

Figure 3.1.5

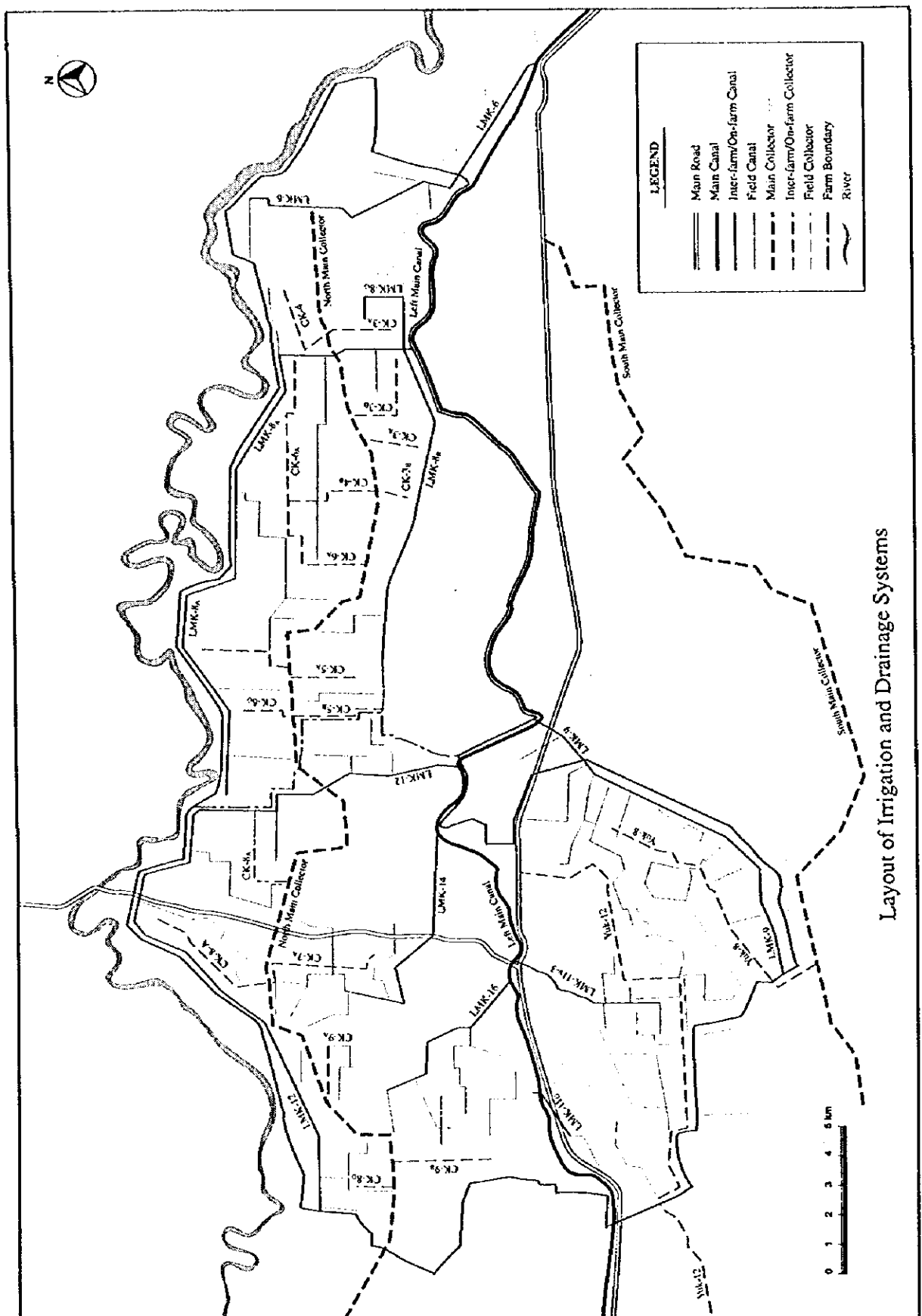


Figure 3.1.6

