INCEPTION REPORT

EFFICIENT IRRIGATION MANAGEMENT AND SYSTEM TRANSFER PROJECT

Technical Assistance Agreement No 937-INO
Government of Indonesia - IIMI - ADB

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE
Digana Village via Kandy, Sri Lanka

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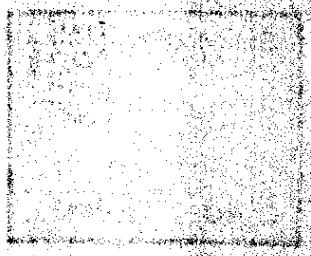

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Contents

1. CONTEXT FOR THE TECHNICAL ASSISTANCE 937-INO

This study on Efficient Irrigation Management and System Transfer is being carried out under a Technical Assistance Agreement (T.A. 937-INO) between the Government of Indonesia (GOI), the International Irrigation Management Institute (IIMI), and the Asian Development Bank (ADB). Additional financing has been provided through a grant from the Ford Foundation and by contributions from IIMI.

The study builds on and extends the results of the Study of Irrigation Management in Indonesia (referred to subsequently as the First Study) which was carried out under a separate Technical Assistance grant from ADB (T.A. 673 INO). It provides an opportunity to continue to test and modify the innovations recommended in the First Study in irrigation systems located in West Java and, for the first time, to transfer experience from the first study to irrigation systems outside Java. In addition, this study will facilitate the process of transfer of responsibility for system operation and maintenance in selected small irrigation systems from Government to local water users.

The two components of the study, efficient irrigation system management and irrigation system transfer are viewed as complementary as both are intended to increase the effectiveness of operation and maintenance practices and procedures, and to strengthen interactions between the Provincial Irrigation Services (PRIS) and water users.

1.1 Indonesian food production, agriculture and irrigation policies

Rice is the major staple in Indonesian diets and previous Government policies towards agriculture and irrigation focussed on increasing rice production. The success of these policies can be judged from the fact that during the early 1970's Indonesia was the largest importer of rice in the world but is now self-sufficient in rice production. Policies now include the management of rice buffer stocks.

Much of this increase in production resulted from increased productivity from existing irrigation systems. During the past 20 years rice production has increased by more than 5% a year, while the irrigated area has expanded by only about 1.6% per year. Increased productivity has resulted from a combination of agricultural policies of intensification (BIMAS/INMAS), development and dissemination of modern rice varieties, rice price support and fertilizer subsidies, and irrigation investments that included rehabilitation or upgrading of existing systems (1.75 mil. ha) and the development of tertiary facilities (2.0 mil. ha). During the same period some 0.95 mil. ha. of new irrigation systems were completed.

While rice production has increased dramatically, production of most other food crops has remained rather flat despite increases in demand. Present government policies have shifted towards greater emphasis on production of these secondary crops. It is anticipated that significant increases in non-rice food crop production can be achieved through more efficient use of existing irrigation facilities: reducing water demand for rice production will release more water for production of secondary crops during the dry season, and will lead to greater equity of income for farmers in irrigated areas. In supporting these policies there is a greater emphasis on efficient system operation and maintenance and a reduction in support for further infrastructural development. Strengthening of the provincial irrigation services in included in this strategy, and there has been increased interest in the greater involvement of water users in operation and maintenance of systems at tertiary level.

1.2 Current ADB investment in the irrigation sector

ADB has provided significant support to Indonesia for development of the irrigation sector, with 26 bank-financed projects totalling some $800 million since 1969. The largest on-going bank-financed project is the Third Irrigation Sector Project (822-INO) which involves a loan of $120 million. Major components supported by this project include rehabilitation and upgrading of existing irrigation systems, special maintenance activities, development of efficient O&M procedures, introduction of irrigation service fees in a pilot area, support for handing over small irrigation systems to Water User Associations, and institutional strengthening of irrigation services and WUAs. There are parallel activities in the agricultural sector, including land development, establishment of tertiary demonstration units, improvement of seed farms, training and improvements in various aspects of the land tax system.

The present Technical Assistance is supportive of several of these components and is intended to test implementation of alternative managerial strategies that can be incorporated into the activities of the provincial irrigation services.

This project covers four provinces in Indonesia, and complements a similar project financed by the World Bank for an additional ten provinces.

2. SUMMARY OF FINDINGS FROM PHASE I STUDY

During the past 15 years, over $12 billion have been invested in Indonesia to rehabilitate and develop new irrigation system infrastructure. By the end of Pelita IV (1988/89), most of Indonesia's irrigation systems will be totally or at least substantially rehabilitated. However, without adequate operation and maintenance (O&M) funding and staff support, the ability to realize either (a) the intended benefits from such irrigation investments or (b) the long-term viability of the irrigation systems is impaired. Although Government of Indonesia (GOI) budgetary support for main system O&M increased substantially over the period of the early 1980s, the level of that support provided fell short (by at least one half) of adequately meeting O&M needs in most of Indonesia's irrigation systems. Severe constraints on government revenues since 1985/86 have more recently forced the GOI to sharply reduce O&M funding. Furthermore, the shifting of main system O&M funding and management responsibility in government controlled irrigation systems (a) from national to provincial levels and (b) from government to farmer beneficiaries as stipulated in Water Law No. 11/1974 and the GOI Irrigation Regulation No. 23/1982 is yet to be realized.

These circumstances have led to a rather major reconsideration of GOI policies for irrigation O&M. Policies being actively considered at this time include: (a) providing O&M budgetary support in line with actual needs of different irrigation systems; (b) shifting O&M funding from national to provincial sources and irrigation service fees; (c) transferring responsibility for main system O&M in small irrigation systems (those with less than 150 ha each during Repelita V and with less than 500 ha each within (15 years) from government to water users via water user associations (WUA's); and (4) restructuring and strengthening the provincial irrigation services (PRIS's).

In contrast to the mid 1970s when Indonesia was one of the world's largest rice importers, Indonesia is now essentially self-sufficient in rice production. The two major challenges currently facing Indonesia are to: (a) effectively maintain self-sufficiency in rice production and (b) expand non-rice crop production in order to reduce non-rice food imports (especially soybeans) and expand non-rice food exports. Therefore, various strategies for encouraging crop diversification are being stressed. One such strategy is the development of irrigation O&M practices to improve the prospects of more intensive non-rice cropping in Indonesia's irrigation systems that were developed primarily for rice cultivation.

Phase I of the IIMI/DGWRD/PRIS Study of Irrigation Management in Indonesia was initiated in October 1985 and extended through September 1987. The Study formally consisted of two components: irrigation systems management and crop diversification. As outlined in the original Phase I technical assistance document, the major objectives of the ISM component were to "measure irrigation system operational performance; identify performance deficiencies; assess the extent to which such deficiencies are attributable to management inadequacies; and develop, test, and recommend field tested management/institutional development interventions aimed at improved system management and hence better water control and delivery." The broad objective of the crop diversification component was to "identify and develop strategies for more intensive non-rice cropping". This objective was to be accomplished through assessing constraints to non-rice irrigated crop production, exploring ways to alleviate those constraints, and pilot testing improved irrigation practices for non-rice crop production.

The levels of sophistication in Indonesia's irrigation infrastructure (hardware) and Indonesia's underlying principles of irrigation water management (software) are some of the highest to be found in South and Southeast Asia. Indonesia's public irrigation infrastructure and method of irrigation water management were first introduced by the Dutch prior to the beginning of the 20th century--primarily for the production of sugarcane as an export crop and rice as the basic food staple. Deterioration of the infrastructure during the 1940s and 1950s from World War II and civil disturbances led to the undertaking of major infrastructure rehabilitation and upgrading programs. Current public irrigation infrastructure, therefore, represents a joint product of the development activities of the Dutch from before the war and the rather recent infrastructure rehabilitation and upgrading financed by major donors and GOI. GOI, of course, manages, operates and maintains the systems.

Irrigation system management involves primarily the non-physical aspects of an irrigation system. As managers of government irrigation systems in Indonesia, PRIS staff are charged with operating irrigation systems to ensure that, within the legal framework of the province and the operating procedures of the irrigation service, water is allocated so as to maximize human welfare. Indonesian irrigation water management planning and operational decisions are based on the concept of pasten. Pasten describes the relationship between the water supplies available at the intake gates and turnouts and the water needed by crops at different growth stages. For planning purposes, potential water availability is estimated by studying historical records of the discharge curve for the water entering an irrigation system. Operational decisions are based on daily observations of flow discharge. Pasten is used operationally to help determine the rate of discharge to the various canals and blocks in order to ensure the most equitable distribution of available irrigation water.

There is currently a growing awareness that irrigation infrastructure that has been developed with the primary goal of irrigating rice to achieve rice self-sufficiency, is not being used as productively as it might be. Recognizing that more effective utilization of existing irrigation systems could make a major contribution toward meeting Indonesia's future food and employment requirements, has led the GOI to target specific problem areas for priority attention during the fourth five-year plan. These problem areas include: (a) inadequate integration of irrigation development activities with other agricultural activities; (b) implementation problems related to provincial capability to manage increasingly complex irrigation systems; and (c) inadequate utilization and maintenance of existing irrigation infrastructure. Recognition of these problems have led to a rather major reconsideration of GOI policies on irrigation O&M. New policies recently approved by the Government include: (a) providing O&M budgetary support in line with actual needs of different irrigation systems; (b) shifting O&M funding from central to provincial sources and irrigation service fees; (c) transferring from government to water user association (WUAs) responsibility for main system O&M in irrigation systems with service areas less than 150 ha each during Repelita V and with service areas of less than 500 ha each within the following 10 years; and (4) restructuring and strengthening the organizational set-up of provincial irrigation services (PRISs).

In particular it is important to focus on the relatively large areas of land in Indonesia that are served intensively by irrigation systems to produce a first, and often a second, rice crop, but are usually only extensively used for palawija crops during the second and third seasons, when water is inadequate for flood irrigation. The two components of the Phase I Irrigation Management Study were designed to help identify new practices that meet the complicated irrigation management requirements for diversified agriculture and to facilitate the expansion of irrigated palawija as well as ensuring that producers are able to earn higher incomes by increasing cropping intensity. In the relatively short time frame allocated, significant progress has been made. Highlights of the major findings from Phase I include:

(a) Documentation of the actual performance levels, both in terms of water efficiency and management performance, of a wide spectrum of irrigation systems and identification of operational and institutional practices that constrain performance.

(b) Development and initial field testing of improved management practices that can potentially increase performance with relatively minor investments in training and staff upgrading.

(c) Using decision-tree analysis, detail the importance of security of water availability, and drainage, as a major influence on farmers' decision to plant irrigated rice or irrigated non-rice crops.

(d) Verify that low yields for non-rice crops often arise, in part, from over-irrigation and excessive moisture in the soil profile, even in the second dry season.

(e) Show the relationship between crop intensity and distance from the water source and establish the potential for increased intensities and yields in the lower sections of many irrigation systems if the proposed improved operational practices are adopted.

Phase I findings and the additional field testing of alternative O&M practices during Phase II are designed to provide a source of new ideas and management practices to be used in the implementation of both the World Bank and ADB irrigation sector loans. As these loans have a similar focus on efficient O&M, early field results from Phase II (where new practices are already in the process of being tested in Java) will become available at a optimal time to help ensure the success of the irrigation sector loans. Phase II results from off Java will become available in time to influence efficient O&M programs off Java during the second year of the loan. In addition, Phase II work on irrigation turnover, implemented in conjunction with Ford Foundation fund DGWRD pilot turnover activities, will provide a model of the process to be used for the World Bank funded project as it focuses on wide scale implementation of a program for turning back public systems under 150 ha. Insights gained from monitoring implementation of the turnover process will also prove valuable to the ADB funded project over the next three years as it prepares to turnover public systems under 500 ha. in size.

Phase II of the Irrigation Management Study (Indonesia) is designed to accomplish five major objectives which are outlined below. The first four objectives deal most directly with the further field testing, extension and operationalization of Phase I innovations. The fifth objective directly addresses the added issue of turnover of O&M responsibility on public irrigation systems from government to water users.

(i) Irrigation Systems Management

1. To improve the quality and utilization of information for irrigation system operation, through streamlining and making more effective the generation, transmission, analysis, and use of information flows concerning irrigation system operations.

2. To identify appropriate organizational changes which permit more efficient and effective use of available O&M resources. Given GOI budgetary limitations and the need to decrease non-rice crop imports and continue to be self-sufficient in rice production, the DGWRD is especially concerned with developing mechanisms to increase irrigation performance and improve the long-term sustainability of systems without adding significantly to the costs.

(c) Show the relationship between water [illegible] and distance from the water source and establish the potential for [illegible] information and yields in the lower sections of [illegible] systems if the proposed improved operational practices [illegible].

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Phase II of the Irrigation [illegible] (Indonesia) is designed to accomplish five major objectives [illegible]. The first four objectives deal most directly with [illegible] testing, extension and [illegible] of these [illegible]. The fifth objective directly addresses the added issue of improved [illegible] sustainability of public irrigation systems from government [illegible].

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3. To examine the interrelationships between irrigation system design and management, with particular emphasis on the ways in which improvements in system operation and maintenance are constrained by initial design and assumptions on operational practices. The study will evaluate alternative methods for measuring water deliveries, and assess the opportunities for modifying existing structures to facilitate the introduction of alternative rotational strategies.

4. To determine O&M practices suitable for irrigating non-rice crops, through studying both how much and when irrigation water is distributed for and applied to non-rice crops. (This will be undertaken in conjunction with the IIMI-IRRI project, supported by the Rockefeller Foundation, which addresses problems of Irrigation Management for Rice-Based Farming Systems, the workplan for which is presented in Annex F)

(ii) Irrigation Systems Turnover

5. To analyze and document the processes used in turning over irrigation systems from government to water users, for selected irrigation systems in pilot provinces chosen in conjunction with DGWRD. The major focus of IIMI's involvement will be on development of a process that can be replicated throughout the country as the Government expands turnover to all provinces by the end of the Repelita V.

With respect to the current Study, it has been demonstrated there are two types of operational management weaknesses that lead to misallocation of water. The first one, and one that is hypothesized to be very prevalent, is miscalculation of the water required during the current time period due to incorrect estimation of actual irrigated area in the block or to incorrect information about area of crops actually growing in the block. The second type of misallocation is that resulting from over diversion into the system. The only way to address the problem of incorrect block size is to resurvey the irrigation blocks and, thus, ensure that the area to be served is known accurately. This exercise is a part of the Irrigation Sector Loan, but unfortunately, resurveying will only be carried out on a limited area. A similar situation arises due to the problems associated with determining exactly what crops are actually growing in the blocks and at what stage of maturity these crops are during each time period. Both of these problems can be solved by developing an accurate field map of each block and using these maps to determine what crops are in the field. Use of a mapping approach will not only make operation of individual irrigation systems more efficient, but it will also free additional water to be used in other irrigation systems served by the same water source.

Diversion in excess of entitlement into secondary canals closer to the water source was frequently found during the course of the Study. In contrast, the canals and blocks that are far from the water source are receiving significantly less water than upper blocks during the same time period. This situation is much more difficult to solve as it is not purely a case of incorrect data, but it reflects a failure of management to properly monitor deliveries in the system. Use of the new, proposed field books will simplify the monitoring process, but it is only when PRIS supervisory staff keep a daily check on the data collected in the field and use a tool such as the management performance ratio to determine performance levels, that there will be a solution to this problem.

One option for improving water allocation would be to test the possibility of calibrating, setting, and fixing tertiary gate offtakes along secondary canals (including many of those for which accurate measurement readings can not obtained) in order to approximate a proportional water distribution system. This would decrease the management burden on staff, and possibly also would decrease some of the discharge fluctuation.

Implications of the above suggestions are quite significant, but they do not come without a price. Even using local, labor-intensive mapping techniques, developing improved land holding maps requires a cost in excess of Rp. 3,000 per hectare. With over 4,500,000 ha requiring mapping, this is clearly an exercise that will take some time to complete and will require special project funding. In addition, it must be recognized that these maps will require periodic revision or soon they will be as dated as the maps that are presently available in the villages. However, without such maps, it is impossible to properly implement the pasten system as well as the new PBB land taxing scheme.

Reducing over diversions into main and secondary canals is also important, yet accomplishing this task requires improved maintenance, better training and a commitment to stricter management practices. All the irrigation systems in the Study were originally designed and built with sophisticated measurement capability, but as stated, in many cases these are no longer functioning properly. Improved measurement requires better testing of measurement devices prior to acceptance, routine and periodic maintenance, and periodic checking and recalibration of all measurement devices. Once the devices are working properly, on-the-job training is required for all new employees to make certain they can read the measurement devices properly.

Finally, it is important that supervisors constantly check and recheck reported data to make certain field staff realize that flow measurement data is a critical element in the feedback and monitoring process. Again, all of these actions have a cost associated with them. Yet, without accurate measuring devices, well trained staff that know how to use the devices and supervisors that utilize the data for management purposes, it will be very difficult to properly manage the sophisticated irrigation systems in Indonesia.

