are not readily evident from surveys or other field data. Asking field personnel to field check data they have submitted or to give opinions about conditions in which they have had little training is not very productive. If there is sufficient civil turmoil in an area that designers can not freely visit most of the system then it would be prudent to defer design work in that area until the law and order situation improves.

# DEVELOPMENT OF MANAGEMENT INFORMATION SYSTEMS UNDER ISM

It is too early to judge whether the introduction of computer technology under ISM-1 has been sustainable. Most of the computers have been installed in the PIDs for less than a year, and key applications are still under development. PID Secretaries are supportive of selective computerization, and have encouraged staff members to become users.

However, with the exception of the Central Design Office (CDO) there are not yet PID staff capable of maintaining applications developed by the consultants, or of developing new applications, or of effectively managing the computer facilities. Part of the problem here can be traced to the PP, which stresses how easy computers are to use, and mentions little about the difficulties of maintaining and managing them. There is a serious concern whether computer specialists can be recruited and retained in PID headquarter-based computer cells, given the minimal salary and benefits. There are questions about the elaborate rehabilitation of computer rooms: this may promote a centralization of information and expertise in the PIDs that reduces the benefits possible from distributed processing systems.

The delays in introducing computers resulted from initial resistance by PIDs to computerization (and to many other aspects of ISM-1, particularly in the Punjab), from the time required for preparing voluminous feasibility studies on computerization for each PID, and from long procurement processing procedures. The consultants counter that they purposely moved slowly on computerization so that PID staff would understand what they were getting into rather than see it as a black box. Yet, even at this snails pace at which the process has moved the consultants have still only trained users, not programmers and managers. Beyond the user interface, the computers are black boxes to nearly all PID computer staff.

## Institutional Development

The consultant's strategy was first to prepare voluminous feasibility studies for each province on overall computerization, with additional studies on key applications such as budget modernization. Much of the detailed work was done by a local subcontractor, Business Computer Systems, who favor a turnkey system approach. The studies make very ambitious recommendations for staffing and applications development, but lack a strategy on which steps to take first, what are the possible institutional barriers and how to overcome them, and which steps are on the critical path (see the annex on Lessons Learned). PRC Cheechi accepted the BCS recommendations for applications and institutional strengthening, but chose a more collaborative approach with the PIDs. Resident computer consultants arrived in each of the PIDs between 8 and 18 months ago, and tried to closely involve the provincial coordinators in creating or collecting information necessary for the proper performance of PID functions, and in planning for its processing, transmission, dissemination, use, storage and disposition.

In the next stage, PRC/Cheechi systems analysts gave computer awareness seminars to PID staff. In the Punjab, for example, computers were initially viewed as unnecessary; now the Secretary thinks he needs 100 computers, and says no one will be promoted without learning to use them. He assigned seven officers for specialized training-- drawn from key user areas. These people have been trained to take over the systems analysis function and user support work being carried out by PRC/Cheechi. The plan was that they would be released to work full-time in the computer cell. Up to now, six have been officially assigned to the computer cell, but only one has been released full-time for computer work by his parent department.

The NWFP is taking a different tack. The PRC/Cheechi consultant there has only trained data entry staff. However, the Finance Department (FD) has approved the creation of five new posts for computer staff, including one systems analyst and two programmers. There may be a delay of up to a year in recruiting staff. There will also be a major training requirement, since the low government salaries will not attract computer scientists, but rather math graduates who will have to learn everything about computers on the job.

The reason for the different approach is that last year, the NWFP Finance Department commissioned a study by the Organization & Management Department, Federal Cabinet Office on computerization of the FD. They recommended and the Cabinet of the NWFP approved the creation of a Directorate of Electronic Data Processing to guide computerization in the province. The Directorate will be initially attached to the FD, but will later be moved to the Service and General Administration department. A Director is currently being recruited. The Directorate will be the focal point for a new cadre of computer staff, including the new positions in the PID.

The danger of this approach is that this small cadre of specialized staff will leave the PID for more lucrative employment as soon as they have mastered the skills. For a successful program, planned redundancy is essential, as the Punjab Secretary seems to understand. Sustainable programs will need a combination of the two approaches: a small cadre of specialists with a larger group of user semi-specialists that could be readily be promoted to specialist posts as they become vacant. The PIDs have a long way to go to reach this point, in all four of the computer cells visited, all meetings with the evaluation team were handled solely by the PRC/Cheechi consultant, with no input from supposedly-trained PID computer staff.

The typical pattern for the project is to carry out extensive renovations on rooms for computers before acquiring and installing them. The renovations are to a very high standard, and are justified by the need for air conditioning, dust free conditions, and security. This need is asserted, but not proved in the feasibility studies. Based on experience in other countries, microcomputers operate nearly as well in standard government offices with fans, desert coolers, dustcovers, and other modest precautions. The approach taken by the project causes three types of problems:

(1) The renovations add further delays to the introduction of computers. It took three years to get the first computer operating in a PID. Most of the key applications have either just started functioning in the last few months, or are not yet installed nearly 4 1/2 years after the start of the project.

(2) The air conditioners are a special problem. High electricity and maintenance costs will be a continuing burden on limited PID budgets. There will also be demands from non-computer staff at the same grade for air conditioners; if these are met, there will be an additional cost burden.

(3) The project has fostered the mentality that the GOP can only use computers in expensively renovated rooms. This will discourage further computerization. The tendency in the PIDs will be to centralize data processing in renovated rooms, rather than move to distributed processing. Thus the computers may be helping to continue traditional practices of centralized control, rather than encouraging a more progressive, decentralized management style.

Applications

The only applications designed and implemented by PID staff are in the Punjab CDO. This work has been led by the Department Director, Mr. Cheema, who has considerable experience himself in computer programming for engineering applications. He and his staff have developed a basic program for calculating the required depth of pilings for bridges. They have used the program over 100 times, and saved hundreds of hours of work. The design cell has written other basic programs including one for the design of multi-story frames, and a few in Lotus. As an example of the latter, they have a Lotus program which calculates design parameters based on HDC, HDC(s), and Lacey equations.

In the computer cells, PRC Cheechi has developed standard packages for all provinces. For example, they have developed for the Provincial Coordinators (PC) an expenditure monitoring system written in dBase3 on the progress of USAID and IDA funded irrigation schemes. This application was first used in the Punjab starting in June. The PC kept a parallel manual system working for the first six months. Now the manual system has been dropped, and the computer system is the sole one being used. Currently, one of the PC's staff comes to the computer cell to do the work, but a new computer has been ordered for the PC's office.