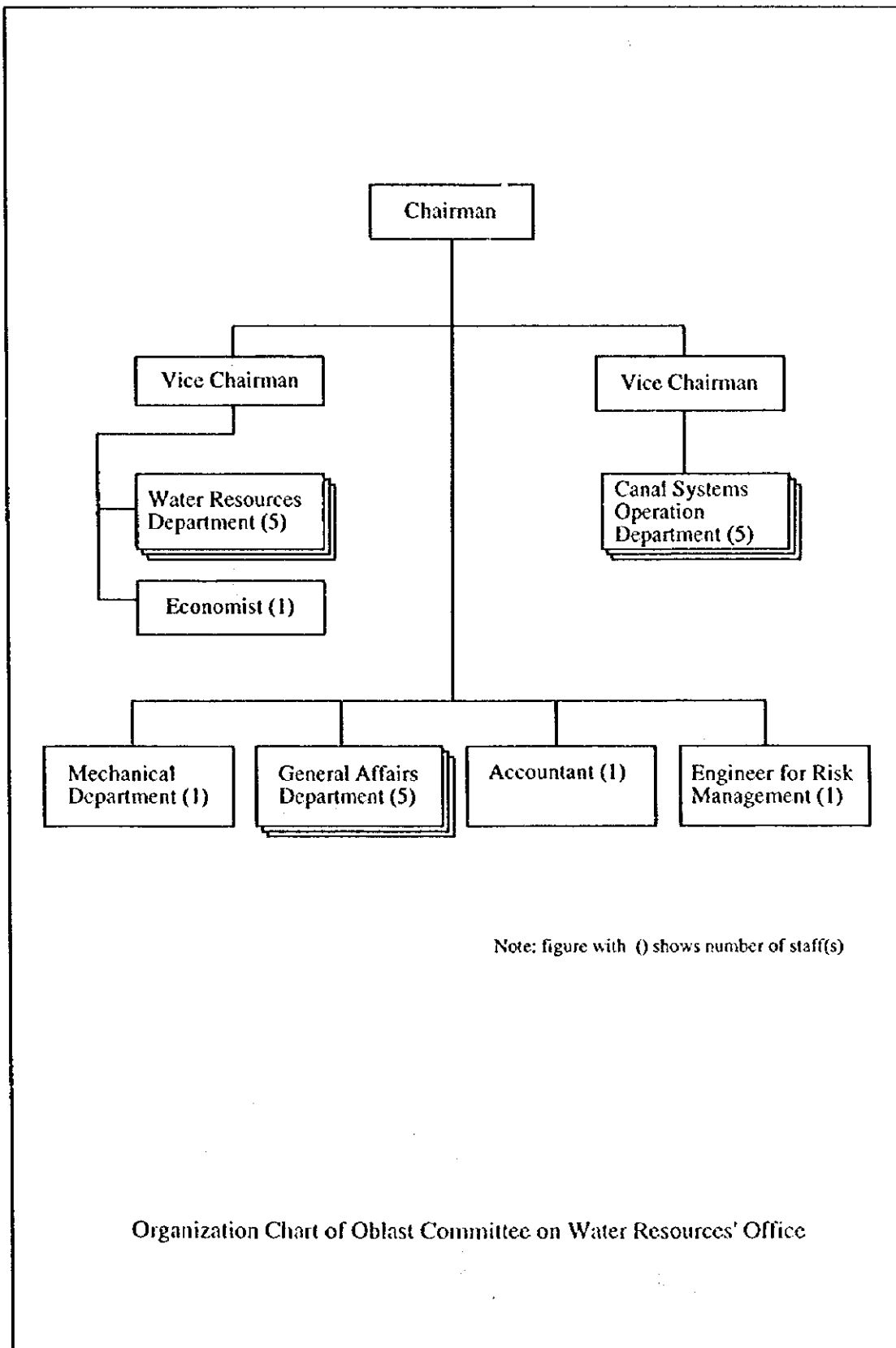


Figure 3.1.7

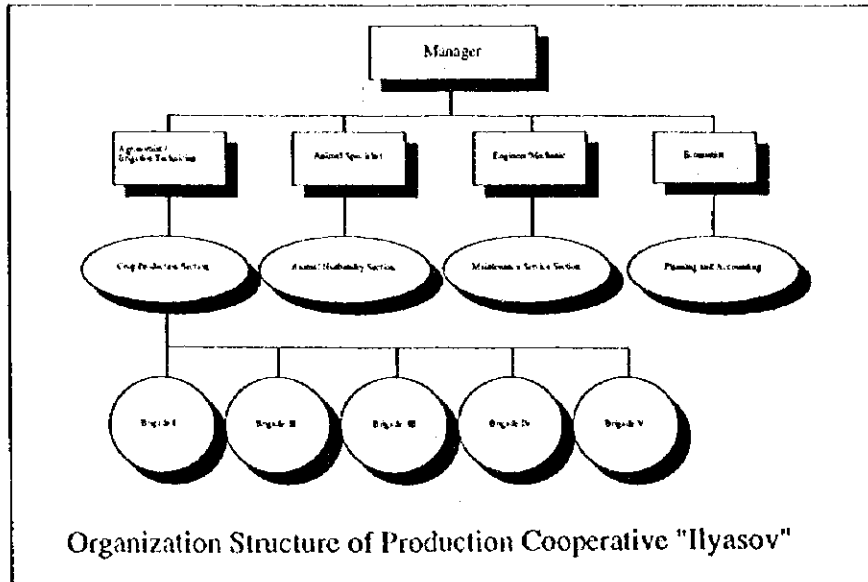