3. ACTIVITIES UNDERTAKEN TO DATE

Administrative Developments

Work on the Technical Assistance for Efficient Irrigation Management and System Transfer Project (TA 937-INO) commenced on October 1, 1987 immediately following the termination of the preceding Technical Assistance for Study of Irrigation Management (TA 673-INO). The activity, carried out by the International Irrigation Management Institute in conjunction with the Directorate General for Water Resources Development, is jointly financed by the Asian Development Bank, the Ford Foundation, the Government of Indonesia, and IIMI Headquarters.

To expedite the Study the Ford Foundation released its full contribution of $300,000 to IIMI in October 1987. This grant is divided into two parts: $210,000 for local costs and $90,000 in foreign exchange costs. The latter sum represented bridging finance until the ADB funds were released.

Final approval for the ADB financing of the Technical Assistance from the Government of Indonesia, totalling $600,000, was given in February 1988.

Staffing

IIMI is providing two full-time internationally recruited staff for the implementation of the Technical Assistance. Dr. Sam Johnson, Team Leader for the First Study, continued in this position until December 19, 1987 when he returned to the United States. He was replaced by Dr. Hammond Murray-Rust, previously with IIMI in Pakistan, who was appointed as Team Leader for the remainder of the current Technical Assistance. Dr. Murray-Rust arrived in Indonesia on December 15, 1987 to enable a brief overlap and orientation with Dr. Johnson.

Dr. Douglas Vermillion, previously Post-Doctoral Fellow with IIMI under the First Study, was appointed as an IIMI Senior Staff member for this study. Since October he has been resident in Bandung to provide close linkage with the Provincial Irrigation Service in West Java and to facilitate supervision of field activities.

Counterpart staff include an engineer from Direktorat Irigasi I seconded to IIMI based in Bandung, two field assistants seconded from PRIS based in West Java and Lampung, and 8 Field Observers (6 in West Java, 3 in Lampung and 1 in West Sumatra). In addition, IIMI has directly hired 2 Field Observers, and 3 Social Scientists on part-time basis for work on turnover activities in West Java and West Sumatra.

Field Activities

The first six months of this Study have seen a transition from research activities undertaken in the First Study. Work in the sites in Central Java was terminated at the end of Phase I, while the East Java research activities terminated at the end of December 1987. Continuation of these activities would not have permitted expansion into other provinces given the staffing levels provided for under the Technical Assistance.

Current research is focussed on three provinces: West Java, Lampung, and West Sumatra. This is consistent with national interest in transferring the experiences of the First Study to irrigation systems off Java. Activities include investigation of irrigation system management in technical systems, and turnover of small systems to farmers.

Irrigation System Management

Three systems are currently under intensive study: Maneungteung/ Ciledug and Ciwaringin in West Java, and Way Jepara in Lampung Province, in southern Sumatra. The major issues being addressed currently are (a) improved information for irrigation system management, (b) realigned government responsibilities for main system O&M, and (c) improved irrigation management for non-rice crop production.

(a) West Java

The West Java sites were included in Phase I so that there has been a smooth continuation of activities. Additional field staff have been stationed there to permit more detailed and intensive data collection that will permit a comprehensive system management plan to be drawn up. The activities that have been initiated since the start of Phase II are listed in Table 3.1.

In addition to these intensive studies, work has commenced on the collection of secondary nature for a number of other systems in West Java. These data will be used in the evaluation of water allocation and distribution along a single rivercourse, upstream of Cikeusik weir, and will be supplemented by selected observations on water deliveries, cropping intensities and management activities. Work will concentrate on the six technical systems along the rivercourse, but some observations will also be made on the ten smaller non-technical systems that draw water from the river.

Table 3.1

Activities Initiated in W. Java since start of Phase II

1. Additional Surveys

   Survey of additional climatological stations;
   Surveys for additional tertiary blocks for detailed study;

2. Inventories

   Location and condition of rainfall stations;
   Data collection on location, size, nature and condition of weirs, measuring structures, etc. of irrigation systems upstream of Ciledug, Ciwaringin and Cikudondong;
   Water sources for irrigation in Cisanggarung river course;
   Boundaries and staffing of pengamat/juru areas;
   Gates and structures requiring calibration;

3. Secondary Data Collection

   Tertiary maps of sample tertiary blocks;
   Cropping data for irrigation systems upstream of Ciledug and Ciwaringin;
   Records of water issues and spillway flows of irrigation systems upstream of Ciledug and Ciwaringin;
   Reservoir storage and releases at Waduk Darma;
   Collection of topographic maps for Ciwaringin and Cikeusik;
   Hydrologic information for Kuningan Cabang Dinas;
   Location map of rainfall stations at Cikeusik;

4. Field Data Collection Program

   Discharges of main, secondary and tertiary structures;
   Records of gate openings and closings at sample locations;
   Mapping survey of additional selected tertiary blocks;
   Procedures involved in operation of gates by PU staff;

Table 2.1

Preliminary Information Requirements for Phase II

1. Multi-zone Surveys

Purpose of Multi-zone Surveys

Surveys for Multi-zone Reservoirs

2. Properties

Description and Prediction of Fluid Properties

Data Correlation on Fluid Properties and Conditions of Tests

Testing, Sampling and Measuring Systems

Selection of Fluid(s) for Laboratory Tests

Tester Sources for Different Fluid Properties (Sources)

Boundaries and Flow Regimes

Oil, Gas and Water Viscosities

3. Reservoir Data Collection

Primary Data of Reservoir Rock and Fluid Properties

Sampling Data for Determination of Fluid and Rock Properties

(Discussion)

Records of Water Influx or Fluid Withdrawal

Existing Data for Determination of Fluid and Rock Properties

Reservoir Pressure Survey

(Selection of Depth and Datum)

Pressure Information for Reservoir Drive Mechanism

Production Map of Reservoir Fluids

4. Fluid Data Collection Program

Purposes of Testing, Sampling and Measurements

Records of Data Sampling and Measuring Locations

Testing Survey of Well(s) and Preliminary Studies

Procedures Involved in Testing and Sampling

(b) Lampung

In October 1987 field activities were started in the Way Jepara irrigation system, Lampung Province, in southern Sumatra. This represented the first set of activities undertaken by IIMI outside Java. A brief description of the site conditions of the Way Jepara system, two hours drive east of the Provincial capital of Bandar Lampung, is given in Section 4.

Since then a number of activities have been started, details of which are given in Table 3.2. Daily observations of discharge are already being taken, calibration of structures has commenced, and equipment installed for monitoring of water table conditions. Data is currently being entered into the computer to permit quick feedback of results to system operators. Historical records of climate, canal discharges and releases from the reservoir at the head of the system have all been collected and are also being computerized. The data collection program will allow a full evaluation of the transition from the wet season to the first dry season.

At present IIMI has fielded one research Assistant and four Field Observers in the system. All are employees of PU seconded to IIMI for the duration of this Technical Assistance. PU has also provided a house which IIMI upgraded to serve as a mess for the Field Assistant and visitors from Jakarta, and has made available a separate room for meetings of the field staff.

The system has so far not been fully effective in maximizing the area irrigated in either of the dry seasons, and it is anticipated that current data collection will enable alternative system management plans to be developed for field testing in 1988-89.

At present the golongan system in Way Jepara merely divides the system into two halves. In alternate years either the upper half or the lower half of the system is permitted to grow rice, other farmers being permitted to cultivate palawija crops. These palawija crops are not irrigated, relying entirely on rainfall. In the second dry season there is much less cropping activity and is largely confined to palawija crops toward the head of the system. Rainfall does not permit much cultivation in the second dry season without irrigation water being available.

Table 3.2

Activities Initiated in Lampung since start of Phase II

1. Initial Investigations

   Survey of Study Area;
   Preliminary identification of Issues for study;
   Tentative selection of measurement locations;

2. Inventory Activities

   Physical condition of gates, measuring structures and division boxes;
   Survey of total irrigated area, including division between older and recent sawah;
   Identification of existing climatology stations;
   Tertiary maps for selected sample areas;
   Reservoir capacity
   Existing golongans for dry season;

3. Secondary Data Collection

   Reservoir water levels and issues into the system for past 5 years;
   Compilation of climatological data;
   Area irrigated and crop types for past seasons;
   Rate of development of sawah during system lifelength;

4. Preparation for Measurement Program

   Survey of suitable sites and installation of piezometers for measuring depth to water table;
   Selection and calibration of structures for daily monitoring of discharges and gate settings;
   Selection of sites for assessment of canal conveyance losses;

5. Measurement Activities

   Daily measurements of discharges and gate settings;
   Measurement of depth to groundwater
   Canal seepage losses
   Climatological data
   Activities of gate keepers and jurus

System Transfer

Two sites, each consisting of a series of small systems along a river valley, have been selected for studies of turnover of small irrigation systems: one near Sumedang in West Java, the other near Solok in West Sumatra. This work is being undertaken in connection with the ADB and World Bank irrigation sector loans, and represents a major area of interest of the Government of Indonesia. The two provinces have been selected by the Government for pilot testing of turnover activities that will then be expanded into other provinces under the sector loans.

The first phase of activity has been an inventory of the number, size, and type of small scale systems along the river valleys. Much of the training of PU staff for this work has been undertaken by LP3ES, an NGO supported by the Ford Foundation. IIMI has developed close relationships with the Consultant sponsored by the Ford Foundation to strengthen LP3ES activities in irrigation activities. The first inventories have been completed, and workshops were held in both provinces during January 1988 to evaluate the results of the inventories and plan the next phase of turnover activities. The preliminary results indicate considerable diversity of the systems themselves, and the nature of support provided by Public Works in the past. These differences will need to be accommodated in the plans for turnover to be drawn up in the near future.

In West Java it was agreed to undertake detailed profiles of seven small systems that have previously received some measure of assistance from Public Works to assess the training and special maintenance required to be undertaken before turnover can occur. In addition, IIMI has assisted in the selection of a larger system in Kuningan Section, Wilayah Cirebon. This will be the first system in the size-range of 150-500 ha to be included in the System Transfer component of the Study. Plans were also drawn up to extend the pilot project into two additional Wilayah during the coming financial year. Initially these activities will be limited to inventory of selected small systems. IIMI has hired two Field Observers to work in the Sumedang area and is currently seeking a third staff member to work in the Kuningan area. A part-time member of Padjadjaran University will shortly join IIMI to assist in the documentation of the turnover process and undertake a number of case studies.

In West Sumatra similar plans were drawn up at a planning meeting held in January 1988 that was attended by National and Provincial staff of PU, IIMI, and LP3ES. IIMI has currently hired one Field Observer for the Solok systems, and has engaged a member of Andalas University in Padang on a part-time basis. A second member of Andalas University will work in West Sumatra on his return from the Philippines in May 1988.

4. DETAILED WORK PLAN

4.1 INTRODUCTION

The basic purpose of the IIMI research program in Indonesia is to assist the Government of Indonesia in making fuller use of its investment in the irrigation sector through making more efficient use of land, water and the existing infrastructure. In Phase I the primary emphasis was on improving irrigation management to support crop diversification, thereby making more effective use of relatively scarce dry season water resources, and supporting the objective of the Government of Indonesia to diversify the agricultural base away from rice.

In the current activity there are two main components to the work IIMI is undertaking:

> Efficient Irrigation Management, in which there is a focus on larger irrigation systems, with emphasis not only at issues of system management for crop diversification in the dry season but also the more efficient use of water throughout the entire year.
>
> Turnover of Small Systems, linked to the overall government objective of handing over increased responsibility for irrigation system operation and maintenance to farmer organizations in small systems. This second component will help in determining optimal ways in which government O&M costs can be reduced without sacrificing performance.

As in Phase I, the work being undertaken within the Technical Assistance is field-based, with development and field testing of innovations carried out in existing irrigation systems within the constraints of normal operating procedures. In this way it is possible to develop modifications to existing irrigation management practices without creating an artificial project environment. Investigations cover the entire irrigation system, including water sources, main and secondary distribution systems, and on farmers' fields. The work is interdisciplinary, with inputs from a number of different agencies and universities representing a wide range of different interests, and it is undertaken in full collaboration with Indonesian counterparts in the planning, implementation and adoption of innovations.

1. INTRODUCTION

4.2 PROJECT OBJECTIVES

The Technical Assistance agreement specifies two sets of activities to be carried out. The first, efficient irrigation management, builds substantially on the activities carried out under Phase I, with a focus on the improved management of larger irrigation systems. The second, system transfer, was developed following discussions with DGWRD, the Ford Foundation, and ADB. While system turnover was included in the ADB and World Bank loan agreements, it was felt desirable to add a research component in the agreement with IIMI that will result in guidelines for implementation of turnover on a national scale. Although the objectives of the two activities are different, the overall focus of the Technical Assistance remains on the effective management of irrigation systems. The project is treated as a single activity for purposes of administration and accounting, and many of the staff involved will participate in both activities.

Efficient Irrigation Management

Following the Phase I Technical Assistance it was recognized that there was a need for further development and testing of alternative irrigation management strategies beyond those that could be development within the limited timeframe of a two year activity. Given natural variability in irrigation conditions between successive years, it is difficult to assess the needs for and develop effective management strategies within two years. A considerable proportion of the current study is to further refine and field test innovations, and, for the first time, to test them in irrigation environments outside Java where there are some significant differences. The four basic activities for this component are summarized below:

1. Efficient irrigation management can only occur if there is an effective mechanism for the collection, transmission and utilization of information on conditions within the irrigation system. Work will be undertaken to continue to refine methods of assessing the actual area being irrigated and the area under each crop, of recording irrigation deliveries at different locations in the system effectively and accurately, develop ways of transferring this information to those responsible for water allocation decisions to facilitate equitable and timely water deliveries, and assess the potential for different methods for rotating water within tertiary blocks, between tertiary blocks and between secondary blocks.

2. Efficient irrigation management depends on the maximizing use of existing manpower resources without compromising their abilities to undertake effectively both routine and emergency tasks. To this end, methods of streamlining reporting and administrative requirements will be evaluated, the workloads of different staff levels examined to see if the density of staff per unit area or per number of structures is optimal, opportunities for delegating greater responsibilities to field staff will be determined, and ways of involving farmers in supplementing the existing O&M responsibilities of irrigation officials will be formulated.

3. The ability of O&M staff to effective manage an irrigation system is, in many instances, related to the original design of the system. These constraints may be related to the physical design of structures and their associated suitability for water measurement or control, the relationships between staffing levels and the number of structures that have to be managed, assumptions on the capability of farmers to participate in system O&M, and assumptions on the water allocation practices that will be adopted. The study will therefore address a number of issues related to the interaction of design and management, and identify possible ways in which inherent incompatibilities can be alleviated. These will include elements of increased farmer participation in the design of systems and their management, recommendations for adoption of more manageable structures for water measurement and control, and adoption of rotational irrigation strategies that can be efficiently implemented during periods of water scarcity.

4. Effective irrigation management depends on being flexible in irrigation operations to accommodate changes in cropping patterns. This is particularly true where irrigation systems are increasingly diversified because improper irrigation practices can damage both rice and non-rice crops. The activity will address a number of issues related to the more efficient management of irrigation systems that grow diversified crops. These include assessment of farmer decisions on how and when to irrigate non-rice crops, assessment of water allocation and distribution decisions within tertiary blocks and the implications for operation of the irrigation system at secondary and primary levels, evaluation of whether existing water conveyance facilities are adequate to meet the needs of irrigation of diversified crops, and evaluation of alternative ways in which deficits in water availability at system level are accommodated in the allocation of water through rotations.

Irrigation System Transfer

Beginning in the latter part of 1987, the Indonesian Government Department of Public Works (PU), through its Provincial Irrigation Service (PRIS), is initiating a pilot project in West Java and West Sumatra to turn over full O&M control to the water users. The Ford Foundation is providing financial and advisory support to assist in the development of concepts and methodologies for the program. Funds for implementation are expected from planned and existing loans from the World Bank and the Asian Development Bank, which have strongly endorsed the new turnover policies. IIMI will be involved in the pilot project by conducting action research and helping monitor the turnover process for national application. This is considered to be the first phase of a nation-wide program to turn over most, if not all, government irrigation systems below 150 hectares in size in the first phase, and then systems between 150 and 500 hectares in size, in the second phase.

Although systems below 500 ha comprise only about 18.7% of the total design area of all government systems in Indonesia, they constitute 70% of all government systems (4,717 of 6,731). Hence, this program will have far-reaching implications for how the government and farmers will interact in the future in managing water within systems and along rivercourses and in designing, constructing, maintaining and rehabilitating systems. Through the turnover program the Government of Indonesia hopes to decrease the O&M burden on the government, allow for more intensive use of government resources in the larger, more "technical" systems and perhaps to develop an improved management capacity at the inter-system level along rivercourses. It is expected that this will improve the efficiency of use of PRIS O&M resources. Hence it is important to remember that the turnover program is not simply a program for decreasing the role of agency and increasing the role of farmers. It also is intended to enhance PRIS management capabilities in larger systems and at a more macro level along rivercourses.