Other standard packages written in dBase3 aid in compiling and printing annual ADP and non-recurrent budget data. In the NWFP, the ADP will be submitted this year on disk to the P&D, to be added to their dBase file stored in the same format.

One of the most successful of the standard dBase3 applications is in the Training & Management Cells. The problem was that training opportunities were arising, and the PID was unable to nominate potentially successful participants in time. The computerized system in Punjab now has data on over 600 PID staff eligible for training, along with data on education, work and training history, TOEFL score, availability, type of training desired, etc. In total, there will be data on 500 engineers in Sind, 250 sub-engineers and engineers in Baluchistan, 87 engineers in NWFP and 700 engineers in Punjab. The system is 90 per cent complete in the Punjab, and presently has a 40% success rate. ie, two out of every five candidates asked for expressions of interest have gone on to the next stages. This compares with close to a 0% success rate before the system was introduced, and is a major achievement. Another benefit of the system is that for the first time the PIDs have a personnel database. In addition, the system helps the PIDs to pull together the information needed to fully justify each of their training requests, which will hopefully speed up the approval process and raise the proportion of requests approved.

Both data collection and programming were carried out by a Karachi-based private sub-contractor. The program is operational, and has been used to select candidates who are presently going through the lengthy screening process by the GOP. The biggest problem of the program is that searches can take hours to complete. This time could be shortened if the program were compiled, but this would require more consultant input, a new PIL, and perhaps a year's delay.

This need for computerized screening of training candidates cuts across many departments. For example, the P&D, NWFP had such a system operational one year ago. Much of the Systems Ltd. development effort might have been saved had they found out about this. To prevent further wheel-reinventing, AID should start publicizing computer efforts across its different projects.

Other applications are in the planning and development stage. The most ambitious will use a package called Mainsaver, a dBase3 program compiled using Clipper, developed by JB Systems of California. Mainsaver is a very versatile program covering equipment inventory, maintenance, personnel, and many other management issues. There have been problems in introduction, but on balance the package is appropriate and the effort to make it operational in each of the four main workshops should be given full support.

The PRC Cheechi systems consultant in Punjab first used this program during his last job with Gillette in California. He says Gillette evaluated 60 packages of this type, and this was selected as the best. The package has been designed for US Fortune-500 companies, and the documentation gives no evidence of its being used in a developing country agency like the PIDs. However, it seems to be appropriate, based on the PID's experience with a prototype.

The project will purchase 4 copies of the compiled version for $10,000 each. The first round of customized modifications will be carried out in California, and included in the price. The first test will be in the Lahore Division, on a pilot basis. Forms have been prepared and data are already being collected to input into the system. Previously, data were collected on an ad hoc basis, and included in ledgers.

The new system will allow automatic daily production of work orders for maintenance, among other things. It can be upgraded to run on a Digital VAX computer if needed.

The consultant is working with the PIDs to establish a system of management control that documents the requirements that the package is intended to serve, and provides for periodic review and verification. The workshop manager should be accountable for the products of the system. A security system needs to be set up commensurate with the sensitivity of the information and the risk and magnitude of loss that could result from improper operation.

A potential problem of the system is that any modifications must be done in California. JB says they will set up an office in Pakistan if the volume of business warrants, but offers no guarantee at this stage. However, because of the equipment management problems highlighted in the recent AID Inspector General's audit, there is a concern to get the system quickly on line, and a concern for reliability that may not be met by a locally developed system. Someone could have tried negotiating with JB for the code, but this would have delayed things further.

Another potential problem is that only one computer is being installed in each workshop, leaving a strategically important application vulnerable to equipment failure. Two computers per workstation would add an important safety factor.

Indeed, the delays are now a major problem. The head of the workshop stores, Hyderabad has already been to three different training classes learning to use Mainsaver, in Hyderabad, Karachi, and Lahore. He expected to have the system to use by now, yet construction on the computer room still hasn't begun. The problem seems to be AID. Because the total procurement for hardware and software is over $100,000, AID/IRM must approve. In an ideal world, PRC/Checchi and AID/Pakistan could easily manage this problem, but PRC/Checchi is a lame duck contractor, and AID is currently overwhelmed by the paperwork of over 100 PILs in the pipeline, and not acting decisively in part because of uncertainty concerning ISM-2.

Many components of the project have been plagued with procurement and contracting delays, and the computer sector is no exception. There have been major delays both in office rehabilitation and in the supply of hardware and software. Because of the complexity of USAID regulations, it takes up to 10 months to procure computer hardware or software packages. First there are delays in getting the proper request from the PID to USAID, then further delays in USAID approval, and then delays while the equipment is procured and shipped from the US. Although much of the hardware and software could be readily acquired in Pakistan, this is rarely done.

Initially, project funds could be used for computer purchases by the contractor of up to $10,000, but now all purchases must be made by USAID. Aside from the delays incurred, another problem is that USAID procures 110v equipment from the US, which requires transformers and leads to more frequent maintenance problems.

USAID argues that they are holding up computer requests in the Punjab because they haven't yet received a logical presentation of how the PID intends to staff computer operations. The Secretary Punjab says he has 83 new staff that have just come on board and are going through training, and thus staffing is no problem. PRC/Checchi says they have a difficult time getting staff assigned from other units to the computer cell, but this may ease up if they train some of the new crop of 83.

In any case, Mainsaver is potentially a valuable application, considerable resources have already gone into installing it, and there has been no serious alternative proposed for workshop and equipment management. Despite the problems, AID should proceed to speedily implement the systems in the four provinces.

# FACT SHEET 1/
## Irrigation Systems Management
(PRC/Checchi-Contract)

**Objectives:**
Assist four Provincial Irrigation Departments in planning and implementing, canal/drainage/ rehabilitation; and in developing/applying operations and maintenance engineering/ management systems.

Start Date: April 15, 1984

Technical Assistance to:

* Sind Irrigation & Power Dept.
* Punjab Irrigation & Power Dept.
* North West Frontier Irrigation & Power Dept.
* Baluchistan Irrigation & Power Dept.
* Federal Coordinator Cell-Ministry of Water and Power
* Federal Flood Control Commission Ministry of Water and Power

**Man/Months: (technical assistance)**

| | |
|---|---|
| Expatriate | 660 |
| Pakistani | 835 |

Number of Teams: (5)
* Design
* Construction Equipment Use/ Workshops Development
* Operations and Maintenance
* Planning and Management
* Training

**Expenditure on each team (to July, 1987)**
US $ 3,236,833
1,964,111

1,294,437
2,809,393
3,013,218

Contractual Tasks:

**Design Team**

(8 tasks, of which 5 are completed)

The 5 include:

* Developed Hydraulic Design Criteria (HDC) for rehabilitating canals.
* Developed Computer-Assisted Design System (CADIS).
* Developed procedures to use ACOP data in HDC.