Figure 3.1.8

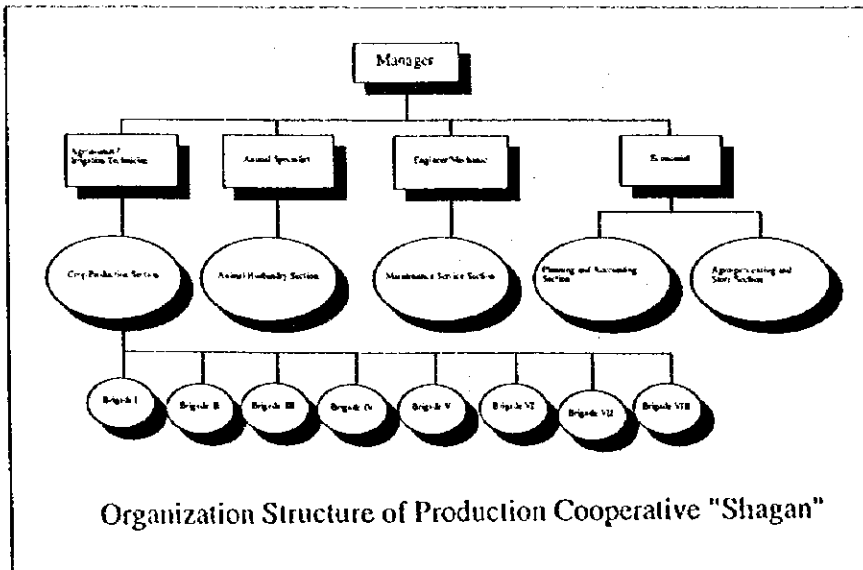


Figure 3.1.9