The Government of Indonesia has decided to use water users association organizers (TP4) to assist with the turnover process. The TP4 will be recruited from the PRIS staff itself, rather than relying on outside university-trained social scientists, as has been done with community organizers elsewhere. It was felt that this would be essential in facilitating the agency reorientation process and would help ensure long-term commitment in the turnover work by the TP4. The turnover preparation process will involve irrigation system inventories of rivercourses, socio-technical profiles of eligible systems, assisting water users to organize, where appropriate, and working together with farmers to design and construct needed physical improvements.

The rivercourse inventory will provide information necessary to permit decision-making about which systems will be turned over and what preparation is required before turnover. Socio-technical profiles will be used to draw the TP4, who is recruited from the PRIS staff, into a dialogue with the WUA as well as to generate information to enable detailed planning of turnover preparation requirements for the given system.

The aim of these activities is to prepare farmers to take over full O&M control, ensure the long term sustainability of the systems and to help reorient the agency toward a new relationship with small systems in the future and perhaps an enlarged role at the rivercourse level. How elements of this process are applied locally and what will be the farmer management roles after turnover will depend primarily on the following:

1. System physio-technical characteristics (such as the nature of water sources and supply, sediment load and type of weir or intake),

2. Demonstrated farmer management capabilities and their willingness to take over full responsibility for O&M,

3. How the system was incorporated into the PRIS and

4. Historically, the nature of water users dependency on the PRIS.

Regarding these four types of characteristics, there is great diversity in local management requirements and capacities among all irrigation systems which are officially eligible for turnover. Some systems have high sediment loads in their water supplies and/or frequent flooding, others do not. Most small systems have free intakes, often consisting only of piles of brush and stones. Some have cement weirs and adjustable gates. Some systems have active water users associations, others do not. Management tasks may be handled formally or informally, collectively or individually, through a "permanent" organization or through ad hoc organizing as incidental needs arise, or not at all.

There are at least five ways in which village irrigation systems have become incorporated into the PRIS. These are listed ranging from low to high levels of intensity and directness of government investment:

1. Simple administrative reclassification from a village irrigation system to a PRIS system (perhaps for policy or budgetary reasons),

2. Reclassification to a PRIS system due to construction of a water supplementation structure at the inter-system or rivercourse level, which indirectly effects the given system,

3. Reclassification due to PRIS assistance in system repair or operation,

4. Technical or managerial "upgrading" of a farmer system, typical of the Sederhana Irrigation Program (e.g., from temporary to "permanent" materials, installing adjustable gates or discharge measurement devices, or assigning of PRIS staff to the system), and

5. Construction of a new system by the government.

The term "turning back" systems to farmers, may be appropriate for the first three types and partially so for the fourth types, because they were originally village irrigation systems. At present systems vary considerably in the ongoing levels, frequency and nature of government management of them, and consequently, the degree of farmer dependence on the government. Such management roles may consist of one-time, periodic repair or regular maintenance of intakes or canals, PRIS staff setting gates and greasing regulator bars, or PRIS staff coordinating the planting dates, water rotations or maintenance work parties. It may be hypothesized that systems with higher management requirements, a history of higher levels of initial and ongoing government investment and low farmer organizational capability will require a more intensive turnover preparation process and closer future coordination with PRIS.

The turnover process will not only cause changes at the system level but will also create new relationships between systems at the rivercourse level, perhaps requiring an association of farmer-managed irrigation systems involving water users associations in inter-system management tasks, such as policing rotations, mobilizing repair parties or dealing with disputes. Indonesia presently is in a state of marked transition in the organization of water management, especially regarding the evolving roles of farmers and government agency in managing irrigation systems.

4.3 RESEARCH ACTIVITIES

Efficient Irrigation Management

To achieve the four objectives identified in the previous section the work has been divided into five sets of activities. Each of these is described in detail below.

A. Continuation and Refinement of Phase I Action Research

In Phase I it was not possible to fully test all of the recommendations, and part of the rationale for Phase II was to permit their testing to be continued for a further season or two. A number of these recommendations will be pilot tested using practical and inexpensive methods that can be readily adopted by PRIS staff.

All of these activities fall within the first objective of the Technical Assistance, improving the Quality and Utilization of Information for Irrigation System Operation.

1. **A practical method for estimating and revising actual command areas of tertiary blocks.**

Objectives: To identify, test and recommend a practical method for measuring the actual commandable areas of tertiary blocks. Also to identify and recommend a more simple means of revising the official command areas of tertiary blocks and ensuring that revisions be incorporated into official routine planning of water deliveries.

Activities: IIMI staff will conduct a survey of juru reports about all blocks in study systems to determine, according to the juru(s), how many blocks are thought to be larger, smaller, or almost the same as the official irrigable area (luas baku) and what the reasons are for divergence (eg. mistakes in original measurement or design expectations, post-design changes in land use). IIMI will evaluate what the juru management responses are to these divergences in terms of modifications to design discharges. A selection will be made of a few blocks and a team, probably on contract, will measure the total commandable areas of designated tertiary blocks. IIMI staff will monitor the team's activities to insure that intended methods are used and proper boundaries are measured. At the same time an IIMI staff member will

examine the revision process in West Java, undertake a short survey of frequency of luas baku revisions in a selected system or section and examine the potential, and requirements, for simplifying the revision process so that PRIS staff have a more accurate assessment of the irrigable area.

Location: DI Cikeusik and DI Ciwaringin, possibly Way Jepara.

Seasonal Timing: Three blocks in DI Ciwaringin will be measured during the first dry Season of 1988. Additional measurements will be done immediately after harvest if possible. More general data collection or interviewing can be done at any time, preferably during 1988 dry season.

2.. Information Use for Monitoring System Operation.

Objectives: To introduce a simple but systematic method for PRIS monitoring of planned versus actual irrigation deliveries to improve management performance. To test the method and observe how interested PRIS staff are in monitoring irrigation delivery performance. Also, to encourage the use of such feedback in making management adjustments and improvements that reflect changes within the system over time and can be incorporated in annual planning activities.

An additional aspect of this activity is to try to identify where field staff have been making informal adjustments to discharges into tertiary blocks to allow for local variations in water requirements. Differences in soils and conveyance losses, presence of suppletions or return flows, and changes in irrigable area from tertiary gates are frequently not accounted for in the planned discharge, which is based on the luas baku and estimated demand. If actual field practices are masking allowances for these differences, then there is merit in incorporating them into the planning process.

Activities: Renewed guidance and monitoring by Field Observers of gate tenders (PPA), juru and subsection heads (pengamat) in the use of the planned versus actual delivery data, and in particular the Management Performance Ratio, in monitoring irrigation distribution performance, interpreting the data and in using it to make management adjustments.

Interviews with juru pengairan and PPA will be held to identify the extent to which they make regular adjustments to design discharges. Where such adjustments are made, the differences can be quantified and the actual water adequacy conditions verified, to determine if such differences should be regularized.

Location: DI Cikeusik, Ciwaringin, Way Jepara.

Seasonal Timing: 1988 dry season through 1989 dry season.

3. Systematic Gate Adjustment Practices and Staff Use.

Objective: To continue to document and interpret current gate adjustment practices of PPA and juru pengairan at sample structures in research systems. Also, to refine and test improved, standard procedures for gate tenders (PPA) and juru to follow for operating intake and outlet gates in response to fluctuations in discharge. Also to document how main systems are being operated on a month-to-month basis.

Activities: Additional documentation of actual gate adjustment decisions of a sample of PPA and juru to identify current practices and decision criteria for gate adjusting--particularly when such adjusting diverges from standard operating procedures. Introduction and monitoring of improved gate adjustment procedures.

Location: DI Cikeusik, at several weirs along the Cisanggarung River, Ciwaringin.

Seasonal Timing: Further analysis and development of procedures during 1988 dry season, with testing of improved procedure from December 1988 through September 1989. Preparation of monthly system operation report.

4. Tertiary Distribution Inspections

Objective: To document how farmers actually distribute water among fields and quaternary channels within tertiary blocks, and determine the criteria, rules and processes whereby farmers distribute water as observed. The effects for equity and productivity of the observed distributional practices will be evaluated.

Activities: Three times weekly inspections of selected tertiary blocks. This involves walking down the length of all channels and recording to where the water is being directed, how far down each of the channels there is flowing water and the location and spatial gain/loss effects of temporary alterations in the normal division of water (such as due to checking channels, diverting flows, etc.). The official distribution regulation will also be recorded (according to the P3A or ulu-ulu), and reasons for deviations determined.

Location: Three blocks each in Cikeusik and Way Jepara.

Seasonal Timing: Through both planting seasons in the dry season 1988 and 1988-89 rainy season.

5. Simplified Conveyance Loss Measuring.

Objective: Test use of a simple method, which can be applied by section or subsection PRIS staff, for measuring actual conveyance losses and deriving local loss coefficients for system management. In all IIMI research sites actual conveyance losses are unknown. This creates significant divergence between quantitatively estimated and actual irrigation requirements. Usually coefficients used are standard across locations for main, secondary and tertiary levels. The activity will utilize the structural and management potential that exists in many systems to make measurements to derive local conveyance loss coefficients. This will reduce some of the current uncertainty in the process of planning and managing irrigation deliveries, and permit more site-specific management.

Activities: During Phase I a few juru pengairan and pengamat staff were involved in measuring conveyance losses along selected canals in sites in East, Central and West Java. This research component will be continued into Phase II by training PRIS staff in selected locations to select an appropriate sample of main and secondary canals, to use simplified methods of estimating actual conveyance losses, and to incorporate such data into the system-wide pasten process determining irrigation requirements.

Location: Preliminary testing has been conducted in the Gung Section in Central Java, the Warujayeng System in East Java and in the Cikeusik and Ciwaringin Hilir Systems in West Java. Additional testing and refinement of a guide for PRIS field staff will be done in DI Cikeusik, Way Jepara in Lampung and perhaps in Leuwimunding AOU in West Java.

Seasonal Timing: Preliminary testing was conducted during the latter part of Phase I and early Phase II. Additional testing and refinement of a guide will be done over approximately two months (part-time) in 1988, during two separate one-month periods comparing dry versus rainy season conditions which may have significantly different levels of conveyance loss..

6. Practical Method of Calibrating Structures for Discharge Levels.

Objective: Widespread outlet structure defects and deterioration, siltation and lack of proper calibration severely limit the ability of PRIS to measure and control discharge, and debilitate PRIS motivation to record and monitor actual deliveries. Hence, there is a need for more frequent calibration activity at the local level. As a short-term but useful research component, IIMI will continue to develop and test procedures for calibrating outlet structures requiring different levels of sophistication, and ascertain the potential for sections and even subsections to have staff working part or full-time as small, mobile calibration teams.

Activities: IIMI will prepare guidelines whereby PRIS sections or subsections (kepengamatan) can use teams to conduct calibration of structures. The guide would include rationale for prioritizing structures needing calibration, staff and training requirements, equipment requirements and a workplan. Field activities would include testing of the guidelines together with selected section and subsection staff during calibration of different types of offtake structures at the secondary and tertiary levels, and comparing less versus more sophisticated methods for accuracy and expense (such as use of portable flumes, current meter, etc). IIMI will provide the necessary on-the-spot training and practice for PRIS staff in simplified calibration methods as a part of the program.

Location: DI Cikeusik, Ciwaringin, Way Jepara and possibly other systems in Leuwimunding.

Seasonal Timing: Some calibrating and calibration training was done by UGM during Phase I. Two month period (part-time) to prepare guide for various methods, when applicable, skills and equipment required, etc. One or two month period for testing while providing local training in selected research sites.

B. Rivercourse and Reservoir Management

Results from Phase I indicated that a significant problem encountered in many systems was the fluctuation of discharges entering the system. Thus, even if proper calculations are done to determine the correct gate settings for each 10 or 15 day period adopted within the pasten system, upstream fluctuations in discharge lead to significantly different discharges within the system. In both the West Java and Lampung sites there are opportunities to look at management opportunities to reduce these fluctuations in discharge at the intake into the system.

D.I. Cikeusik in West Java is the last system served by the Cisanggarung River. Upstream of the weir are several other weirs, all of which serve irrigation systems. The river is partly controlled by a reservoir, Waduk Darma, near Kuningan, which provides some opportunity to augment discharges during the dry season.

Way Jepara in Lampung is entirely reservoir controlled, and provides an opportunity to examine in detail reservoir allocation practices as a function of irrigation demand.

7. Weir Operation Along Cisanggarung River

Objective: To document current practices, and rationale, for operating weirs along the Cisanggarung River and propose and test new procedures for weir operation that will minimize the fluctuations in water availability at each weir and permit a more systematic implementation of the pasten system..

Activities: To assign local PRIS staff assigned to the respective weirs to record daily discharge levels and gate adjustments. Observe and interview weir operators to determine the actual operational rules employed by them in operating the weir. Identify current information transfer procedures between weir operators and PRIS staff at the Cabang Dinas, and propose modifications to the information transfer process so that downstream weir operators can have better estimates of likely discharges reaching their structures.

Location: Six or seven weirs along Cisanggarung river.

Seasonal Timing: Continuous monitoring, with evaluation of dry season operation in late 1988, and development of recommendations for alternative management activities in 1989 dry season.

8. Enhanced Reservoir Management Through Improved Information Use.

Objective: To improve operation of reservoir and water distribution based on better prediction of water supplies and irrigation demands. Better prediction is based on better utilization of historical and current data on water supply and in the catchment and expected demand in downstream areas served by the reservoir.

Activities: Collection of primary and secondary data on water supply and demand over last several years. Analysis of these data to determine probability levels of different inflows and storage. Observation of current management practices at the reservoirs, including evaluation of information available to reservoir operators and PRIS staff at Section level. Development of recommendations for more efficient operation of the reservoirs to maximize the cropped area and minimize fluctuations in downstream discharges.

Location: Waduk Darma and Waduk Jepara.

Seasonal Timing: Continuous monitoring of inflows and outflows from the reservoirs throughout Phase II. Annual evaluation of operations in relation to demand and development of alternative operational plans for the following year.

C. Annual/Seasonal Management Innovations

In Phase I it was demonstrated that there were several areas in which the process of planning for annual and seasonal irrigation activities could be improved. Some of these improvements relate to information availability and information flow, while others reflect as yet untested alternatives for system operation that would permit scarce water to be equitably distributed.

9. Improved Information Base and Planning Process for Annual Crop Plan.

Objectives: To identify potential ways of improving the information base of the annual crop plan and of achieving closer similarity between the crop plan and actual cropping practices of farmers. This includes four basic practices: 1) crop choice, 2) planting date, 3) irrigation field application rate and 4) application timing. Further objectives are to recommend and possibly test institutional improvements to encourage greater farmer participation in, and awareness of, the crop plan process. Evaluate the economic productivity and equity of current crop plans in use in Cikeusik and Ciwaringin.

Activities: Analyze the spatial nature of divergences between plan and actual practice and the implications of this for irrigation management performance. Document current annual crop planning practices and evaluate the causes for such divergences, the adequacy of information utilized in the crop plan process and the extent or significance of current farmer involvement in the process. Specify additional information which should be incorporated into the crop plan process and recommend appropriate improvements in the current official procedures. Make map graphics designating locations of divergences between planned and actual conditions for the four behavioral aspects of the crop plan mentioned above. Interview farmers in selected blocks about their decision-making rationale with regard to the crop plan. Collect supporting physio-technical data relative to cropping practices (soil textures and/or infiltration rates, drainage problems, etc.). Collect data on relative profitability per hectare and per unit of water of alternative crops.

Location: Ciledug area, Way Jepara, Lampung, and possibly Leuwimunding.

Seasonal Timing: Main data collection and analysis from May 1988 through April 1989; formulate improved process from October 1988 through March 1989, possibly test aspects of recommended new procedures between April and July 1989.

10. Alternative Rotation Practices.

Objective: To test and compare the benefits, costs and manageability of different irrigation scheduling and rotational practices through both simulation modeling and field testing. The different rotational practices would have to take into account the existing cropping patterns, the maximum and effective minimum conveyance capacities of canals, short-term variations in water supplies, and location of control points at which rotations can be effectively introduced and controlled. To identify under what conditions decisions should be made to switch from within tertiary block rotations to those between tertiary blocks, and when rotations at secondary level may be necessary.

Activities: Identify rotational methods used in study sites and construct a typology of different irrigation scheduling and rotation practices used in DI Cikeusik, Ciwaringin, Lampung and in Phase I sites in East and Central Java. Identify management, agronomic and economic effects of scheduling/rotation alternatives and specify improved procedures for actual IIMI sites. Test improved scheduling/rotation procedures in the field and possibly simulate a model of alternative rotation methods.

Location: Main system and selected secondary canals in DI Cikeusik and Way Jepara, Lampung.

Seasonal Timing: Model development based on observations made during 1988 dry season, with proposed testing in 1989 dry season.

11. Proportional Allocation.

Objective: To analyze the potential for implementing simplified, proportional means of water allocation in systems built for "technical" management--where management capacities do not permit implementation of the pasten system nor "technical" water measurement and control.