**Construction Equipment Use/Workshops Development Team**

(9 tasks, of which 8 are completed)

The 8 include:

* Workplans for equipment use, six canals, four Provinces.
* 376 PID personnel training in equipment use
* Main Branch Lower Canal demonstration center for all four Provinces.

1/ Source: PRC/Checchi Staff

Design Team (continued)

* Trained 252 PID engineers in HDC modelling and CADIS use.
* Developed technical papers on special problems in hydraulic structures, soil mechanics, earthen rebankments.

Operation and Maintenance Team

(4 tasks, of which all are completed)

The 4 include:

* Demonstrate and test an O&M inspection system in each Province.
* Develop a long-term O&M study concerning standards, full-funding management, transport, communications, training.
* Develop physical yardsticks based on full-funding budgets.
* Develop O&M manuals for rehabilitated canals

Construction Equipment Use/Workshops Development Team (continued)

* 115 PID personnel trained in output calculations, costing, work planning.
* Comprehensive overhaul program developed for implementation in 1988-91.
* Developed procedures for preventative maintenance, coding equipment. created MAINSAVER computer program.
* Assisted in installation of USAID provided machine tools in shops.
* Assisted in development of stores systems.

Planning/Management Team

(16 tasks, of 12 which are completed)

The 12 include:

* Procured and installed US $560,000 worth of computer and mgmt. equipt.
* Conducted planning/mgmt. seminars for high-level PID staff.
* Recommended modified systems of management and procedures for Provincial Coordinator and Federal Coordinator Cell offices.
* Recommended restructuring of PID organizations for Micro-Computer Directorates; Workshop/Stores Management; Design Directorates.
* Completed study for strengthened, more independent Federal Coordinator Cell.
* Recommended improved motivation approaches for PID personnel in special skills cadres, i.e. micro-computer, design directorates, workshops/stores.
* Began institutionalization of micro-computer's management info. flow centers, micro-computer

**Planning/Management Team** (continued)

Directorates, profit-centered operations of workshops/stores.

* Recommended budget planning/ implementation modernization actions based on adaption of off-the-shelf budget planning/monitoring computer programs.
* Completed farmer ability-to-pay studies.
* Recommended system of internal cash generation for 'test' on flat water rates in the Punjab Province.
* Developed and applied 16 micro-computer programs in engineering and management with supporting computer rooms.

Developed management info. systems based on institutionalizing mgmt. info. flow centers, each Province.

**Training**

(6 tasks, of which 5 are completed)

The 5 include:

* Design and installation of manpower development and training systems with micro-computer supported training management units.
* Assisted the development of Punjab Engineering Academy - Lahore.
* Developed overall training programs for PID staff on an annual basis; eight modules stressed upon O&M for Phase-II.
* Designed and operated (through Pakistani private contractors and government training institutions) 43 courses for 1,782 PID participants.
* Developed long-term and short-term training programs abroad for a total of 328 irrigation department personnel.

## Chronology of Major Events in the Development of HDC for Rehabilitation of Canal Systems in Pakistan

| | | |
|---|---|---|
| March '84 to Feb. 1986 | HDC Developed using ACOP and International data sets | |
| Feb. '86 | PRC/Checchi Report-Hydraulic Design Criteria of Alluvial Canals in Pakistan | Abstract of equations and approach |
| June '86 | HDC Approved by Sind, Baluchistan and NWFP Provinces | Design Cell (with Pakistani Consultants) begins work in Sind (Hyderabad) on design of Hala and Amerji Branches. |
| Sept.'86 | PRC/Checchi Report-Study to Establish HDC... | Summary of Research Results |
| Sept. '86 | Sind PID Design Cell staff begin preparation of first subsystem design. | |
| Nov. '86 | PRC/Checchi Report-Technical Criteria for... | Gives criteria, standards, and equations for remodeling lined and unlined channels, embankment design, non- hydraulic canal design criteria, and related structural design criteria |
| Jan. '87 | Report of Special Committee on Irrig-Systems Rehab. (Punjab PID) | Review Punjab PID of Sept. '86 HDC Report, but did not suggest Alternatives to HDC. AID response open rejection of report and request to PID to propose alternative. |
| was | | |
| Feb. '87 | Technical Committee formed to consider alternatives PID | subcommittee consisting of representatives of PID and by Punjab PRC/Checchi met 6 times between 26/2 and 29/3 to consider four alternatives sets of equations and procedures. |

| | | |
|---|---|---|
| April 28, '87 | Subcommittee finalizes recommendation consisting of PRC/Checchi relations for D,V, and S; PID relation for Wt, and PID consultant's proposal for C (Sediment transport capacity) | Sub-Committee Report is a variation on PRC/C proposed simplification of HDC |
| June 25, '87 | Review Report of the Special Committee on suggested Hydraulic Design Criteria and approach for Irrigation System Rehab. Project | Report discusses a canal Rehabilitation Criteria, proposes a continuing research program, and essentially adopts the subcommittee report with the proviso that the traditional approach be used together with the new simplified HDC. |

# TERMS OF REFERENCE FOR MONITORING AND EVALUATION FUNCTIONS FOR ISM/ISR PROJECTS, PHASE-II 1/

## Introduction

The long-run expectation of results from the irrigation systems rehabilitation program is not limited to achieving physical rehabilitation of Pakistan's irrigation system per se. Rather, it is also expected that the rehabilitated system will then be subjected to preventative maintenance so as to insure an efficient operating system over time in a cost effective manner. To accomplish the latter above-stated long-term objective, not only will the physical infra-structure of the system have to be rehabilitated, the managerial structure of the PID will have to be "rehabilitated" (modernized) as well. That is to say, effective procedures for monitoring and evaluating program performance (both during rehabilitation and for follow-on operation and maintenance) will have to be institutionalized within the PID. And, for serving GOP, GOProvincial and co-financiers' interest in cost-effective project financing, monitoring of farm level project impacts and economic evaluation of project benefits and distributional effects will have to be carried out by a non-PID public entity, so as to insure objectivity in these analyses.

## Purpose and Approach

An effective monitoring and evaluation (M&E) program will provide:

a. On-going information and analysis for PID internal management decisions related to system rehabilitation and operation and maintenance (O&M) on a continuing basis; and

b. An economic assessment of project benefits and distributional effects as required by GOP, GOProvincial and co-financing agency administrators.