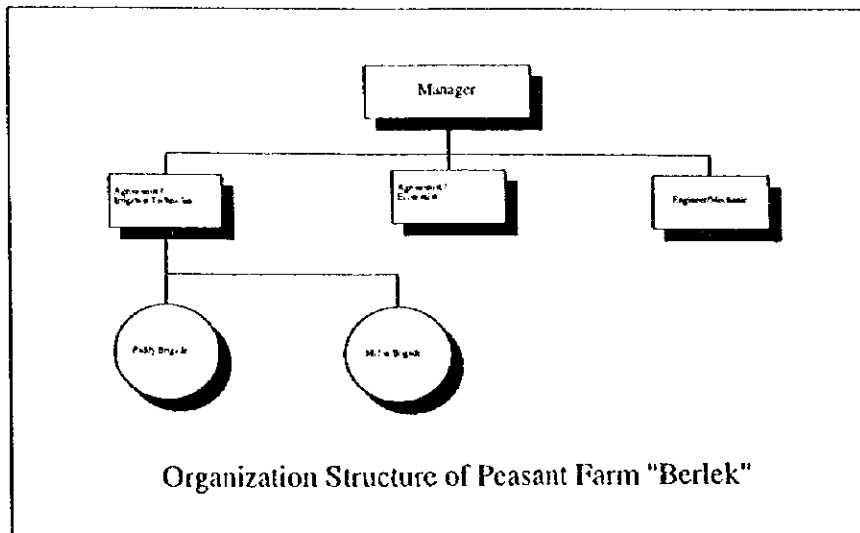
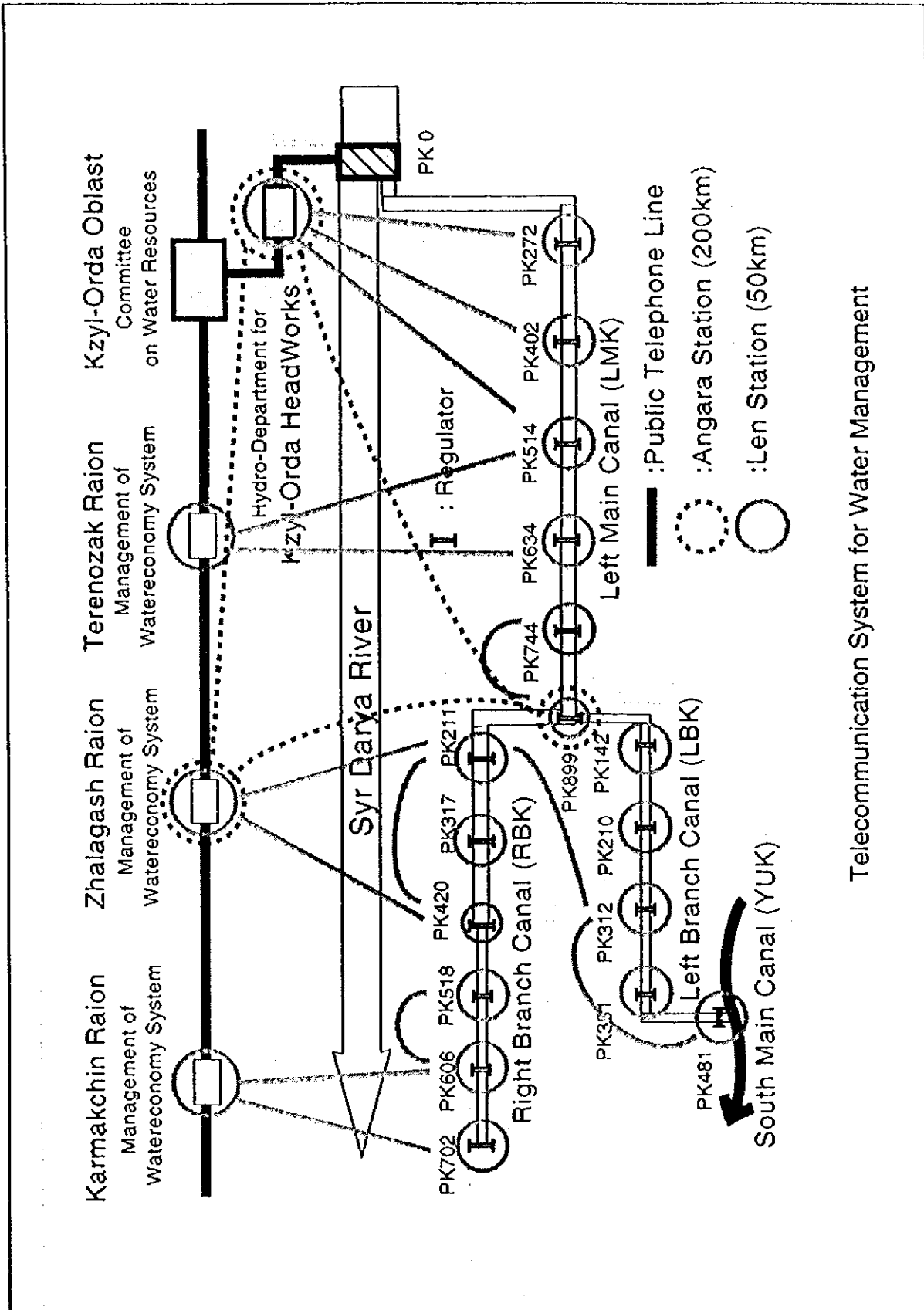