Activities: Develop a canal operation guide which includes aspects of proportional allocation procedures which require less information and management intensity than does the pasten system. Test the procedure, in terms of manageability and performance results along selected secondary canals through one or two seasons, using FOs to guide and monitor involved PRIS staff and farmers. To implement this, it would be necessary to maintain relatively constant water levels and then fix gates so that the amount of water delivered to each tertiary block was in proportion to the irrigated area.

Location: A selected secondary canal in Way Jepara, Lampung and/or Cikeusik.

Seasonal Timing: 1988-89 rainy season and 1989 Gadu I season

D. Evaluating Irrigation Management Performance

Fundamental to the improvement of irrigation management is evaluation of performance of irrigation systems. Work will focus both on short term performance in respect of discharge deliveries, and seasonal performance in respect of agricultural conditions. The two activities described here draw on much of the data collected for previous activities, but are focussed on development of comparatively simple techniques that will be useful to system managers in evaluating system performance and ways in which this performance can be improved.

12. Continuous Performance Monitoring

Objective: To monitor and evaluate the nature of irrigation system management performance for DI Cikeusik, Ciwaringin and Way Jepara.

Activities: Daily measurement of actual discharge levels at selected water division structures in upper, middle and lower sections of study systems. Documenting and analysis of planned deliveries, management performance ratios, irrigation distribution efficiencies, gate adjustment responsiveness to fluctuations in discharge, relative water supplies. Monthly computer analysis of some of the above performance indicators.

Location: Cikeusik, Ciwaringin and Way Jepara systems. Also some performance monitoring of management of Waduk Darma and sample weirs along Cisanggarung River.

Seasonal Timing: Currently in a year-round mode. However this will change in the future to where interrupted sample time slices, based on periodic sample assessments, will be used rather than non-stop daily measurement. Monthly assembling of data on actual and planned discharge, entry into computer, and development of procedures for feedback of the analysis to system managers.

13. Seasonal Performance Monitoring

Objective: To examine the spatial variations in crop yields, planting timing, length of harvest/planting turnaround time, perceived water adequacy, limitations due to poor drainage, use of groundwater in conjunction with the irrigation system network, and then use the information gained in improving the seasonal planning process.

Activities: Post-harvest interviews with sample farmers in selected tertiary blocks. Farmers are selected on the basis of two-dimensional interquartile grids. By mid dry season monthly monitoring of sample farmer use of groundwater will begin.

Location: Cikeusik, Ciwaringin, Way Jepara.

Seasonal Timing: End-of-season.

Irrigation System Transfer

IIMI will conduct research at the field operations level, both in selected irrigation systems, along rivercourses and at the section (cabang dinas, ± 25,000 ha.) and subsection (pengamat, ± 6,000 ha.) levels of the PRIS. The research would be closely linked to, and be interactive with, field operations. It would be intended for immediate use by national and provincial working groups in facilitating the development of an effective and nationally replicable turnover process.

However, IIMI will not only be involved in research for the turnover program. IIMI will also assist in developing a method for transmitting timely and pertinent information about turnover process field operations to regency, provincial and national-level working groups, which would be of use for the planning and decision-making tasks of these groups. This will involve monitoring and documenting the process of implementing the turnover program with the objective of reorienting the role of the irrigation agency towards small-scale irrigation systems. It is expected that IIMI will be an active and regular participant in national and provincial-level working group meetings, workshops and other turnover project meetings, helping to ensure that the turnover pilot project be as much of a learning process as possible for all involved participants.

The purpose of IIMI's research is to produce, on a regular and frequent basis, information, analysis and suggestions aimed at: 1) improving the turnover process in the pilot areas--in time for key policy decisions, 2) clarifying the implications of this process for the farmers, for the provincial irrigation service and for water management, and 3) facilitating the emergence of an effective turnover process model for nation-wide application. This necessitates a flexible research program consisting of multiple, short-term components which address key research questions. For most of these components, collecting and analyzing data and presenting results and recommendations will be done within three to six months. IIMI will consult with members of turnover working groups at the national and provincial levels both about the emerging turnover process and the direction of IIMI's activities.

IIMI's research will focus on the four following topics: 1) the nature of Provincial Irrigation Service (PRIS) investment in systems and farmer dependency on the PRIS prior to turnover, 2) monitoring and assessment of the turnover process, and 3) organizational implications of turnover for PRIS sections.

1. Nature of PRIS Investment in Systems and Farmer Dependency on the PRIS Prior to Turnover

(a) Section and Subsection Level Patterns of Government Investment in Irrigation Systems

IIMI will assess the nature and extent of PRIS investment in irrigation systems which are eligible for being turned over. Such investment includes construction, rehabilitation, repairs, routine maintenance and water distribution. This will provide insight into both the nature of farmer dependency on the PRIS and the degree to which turnover will actually decrease the O&M burden on the PRIS.

Key Research Questions

1. What are the current PRIS O&M roles and how have investments been concentrated in smaller irrigation systems to date?

2. To what extent will the turnover process decrease the financial, personnel or management burden of the public works department?

3. At present, what priorities shape PRIS O&M investment decisions?

4. To what extent have farmers participated in PRIS investments such as system rehabilitation, repairs, and routine operations and maintenance?

Data To Be Collected Data is being collected from PRIS section records on yearly expenditures and the use of staff and materials for all irrigation systems in the pilot sections since at least the beginning of the first five-year planning period (1969/70) to the present. Information will be collected on PRIS procedures and priorities for allocating resources to systems and on PRIS system management roles.

Methods IIMI field staff in the Sumedang and Solok PRIS sections have begun recording on forms PRIS investment data on construction, repairs, routine maintenance and operations expenditures from section records for all irrigation systems, of all sizes, in the two sections. Interviews will be conducted, combined with direct observation, with PRIS field staff regarding how investment decisions and priorities are made and which tasks are generally performed, and how so, by PRIS field staff.

Time Schedule IIMI field staff began collecting data on PRIS investments in systems in Sumedang and Solok sections in November 1987. Interviewing of PRIS staff began in March 1988. Data collection, analysis and reporting on the PRIS investment research component is expected to be completed by June 1988, at which point a turnover process research recommendation report will be submitted to the national and provincial turnover working groups. IIMI will also produce more frequent, short memoranda for use in decision-making by the national and provincial-level turnover program working groups.

(b) Farmer-Government Investment Case Histories in Selected Systems

The history of farmer investments and management roles in selected systems will be examined. Farmer responses to PRIS investments will be recorded. Comparisons will be made of PRIS versus farmer investment preferences, design and construction criteria, and use of labor and materials. This information will help shape the turnover process and facilitate farmer participation in system physical improvements prior to turnover. It is assumed that the historical nature of farmer versus government investments is a primary determinant of: 1) farmer conceptions of system ownership and responsibility, 2) farmer organizational capabilities and incentives and 3) dependency on the PRIS for irrigation system improvements and O&M support.

Key Research Questions

1. How do PRIS O&M investment priorities, practices and socio-technical design and construction criteria differ from farmer investment priorities, practices and local socio-technical knowledge?

2. How can knowledge about such differences assist in developing effective turnover preparation methods? (including inventory, profile, design and construction and post-turnover shifts in P3A/PRIS roles)

3. How can knowledge about such differences assist in developing an organizational model for post-turnover PRIS interactions with, and assistance to, small systems?

Data To Be Collected Data will be collected on farmer reactions to, and use of, various irrigation system structures built by the PRIS. IIMI field staff will document farmer investment priorities, design and construction criteria, operations and maintenance practices and suggestions for fruitful PRIS-farmer interaction after turnover.

Methods One or two irrigation systems per section in the less-than-150-hectare size range will be selected for intensive, but tightly-focused, case studies of farmer and PRIS investment practices. Two systems in the 400-to-500 hectare range also will be selected for intensive study. The larger size systems are located in the Kuningan section of the Cirebon region of West Java and the Solok section in West Sumatra. Each of the systems selected will be systems which will be designated for physical and organizational improvement assistance prior to their turnover. Extensive group and individual semi-structured interviewing, direct field observation and inventorying of structures will provide most of the data required for this research component. Following these case studies a small set of information about farmer and PRIS investment practices may be collected from a number of other systems in each section, enabling broader generalization of findings.

Time Schedule Final selection of the systems for intensive case study will be done in March 1988 and field interviewing and other data collection activities will begin in April 1988. Case studies and a turnover process research recommendation report will be prepared by the end of September 1988.

2. Monitoring and Assessment of the Turnover Process

(a) Documenting Field Activities Through Direct Observation

IIMI will evaluate the nature and effectiveness of agency/farmer/TP4 interactions at the field operations level during the turnover preparation phase in selected irrigation systems. IIMI will provide on-going recommendations to the national and provincial working groups regarding how to improve materials, instruments and methods used in turnover field operations, both for the pilot project and for the national turnover program. This would include such materials and methods as: rivercourse inventory guides, socio-technical profiles of irrigation systems, training methods, farmer participation in design and construction in system improvements prior to turnover, water users association (P3A) development and PRIS field staff reorientation. IIMI will provide recommendations on the adequacy of the information base supporting decisions such as the following: which systems should or should not be turned over, what kinds of preparation are required prior to turnover and the classification of types of systems for turnover.

IIMI will base its assessments of the effectiveness of the turnover process mainly on officially-stated Government of Indonesia objectives of the turnover program. At this point these appear to be as follows. The preparedness of P3A to: 1) fulfill O&M roles, 2) support the long-term sustainability of their systems and 3) take a broader role in coordinating water management along the rivercourse. Objectives related to the PRIS apparently are as follows: 1) a reallocation of O&M resources to intensify water management in larger technical systems, to improve their sustainability (preventing the need for frequent rehabilitation), 2) transition to a more indirect, service-oriented approach to assisting small irrigation systems and 3) a more formal, rational management approach at the inter-system level along rivercourses.

Key Research Questions

1. What is the extent to which the PRIS system inventory manual (buku pintar) has administratively defined irrigation system boundaries with multiple intakes?

2. Should inventory or profile-making have as additional objectives the redefining of system boundaries according to single hydrologic or management units?

3. What would be the implications for turnover planning and for PRIS sections if all systems with multiple intakes, regardless of size, were inventoried--in order to redefine systems according to single hydrologic or management units?

4. What adjustments need to be made to improve the effectiveness of the inventorying, profiling, design and construction, P3A development and PRIS field staff role reorientation processes?

5. What method can be developed to determine what, if any, operation or maintenance procedures need to be changed during turnover?

6. What should be the criteria for deciding whether or not to turn a given system over to farmers?

7. What is the best, practical method for ascertaining whether or not P3A are prepared to take over O&M responsibilities?

8. What method can be used to ascertain the degrees of management intensity required for meeting acceptable levels of irrigation management performance?

Data To Be Collected Utilizing data collected from the case study systems on the physical and agricultural setting, irrigation structure conditions and use, management requirements inherent in local settings, and observed system management practices, IIMI will assess how the inventory, socio-technical profile, participatory design and construction and organizational development methods used in the field should be improved for nation-wide application. Actual activities and interactions between turnover preparation field staff (TP4), farmers, contractors and PRIS staff will be documented.

Methods IIMI will directly observe, monitor and evaluate the activities and effectiveness of the TP4, the effectiveness of involving farmers in system improvement design and construction and the extent of farmer, as well as agency, preparedness for turnover. IIMI field staff will be trained in so-called "participation observation" techniques and will regularly and directly observe TP4, farmers, contractors and PRIS staff as they interact in day-to-day activities in the irrigation systems, farmers' fields, farmer meeting locations and PRIS or contractors' offices. These participants will be interviewed to elicit their own interpretations of events in the field, so as to identify problems and aspects of the process which need improvements.

Time Schedule In mid-March 1988 IIMI field staff will attend the profile-making training sessions in Sumedang and Solok, respectively (conducted by the Indonesian NGO, LP3ES). Immediately following this they will join TP4 staff in the field in selected systems to observe profiling. By June through September it is expected that they will begin observing farmer, PRIS, TP4 and contractor interactions in the design and construction processes. Two turnover process recommendation reports will be prepared for this component (the turnover process documentation component). The first one should be submitted by December 31, 1988. This one will focus on the inventory, profile and design and construction processes. It is expected that the second one with additional recommendations on the design and construction process as well as recommendations on the P3A development and PRIS field staff rivercourse management reorientation activities will be submitted by June 1989.

3. Organizational Implications of Turnover for PRIS Sections

(a) Implications for Staff, Budgets and Resources

IIMI will analyze the implications of the turnover process for the allocation of financial and staff resources at the section and subsection levels. It will provide recommendations to the national and provincial working groups on altering the use of agency staff and material resources. Of particular concern is the advisability and feasibility of relocating, retraining or reorienting staff affected by the turnover program. IIMI will also assess how observed turnover program implementation activities will shape future PRIS approaches to assisting small-scale irrigation systems after turnover.

Key Research Questions

1. How will the turnover process effect section budgets and how budgets are prepared?

2. What is the feasibility of reallocating displaced turnover staff to larger, more technical systems?

3. What is the advisability of altering present PRIS field staff roles to more coordinative management roles between systems along rivercourses?

4. Which PRIS field staff roles can be turned over to P3As, and what are the long-term implications for PRIS staffing?

Data To Be Collected Data will be collected on PRIS section budgets and the bases for preparing the DUP (annual section budget requests to the province), during the last two or three five-year planning periods (repelita). General data will be collected on the functions, roles and locational placements of the section and subsection irrigation staff and on the training, experience, attachments and incentives which would influence the reorienting of post-turnover staff organization. Some information will also be collected on weaknesses in the present forms of PRIS investment, personnel management and budgeting which are most closely related to failures in the sustainability of larger or more "technical" systems. This will help in identifying priorities for post-turnover staff and resource allocation.

Methods The above budgetary and personnel data will be collected from the two PRIS section and subsection offices. An analysis will be made of the comparative effects of turnover on section budgets and staff allocation. This will involve comparison of different budgeting methods such as, basing budgets on size of irrigated area versus needs-based budgeting relative to type/number of structures and required O&M management frequency. It will also involve comparison of implications of different staff reallocation opportunities. A sample of PRIS staff will be selected and interviewed about their skills, job practices, local attachments and institutional incentives which might inhibit or shape effective staff reallocation. Some key informant interviews will also be held to identify priority staff personnel

and training needs in larger systems. (IIMI ISM research in large system management will provide input for this as well.)

Time Schedule It is expected that analysis for this component will be conducted primarily between October 1988 and March 1989. A research recommendations report regarding the budgetary and personnel implications of the turnover program will be disseminated by March 31, 1989.

(b) Implications for Improved Inter-System Management Along Rivercourses After Turnover

IIMI will examine and describe the nature of inter-system water management interactions involving either farmers or PRIS personnel along selected rivercourses, probably one in each of pilot project sections.

Key Research Questions

1. How does the turnover process effect rivercourse water management performance?

2. What staffing, facilities, training and budgetary means are required to meet the need for more macro, rivercourse-level coordinating?

3. Should the panitia irigasi, or a sub-committee, be enlarged slightly to include farmer representatives?

4. Should both the panitia irigasi as well as sub-section and irrigation inspectors have work areas based on rivercourses rather than on administrative areas?

Data To Be Collected Data will be collected on such irrigation management performance indicators as: spatial variations in cropping intensities, reported yields, proportion of systems irrigated, or fallow, during dry season. A simple method will be developed and tested to ascertain which O&M tasks need to be carried out at what level of frequency to meet performance standards acceptable to the water users and to PRIS staff involved in managing the rivercourse.

Methods Irrigation performance variations along selected rivercourses will be assessed in order to ascertain the need and potential for an enlarged PRIS, and perhaps P3A coordinative management role at the rivercourse level. Key informant interviews will be held with relevant PRIS staff and P3A officers or others who are involved in inter-system management interactions along the selected rivercourses. IIMI may conduct some mapping of rivercourses to identify the locations and interconnections of all systems along the selected rivercourses.

Time Schedule It is expected that this rivercourse component will be the final research component to be completed, with most of the data collection and analysis occurring between January 1989 and August 1989. A research recommendations report will be submitted by August 31, 1989.

4.4 FIELD SITES

Efficient Irrigation Management

Work for this component of the Technical Assistance is being undertaken in two Provinces: West Java and West Sumatra. Additional activities in East Java and Central Java remaining from the Phase I study have been completed during the first few months of Phase II activities, in order to maintain data collection to the end of the second dry season of 1987.

West Java

Two irrigation systems in Cirebon Wilayah, Ciledug and Ciwaringin, were selected for intensive study during the Phase II Technical Assistance. Both of these systems were included in Phase I activities, so that it has been possible to continue work there without disruption.

Ciledug Irrigation System is the last irrigation system served by the Cisanggarung River before it flows into the sea 25 km east of Cirebon. The total irrigable area is approximately 7200 ha. The system was selected because it has a number of characteristics that lend themselves to an intensive study of irrigation management:

- Being at the tail end of the Cisanggarung River results in variable water deliveries into the system during the dry season, requiring more intensive management than in more favored locations.