There is an important distinction between (a) and (b) above. In the comments that follow, (a) will refer to internal (PIDs) efforts and (b) will refer to external (non-PIDs) efforts. The PIDs have responsibility for conveyance of the water input via the canal system and thus should retain responsibility for monitoring their project activities as related to (a). The primary focus will be on monitoring project inputs and the physical parameters of the system, e.g., changes in water delivery as related to achieved efficiency and equity in water delivery objectives. On the other hand, the evaluation of economic impacts and distributional effects as outlined in (b) are concerned with government investment efficiency and should therefore be carried out by an appropriate non-PID agency.

Data collected and analyzed internally by the PIDs' monitoring and progress reporting activities will be critical to carrying out the external (non-PIDs) monitoring and evaluation function. In addition, however, these external M&E groups will also require data on output effects of the project, e.g., base-line and change over time information on such things as crop yields, cropping patterns, cropping intensities, levels of non-water inputs, and employment generation and distributional effects.

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1/Drafted as an Addendum to SAR, ISM-II, 1987

Given the scale of activity being planned for ISM/ISR-II, it would not be cost-effective to base the external M&E effort on a 100% analysis of all areas to be impacted by project rehabilitation activities. Selection of a sample of completed systems/subsystems representing 15 to 20% of the respective ceas of the provinces would suffice. It will be extremely important to coordinate the sample selection and data collection process, however, so that all M&E participants, both internal to the PIDs and external, are focusing their attention on the same sample areas and parameters.

**Internal Monitoring, Inspection and Analysis:**

In appraising the accomplishments achieved under ISM ISR-I, it became readily apparent that modernization of the PIDs' office and program management procedures fell far short of the physical system rehabilitation targets that were achieved. While it is true that training activities and management studies by the TA team have provided the necessary components for modernization, ranging from computerized design and data base management systems to personnel trained to operate them, the process yet remains to be institutionalized with the PIDs.

Building on the training and management studies carried out under ISM ISR-I, it is now fully possible to modernize the program and office management functions of the PIDs during ISM ISR-II. The place to start is with full staffing of the PPC offices and giving them direct responsibility for internal monitoring, reporting on progress and analysis of project input activities and results. Once these modernizing methods and procedures are institutionalized, then the stage will be set for extending them to all post-project routine O&M functions. (Indeed, the latter phase of application should begin on the completed subsystems as soon as they have been renovated).

It will be the responsibility of the PIDs to insure that minimum staffing needs for M&E in their PPC offices are met early in the project. Since the PPCs report directly to the PID secretaries, it becomes their responsibility to sanction the required M&E functions in their respective PPC offices. Financing for this aspect of the project depends on the manner in which the PIDs wish to carry out this activity. For example, the Punjab PID wishes to carry out this activity with its own personnel so the cost may be reimbursed directly to the PID. Alternatively, if a PID is not ready to assume this responsibility during the initial stage of the project, as has been indicated by Baluchistan, Sind and NWFP, assistance from other organizations (as was done in ISM ISR-I) may be provided under contract with the FCC.

**External Monitoring and Evaluation**

The responsibility for this function at the provincial level should be vested in the respective Planning and Development Departments. It is not necessary, however, for the P&D department to do the M&E work directly. This activity would appropriately be delegated to an associated economic research entity within the P&Ds where available (e.g., PERI in the Punjab) or provided under contract to any other available qualified evaluation group. For example, a university based economics institute or agriculture economics department, the Sind Regional Planning Organization (SRPO) or a private consulting firm could be retained.

The external M&E group will be faced with three major technical issues. These are: (a) determination of project benefits and distributional effects within a short-time project time-frame, (b) selection of a workable sample size that is representative of the

total area to be impacted; and (c) development of an adequate data base for analysis. These will be discussed in reverse order below:

With the PIDs taking direct responsibility for internal monitoring and analysis of the project activities, it can be assumed that such data will be available as well for use by the external M&E group. Relevant data from this source will include but not necessarily be limited to changes in water deliveries among chaks before and after completion of rehabilitation work; unit costs of various project components and physical and cost data related to O&M.

A second set of important data for economic analysis relates to farm level and related changes in the project impact areas. These are primarily agronomic responses including changes in crop yields, cropping patterns and cropping intensities but also including changes in labor force applied to production, marketing and providing of non-water farm input. A final set of needed data includes the cash flow parameters of farmers related to the agronomic changes impacted by the project so as to estimate impacts on net farm incomes. The above-listed two sets of non-PID-supplied data are normally obtained by field surveys and follow-on-surveys will be needed. It is particularly important to carry out the base-line surveys early during the project and preferably before any rehabilitation work is initiated. The groups selected to carry out the external M&E work should be given direct responsibility for obtaining the non-PID supplied data that is needed.

Selection of a workable study sample that is representative of the total project impact areas will have to be dealt with on a case-by-case basis. It is suggested that the sample include three such areas in the Punjab, two in the Sind and one each in NWFP and Baluchistan.

In terms of project impact response time, the proposed five-year life ISM ISR-II (FY88-93) is barely adequate for analysis. Achieving most project impacts is expected to take four years as a minimum, and some long-term impacts that affect the economic analysis may take 10 years or more. About the only thing that can be done is to limit the sample areas to those systems/subsystems to be completed early in the project. The important thing is to select the sample at any early date and complete the base line surveys in the selected systems/subsystems study areas as soon as possible. Then, in the event an ISM ISR-III project develops, such areas would have a long enough time frame to fully reflect project impacts.

Since more than one evaluation group will be involved, the ECC must insure the use of a standard evaluation procedure. Provision of access to a long-term TA team member with expertise in project evaluation would also be highly desirable, and/or supported by FDY personnel. This is a USAID area of responsibility since it will provide the total TA package for the project.

Funding and Work Assignment Arrangements

The PIDs are being assigned direct responsibility for internal monitoring, but only the Punjab plans to carry out this function totally with its own personnel. The Sind and NWFP PIDs plan to use some technical assistance from other agencies (ACOP, WAPDA) during a transition phase lasting at least one year, and Baluchistan plans to use these services throughout the life of the project. Funds will be provided directly to the PIDs to cover their own personnel and the equipment needed will be provided under the

project. Funds for providing the services of ACOP/WAPDA, as needed, will be provided via the FCC through contract.

The provincial P&D departments will have responsibility for the external monitoring and evaluation efforts. Actual work to be performed will be sub-contracted to selected economic evaluation units. Specifically, it is anticipated that the work will be done by PERI in the Punjab, an agricultural economics unit at a University in the Sind (or by the Sind Regional Planning Organization), and by the Institute of Development Studies at NWFP Agricultural University for NWFP. Such a unit is not available in Baluchistan so its evaluation function could be assigned to one of the three aforementioned units identified for the other three provinces, or any other qualified unit. Funds to cover contractual costs of the external M&E function will be administered by the FCC and contracts let upon the recommendations of the respective P&D departments.