Figure 3.1.10

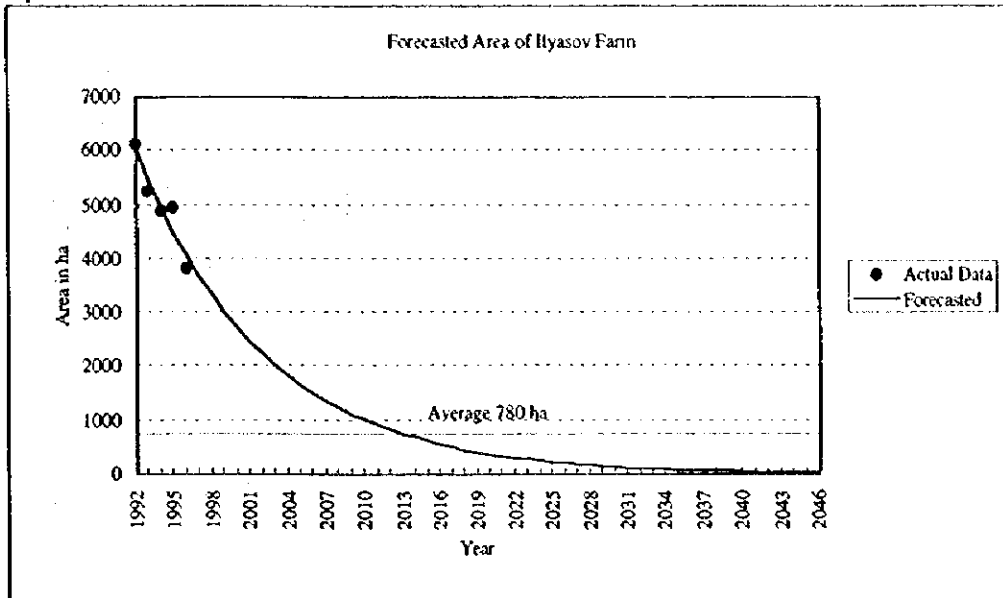


Telecommunication System for Water Management

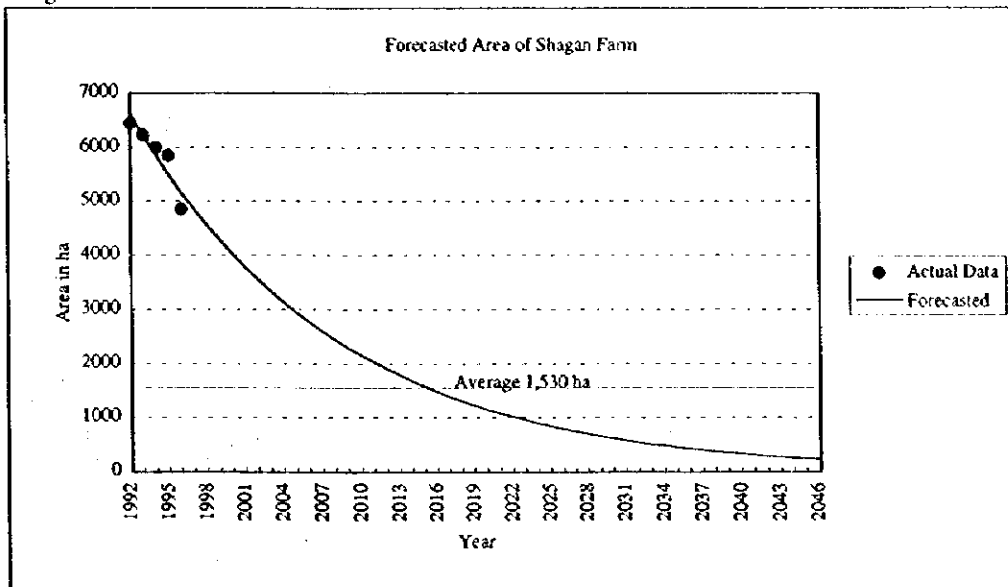


Figure 3.2.2

Ilyasov Area