- During the dry season there is generally insufficient water to irrigate the entire system, and yet some farmers persist in growing rice; there are clear opportunities for developing more equitable water distribution during periods of water scarcity.

- There has been a long history of production of palawija crops in the system, notably the cultivation of onions, that enables realistic assessment of dry season management practices.

- Alternative types of rotational irrigation are well established in the system, making it easier to pilot test alternative strategies.

- In the lower portions of the system there are significant drainage problems that limit the cultivation of rice in the wet season, and which appear to limit opportunities for palawija crops in the first dry season.

- The system is sufficiently large to represent the full organizational structure of a typical technical irrigation system, providing an appropriate opportunity to evaluate alternative organizational and management structures.

IIMI currently has a Field Assistant and three Field Observers based in Ciledug. A mess has been provided that serves as an office, and will also be the base for research activities in Ciledug to be conducted under the IIMI-IRRI collaborative project, with inputs from AARD, PRIS, PRAS, and University of Gadjah Mada.

A total of twelve tertiary blocks have been selected for intensive study, and regular observations are being made of discharges and cropping activities at selected locations in the system.

Ciwaringin Irrigation System, located approximately 25 km west of Cirebon, irrigates about 2420 ha. It was included in the Phase I study, and work there has continued without significant modification into Phase II.

Ciwaringin shows some contrasts with Ciledug that favor its retention for comparative purposes:

- Although water is in relatively short supply during the dry season, most farmers choose not to cultivate palawija crops. While this may be in part a reflection of rat infestations, it also appears that the cultivation of rice on both dry seasons near the head of the system also limit opportunities for other farmers.

- Parts of the main canal system utilize existing rivers, making for a different set of management activities than in a fully controlled system such as Ciledug.

- There are few drainage problems that limit opportunities for cultivation of palawija crops in the dry season.

Other Systems in West Java. Because staffing and budget constraints do not permit intensive studies to be conducted in more than two systems in West Java, a number of other systems have been identified for less intensive study. The merit of this approach is that it reduces the risk of relying too much on a very small number of systems, and permits opportunities from management interventions to be made without first going through a detailed and time-consuming intensive evaluation.

The systems selected all lie along the Cisanggarung river between Waduk Dharma and Ciledug. The purpose for selecting these systems is two-fold: there are marked differences in cropping intensity, largely reflecting their position relative to the head of the river system, and they provide an opportunity to evaluate opportunities for improved rivercourse management.

Along the course of the Cisanggarung River itself, excluding tributaries, there are some 17 systems in total. Of these, six are technical systems operated and maintained by PRIS in Kuningan and Cirebon Sections, while the others are small, non-technical systems operated and maintained by farmers.

Lampung

The system selected for intensive study is the Way Jepara Project, about 60 km east-northeast of Tanjung Karang (Bandar Lampung). It is a transmigration resettlement project, with the first major inflow of transmigrants coming from throughout Java and Bali in the late 1950's and early 1960's. Transmigrant families received land allotments of about 2 ha each. The project area was developed for irrigation, with assistance from the Japanese Government, beginning in the early 1970's. The Way Jepara Project's potential irrigated area is 6,650 ha, while its current functional area is about 4,700 ha.

Unlike other irrigation systems in Lampung, the water source for the Way Jepara Project is a reservoir. The reservoir's design capacity is 19 million cu mt of water. The two main canals were designed to be 38 km (Left Bank Canal) and 12 km (Right Bank Canal) in length. The project design called for 29 secondary main canals and 16 lateral canals branching off from the secondaries.

The annual rainfall in the project area averages 2,000 mm. More than 70% of it falls during the November to April wet season. The remainder is distributed rather evenly among the other six months.

The irrigation infrastructure in the project area is new. Nevertheless, some of the water control structure and measurement devices are not fully functional, and the general level of irrigation management in Lampung is somewhat less than that in Java.

During the first dry season about 50% of the area is planned for rice cultivation. The area is rotated every other year between the upper and lower halves of the system. In areas unscheduled for rice irrigation, many farmers grow palawija crops, although the bulk of water for these crops is from rainfall rather than irrigation.

IIMI currently has one Field Assistant and three Field Observers based in Way Jepara, and the field measurement program has been active since October 1987.

System Turnover

IIMI will conduct research at the field operations level, both in selected irrigation systems, along rivercourses and at the section (cabang dinas, ± 25,000 ha.) and subsection (pengamat, ± 6,000 ha.) levels of the PRIS. The research would be closely linked to, and be interactive with, field operations. It would be intended for immediate use by national and provincial working groups in facilitating the development of an effective and nationally replicable turnover process.

Work has commenced in two PRIS Sections: Sumedang in west Java and Solok in West Sumatra. In each of these Sections a total of 35 small systems, each less than 150 ha, have already been inventoried to determine the status of the system in respect of assistance received from PRIS, and identify those systems suitable for detailed profiling prior to institutional development and special maintenance, if deemed necessary. In both Sections there is a large number of small systems, and it was agreed early on to focus here as they best represent both the technical and institutional issues that must be addressed as the program expands into other parts of Indonesia.

In West Java IIMI is currently selecting a system between 150 and 500 ha, that will act as the pilot study for turnover of larger systems. This system will be in Kuningan Section, Cirebon Wilayah, probably in the catchment of the Cisanggarung River. This will enable some integration between the System Turnover activity and the Efficient Irrigation Management Activity as both will address issues of rivercourse management, and it was considered appropriate to undertake these parallel activities in the same river system.

Although there are plans to extend the turnover process into at least two other Sections in West Java, IIMI will concentrate its work in Sumedang and Kuningan Sections because the activities scheduled for other Sections in 1988-89 will largely be confined to inventory activities. Only in Sumedang and Kuningan will there be active moves towards turnover during the life length of this Technical Assistance.

In West Sumatra it is expected that the work will be confined to Solok Section throughout the length of the Technical Assistance. It would be difficult, given current staffing levels to expand beyond the single Section now included in the turnover study.

4.5 TIME FRAME

The Technical Assistance commenced on 1 October 1987 and will conclude on 30 September 1989. This period coincides approximately with two full cropping years, allowing further development of innovations in the first year, and their adoption on the second year.

Efficient Irrigation Management

In West Java activities already initiated in Phase I are being continued in Phase II. Despite some changes in the measurement program it is possible to continue to test innovations developed in Phase I throughout the full length of Phase II. It is expected that additional modifications and refinements will be developed during the first year that will be field tested in the second year.

In Lampung there will be limited opportunities for field testing of innovations during the first year because of the time required to start up the measurement program and make modifications to the innovations already developed to accommodate differences in system conditions off Java. Because Way Jepara is served from a reservoir, it is necessary to include analysis of reservoir releases in analysis before innovations can be introduced. The bulk of the field testing of innovations will therefore be conducted in the second year of the project.

In both Provinces there will be transition in activities from the first to the second year. This period will be used for consultation between the different agencies involved in the work, and the development of a detailed workplan for the second year. It logical to expect this consultation to occur shortly after the completion of the Interim Report which is due by 30 September 1988, approximately in the middle of the second dry season. The consultations, part of which will be in the form of a workshop, will allow full participation in the development of recommendations for activities in the second year of the project.

The proposed schedule of activities for the efficient irrigation management component of the Technical Assistance is presented graphically in Figure 4.1.

TABLE 4.1: TIMETABLE OF ACTIVITIES FOR EFFICIENT IRRIGATION MANAGEMENT

PROJECT ACTIVITY	1987			1988												1989											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Continuation of Phase I Activities																								
1. Command Area Verification							*	*				*	*											
2. Information Use for Monitoring				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3. Gate Adjustment Strategies	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
4. Tertiary Distribution Practices								*	*	*	*	*	*	*					*	*	*	*	*	
5. Conveyance Loss Measurement		*	*							*	*					*	*							
6. Calibration of Structures											*	*						*	*					
Rivercourse and Reservoir Operations																								
7. Operation of Weirs, Cisangarrung					*	*	*	*	*	*	*	*	*	*	*				*	*	*	*	*	*
8. Reservoir Operations	*	*	*				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Annual/Seasonal Management Innovations																								
9. Information Base: Annual Crop Plan			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
10. Alternative Rotation Strategies									*	*	*	*	*	*					*	*	*	*	*	
11. Proportional Allocation									*	*	*	*	*	*					*	*	*	*	*	
Irrigation Management Performance																								
12. Continuous Performance Monitoring	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13. Seasonal Performance Monitoring			*	*			*	*			*	*			*	*			*	*			*	*
FORMAL REPORTING																								
Inception Report						*																		
Mid-Term Report												*												
Draft Final Report																						*		
Final Report																								*
MEETINGS AND WORKSHOPS																								
Planning Workshop						*																		
Mid-term workshop													*											
Workshop on Draft of Final Report																						*		

Irrigation System Transfer

In some respects the time frame for this activity is less dependent on the cropping season. Activities such as inventory and profiling of small systems can occur at any time, as can the process of strengthening the water user groups. However, construction work involved in the Special Maintenance program may be limited during the peak of the wet season. For much of the activity, therefore, the work can proceed at its own pace.

For the first year project activities will focus on three main items: the review of investments currently made by PRIS in the small scale irrigation sector of the two Provinces; the completion of a series of case studies of selected small irrigation systems; and the process documentation of the first phase of the turnover activity, concentrating on the inventory, profiling, and design and construction phases.

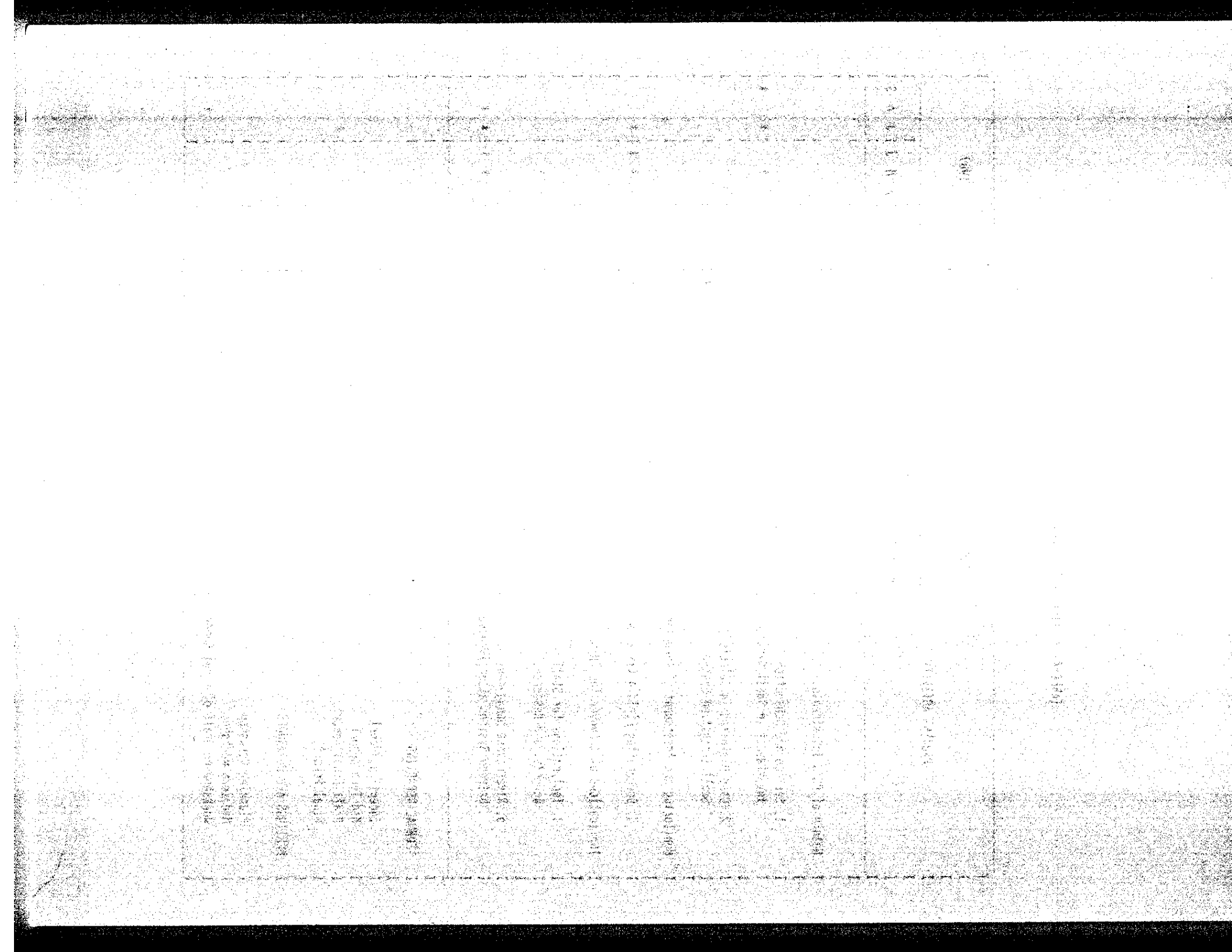
Monitoring of the impact of the program, however, will be more closely linked to agricultural performance and the utilization of irrigation water during the dry seasons. As few, if any, systems that require training of the water user group or Special Maintenance will be handed over before the 1988 dry season, much of the monitoring and evaluation of the impact of the program will be undertaken in 1989.

In the second year of the Technical Assistance three separate activities will be undertaken: the process documentation of design and construction, and the development of relationships between P3A and PRIS; evaluation of the impact of the turnover program on the budget and personnel of PRIS; and the implications of the turnover program on rivercourse management and the interactions between different systems that have been fully turned over to farmer organizations.

The proposed schedule of activities for the turnover activities is presented graphically in Figure 4.2.

TABLE 4.2: TIMETABLE OF ACTIVITIES FOR SYSTEM TURNOVER

PROJECT ACTIVITY	1987			1988												1989									
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Nature of PRIS Investments																								
1. Section and Subsection Investments in Small Systems	*	*	*	*	*	*	*	*	*	*	*	*		*		*		*		*		*		*
2. Case Histories in Selected Small Irrigation Systems							*	*	*	*	*	*	*	*	*									
Monitoring and Assessment of Turnover																								
3. Documenting Field Activities		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Implications of Turnover for PRIS																								
4. Implications for Staff, Budgets, and Resources											*	*	*	*	*	*	*	*	*	*	*			
5. Rivercourse Management between Systems after Turnover														*	*	*	*	*	*	*	*	*	*	
FORMAL REPORTING																								
Inception Report						*																		
Mid-Term Report											*													
Draft Final Report																						*		
Final Report																								*
MEETINGS AND WORKSHOPS																								
Planning Workshop						*																		
Mid-term workshop													*											
Workshop on Draft of Final Report																							*	



4.6 ORGANIZATION FRAMEWORK

The Technical Assistance calls Coordinating Committee that provides overall guidance and direction for the project. Its membership consists of representatives from the Ministries of Public Works, Agriculture, Home Affairs, and Planning (BAPPENAS), the Asian Development Bank, the Ford Foundation and IIMI. The Committee meets to accept the Inception Report and the Final Report, and may meet during the project should the need arise. Coordination for implementation of the Technical Assistance is provided by periodic meetings between the concerned parties at both National and Provincial levels.

For the Efficient Irrigation Management component, this coordination is largely within the existing structure of Public Works. At National level this involves the Director General of Water Resources Development and the staff of the Sub-Directorate of Operations and Maintenance, while at Provincial level it involves the Head of Water Resources, the Head of O&M, and the Head of the Wilayah, Head of Operations, Section Heads (or Project Managers) responsible for irrigation systems where field studies are being carried out.

