

MEMORANDUM

Date: February 15, 1991

To: Mr. James C. Ringenoldus, Chief of Party, ISM-II

From: Dr. Gene T. Thompson, Chief Design Engineer, ISM-II

Subject: End of Tour Report, Gene T. Thompson, Chief Design Engineer, ISM-II Project, USAID, Pakistan

This "End of Tour Report" covers the services of Dr. Gene T. Thompson, Chief Design Engineer for the USAID funded second phase of the Irrigation Systems Management Project (ISM-II) in Pakistan. The purposes of the services was to provide advisory services to the four Pakistan Provincial Irrigation Departments (PIDs) for the strengthening of their design capabilities for their rehabilitation and remodeling schemes.

Dr. Thompson's services commenced in November 1989 and was scheduled (including earned vacation) to be completed about mid-May 1991. Due to the Gulf conflict an USAID Ordered Departure, effective January 8th for 30 days, was issued on January 11, 1991. Harza Engineering Company's home office in Chicago, Illinois as the directed safehaven until USAID gave the clearance that it was safe to return. During the first week of February the period of evacuation was extended another 30 days. After review between the Chief of Party and the responsible USAID official on site in Islamabad it was suggested that with the mutual concurrence of the employee the resident assignment could be terminated upon the completion of the earned leave which was accumulated during the assignment.

This report does not provide a chronological statement of activities during the work but highlights observations made and updated during the services, and some recommendations for future implementation consideration that may assist the PIDs in strengthening their design capability in a continuous manner. Also included are recommendations for some of the equipment needed to assist the PIDs in development of improved design capabilities.

I. Assessments and Recommendations

Reviews and assessments during the assignment indicate that each Provincial PID could utilize an effective Central Design Unit. Although the development of such units has been the focus of design efforts under ISM-I and ISM-II, it must be recognized that the actual development of such units has been very limited. The final designs for rehabilitation schemes are carried out in all provinces by the field divisions or by consultants. It certainly appears that this will continue to be the approach used for design of schemes by the Irrigation Departments after the ISRP project is completed. The recommendations presented in this report addresses modifications in approach that might result in developing capabilities that could be sustained by the departments after completion of the ISM and ISR projects.

Based on the reviews and assessments of progress to date it is concluded that:

- It is unlikely that Central Design Units that are fully responsible for the production of designs, drawings, specifications and contract documents will be established by any of the PIDs.

- Active Central Design Units, such as the Punjab's ISRP Design Cell and the Sindh's formerly active Central Design unit in Hyderabad functions have been to provide hydraulic analyses and recommendations for the actual design of projects and schemes by the field divisions.

- Considerable employment of local and expatriate consultants has occurred to carry out design and construction management by all PIDs in the past, and larger projects have been seconded by the PIDs to WAPDA, who in turn, usually employ consultants for design and construction management. This approach is likely to continue in the future.

- Emphasis should be continued to encourage the PIDs to develop competent small Central Design Units, and to modify their duties to more fully cover project design responsibilities, even though expectations for this to develop, especially towards staffing, should be limited.

- It is concluded that improvement in the design of PID prepared schemes will come mainly from improvements in the divisional staff's capability to plan and design the schemes.

An outline for initiating an effort to strengthen the design capability of PID divisional staff is provided here, followed by a brief review of the assessment that led to recommending this modification, and finally a summary which lists some of the computer support equipment to support the recommended for the development of a Pilot Design Trial development program. It is recommended the the Pilot Design Trial be initiated, pursued and evaluated in the different provinces during the remainder of the project.

The two major areas for future emphasis are to continue to work with Central Design Units where they exist or are being initiated, and to encourage the development of improved planning and design capabilities in the field divisions and, or circles.