Shagan Area



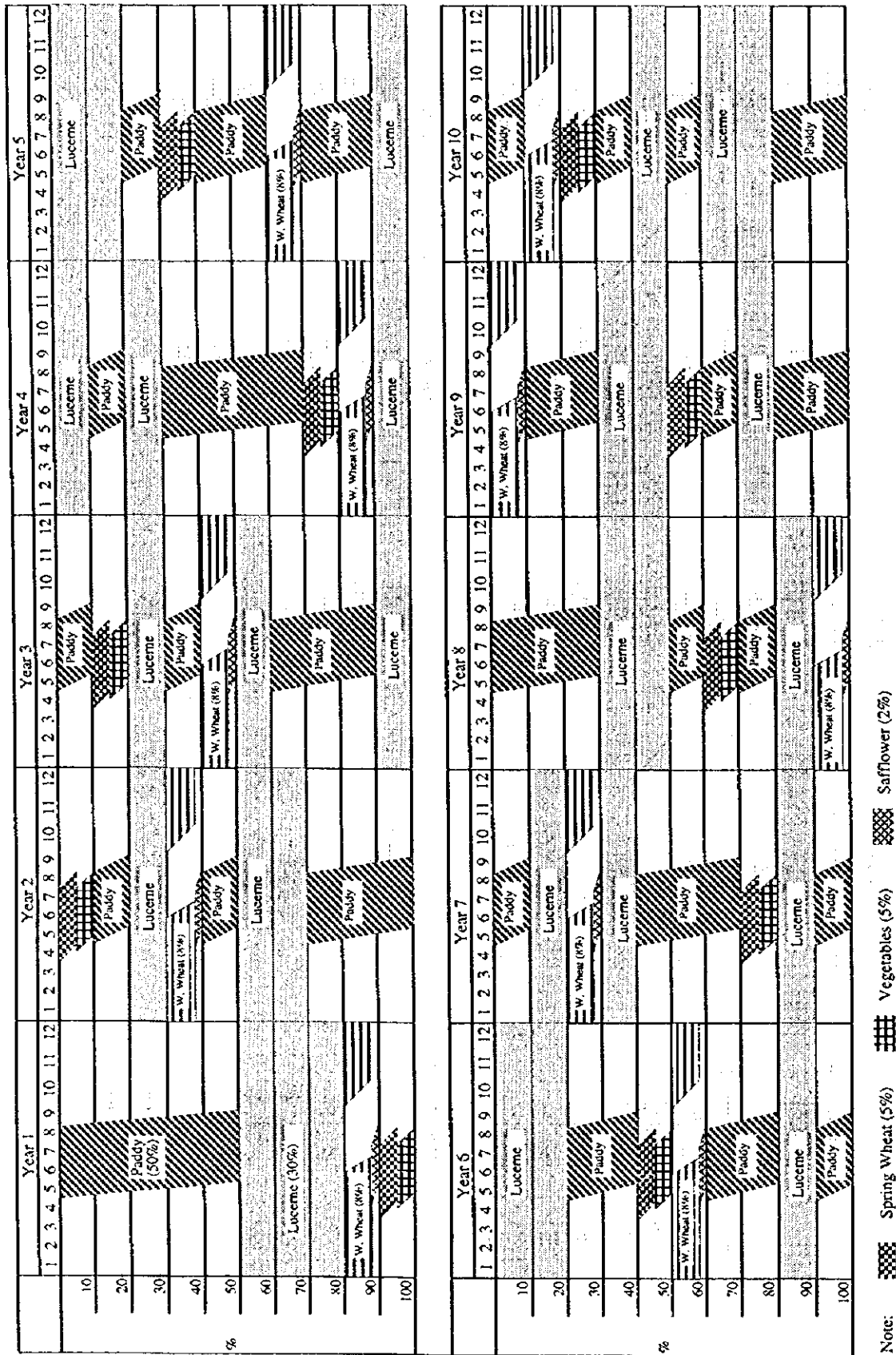
Irrigation Area

Year	1992	1993	1994	1995	1996
Ilyasov Farm	6108	5240	4890	4960	3821
Shagan Farm	6438	6230	6000	5850	4855