Dated Condition for Project Effectiveness.

A dated condition for consultancy services to be performed by the external M&E groups should be required, with contractual arrangements to be completed on or before September 30, 1988. Such agreements should specify completion of the base-line surveys no later than March 31, 1990.

# LESSONS LEARNED FOR ISM-II

## KEEP IT SIMPLE

Many of the essential systems called for under ISM-I were too complex, never got to the point of producing useful results, or were never even begun. The answer is not fewer systems, but simpler ones. Detailed systems for tracking equipment maintenance and the like are essential, but they are no substitute for the need by managers to track one or two key variables on a regular basis.

Give the Punjab a simple, revenue assessment model if that is what they think they need, and worry about linking it to collections data later.

The same lesson applies to the management of ISM-II: Do not try to do everything at once. Prioritize the tasks and do them one or two at a time. For each PID, select the capability most in need of strengthening, develop a workplan with measurable benchmarks, and carry it out. Do not move on to another task until significant progress has been achieved on the first, as measured by the benchmarks. Trying to carry out different improvements simultaneously confuses the PIDs, and is too complex for AID or its contractors to manage.

## INVOLVE EVERYONE

Changing long standing procedures, or introducing new ones, in the PIDs will be very difficult. However, it is not impossible, if all key staff contribute to the process, and do not feel left out or threatened. One strategy that has worked in other countries would be to have each of the PIDs establish a Task Force on Irrigation Management. The Task Forces would have a series of full day meetings taking place every 3 to 6 months, each attended by 40 to 60 officers and their technical advisors. Largely the same group of officers and advisors should attend each meeting. At these meetings progress since the last meeting would be reviewed, problems discussed, and planned accomplishments for the next period agreed upon. These meetings would allow for an innovative, inter-divisional exchange of views, and would help to coordinate planning and monitoring activities. They would also help to stimulate action, since divisions will not want to have to admit the presence of their peers that they have not accomplished what they promised to do.

## FOCUS ON THE "DOABLE"

Now that there is momentum for streamlining within the departments, it is crucial to deliver. ISM-II should station a senior advisor in each PID, reporting directly to the Secretary. He should work closely with the Provincial Coordinator's Office and try to strengthen it, but the success of the project should not hinge on this. The senior advisors should deploy specialized TDY's as required.

Despite all AID's experience with the PIDs under ISM-I, there is still only limited understanding of how the PIDs are organized, constraints senior management must operate within, the range of incentives available, and what the underlying issues are. The senior advisor will have to achieve much better understanding of these elements early in ISM-II, so he can effectively develop a realistic workplan with the PIDs. The organizational dynamics are too subtle to be picked up by a short-term public administration type consultant, and yet are crucial to the success of the project.

Initial computer applications should address the highest priority data problems perceived by PID management, and should yield quick solutions. Lengthy background studies or feasibility studies should be avoided except where the strategy and methods are well established by experience and financing is the only issue. At the early stages, the most productive applications are those which assemble all the information needed to make a decision. ISM-II senior advisors will develop such applications by working with the Secretary and other senior managers on a day-to-day basis (ie working with Chief Engineers, Superintending Engineers in a Circle Office, and/or Executive Engineers in a Division Office depending on the nature and focus of the problem), finding out which critical decisions are coming up, and building pragmatic, decision-support systems in time to be useful.

## TRAIN AND RETRAIN

Training is the key to improving institutional capabilities of the PIDs. Training and education are also the key to motivating the PIDs to adopt new procedures and to adopt greater professionalism. The PIDs now support the importance of training as long as the bulk of it takes place in the province. Training should be ongoing, and should be available to all professional staff. The primary training objective should be to give officers the basic technical background necessary to do their present jobs(eg. train SDOs to effectively manage sub-engineers and beldars in carrying out routine O&M). Whenever staff are transferred, they should be retrained. A secondary objective should be to train staff in new skills and technologies that would allow them to do new things (eg. HDS , computerized equipment management).

Management training should focus on the basics of leadership: the ability to make good judgments, and to do so again and again. Leadership and effective management, like fine art, are too complex to be reduced to a set of rules; they have to be learned and practiced in real situations, with real outcomes. The difference between leaders and everybody else is not what kind of people they are, but what they accomplish, and whether they can avoid blunders as big as their victories. The challenge for the ISM-II TA team is to teach these skills through their own example. The effective management of ISM-II should be a model for future leaders of the PIDs.

## BE FLEXIBLE

Many of the benefits of new systems will be unexpected. They are so far removed from the experience of most PID managers that they will not be able to anticipate in advance where new systems will be most useful. Thus, elaborate feasibility studies are likely to be a waste of time, at least until several pilot projects have been completed and digested.

ISM-II should not accept long written reports on proposed management improvements as deliverables. There are enough proposals and recommendations in the ISM-I reports to last for generations of PIDs. Instead, the senior advisors assigned to each PID should work with their counterparts to articulate clearly a realistic strategy of management streamlining, and then exploit targets of opportunities as they arise to meet strategic targets.

## SHARE INFORMATION WITH EVERYONE

Information motivates. Prior to microcomputers, the collection, processing and analysis of data represented drudgery. Because of their antiquated systems and the low level of staff training, retrieving and processing data accurately perhaps one of the most difficult tasks faced by the PIDs. Essential reports were late, and information hoarding and the exercise of power by the hoarders were rampant.

New systems make it possible for all levels of an organization to use timely information for problem solving. Every effort should be made to move these systems out side sterilized computer rooms, and into the hands of users.

## MEASURE WHAT IS IMPORTANT

Many management systems mislead. For example, the TA effort produced hundreds of reports, but little guidance on which recommendation should be carried out first how to do it, and how long it would take.

It is also critical to measure whether or not the basic premise of the project is correct. better irrigation systems management will lead to increased agricultural production and farmer income. Production and income data need to be collected for a stratified sample of command and catchment areas before and after rehabilitation and/or enhanced maintenance are carried out. The PIDs and the Donor's request increased funding for O&M, but the P&D's want them to demonstrate that the funds are being used cost effectively. The data the PIDs need to respond to the P&Ds can be generated by monitoring maintenance activities and costs. These monitoring activities were called for in the ISM-IPP but were not done.

To be most credible, this monitoring should be done by an independent agency such as PERI. A demonstrated link between better ISM and increased agricultural production and incomes would be a strong argument for greater GOP budget allocation to support this work.