1. Assistance, Support and Training for Central Design Units:

a. Balochistan Province

- Encourage continued efforts to staff the Central Design Unit and provide technical assistance in accordance to results (at the present level of staffing very little technical assistance can be provided);

b. Northwest Frontier Province

- Continue computer and computer spreadsheet programming training to ADAs and Small Dams Directorate staff;
- Continue selection, and development of standardized irrigation structures; and
- Provide two short courses on small irrigation system design which will include; 1) small channel layout and hydraulic design, and 2) selection and design of structures for small channels.

c. Punjab Province

- Encourage further development of the present ISRP Design Cell, including the assignment of added design responsibilities for areas other than hydraulics.

d. Sindh Province

- Continue to encourage the reestablishment of the previous Central Design Unit at Hyderabad.

The strategy to address field divisions will be commenced in the cooperating provinces by selecting two divisions for the initial efforts. A general listing of logistical support is given for the division in Section of this report, but areas that will be addressed during the coming months are outlined in general and by province below.

2. Assistance, Support and Development for Field Divisions

Recommendation: Action should be taken to strengthen the design function in all provinces, and initially it is recommended the provinces each select two provinces for instituting a "Pilot Design Program".

a. Balochistan Province

- Carry out three design short courses covering; i) small channel hydraulic designs, ii) small channels structure selection and design and iii) design of small aqueduct structures;
- Initiate the development of standard structures for small channel irrigation systems; and
- Identify logistical support required to improve divisional design functions.

b. Northwest Frontier Province

- Initiate computer and computer spreadsheet programming for

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selected divisional staff;

- Continue the selection and development of standardized irrigation structures;

- Continue the review and recommendations to the department's divisional staff for ISRP scheme designs; and

- Carry out training short courses for departmental assigned staff from both field and headquarters personnel in design of small channel irrigations systems where subjects to be addressed are; i) small channel layouts and hydraulics; and ii) selection and design of small channel irrigation structures.

c. Punjab Province

- Encourage the department to identify two divisions for training, and identify the logistical and technical support that is needed for desired improvement.

d. Sindh Province

- Encourage the department to identify two divisions for training, and identify the logistical and technical support that is needed for desired improvement.

II. General Assessment of PID Design Activities

This assessment briefly reviews background and current situation concerning the strengthening of the design capabilities of the provincial Irrigation Departments. Based on the background, current conditions and the concerns of the individual provinces revisions are provided to either modify or strengthen past strategies. An overall assessment shows that the actual preparation of the documents for implementing Irrigation department prepared schemes occurs in the field divisions.

In some cases where hydraulic problems have been identified the hydraulic designs have been carried out by a central cell. But even in these cases the actual final design preparations have been completed by the field divisions. Therefore, the revision and modifications in strategy direct efforts toward strengthening the field divisional design capabilities. Included in this strategy is the identification of logistical support that is recommended for this improvement in field divisions, including training of staff.

During ISM-I, and initially during ISM-II, strong recommendations and efforts were made by the TA Teams to assist PIDs with development of central design units. This included encouraging the establishment of new central design units or cells in provinces where they did not exist, and providing funding for upgrading space for offices, and the provision of furnishings and equipment, including computer systems for all PID central cells.

Assistance was provided to assist the departments in improving the technical capabilities to analyze the hydraulics of fluvial channels for design purposes. Considerable effort was directed toward the development of analytical equations and procedures for the design of Pakistan's fluvial channels. These equations and procedures resulted in the development of a Computer Assisted Design of Irrigation Systems known as CADIS.

The use of CADIS, at least on a preliminary basis, for redesigning canals in Pakistan was accepted in all the Provinces except the Punjab. The Punjab provided some modifications for the existing "Lacey Regime" approach and a sediment transport equation known as the "Mushtaq" equation for sediment transport. These empirical equations form the basis for the Punjab's analysis for redesign of problem channels.

The progress of establishing central design units to date is, for the most part, discouraging. The Sindh initiated and made functional a Central Design Cell under ISM-I, but the assignment of activities were discontinued at the end of the first phase. Until now the cell has not been functionally reactivated.