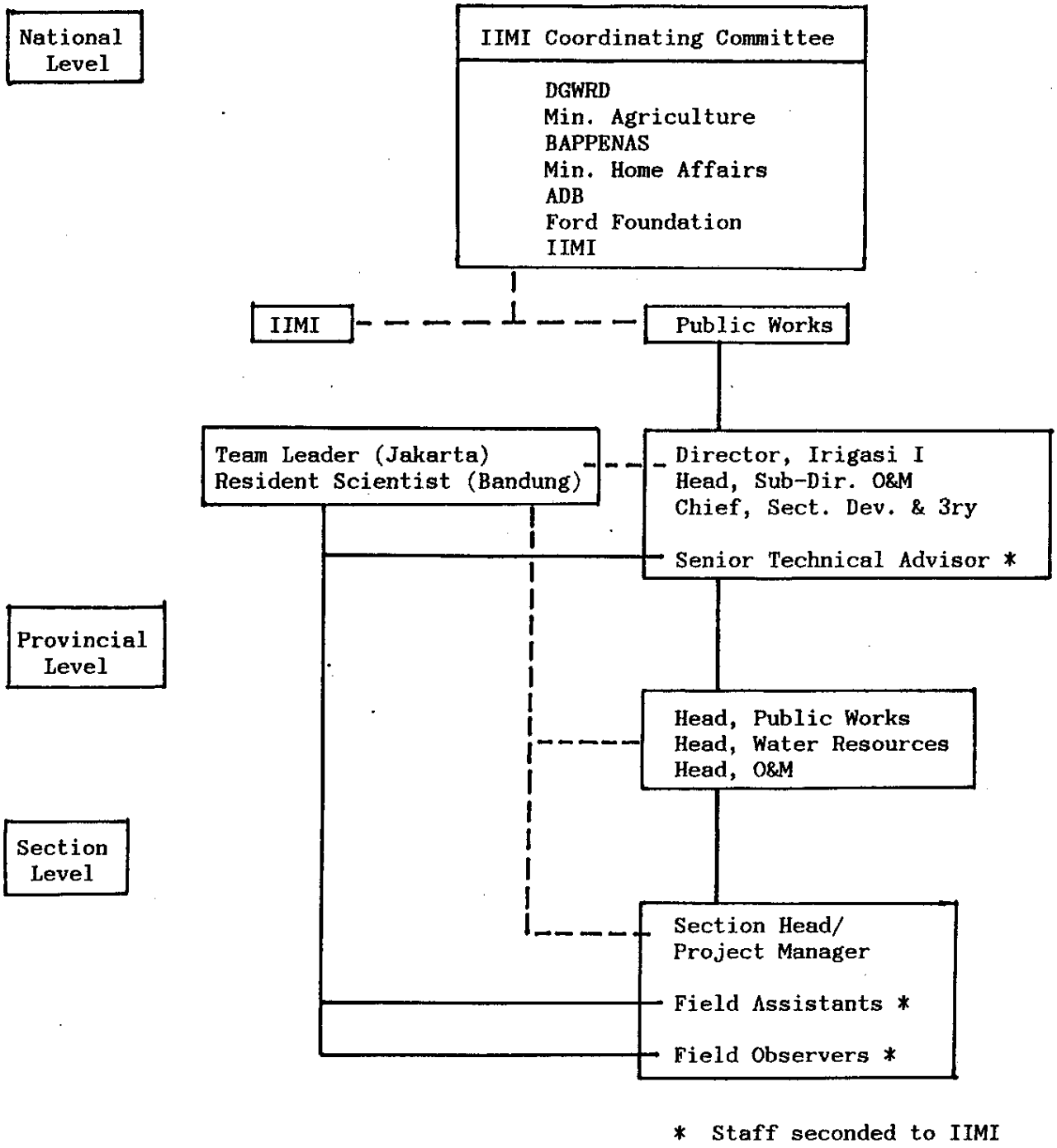
To date, in both Phase I and the current activity, this coordination has been structured informally. It has been agreed by DGWRD that is is appropriate to have a more formally structured set of meetings for the remainder of the activity.

The System Turnover component has a more structured format. At National Level a Working Group has been formed and meets periodically to develop plans for each stage of the program. Members of this Working Group include staff of DGWRD, the Sub-Directorate for O&M, representatives from the Provinces involved, the Ford Foundation, LP3ES, and IIMI. At Provincial Level smaller Working Groups have been established that involve DGWRD, Provincial, Wilayah and Section staff, LP3ES, and IIMI.

The overall relationship between IIMI and Government Agencies for the Technical Assistance are shown diagrammatically in Figure 4.3

Figure 4.3

Organization Structure for the Technical Assistance



4.7 INTEGRATION WITH OTHER PROJECTS AND ACTIVITIES

In accordance with Government policy considerable attention is being paid to the strengthening of O&M, irrigation financing, and irrigation institutions in efforts to make the irrigation sector more efficient and able to bear a higher proportion of costs without relying entirely on a stagnant Government appropriation.

The Technical Assistance is directly related to the two major irrigation projects that are funded by the Asian Development Bank and the World Bank. The Third Irrigation Sector Project totals $150 million, with $120 million provided by ADB and $7.5 million from the Dutch Government. The Irrigation Sub-Sector Project is to cost $359 million, of which the World Bank is providing $234 million, with additional support of $11.8 million from the Dutch Government, $3.0 million from the Italian Government and $0.6 million from the Ford Foundation.

In most respects the two projects are the same, with differentiation mostly in respect of geographical areas covered rather than major differences in approach. The Technical Assistance provides the opportunity to undertake some in-depth evaluations of several issues covered by both Projects, neither of which contain a research component.

The Projects aim at supporting the Governments efforts to improve O&M, introduce direct cost recovery from beneficiaries and rationalize existing investments through a series of measures that include (a) special maintenance on 400,000 ha of irrigated land, (b) systematic introduction of efficient O&M on 700,000 ha, (c) completion of 40 on-going projects, (d) pilot groundwater development, (e) support for policy reforms and institutional strengthening, including turnover of small systems to farmers, pilot testing of introduction of irrigation service fees, improving revenue generation through land reclassification and revaluation, and support for irrigation institutions and water user associations, and (f) technical assistance and special studies.

IIMI is directly associated with the turnover program in the two Provinces of West Java and West Sumatra, which are the pilot areas for the World Bank Project. In addition to this, close contact with the World Bank and their consultants is being maintained in various aspects of O&M, institutional strengthening and development of water user associations so that the results of the Technical Assistance can be utilized in a coordinated fashion.

Annex A

Terms of Reference for IIMI under TA 937-INO
Efficient Irrigation System and System Transfer Project

I. INTRODUCTION

1. The Technical Assistance is intended to build on and extend the results of the Study of Irrigation Management in Indonesia (hereinafter called the First Study) which was carried out under the Bank's Technical Assistance (No. 673-INO). It will also provide an opportunity to test the innovations recommended in the First Study under conditions in both Java and elsewhere in Indonesia. In addition, based on IIMI's widespread experience in farmer-managed irrigation systems, the Technical Assistance will facilitate the process of transferring main system operation and maintenance responsibilities in selected small irrigation systems from the Government to local water users. These two areas of efficient irrigation management and irrigation system transfer are complementary as both are intended to increase the effectiveness of operation and maintenance practices and procedures and to enhance the interaction between the Provincial Irrigation Services (PRIS) and water users.

II. EFFICIENT IRRIGATION MANAGEMENT

2. Three different programs of work are needed to put the findings of the First Study into operation. First, alternative management strategies for improving irrigation operation and maintenance will be further tested in 15 research sites in West, Central and East Java and in Lampung. This applies to the 1987 second dry season and subsequent dry seasons in 1988 and 1989 when new and revised strategies shown through testing to be workable and productive will be put into operation by PRIS in areas outside the original research locations. Third, in areas of Indonesia not yet studied (including irrigation systems outside Java) new research will be initiated to determine improved operation and maintenance practices suitable to those production environments.

A. Scope and Objectives

3. The broad program objective of the efficient irrigation management programs is to further test and extend the innovative irrigation management practices identified during the First Study. The irrigation system management component is designed to:

(i) improve the quality of data and utilization of information for irrigation management; (ii) identify appropriate management changes which permit more effective and efficient use of available operation and maintenance resources; (iii) analyze design and approaches to system design in regard to irrigation management performance; and (iv) determine operation and maintenance practices and design changes that improve and encourage the irrigation of non-rice crops.

4. The specific terms of reference of this component are as follows:

(a) Quality and Utilization of Information for Irrigation System Operation

i) Develop tertiary block maps showing individual land-holding boundaries, and use the maps to improve the estimation of irrigated areas by crop and crop type; test least cost means of developing block maps and document the value of introducing such maps on a province wide basis;

ii) use recently designed field books and water discharge forms to improve the accuracy and equity with which irrigation water is allocated among comparable irrigation units within individual irrigation systems; facilitate introduction of these new field books and revised forms into PRIS operational procedures;

iii) introduce relevant data collection systems that will improve the quality of irrigation performance data and establish procedures for determining other critical types of data that need to be routinely collected for use in improving the operational management of irrigation systems;

iv) develop mechanisms for the effective and timely transmission and analysis of irrigation systems operations data; assist in the implementation of practices and procedures that utilize these data to ensure more efficient and equitable allocation of water volumes within irrigation systems and across systems receiving water from the same source; and

v) monitor the implementation and analyze the effectiveness of (i) the golongan system for decisions on the staggering of land preparation and planting within irrigation blocks and (ii) the giliran system for decisions on rotating water deliveries among irrigation blocks.

(b) Management Changes which Permit More Efficient and Effective Use of Available Operation and Maintenance Resources

i) Streamline the reporting and administrative requirements at the section level in order to facilitate the transfer of certain duties and resources to the sub-district field operation level;

ii) based on field data, determine the optimal numbers of gates per gate tender, gate tenders per inspector and inspectors per water master; assess the costs and constraints that limit operating at the optimal level;

iii) delegate more operational and reporting duties to gate tenders, such as adjusting gates and recording discharges; for gate tenders, assess the need for additional training and supervision; and

iv) help formulate procedures to invoke and coordinate greater support from farmers, irrigation department and village officials to supplement PRIS operation and maintenance objectives.

(c) Irrigation Systems Design

i) Analyze the implications of irrigation systems design characteristics, processes and problems for irrigation system management constraints;

ii) develop approaches to the design of irrigation systems that ensure farmers' participation in the various stages of irrigation system development;

iii) develop alternative design criteria that take into consideration the local operational capabilities;

iv) determine the parameters that would govern the feasibility of introducing proportional water distribution in existing irrigation schemes; and

v) test the impacts on operations funding, staff requirements and system performance of calibrating and fixing tertiary offtakes along secondary canals, thereby approximating a simpler, but more cost effective, means of allocating irrigation water along secondary canals.

(d) Operation and Maintenance Practices Suitable for Irrigating Non-Rice Crops

i) Determine how farmers decide when to irrigate non-rice crops and the amounts and timing of actual irrigation water applications by farmers for different non-rice crops; based on this information, provide and study the outcomes of irrigation scheduling recommendations to selected farmers for different non-rice crops;

ii) analyze alternative strategies used by farmers to efficiently manage water distribution among crops with differing irrigation requirements in given tertiary blocks; critically assess the impacts of such strategies on system-wide irrigation management;

iii) determine whether the required density of field ditches and the number of water control structures are significantly different for non-rice crop production; if it is determined that there is a difference, field test in one system alternative management practices that could minimize this difference, such as rotations and different bed shapes;

iv) determine the underlying reasons for, and possible means of overcoming, variations in planting dates within given irrigation blocks; and

v) develop and test alternative rotational irrigation schedules to study the underlying rationale (and limitations, if any) for using the Faktor-K and Faktor-Palawija-Relatif methods as a technique for planning the allocation of water flows to non-rice crops that usually are irrigated on an intermittent basis.

B. Organization and Implementation

5. Three irrigation systems will be selected for irrigation systems management field testing. These include two systems in West Java and one in Lampung. The two systems in West Java are already included in the first Study as is the system in Lampung. However, field systems for testing may change as a result of further discussions with the Directorate General of Water Resources Development (DGWRD) and the Agency for Agricultural Research and Development (AARD)/the Center for Agroeconomic Research (CAER). The tertiary block mapping that has already been completed in the First Study's research sites will be expanded to the new research sites. In addition, tertiary block maps will be prepared under the World Bank's Irrigation Subsector Loan and the Bank's Third Irrigation Sector Project.

6. The efficient irrigation management component will focus on testing and evaluating improved operation and maintenance practices. Improved irrigation practices will be evaluated based on irrigation performance and ease of adoption, and on acceptability be PRIS staff. In particular, improved operation and maintenance practices for the dry season will by emphasized in irrigation systems or parts of irrigation systems that have additional potential for non-rice production. In order to approximate the simpler proportional water distribution, system design possibilities will be tested to calibrate and fix tertiary gate offtakes along secondary canals in selected schemes.

III. IRRIGATION SYSTEM TRANSFER

7. Under the World Bank-funded Irrigation Subsector Project and the Bank-funded Third Irrigation Sector Project, the Government has agreed to implement a series of pilot projects to explore methods of turning responsibility for operation and maintenance over to the users of smaller public irrigation systems. Pilot projects will be implemented in West Java and West Sumatra. Implementation of these pilot projects will be coordinated by the National Development Planning Agency (BAPPENAS) at the national level. Coordination and monitoring of project implementation at the provincial level will be the responsibility of the development planning agency (BAPPEDA) and relevant district irrigation committees with technical guidance from various services responsible for carrying out project implementation.

A. Scope and Objectives

8. The system transfer component under the Technical Assistance provides for research and monitoring activities to facilitate the process of turning over main system operation and maintenance responsibilities from the government to water users. The broad objective is to assist the Government in developing a system transfer process that is viable under the widest set of conditions by analyzing and documenting the processes used in turning over irrigation systems from the Government to water users, for selected irrigation systems in pilot provinces chosen in conjunction with DGWRD.

9. The specific terms of reference for this component are as follows:

i) help in the formulation of the methods, rules and procedures of the transfer process and plan the long-term strategy; provide advice to DGWRD and PRIS staff, particularly in the provinces of West Java and West Sumatra, as required to facilitate the pilot testing and expansion of the turnover process;

ii) in selected small systems in West Java and West Sumatra monitor PRIS/water user/community organizer (CO) interactions at the field operations level during the preparation phase and after the transfer is completed; ensure that monitoring information is fed back to PRIS and DGWRD staff in order that necessary modifications made in the process be made on a timely basis;

iii) assist in the introduction of simple accounting systems to keep track of costs incurred for operation and maintenance so that the water user group has a basis on which it can assess a water user fee to recover its cost;

iv) analyze the implications of system transfer on the organization and roles of PRIS, the water users associations (WUAs) and the relationships among irrigation systems served by common river courses in the provinces of West Java and West Sumatra; develop alternative management systems to address problems arising from system transfer; and

v) based on the above activities, provide on-going policy recommendations to the national executive and provincial steering committees on the transfer program; work closely with PRIS and consulting firm staff to see that these recommendations are followed correctly.

B. Organization and Implementation

10. IIMI will station field staff in West Java and West Sumatra to work on the transfer program. In West Java, IIMI will station one staff member in the operation and maintenance section of the PRIS along with an MS level engineer. In West Sumatra, IIMI will post an MS level staff member either at the provincial or section level PRIS offices, depending on the site locations. In conjunction with these officers, IIMI will post field observers at the section level as well as within selected irrigation systems. At a minimum, IIMI will have two field observers per province where they will work closely at the field level with the respective TP4s.

11. In furtherance of pilot transfer activities, IIMI in conjunction with DGWRD and PRIS will select over 20 small irrigation systems in West Java and West Sumatra for turning over to the water users. PRIS and IIMI staff will jointly participate in the initial selection process. As needed IIMI staff will help develop and field test the necessary instruments for carrying out an initial inventory and for making a profile of the local situation.

12. IIMI will establish a data collection and monitoring system for assessing the nature and effectiveness of PRIS/water user/TP4 interactions at the field level during the turnover preparation phase. Based on data collected, IIMI will help develop modified systems that improve interactions at all levels during the process of turnover.

13. In the respective sections and provincial offices, IIMI will analyze the implications for system transfer on the institutional structure of the offices. Where needed, IIMI will develop new organization structures and revised roles for key individuals in order to assist the PRIS office to adapt to the needs created by the newly turned over systems.

14. As systems are turned over, IIMI will establish a monitoring system to determine how well the systems are operating. This information will be fed back in order to facilitate the modification of the turnover process. This monitoring system will also examine relationships between public and private irrigation systems on at least two river systems to identify the implications for turnover on basin wide management.

IV. REPORTING REQUIREMENTS

15. The irrigation system management component and the irrigation system transfer component of the Technical Assistance will be undertaken concurrently over a period of 20 months. An inception Report will be submitted by IIMI within one month of the effective date of this Agreement and an Interim Report by 30 September 1988. The Interim Report will include recommendations for innovations to be tested outside Java during the remainder of the period of the Technical Assistance. The Draft Final Report will be submitted by 30 July 1989 and the Final Report on 30 September 1989

Annex B

Relationship to Ford Foundation in Indonesia

The current Technical Assistance provides for cofinancing from the Ford Foundation. One third of the total cost, or $300,000, will be borne by the Ford Foundation under this arrangement. This agreement on cofinancing consolidates support from both ADB and Ford that was provided under the First Study. In addition to the ADB financing of the First Study, Ford Foundation provided two grants. The first grant of $16,200 was for calibration work undertaken by the University of Gadjah Mada. The second grant of $25,000 was to support meetings, workshops and the costs incurred by a seconded PU engineer to work with IIMI. These grants were made when it became clear that there were additional expenses being incurred by IIMI that could not be covered from the ADB Technical Assistance for the First Study.

The second grant will enable IIMI to host a final Workshop to discuss the recommendations developed in the First Study that could not be included in the activities financed by ADB. Representatives from national agencies and from the provinces involved in both the First Study and the current Technical Assistance will be invited to this workshop to be held during the first quarter of 1988.

The Ford Foundation not only agreed to cofinance the Technical Assistance but also to release its funds effective from 1 October 1988 to permit a smooth transition the First Study. This has enabled IIMI to maintain its staffing levels for both international and national staff, and continue uninterrupted data collected in those sites included in both studies. The provision of financing from Ford has also permitted the continuation of administrative and other services that would otherwise have had to await final signing of the ADB Technical Assistance agreement.