The PID Secretary, Sind, has ambitious plans to set up an M&E system starting with data collection in each of the 46 divisions, to formulate baseline data and to update it continuously. He thinks M&E should be started by consultants, and then gradually handed over to the PID. The Sind P&D formed an M&E cell 8 months ago, wrote a manual, and equipped it with a computer. He would like USAID to support his effort, at least by advising him on what to do. The P&D group could be the nucleus to start to do what the Secretary asked for. The PID could second staff to work with the P&D cell. The cell could establish a branch in Hyderabad, and start collecting the requisite baseline data. ISM-II resources could support this effort.

However, the enormity of the task for the Provincial P&Ds to do this is apparent. In recent years, the number of schemes being carried out by the provincial governments has significantly increased, along with political pressures to short-circuit traditional planning procedures and speed up implementation. For example, in NWFP the 1987-88 ADP has 42% more schemes then the previous ADP. Additional schemes selected by MPAs will be funded under a special federal grant. Yet budgetary restrictions have prevented departments from hiring sufficient additional staff to meet this increased workload.

The NWFP P&D has gone around this problem somewhat by computerizing their ADP last June. As a result, the ADP was published before the target date, with greater accuracy, and atone-quarter of last-year's printing costs, despite chronic delays in getting federal grant levels confirmed and a strike of all clerical staff during the peak of the work.

In addition to increases in the size of the program, the emphasis has shifted more to schemes designed and implemented at the village-level and district-level. This proliferation and increased geographical spread of schemes has reduced the P & Ds' ability to carry out much needed analysis, M&E, etc. While the numbers of small-scale, local schemes have increased, the P&Ds have not posted qualified planners at the district level to provide assistance in design, coordination and monitoring. It is often overlooked that the PIDs are already a highly decentralized organization with most of their staff permanently assigned to the field

# ANNOTATED LOGICAL FRAMEWORK

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| 1. Objective to which this project contributes. | |
| - To increase agricultural production and farmer incomes. | - Objective is viable, but no data is available to determine impact of project activities |
| Measures of Goal Achievement: In Project Areas: | |
| - Increase agricultural per capita income by 5 to 20 percent | - Data produced not adequate to measure achievement |
| - Increased yields and cropping intensities by 2 to 5 percent in Sind, Punjab and NWFP and by 30 to 56 percent in Baluchistan | - Same as above |
| - Increased agricultural input utilization | - Same as above |
| - Decreased income disparities within the farming community | - Same as above |
| - Improved research capability at following institutions: | - No project activities |
| - Punjab Irrigation Research Institute | - Same as above |
| - Hydrology and Systems Analysis Organization, WAPDA | - Same as above |
| - Central Monitoring Organization WAPDA | - Same as above |
| - Mona Reclamation Experimental Project, Punjab | - Same as above |
| - Lower Indus Water Management and Reclamation Research Project, Sind | - Same as above |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| - Sind Hydrology Research Station | - Same as above |
| **Means of Verification:** | |
| - GOP, IBRD, AID and donor records on agricultural production and farmer income | - Data available is not applicable |
| - Data Collected by WMEC | - Faulty methodology resulting in unusable data |
| - Project Evaluation | - Inadequate basis for evaluation |
| **Assumptions for Achieving Goal Targets.** | |
| - GOP policies will continue to encourage canal and drain rehabilitation and maintenance, increased agricultural production and increased farmer income | - Viable assumption |
| - Other agricultural inputs and support services will be available to farmers | - Groundless assumption, but CWM component is now addressing this issue in selected areas |
| 2. **Project Purpose:** | |
| - To increase the capabilities of institutions involved in irrigation systems planning, design, research, operation and maintenance, and to bring about policy changes needed for proper irrigation water management | - Laudable, some progress being made |
| **Objectively Verifiable Indicators:** | |
| - PID capabilities improved by trained staff and additional equipment | - Visible improvement in selected areas |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| - In-service training programs institutionalized by PIDs where needed | - Programs not institutionalized, but Training Management Cells are being established with Secretary's support |
| - Priority canal systems rehabilitated such that future operation and maintenance problems will be minimized | - System approach deferred, attention focused on isolated priority works |
| - Improved planning, design and water management capabilities in government organizations | - Some progress visible |
| - Water charges are increased and rationalized such that water charges are more in line with water use | - Charges were increased, but they have nothing to do with water use |
| - Adequate funding is available for O&M through increased water rates, reduced expenditures for publicly owned tubewells, and/or other financial arrangements | - Funding significantly increased, above covenant requirements |
| - Canal freeboard is maintained on rehabilitated canals | - Achieved |
| - Lower costs of maintenance | - No data available |
| - Adequate and efficient maintenance plans and schedules in use | - No plans developed or used |
| - No aggradation/degradation of beds | - Not applicable |
| - No sloughing/erosion of banks | - Not applicable, sloughing and erosion visible on drain banks |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| **Means of Verification:** | |
| - Data collected by ACOP and WMEC | - Faulty methodology |
| - AID, GOP, Provincial Government, WAPDA, IBRD, and NESPAK project records and reports | - Inadequate, no monitoring and evaluation system |
| - MIS in the FCC and PCCs | - Now being implemented |
| - Project evaluation | - No project monitoring system. Interim evaluation was inadequate and misleading |
| - Consultant reports | - Numerous, many unacceptable |
| - Site inspections | - Too few, lack of detailed records |
| - Project-financed research findings | - Research, dealt with cost-recovery only |
| **Assumptions for Achieving Purpose:** | |
| - Adequate personnel and budgetary support will be provided by the GOP | - Viable but limited progress made, increased budget support, limited counterpart assignments |
| - GOP and Provincial agencies will adopt and utilize new technologies and systems for improved irrigation water management | - Viable, but only selected progress made |
| - WAPDA and PID personnel involved in research activities at all organizational levels will be receptive and responsive to the policy and operational reforms required to undertake research and eventually to improve the overall irrigation system | - Viable in long-term |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| - Farmers will respond favorably to the opportunities offered them by the improved management of water | - Viable |
| 3. Outputs: | |
| - Reliable, safe, and stable water delivery by rehabilitated canals | - Breaches have been prevented |
| - Prompt disposal of surface water by rehabilitated drains | - Unverified |
| - Increased farm employment | - No data available |
| - Increased irrigation system construction employment throughout the project life | - Likely to occur |
| - Improved rehabilitation design criteria based upon the collection of hydraulic data to minimize maintenance requirements | - Criteria developed but effects on maintenance requirements unverified |
| - Improved operation and maintenance procedures | - No evidence; manuals drafted but not yet in use |
| - Provincial Irrigation Workshops upgraded in the four Provinces | - Partly upgraded, but not yet functional in all Provinces |
| - WAPDA, University, and PID personnel will have completed long-term and short-term training in the US including non-degree, Ph.D. and M.S. degree candidates, and short-term in-country training courses | - Long-term below expectations; short-term exceeded initial expectations, in-country opportunities utilized |
| - A new procurement and inventory management system for earthmoving and workshop equipment and spare parts developed and institutionalized | - Inventory not yet functional; Procurement not started |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| - A management information system (MIS) developed and institutionalized | - Development, but not complete or installed |
| - Priority research studies in water management completed | - Component not evaluation |
| - A CWM feasibility study completed for the implementation of a CWM pilot program consisting of one subproject in each of the four Provinces | - Completed and subproject started |
| - Modelling system available for water resources utilization (watershed, ground, and surface) | - No project activity in this area |
| Magnitude of Outputs: | |
| - 14,000 Km | -9064 (as of 7/87) |
| - 3,500 Km | -1898 |
| - 62,000 full-time jobs | - No data |
| - 29,000 full-time jobs | - No data |
| - In all four Provinces | - Yes |
| - In all four Provinces | - Yes |
| - 7 | - Six |
| - 1,895 personnel trained | - 1782 |
| - In all four Provinces | - Yes |
| - In all four PIDs and the Federal Ministry of Water and Power | - No |
| - At least 6 | - No |
| - 1 | - Yes |
| - Several | - None |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| **Means of Verification:** | |
| - Data collected by ACOP and WMEC | - Same as above |
| - AID, GOP, Provincial Government WAPDA, IBRD, and NESPAK project records and reports | - Same as above |
| - MIS in the FCC and PCCs | - Same as above |
| - Project Evaluations | - Same as above |
| - Consultant reports | - Same as above |
| - Site inspections | - Same as above |
| - Project-financed research findings | - Same as above |
| **Assumptions for Achieving Outputs:** | |
| - Qualified participants are selected for training | - Significant improvement because of Training and Management Cells |
| - The FAR system is a feasible implementation procedure for civil works | - Yes |
| - Remodelling of PID maintenance workshops proceeds on schedule and within the PIDs' budgets | - No, no |
| - Technical consultants are effective in working with WAPDA and PID personnel | - Occasionally |
| - Training program effectively transfer skill and technology | - Viable |
| - Research results are disseminated and used by decision-makers | - Viable |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| 4. Inputs: | |
| 1. AID | |
| - Short and long-term expatriate and Pakistani technical assistance | - Complete |
| - Short and long-term US and in-country training | - Offered, organized, and partly utilized |
| - Vehicles, computers, and related commodities, planning management equipment and supplies and spare parts for earthmoving equipment | - Partly supplied, but some backlog exists |
| - Reimbursement for civil works (FAR system) | - Yes |
| - WMEC operating expenses | - Not applicable |
| - Field Research Demonstrations | - Not applicable |
| 2. GOP | |
| - Staff salaries and operating expenses | - Yes |
| - Land royalties | - Not applicable |
| - Remodelling of PID maintenance workshops | - In progress |
| - Travel of long-term (over one year) participants | - Yes |
| - Salary of participants while in training status | - Yes |
| - Locally-procured commodities | - Yes |
| - In-country training | - Yes |
| - Civil works | - Yes |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
|---|---|
| **3. IBRD** | |
| - Reimbursement for civil works | - Yes |
| - Local consultants (NESPAK, ACOP and WMEC) | - Yes |
| - Budget support for FCC | - Yes |
| - Funds for remodelling of PID maintenance workshops | - Not applicable |
| **Implementation Target (type and quantity)** | |
| - See financial analysis, implementation schedule and commodity, technical assistance, and training plans in the project paper | - Not evaluated, except for training plans and TA. (see Chap-3) |
| **Means of Verification:** | |
| - AID, GOP, Provincial Government and IBRD project records and financial documents | - Same as above |
| - Project evaluation | - Same as above |
| **Assumptions for Providing Inputs:** | |
| - AID and GOP and Provincial Government proposed funding levels are approved by their respective governments and disbursements are made on a timely basis | - Yes |
| - Appropriate overseas training programs can be identified | - Yes |
| - Local works are undertaken according to agreed upon standards and procedures and are certified for reimbursement under the FAR system | - Yes, improved during project |
| - The GOP meets the conditions precedent for this project | - Yes |