The only presently active central cell is the ISRP Design Cell which is a small separate cell under the Central Design Directorate that has been set up by the Punjab PID for ISRP hydraulic design work. This cell only carries out the hydraulic analysis part of channel design for PID designated "problematic" channels and does not carry out a full design process for the rehabilitation schemes. The actual designs for the Punjab rehabilitation schemes that go to contract are carried out in the divisions, although recently the Punjab has modified this process and has initiated a centrally controlled ISRP Circle under the direction of the Provincial Coordinator. It is presently unclear as to how design work under the ISRP Design Cell for the schemes managed by this circle will be carried out. It is suggested that possibly the ISRP Design Cell could be made totally responsible for the ISRP rehabilitation work under the ISRP Circle.

III. Provincial Design Status and Conditions

Briefly, the progress toward developing and strengthening the irrigation departmental design capabilities in the provinces is:

1. Balochistan. In Balochistan the department initiated the development of a Central Design Cell by setting up space and engaging a Chief Engineer by secondment from WAPDA. The Chief Engineer was assigned in March 1990 to carry out the development of the cell, but to date no engineering design personnel has been provided other than tracers for drafting support. Prospects for staffing the cell with engineers who will actually carry out design work is indeed discouraging.

The design of the rehabilitation and other development schemes is either carried out by field divisional staff, or by consulting

engineers (both local and expatriate) engaged by the department. Major remodeling and rehabilitation work has been entrusted to WAPDA for design and implementation.

2. Northwest Frontier Province. The NWFP has a Central Design and Hydrology Cell. The cell for sometime has not actually carried out any design work as such but acts as a review unit for designs prepared by the field divisions or by consultants. The TA Team's local Design Engineer has been assisting departmental Assistant Design Engineers by providing them with training in the use of computers for carrying out computations, and with their development of initial spreadsheet programs for computing analytical procedures for design. But even with this capability it is assessed that the responsibility for planning and designing rehabilitation schemes will remain under the field divisions and the Central Cell will continue to act as reviewer. The actual design for minor works is carried out either by field divisions or by consultants, while the designs for remodeling and new projects is being entrusted to WAPDA.

3. Punjab. As noted above the Punjab PID activated and ISRP Design Cell within the Central Design Directorate for carrying out the hydraulic analysis for channels designated as "problematic" by the field divisions. But they do not function as a design cell fully responsible for the designs to be used by contractors to implement ISRP or any other schemes. The staff of this cell has two members who are now pursuing Ph. D. degrees at the University of California, Davis. The cell is headed by a Deputy Director who is supported by two ADAs, a Research Assistant, and clerical staff.

The staff of the cell is reasonably competent in carrying out the hydraulic work assigned to them, and with training could competently carry out a full design process. The performance of a full design process for rehabilitation schemes, or even the review and approval process relative to design for field divisional developed designs would require revisions in the departments administrative procedures. The cell, after completion of the ISRP work is expected to become a strong element in the Central Design Directorate. It appears that several of the staff members wish to continue with the cell as a permanent future career assignment. This could bodes well for the future of design in the Punjab PID if appropriate administrative modifications are made to assure they perform an effective function for the department.

At present ISRP scheme designs, even those for "problematic" channels are finalized by the field divisions, or by consultants. Larger schemes, such as SCARP transitions, drainage works, etc., are entrusted to WAPDA for design and implementation.

The recommendation to assist the ISRP Design Cell carry out a complete design process was placed in abeyance by the Provincial Coordinator. It is assessed that is unlikely the Punjab PID desires TA assistance relative to their development and strengthening of design capabilities.

4. Sindh Province, Under ISM-I the Sindh PID developed and staffed a Central design Cell in Hyderabad. The logistical development included adequate premises of design and drafting rooms that were centrally air-conditioned and furnished, appropriate desks, drafting tables, map files, computers, printers and a copier. A computer driven plotter adequate for producing report sized plots was provided, although it was not adequate to produce construction sized maps and drawings.