Independent of the current cofinancing arrangement, Ford Foundation is actively supporting a number of related activities in the irrigation sector that have a direct relevance to the Technical Assistance. They have provided funds for a consultant to LP3ES, the organization responsible for training, fielding and supervising the Community Organizers for the System Transfer Project. A small Working Group established through Ford Foundation, the membership of which includes representatives from DGWRD, PRIS, IIMI, and LP3ES, will ensure close coordination of field activities and provide a mechanisms for developing the appropriate policy recommendations to national and provincial bodies. They have also sponsored graduate studies for two members of Andalas University, Padang, West Sumatra, both of whom will undertake research on aspects of turnover of small irrigation systems from government to water users.

Annex C

Parallel Activities under the IIMI-IRRI-Rockefeller Foundation Grant

As part of their program to foster relationships between CGIAR funded International Agricultural Research Centers and the affiliated Institutes which do not receive CGIAR funds, the Rockefeller Foundation provided a grant to IIMI in 1987 to undertake cooperative activities between the International Rice Research Institute (IRRI) and the International Irrigation Management Institute (IIMI). The grant provides funding for activities in three countries (Indonesia, the Philippines and Bangladesh) where both IRRI and IIMI either have or propose to have active programs in the irrigated agriculture sector.

In Indonesia it is proposed that a number of research questions be addressed that link IIMI interests in Irrigation System Management with IRRI interests in increasing yields of non-rice crops in rice-based cropping systems. These research questions include:

- What factors influence farmers' decisions to plant rice and palawija crops during the dry season?

- To what extent can these factors be mapped in relation to topographic conditions in irrigation systems?

- What resources of saturated and unsaturated soil water persist after the harvest of wet season rice?

- What management of puddled soil-structure can best exploit these resources for the production of non-rice crops?

- How can irrigation water deliveries and farmer irrigation practices be improved to increase production of non-rice crops after rice?

Research under this three-year Rockefeller Grant will be carried out with active involvement of core staff from IRRI in the Philippines and IIMI in Sri Lanka. IRRI will work through AARD in close cooperation with staff from Bogor and Sukamandi while IIMI will work through DGWRD and the University of Gadjah Mada. The grant provides substantial funding for local graduate students and post-doctoral fellows. It is expected that field activities will start during the first quarter of 1988 and will be undertaken in Maneungteung Irrigation System in parallel with existing IIMI work under the current TA.

Annex D

Recommendations from Phase I Study

Although the Study has only been active in the field for 15 months, a number of areas have been identified where improvements in management can be made. The major findings to date from the Study are discussed in depth in this report. However, for those that do not have sufficient time to read all of the report, the principle recommendations arising from Phase I, Parts I and II, are presented in this section. All of these topics are addressed more completely in the body of the report.

Irrigation System Management

1. From Study data, it is clear that landholding maps are required if the present system of calculating water discharge is to work correctly. Such maps are also required if the new PBB land and development tax is to be successfully implemented. Unless PRIS staff want to completely change their method of determining water requirements, such as using some type of proportional allocation basis, there is no way to avoid the need for accurate landholding maps. Therefore, it is recommended that least cost techniques be explored to develop the required landholding maps and that a program for mapping all public irrigated land in Indonesia be implemented over the next five years.

2. Almost all of the larger irrigation systems in Indonesia have been rehabilitated over the past decade. A major part of the rehabilitation and upgrading process has been the installation of expensive measurement and control structures, even down to the quartenary level. Yet, Study findings have found that many of these gates are not working properly, and even those that are still in working condition, are not being read and reported correctly. (In some cases, gate keepers and irrigation inspectors are even using the wrong discharge table.) It is important that all PRIS staff realize the value of measurement devices is directly correlated to the frequency and accuracy with which they are read. Reporting theoretical, planned discharge as measured flow rather than actual flow measured in the field may appear to make the boss happy, but it does nothing to improve the quality of management in the irrigation system. In order to actually benefit from the expensive measurement devices, the following recommendations need to be considered:

a) Under the special maintenance program, a focused effort needs to be made to correct all measurement structures that presently cannot be measured and to check the calibration and calibration tables used for every measurement structure. If done properly, this will effectively eliminate mechanical problems with gate measurement. Much of this work involves tasks that could be done by staff at either section or sub-section levels, if training were provided. Given the large numbers of structures which do not permit measurement, transmitting information on which structures do not permit measurement as a part of the routine maintenance work plan and the "Technical Report" (Laporan Teknis) on the condition of physical structures has the potential for significantly improving system performance and fulfilling the information requirements of the pasten system.

b) Use of a reporting device such as the PPA Discharge Books tested during Part II is required in order to ensure data collected in the field by gate keepers is recognized and properly transferred to PRIS data forms. Data recorded by gate keepers forms the basis for all monitoring of irrigation discharge. Therefore, it is critical that such data is collected accurately in the field and is not changed by staff in the office.

c) Officially, gate keepers are not delegated authority to record discharge readings. However, "unofficially" they are the ones that usually collect and record such data. Based on this fact, it is recommended that gate keepers be officially delegated responsibility for recording discharge data. PRIS must ensure either that the gate keepers have the correct discharge tables and are trained to set the gates and use the discharge tables or else that the gate keepers properly make staff gauge readings and the irrigation inspector converts these into discharge rates.

3. As can be seen in the report, irrigation inspectors have been given an inordinately large percentage of the operation and maintenance activities. At the same time, due to declining budgets, there appears to be a tendency for fewer irrigation inspectors and gate keepers to become permanent civil servants. This means that many gate keepers and irrigation inspectors tend to work at sideline income-generating activities which compete for time with their PRIS assignments. In order to address this issue, at a minimum, it is recommended that fewer gates and more gate keepers be assigned to each irrigation inspector. Although IIMI is still completing an analysis of optimal levels of field staff needed, it can be said that the levels found in the Gung Section of Central Java are close to optimum levels (especially the ratios of gates to gate keepers and gate keepers to irrigation inspectors). This is reflected in the generally better management performance in the Gung Section.
In the long run, it is worth considering adopting the policy found in the Gung Section of Central Java of placing an emphasis on assuring that field staff such as irrigation inspectors are given permanent civil service status, even if it means that some of the office staff are not.

4. This Study has shown that the official command area figures are very rarely revised and are often out of date or incorrect (See Chapter II). It is suggested that the PRIS identify and provide standard instructions to enable water masters and irrigation inspectors to more rapidly revise the command area figures which are used for calculating irrigation requirements. A new procedure for doing this has been initiated in West Java (as a temporary measure for PRIS while waiting for the more cumbersome process of changing the official status of landholdings.)

5. Given the shortage of funds for maintenance work, proper prioritizing of maintenance needs which will be met each year is essential. Under the present system of maintenance scheduling, it appears that too much time and funds are being allocated to low priority maintenance. A system of province-wide maintenance priority regulations needs to be standardized. Compliance with such maintenance priority regulations needs to be monitored seasonally by regional and provincial offices.

6. Involving water users in some select aspects of main system maintenance is one method which could be tested as a possible means to lighten the maintenance burden of the PRIS, decrease the level of irrigation service fees required and decrease the need for the common practice of utilizing routine maintenance funds for emergency repairs, such as for canal breaches. Water user association (WUA) representatives meet monthly with the water master and irrigation inspectors. Perhaps such meetings could be used occasionally to arrange work groups. Using labor as a partial substitute for service fees, discontinuing the use of routine maintenance funds for emergency repairs and informing WUA representatives of the consequences of not making the repairs (due to lack of funds) may be adequate incentives to mobilize such assistance.

7. Given the profusion of supplementary sources of water in so many of Indonesia's irrigation systems (eg. groundwater, return flows, village-built weirs, supplemental channels, springs), a systematic inventory should be made of the proportion of each tertiary block's water supply which comes from sources other than the official turnout. This information, even if only approximate, would greatly improve the accuracy of calculating the irrigation requirement and limiting the inequities between blocks with, versus without, such supplementary water sources. Such information could be incorporated into the process of calculating the tertiary irrigation requirement.

8. In order to expand palawija production, it is often necessary to rotate water. Yet dominance by upper blocks and reaches of the irrigation systems, as indicated by higher intensities and yields, imply that there is a problem with irrigation management along a water system. This problem is particularly critical when water is rotated. Therefore, it is recommended that various types of rotations (<u>gilirans</u>) be investigated to see how they fit with the water requirements of palawija crops. This investigation needs to focus on management practices and monitoring systems as well as procedures used to estimate actual water requirements.

9. Imposing greater discipline, including more use of sanctions, is essential in order to improve the allocation of water, particularly in the dry season. Such is necessary in order to help restrict third season padi planting and enlarge the irrigated areas planted in palawija crops during the dry season. The most effective means of stopping planting during the wrong time or the planting of incorrect crop types is to ensure water deliveries are made in accordance with announced plans. In order to begin doing this consistently, PRIS would need strong support from the regency and district heads (bupati and camat). Irrigation inspectors would need to have enough gate keepers to be able to inspect gate settings and make necessary adjustments at least twice daily.

Monitoring Irrigation Management Performance

10. Cropping intensity is one means of monitoring irrigation management performance. In every research area where the Study is being carried out ~~there is a minimum of 220%~~ cropping intensity and, in most cases, the cropping intensity is approaching 300%. Yet, only in East Java are the reporting forms set up to recognize more than a wet season and a dry season. Although PRIS staff have been instructed to include both first and second dry season crops in the column for dry season, it is apparent from checking the data, that there is a natural tendency to under report second dry season cropped area. As a consequence, the overall importance of irrigated agriculture in Indonesia tends to be under estimated. It is recommended that all the provinces in Indonesia use forms that explicitly recognize and report on three seasons every crop year.

11. In addition to using forms that explicitly recognize three seasons, all PRIS's need to develop and standardize an improved methodology for determining and reporting actual cropping intensity. Given both the dynamic nature and the high level of cropping intensities found in Java, it is probably necessary to move toward a system of reporting cropping intensities on a monthly basis, rather than on a seasonal basis, since seasons vary so widely between blocks. At a minimum, it is recommended that DOI-I establish standard reporting procedures for reporting cropping intensities including a mechanism to ensure that the data is transmitted to DGWRD in Jakarta in a timely fashion. After development and field testing, all PRIS offices should be asked to adopt this procedure.

12. Once discharge readings in the field are being recorded accurately, it is important that these are used to identify locations where the irrigation system is not operating as well as possible. During Part II it has been demonstrated that such information can be used to pinpoint problem areas where either too much or too little water is being supplied. As a device that can be used to facilitate such identification it is recommended that forms which provide a rapid comparison between actual/planned discharge be used. Under normal circumstances, the ratio of actual to planned discharge should be close to 1.0. Wide divergence from 1.0 indicates a problem, either technical or managerial, exists at that location.

Irrigation Management for Crop Diversification

13. Crop diversification can be supported more effectively in the second dry season (gadu II) than in the first dry season (gadu I). While variation in cropping patterns exists between farmers, the most widely-followed (and apparently the most widely desired) cropping pattern is padi-padi-palawija--as long as water is enough for padi during gadu I and not too much for palawija during gadu II. This study indicates that the water environment is a crucial element in farmer decisions to plant padi or palawija, being even more determinative than other factors such as markets, prices, and land tenure. Evidence indicates that the majority of farmers in the research blocks in East, West and Central Java would pursue this cropping pattern (i.e., padi-padi-palawija) if the water environment were conducive, as mentioned. This means that more strict control over water allocation and distribution has high potential for supporting more widespread and productive crop diversification.

    The Ministry of Agriculture's national policy of there being no padi in the gadu II season can be supported by the PRIS pursuing a strategy of maximizing the area in irrigation systems in padi during gadu I and the area in palawija (versus padi or fallow) during gadu II. Ensuring enough water to permit palawija throughout a system, but not allowing too much in any locations (so as to discourage palawija production or tempt farmers to plant padi, as the case may be) will require improved management practices, such as are explained in this report.

14. Reduction of excess moisture, less variability in planting dates and better drainage are needed to encourage more crop diversification. With respect to this problem, it is recommended that irrigation inspectors and water masters maintain stricter control over water deliveries and enforcement of planting dates. In Waru Jayeng in East Java, it is recommended that the method used for determining diversions at the Brantas be checked to determine why more than half the secondary canals are receiving twice their official allotment.

15. There appears to be a considerable amount of confusion concerning the correct irrigation allocation for palawija crops. Greater interaction is required between PRIS and agricultural staff in the identification, testing and dissemination of information and practices for irrigation of palawija crops. Farmer group coordination is also needed to coordinate irrigation distribution and minimize pest attacks. In light of this, it is recommended that better information on irrigation practices and procedures for palawija crops be developed and provided both to PRIS and to extension staff.

Training Needs

16. The results of this Study pinpoint the need for further training in proper O&M practices by PRIS staff. However, there is not a need for highly theoretical training nor should the training be given to individuals that have no field-level O&M responsibility. Therefore, in order to develop efficient O&M practices, it is recommended that the majority of training under the new World Bank and ADB irrigation sub-sector loans be focused on sub-section staff, with both the gate keepers and the irrigation inspectors receiving the bulk of the training.

    a) If gate keepers are delegated the task of making staff gauge readings, and perhaps in using staff gauge reading/discharge level conversion tables, then they will need on-site training for this. Gate keepers will also need training in the proper use of the field discharge data books.

    b) Given the commonness of offtake structures which need calibrating, there would be substantial payoff in expanding broadly the numbers of PRIS field staff that are capable of calibrating such structures. Section-level technical staff or even irrigation inspectors could be given training in simple and inexpensive techniques of calibrating, such as using portable weirs or flumes. In addition, training in measuring conveyance losses along main and secondary canals should be provided to section-level technical staff in order to enable PRIS staff to use locally-measured conveyance loss estimates instead of the currently typical standard assumed estimates.

    c) Should the above recommendations be acted upon by the Government of Indonesia, training for the relevant PRIS staff would be needed in the following areas: conducting block-level water source inventories (point 6 above), new cropping intensity method (points 9 and 10 above), block command area revision procedures (point 4 above) and discharge information management for performance monitoring (point 11 above).

Annex E

Turning Over Irrigation Systems From the Government of Indonesia to Farmers

I. Introduction

The purpose of this paper is to contribute to discussions about the process of turning over irrigation systems from the Government of Indonesia to the water users, particularly in Indonesia. The intent herein is to identify and briefly describe the major issues concerning policy and the process of implementation.

Several governments in Asia (such as the Philippines, Nepal, and Indonesia)--as well as development agencies, the Ford Foundation, the World Bank, the Asian Development Bank, and the International Irrigation Management Institute (IIMI)--very recently have become concerned with the need to turnover (or "turn back") control and/or ownership of assets of government irrigation systems to the water users. The growing movement toward turning irrigation systems over to farmers is consistent with the current interest in "privatizing" the production sectors of the economies of developing countries. It is based on a desire to decrease the budgetary burdens of governments for irrigation O&M and to enhance the long-term sustainability of irrigation systems through local control. It is hoped that this will slow down the deterioration of systems and limit the need for frequent rehabilitation.

In Indonesia over the last fifteen years, O&M budgets have not been able to keep up with the increase in the number of government systems constructed or incorporated into the Public Works Department (DPU) from the Prosida and Sederhana programs. There has been a trend toward ever larger proportions of provincial irrigation service (PRIS) O&M budgets being used for routine personnel costs and less for maintenance-oriented supplies and resources.

In IIMI research sites section chiefs (kepala seksi) report that only roughly one-third of requested O&M funds (DIP) are actually allocated by the PRIS (DUP). On the maintenance side, the section chief tends to place first priority on the repair and maintenance of major water division structures of larger, "technical" systems, then the repair and desilting of main and secondary canals in such systems, then the routine weeding and cleaning of main and secondary canals, and finally the repair and maintenance of smaller and "semi-technical" systems. It is common for irrigation inspectors (juru pengairan) to be responsible for twenty or more gates.

History tells us that the deterioration of irrigation systems is not inevitable. Systems may appreciate in value, design capacity and manageability over time, without dependence upon the state. In Indonesia and elsewhere irrigation systems built by farmers often evolved from small diversions irrigating a few hectares to larger, integrated networks (sometimes with only brush and stone weirs) which irrigate several thousand hectares. In numerous locations (such as in Bali, West and North Sumatra, Himachal Pradesh in India, Northern Thailand and the lowlands of Nepal), locally self-sustaining irrigation systems expanded and even improved over time through the regular investments and maintenance efforts of organized farmers.[1]

During the colonial and post-colonial era governments made huge investments in irrigation systems, usually designing, constructing and operating systems with little farmer participation. The ensuing pattern of dependency on the government for irrigation investments left the farmers without a sense of ownership of the systems and subsequently eroded the farmers' sense of responsibility for O&M as well. However, farmers were expected to maintain the systems--regularly at the tertiary level and occasionally to help repair damages at the secondary level. Requirements for payment of a water service fees were established in many countries.