| LOG FRAME STATEMENT IN PROJECT PAPER | CURRENT STATUS |
| --- | --- |
| - Appropriate consultants can be recruited to provide the required technical assistance | - Yes, but results were very disappointing. |

## DESCRIPTION OF THE METHODOLOGY USED IN THE EVALUATION

The Team was initially mobilized in Washington for a three day team planning meeting and briefings by ISPAN, AID/W, and World Bank staff, and then mobilized in Islamabad about five days later. After two days of meetings with AID and TA Consultant staff, the Team then spent about three weeks in the field visiting each Province, and an additional week in Islamabad where the draft report was completed.

Three techniques were used in gathering data for this evaluation: (1) a review of existing files and documents; (2) interviews with USAID officials, TA Consultant staff, GOP and Provincial officials, and World Bank staff; (3) site visits to all four Provincial Irrigation Department offices, including field offices, workshops, and ongoing and completed canal and drain rehabilitation sites.

**Files, Documents, and Reports.** The team initiated its field activities on 19 and 20 January in Islamabad. AID Mission and TA Consultant staff were interviewed and reports and documents available in Islamabad were obtained. There were too many of these to carry on the extended field trip planned for the Team so many were left for review upon its return. As noted in Annex-10, over 100 reports and papers were read or perused by the Team.

**Interviews.** The Team spent five days in the Punjab and Sind Provinces, and divided a week between Baluchistan and NWF Provinces. Discussion were held with the Secretary, Chief Engineers, the Provincial Coordinator, and the heads of various directorates and cells (See Annex-9 for a complete list of persons consulted). The Team also met with Senior officials of the Provincial Planning and Development Dept.

**Site Visits.** The Team spent two full days in the field in Punjab and Sind Provinces, and a single day in the field in the NWF Province. Ongoing and completed rehabilitation works on both canals and drains were visited as well as works funded by the Provinces and unrehabilitated facilities. ISM procured equipment was observed in use, as was contractor supplied equipment. Upgraded and rehabilitated workshops were visited in all four Provinces. The site visits afforded ample opportunity for the Team to interview PID field staff concerning operation and maintenance practices and problems.

Upon return from the three week field trip, the Team held further interviews with AID and World Bank Mission and TA Consultant staff, and the Federal Project Coordinator.

# CONCLUSIONS AND RECOMMENDATIONS MATRIX

The conclusion and related recommendations have been concisely summarized in Chapter 8 in a nearly identical form to that required for this Annex and hence have not been repeated here.