The cell was staffed by departmental personnel and assisted by TA Team consultants for ISM-I. During 1986 through 1988 the cell carried out hydraulic design analyses for several irrigation canal systems. For the hydraulic design work the Computer Aided Design of Irrigation Systems (CADIS) procedures developed by the ISM-I consultants were used. The results of these designs are now the basis for rehabilitation work funded by USAID, although the irrigation department states that Lacey design procedures are being used to prepare IDA funded work, as directed by the Supervisory Consultants for ISRP.

After completion of the work underway when the ISM-I consultants departed in 1988 no further work was carried out. The reason given by associated personnel is that since then no work had been assigned to the cell by the department. The department indicated a desire to reestablish the functioning of the Cell by assigning a system for analysis in June 1990, but even though the staff positions are filled no functional design activity has occurred until now. The situation relative to Law and Order, elections, governmental transfers and appointment actions on many departmental personnel has had a major effect on dedication to duty by the staff.

The actual design work for implementing rehabilitation schemes in the Sindh is carried out by field divisional staff and consultants. The design work for remodel or rehabilitating larger projects has been fully or partially entrusted to WAPDA who in turn engage local and expatriate consultants.

IV. Considerations for Design Strengthening Strategy

One of the major problems to the development of a strong Central Design Unit the resistance of engineers to postings in such cells. The reasons for this resistance has been thoroughly discussed in reports prepared under ISM-I, and the same reasons still occur under ISM-II. Primarily it is because of the lack of incentives and support, including the lack of prestige when compared to field postings that the departmental engineers view a posting in the design and planning groups as being undesirable.

Recent reviews indicate that under present conditions, and possibly even if some incentives are provided, it is unlikely more than very limited success will occur in the near future from efforts to establish and staff Central Design Units. If strengthening of departmental design capability is to occur it is judged that it must occur in the field divisions. The only PID that has a limited

functioning Central Design Cell is the Punjab who established a separate unit known as the ISRP Design Cell in their central directorate. But even in this Department actual functional strengthening of design activities must occur in the field divisions if real progress is to be made. This is discussed in some detail in the memo "Design Strategy in the NWFP", dated September 5, 1990 that was prepared by Dr. Farhat Javed of the TA Team.

Certainly, because of existing staffing of divisions, there are limits as to level and amount of design work that can be expected. Normal rehabilitation and remedial designs such as channel hydraulics, replacement of minor structures, small bridges etc. should be well within the capability of the divisional staff, especially if supported by computers with basic engineering programs and augmented by training. Basic computer programs are being developed in the NWFP, and staff, mainly from the Central Design Directorate, are being trained in the use of computers. Existing programs and introductions to the use of computers are being provided through short courses to primarily field staff personnel in Balochistan.

The selection of contemporary standard structures is also a desire of these departments, and initial selections are underway. Projects, such as Mardan SCARP in the NWFP and the work on small systems in Balochistan provide examples of many appropriate structures for standardization purposes. Such standardization will assist the departments by providing standard designed structures to the field divisions from which they can make appropriate selections.

V. Logistical Support Requirements For Divisions

The following items are recommended to initiate each Divisional Pilot Design activity.

1. Dedicated Office Space - one room (clean, painted)

Rug for office floor - one sized to fit

Vacuum Cleaner - one (do not use Pakistan straw brooms)

.. Office Furniture

Desk - one

Tables - two (one for computer, one for printer)

3. Computer Equipment - It is suggested that with limited funds older IBM XT or AT computers would be very adequate for divisional, and even Central Design Cell design work. Consideration should be given to the development of basic programming capability in the departments so that simple throw-away programs could be written, or programming with use of macros using the 1-2-3 spreadsheets. The reason for this is that many computational needs are computational specific, and can be solved with fairly simple programs, whereas a program general enough to be thorough for a specific design area are

quite comprehensive so are very voluminous in nature.

Computer XT, AT or equiv. with a minimum of 640 RAM with a minimum of 30 mb hard disk, one 5-1/4 inch and one 3-1/2 inch floppy disk.

Printer - wide carriage (Epson 1050 or equiv.)

Software should consist of Lotus 1-2-3, and a word processor program such as Word Perfect 5.1 or Wordstar 5.0.