Nevertheless, farmers often report dissatisfaction with government-built structures. They become accustomed to the government providing free water deliveries and maintenance services. They come to expect that the government will rehabilitate the system every few years. Hence, they tend to feel that it should be the role of the government to maintain its own systems. If Indonesia is to move toward a more self-sustaining pattern of irrigation development, such attitudes will have to change, as well as the policies which encourage them. Only then can the turnover of systems be effective in the long-run.

By the nature of the issue, turning over government systems to farmers is embedded in numerous legal, topographical, hydrological, agricultural, socioeconomic and organizational matters. Answers to questions of exactly what roles should be turned over, which systems are to be turned over, and how they should be turned over require considerable adaptability to local physical and social conditions. The scope and style of system turnover must vary according to local settings, needs and capacities. Consequently, national-level turnover policies and processes should evolve over time and place to fit identified local needs and conditions.

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[1] See Coward and Levine, 1986 for a comparative discussion of these processes.

II. Policy Issues

What should be turned over?

It may be that only maintenance obligations are turned over, or both maintenance and operations below the offtake, or both O&M within the system as well as control (limited or full) of the system offtake gate, or also representative authority along a river course coordinated by a federation of water users associations. Which roles and tasks are turned over to the water users depends in part upon how much management PU has invested in the system, and hence, how much dependency there is on PU. In many cases, especially in the outer islands, many smaller systems are listed by section and/or provincial as being PU systems merely as the result of a policy to incorporate into PU all small farmer-managed systems below a certain size. In such cases turnover may be done simply by reclassifying systems again.

If all physical structures are in good condition, it may be that only O&M control may be turned over or the ownership of system property or assets may be transferred to the farmers as well. Or minor or major improvements and repairs may be made in the systems, with assistance from DPU, prior to turnover. DPU may turn over systems with or without any future expectation for providing assistance for occasional major repairs or rehabilitation.

Each level of turnover has its own advantages and disadvantages. For example, if only additional maintenance obligations are turned over to the farmers, they may see little benefit for them in the turnover. At present DPU has maintenance responsibility for the offtake structures (weirs in small DPU systems and tertiary offtakes, sadap, in larger systems) and 50 meters of channel below the offtake. In such situations turnover of maintenance might mean giving farmers this responsibility and perhaps also (inverting the 50-meter rule) giving farmers responsibility for maintaining 50 meters upstream and downstream from the offtake. However systems may continue to deteriorate, or do so even more rapidly, unless the current expectations and incentives of farmers can be altered. While immediate DPU maintenance expenses might be decreased, longer-term rehabilitation expenses might increase.

Some view turnover as handing over a complete maintenance role but incomplete water distributional role. That is, leaving distribution within the system up to the farmers, but keeping offtake gate operation in the hands of either the DPU weir keeper (penjaga bendung), if there is one, the DPU gate keeper (penjaga pintu) or else the juru pengairan. Another variation of this is officially to turn over the penjaga bendung function (including the gate key) to a water user group representative (perhaps the ulu-ulu, if it were to become a decision-making role, or else an assistant, if it were to be merely a gate setting and regular maintenance role). Where penjaga or juru have too many gates to control it often happens that ulu-ulu or the P3A heads informally may be given the gate key anyway. However. also it seems that often, even in larger, more technical systems, the juru pengairan delegates

II. [illegible] issues

What should be [illegible]

the function of measuring discharge rates to the penjaga pintu, a function which could be delegated to a water users representative without much training. In some cases, farmers are able to, and often do, reset the gate after the penjaga or juru have come and gone. This farmer gate keeper, or penjaga bendung, with some training, could be given official responsibility to maintain and operate the gate either with total local discretion or within certain guidelines and seasonal maximum discharge limits, as provided by the juru pengairan. The juru pengairan might still be responsible to coordinate water use along a river course. Presumably, the farmer penjaga bendung would receive additional remuneration for services from the users.

In some settings (such as where multiple small diversions are located along a river course) it may also be possible to organize a federation of water users representatives along a river course, to directly involve farmers in water management at this level. This could enhance farmer appreciation for water distribution constraints at the river-course level, by setting up a direct communication mechanism between farmer representatives of systems which have been turned over to farmers. This could decrease further the management burden of DPU at both the penjaga and juru levels.

It seems that farmers sometimes have little incentive to maintain channels if the timing of water deliveries is not felt to be appropriate or is not known in advance, especially at the outset of the planting season. With regard to farmer involvement in O&M, the two functions are interrelated. Turning over maintenance but not also some operation functions probably will not alter the status quo. Even if the irrigation inspector could always guarantee appropriate deliveries, if the farmers are not aware of conditions elsewhere along the river course and do not have a decision-making voice in operations, they are not likely to develop a sense of responsibility either for maintaining their own systems or for the equity of distribution along the river course.

Studies have shown that indirect investment approaches to irrigation development (such as the Subsidi Desa program) which are based on local initiative and decision-making prompt greater farmer participation in O&M (within the systems) than do the less participatory, direct investment approaches (such as the Sederhana program).[2] However at the river course level, it may be observed in numerous locations in Indonesia that O&M performance within these systems tends eventually to decline where Subsidi Desa weirs proliferate along a river course and cause water scarcity or siltation. As yet there is no formal institution for regular farmer coordination between such systems.

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[2] See Anwar Hafid and Yujiro Hayami, "Mobilizing local resources for irrigation development: the subsidi desa case of Indonesia," in D.C. Taylor and T.H. Wickham, eds., Irrigation Policy and the Management of Irrigation Systems in Southeast Asia. Bangkok: Agricultural Development Council, 1979.

The question remains as to whether or not having a measure of local control will be sufficient to provide farmers with a "sense of responsibility." It has been argued that a "sense of ownership," if not actual ownership, of system assets is necessary in order to develop this sense of responsibility. At present there already is a legal structure in place to enable the regency head (bupati) to turn over management control of irrigation systems to farmers. However the actual turnover of ownership of system assets, which are currently public property (milik negara) apparently is a much more involved and time-consuming process which would involve higher levels of government, including the finance ministry. If this is the case, then turnover (if it is to happen soon) may have to proceed in a two-step process. First, control of O&M is turned over. Later, actual ownership of system assets are turned over. To the extent to which having actual ownership is a necessary precondition for the farmers' sense of responsibility, it would make sense, if possible, to attempt to turn over ownership as well as control, at the same time.

And yet it is not clear that ownership is necessarily something the farmers would value as an end in itself. Various incentives or disincentives may be connected to it. On the positive side, these may entail the legal right to contract for and supervise system repair. Or it may grant the right for water users to apply as a corporate body for loans or rehabilitation assistance (perhaps in some sort of DPU/water users joint-supported arrangement). On the negative side, turnover of assets could entail the loss of services and rehabilitation support from DPU. Or perhaps it could result in the new obligation to pay a tax on the assets. If farmers have the expectation that the government will pay for rehabilitation (requiring no counterpart support from farmers), they will be more likely to defer making minor repairs and desilting work to some anticipated government rehabilitation. Care should be taken that neither the turnover of control nor ownership entail unwanted side-effects on farmer incentives to ensure the long-term sustainability of "their" systems.

What should be the criteria for selecting systems for turnover?

Preliminary discussions among development bank and DPU personnel have emphasized the criterion of system size (in hectares) as the main basis for selecting which systems should be turned over to farmers. Some propose that systems under 150 hectares be turned over. Others propose that 450 hectares be the maximum size limit. Currently, 2,304 systems or about 34% of the total 6,731 DPU irrigation systems in Indonesia are below 150 hectares. 4,028 systems (60% of DPU systems) are below 300 hectares. And 4,717 (70% of DPU systems) are below 500 hectares. However, all systems below 500 hectares in size only constitute about 18.7% of the total design area of DPU systems (which is about 4.8 million hectares). All systems below 150 hectares constitute only about 3.9% of this total area. Hence, a turnover of even all systems below 150 hectares would constitute a sizeable proportion of all DPU systems, although it would be a less significant part of the total area.

Given the nature of maintenance priorities mentioned above, a large reduction in the number of small-scale systems under the O&M purview of DPU may have more effect on lightening personnel requirements than on maintenance outlays (apart from the question of rehabilitation). However, this could permit a reallocation of staff away from operations and towards maintenance. At any rate, the turnover of all systems below 150 hectares is already a very large turnover process to manage if it is to be done nation-wide. It might be wise first to limit turnover to the smaller size and later, after learning how to do this effectively, attempt to turnover larger systems.

But the next question is, "Should factors other than size be considered as criteria for selecting systems suitable for turnover to farmers?" Section-level DPU officials express concern that other factors should be taken into account, such as: the level of technical complexity or government investment in systems, the level of maintenance investment required as determined by the nature of system water sources or the amount of sediment load in the water supply and also the organizational capacity of the water users. Also there is the need to know the <u>will</u> of the users to have total O&M responsibility and/or ownership of their system turned over to them. Turning over systems to farmers without their consent may not help to instill either a sense of ownership or an interest in sustainability.

For example, one section chief reported that he has one system which is 87 hectares in size. He said that he would not recommend that O&M be turned over to the farmers, because it is a "technical" system with cross regulators and an adjustable offtake gate. The gates need frequent adjusting and greasing. Furthermore the river embankment immediately upstream from the weir frequently collapses. He estimated the annual maintenance cost of the system to be over Rp. 20,000 per hectare, which he thought was too much of an additional burden on farmers. In this case the farmers were very well organized and had their own water fee. He also mentioned that there were other systems over 400 hectares in size that he would recommend be turned over to farmers. These were "semi-technical" systems with simpler offtake structures and much lower O&M requirements. Certainly both farmer and government budgetary capacities have to be considered. However, if current PRIS O&M spending priorities already are directed at the larger, technical systems and with smaller, less technical systems receiving little, if any, actual O&M support, then the turnover process may not actually save the government much money anyway. It may only make the existing reality of the lack of O&M support for smaller, less technical systems become official policy.

Some have expressed concern that the PRIS may feel threatened by the prospect of having a significant proportion of their systems turned over to farmers--out of the fear that provisional or section-level O&M budgets may be cut, due to the decreasing area requiring DPU O&M support. However, DPU officials have stressed that O&M budgets will not be cut even though their service area decreases. Furthermore, they have indicated that O&M budgets in the future will be based upon the total length of DPU channels and not on the

number of hectares. Undoubtedly, this will help to adjust for topographical variations and be a truer estimate of actual maintenance requirements. Also it would be a less sensitive measure to changes in the number of PU systems in a given area, partly because of the 50-meter jurisdictional rule. Nevertheless, if the provincial and section DPU O&M budgets are not going to be reduced as a result of turnovers, then the benefit to the government of turnovers will be not to save actual O&M outlays, but to permit more intensive use of funds on larger, more technical DPU systems. Presumably, this would decrease the need for rapid cycles of rehabilitation and perhaps improve the long-term productivity and sustainability of the larger systems.

Another matter that will have to be considered is the implication of the turnover of systems for PRIS field and office staff. DPU officials have expressed concern about the difficulty of relocating field staff away from systems which have been turned over to farmers. This is especially awkward where such staff have been assigned to government housing, own and/or farm land, or have "sideline" employment. IIMI data collection is showing that sampled juru pengairan and penjaga pintu/bendung, given their low salaries, understandingly tend to work only between four to five hours a day and then seek additional income in the afternoons.

Furthermore, the nature of work for field staff at the subsection (pengamatan) level seems to be relatively more regular and stable than that of office staff at the section and higher levels. At the section level, the work tends to be more cyclical, with periods of little or no work for a large part of the staff being followed by spurts of more intense activity by most or all of the staff, as periodic reports come due. The lifestyle of the section office staff usually is seen as preferable to that of the subsection field staff. This is partly because of the advantages of the cyclical versus regular work schedules and the greater sideline income opportunities in the city. Therefore, personnel tend to be quite willing to transfer from the subsection to the section levels but not the reverse. The subsection level seems to be more understaffed than section level staff. And yet the subsection level tends to be where O&M performance is most determined. Hence, transferring field staff out of areas where turnovers occur probably would mean assigning them to other field locations still at the subsection level. In a time of declining government budgets and resources this could mean more uncertainty at the section levels and proportionately increasing resources and job security at the subsection levels.

III. The Process of Turning Over Government Systems to Farmers

It is possible to implement the turnover of irrigation systems according to three basic models. One is the blanket approach, where a key selection factor (such as size) is used for an otherwise indiscriminate and rapid turnover of large numbers of systems. The emphasis is upon quick and inexpensive turnover of systems, with little information-gathering (other than size) and little or no physical and organizational improvements. Proponents of this approach might assume that when faced with the hard realities of independence, farmers will act collectively to ensure the sustainability of their systems as long as it is in their long-term interest to do so.

A second model is the diagnostic approach, where more intensive information is obtained by experts about multiple factors hypothesized to effect which systems are appropriate for turnover and what their needs are for preparing for turnover. What kinds of information is useful for the selection and needs identification stages is assumed to be known in advance. The diagnostic approach places greater emphasis, than does the blanket approach, upon preparation for long-term sustainability. Nevertheless, it is essentially a top-down process.

A third model is the dialogue approach. It includes much of the same information-gathering process as the diagnostic approach but does so in a more interactive way. It encourages a process of farmer group self-selection for turnover, mutual DPU/farmer needs identification, and a process of dialogue and mutual adjustment both prior to and following the turnover. This latter model contains more potential for cultivating attitudes of self-reliance and establishing what should be the kind of relationship existing between farmers and DPU in the future. This relationship will not be one of total detachment, but rather local initiative, coordination with DPU and other farmer-managed systems and occasional farmer-requested assistance from DPU. The following is a description of a process which could be followed for implementing the turnover of irrigation systems via the dialogue approach.

IV. A Scenario for the Turnover Process

The following steps probably will have to be taken in the process of preparing systems for turnover, and then turning them over to the users.

Stage One--the Inventory

An inventory of all systems along a given river course is conducted. This might include information on the size of command area and the nature of physical structures in the systems, such as the type and size of weir, water measurement structures, channels, etc. It also might serve to classify

systems according to their level of technical complexity. Additional information could be gathered about administrative boundaries of the systems, nature of all water sources, amount of sedimentation, topographical setting and the existence of a water users association.

Information gathered during the inventory stage would enable a "Section-Level Turnover Support Committee[3] (STSC) to make a preliminary selection of a large set of systems which seem to qualify for turnover according to a generally-agreed-upon set of basic criteria.

Stage Two--the Agro-Institutional Profile

An agro-institutional profile of each of the potential systems would be prepared, with the expectation that about four out of five of the systems profiled would be turned over. The purpose of profile-making would be mainly for assessing what the systems' needs are in preparing for turnover, allowing the TP4 time to gain rapport with local water users while collecting information about local capacities and needs.

Stage Three--the Selection

During this stage the TP4s, the STSC, and section chief would evaluate the profiles and select not only which systems should be turned over, but the time-table for each system, on a case-by-case basis.

Stage Four--Preparation for Turnover of O&M Control

During this stage the physical improvements are made and the organizing and training of farmers is done. It is possible that this stage may begin during the last month of the profile stage. Physical improvements should not be made in the conventional way, but at the request and advice of the farmers, mobilizing farmers for all "unskilled" labor and perhaps the raising of funds for the improvements.

Stage Five--the Turnover of O&M Control

The actual date of official turnover may be contingent upon the completion of physical improvements and the progress of organizational preparations for turnover.

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[3] Initially, this committee might be section-level DPU staff, assigned part or full-time to turnovers. They would be assisted by a consulting group from the provincial DPU office and by a trained Provincial-Level Turnover Support Committee (PTSC).

Stage Six--Preparation for Turnover and a Role at the River Course Level

This is the time when the TP4 assists the water users in moving forward their petition for turnover of assets. The TP4, perhaps assisted by a sort of extension person from the Department of Internal Affairs (Dep. Dalam Negeri), would help train the water users' group in the legal aspects of becoming a corporate body which can obtain loans and enter into contracts.

Also this would be a time when the water users would need some assistance in possibly taking on an expanded role in a federation of farmer and DPU-managed systems along the river course. The TP4 also would be involved in this process, together with the juru pengairan.

Stage Seven--the Turnover of Assets

At this time the turnover process would be complete and the turnover ceremony may be arranged to coincide with the beginning of a system repair or improvement project, initiated by the users' group and which would demonstrate their discretionary privileges to mobilize local resources (perhaps with matching assistance from the PIS) with their newly-gained system assets.

PRINCIPAL ACRONYMS AND GLOSSARY

AARD	Agency for Agricultural Research and Development
ADB	Asian Development Bank
BAPPENAS	Ministry of Public Works, Agriculture, Home Affairs and Planning
BAPPEDA	Development Planning Agency
CAER	Center for Agroeconomic Research
CO	Community Organizer
DGWRD	Directorate General of Water Resources Development
DPU	Department of Public Works
GOI	Government of Indonesia
IIMI	International Irrigation Management Institute
IRRI	International Rice Research Institute
ISM	Irrigation Systems Management
NGO	Non Governmental Organization
O&M	Operation and Maintenance
PRIS	Provincial Irrigation Service
STSC	Sector Level Turnover Support Committee
WUA	Water User Association