## PERSONS CONSULTED BY THE EVALUATION TEAM

The Evaluation Mission during the course of its review of the ISM Project Phase-I met the following officials of the various organizations:

### Ministry of Water and Power, GOP, Islamabad

Maj. Gen (Rtd) Agha Manzoor Rauf, Additional Secretary, (Water) and Chief Engineering Advisor

### Planning and Development Department, Government of Punjab, Lahore

1. Dr. Bashir Ahmed, Chief Economist
2. Mr. Zaka-ud-Din, Chief of Irrigation

### Irrigation and Power Department, Government of Punjab

1. Mr. Ch. Nazar Mohammad, Secretary
2. Mr. S. K. Bhatti, Additional Secretary
3. Mr. Ch. Mazhar Ali, Advisor to the Gov. of Punjab
4. Mr. Mohammad Aslam Chohan, Chief Engineer, Development
5. Mr. R. K. Anwar, Chief Engineer, Lahore Zone
6. Ch. Mohammad Iqbal, Chief Engineer, Provincial Coordinator
7. Mr. G. R. Firdausi, Chief Engineer, Research, IRI
8. Mr. Sikindar Hayat, Chief Engineer, CWMI
9. Mr. Naseer Ahmed Malik, SE Depalpur Canal Circle
10. Mr. Maqsood Ahmed Malik, Director, CDO
11. Mr. Shafaat A. Qureshi, Director SCARP-I, Tubewell Transition Project
12. Dr. Irshad Ahmed, Principal Research Officer, IRI
13. Mr. Mohammad Ali, Deputy Secretary, Development
14. Mr. Naimat Ullah Cheema, Dy. Director Design, CDO
15. Mr. Israr-ul-Haq, Dy. Director, ISR Project, CDO
16. Mr. A. Qayyum Bhatti, SRO, Instrumentation, IRI
17. Mr. Shakoor Ahmed, SRO, Hydraulics, IRI
18. Mr. Hayat Yousaf, XEN, Equipment Workshop, Lahore
19. Mr. Ch. Munir A. Zafar, XEN, Sukhrawa Drainage Division
20. Mr. Sardar Ali, XEN, Lahore Drainage Division
21. Mr. Wasif Sultan, SO, Computer Cell

## Alluvial Channel Observation Project (ACOP), WAPDA, Lahore

1. Dr. Ch. Ahmed Masood, Director General
2. Mr. Tariq Masud, Director

## Planning and Investigation Division, WAPDA, Lahore

1. Mr. Iqtidar H. Siddique, Chief Engineer, P & I
2. Mr. M. Sadiq Hussain, Dy. Director, WC, Monitoring and Evaluation Directorate

## National Engineering Services of Pakistan (NESPAK)
## Supervisory Consultants ISM/ISR, Lahore

1. Mr. Z. S. N. Janjua, General Manager, ISR Project
2. Mr. Mohammad Ehsan, Resident Engineer, ISR, Punjab

## Planning and Development Department, Government of Sind, Karachi

1. Mr. A. B. Soomro, Additional Chief Secretary, Development
2. Mr. Mohammad Umar A. Qazi, Chief Foreign Aid
3. Mr. Idrees Rajput, Additional Secretary, P&D

## Irrigation and Power Department, Government of Sind, Karachi

1. Mr. Muzammil Hussain Qureshi, Secretary
2. Mr. Abdul Aziz G. Sheikh, Chief Engineer Provincial Coordinator for ISM Project
3. Mr. Ali Gohar, Chief Engineer (Dev), Hyderabad
4. Mr. Mohammad Hassan Sahto, Director Design, Hyderabad
5. Mr. S. A. I. Zaidi, SE, Mechanical, Hyderabad
6. Mr. Sheikh Rasul Bakhsh, SE, Rohri Circle, Hyderabad
7. Mr. Nazar Ali Rajpar, SE, Rohri Circle, Hyderabad
8. Mr. Khawaja Shir Ali, Dy. Director, Design, Hyderabad
9. Mr. Shuja Ahmed Junejo, XEN Hala Division
10. Mr. Abdul Hakim Domki, XEN Thatta Drainage Division

## Planning and Development Department, Government of Baluchistan, Quetta

1. Mr. Ata Mohammad Jafar, Additional Chief Secretary
2. Mr. Sardar Mohammad Sharif, Secretary
3. Mr. Yousaf Niazi, Economic Advisor, Finance Department

**Irrigation and Power Department, Government of Baluchistan, Quetta**

1. Mr. Abdur Raziq Khan, Secretary
2. Mr. M. Amin, Chief Engineer
3. Mr. Abdus Salam Khan, Provincial Coordinator
4. Mr. Zain-u-Din, SE

Irrigation Power Department, Government of NWFP, Peshawar

1. Mr. Mohammad Amin Khattak, Secretary
2. Mr. Amir Haider Khan, Provincial Coordinator
3. Mr. Abdul Jalil Khan, Chief Engineer
1. Mr. Rab Nawaz Khan, SE
2. Mr. Nawab Khan Khattak, XEN, Mardan
3. Mr. Abdul Qayyum Khan, XEN, Tubewell Division
4. Mr. Aslam Saleem Khan, XEN, Sawabi Division

World Bank Resident Mission, Islamabad

1. Mr. Anis N. Youssuf, Senior Irrigation Engineer

PRC/Checchi, TA Consultant, ISM Project

1. Mr. Fred Schantz, Acting Chief of Party
2. Mr. Jim Dalton, Planning-Management Specialist
3. Mr. Ramiz Ahmed Malik, O&M Specialist PRC, Lahore
4. Mr. Khalid Masud, Design Engineer, Hyderabad
5. Mr. Mahboob Karim, Computer Cell Incharge, Karachi
6. Ms. Farhat, Computer Assistant, Karachi
7. Mr. Naseer, Computer Specialist, Islamabad
8. Mr. Tariq Qureshi, Training Officer

USAID Pakistan

1. Mr. Eugene S. Staples, Director, USAID, Pakistan
2. Mr. Jonathan Addelton, Evaluation Officer
3. Mr. Grant Morrill, PD&M
4. Mr. Hans P. Peterson, Chief, O/ARD
5. Mr. Alvin Newman, Chief WRD, O/ARD
6. Mr. John R. Quay, Project Management Advisor, ARD
7. Mr. M. I. Chishti Advisor USAID
8. Mr. Muzammil H. Qureshi, Project Officer, O/ARD
9. Mr. Sohail M. Malik, Project Engineer, O/ARD
10. Mr. M. Kifayatullah Choudhry, Project Engineer, ARD, Lahore

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