unit: ha

Forecasting of Irrigation Area in Ilyasov and Shagan Area

Figure 3.2.3



Cropping Pattern in the Project Area under with Project Condition

Figure 3.2.4



Layout of Short-cut Canal



Figure 3.2.5

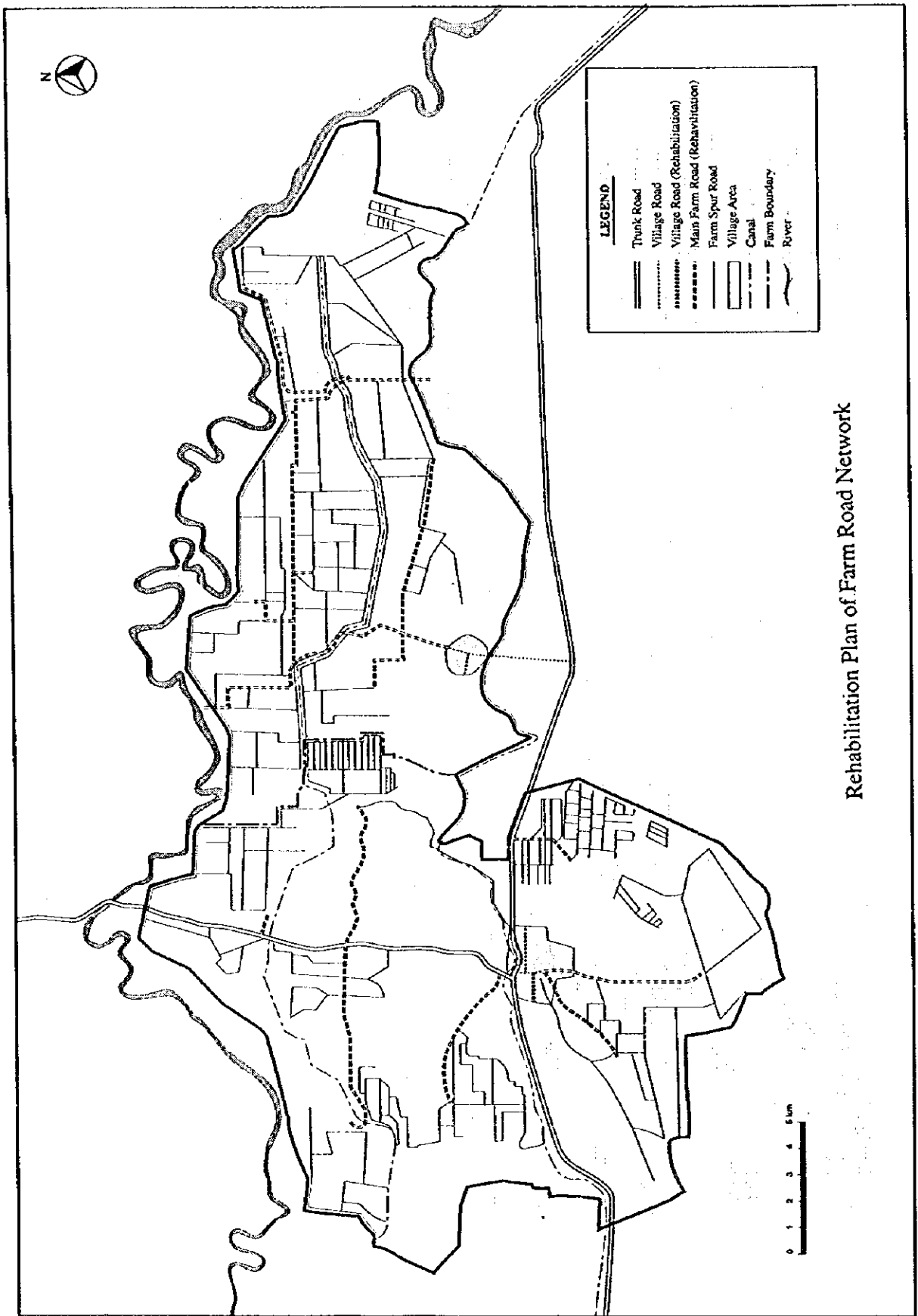


Figure 3.2.6

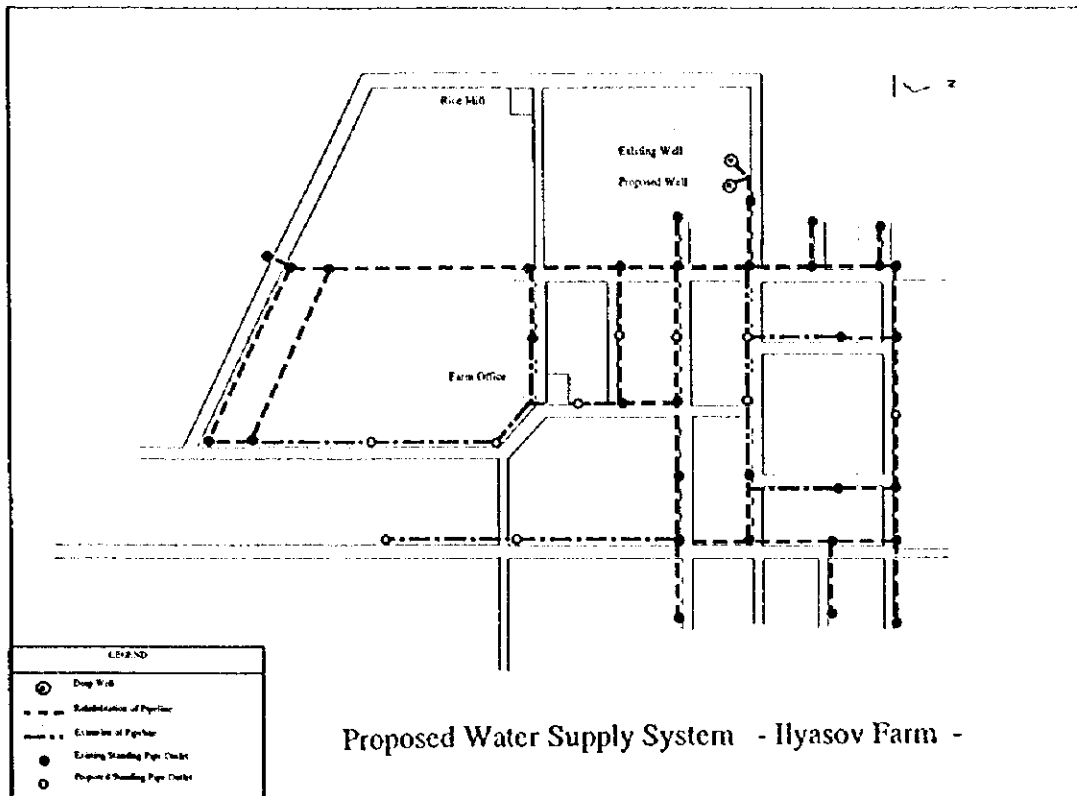


Figure 3.2.7

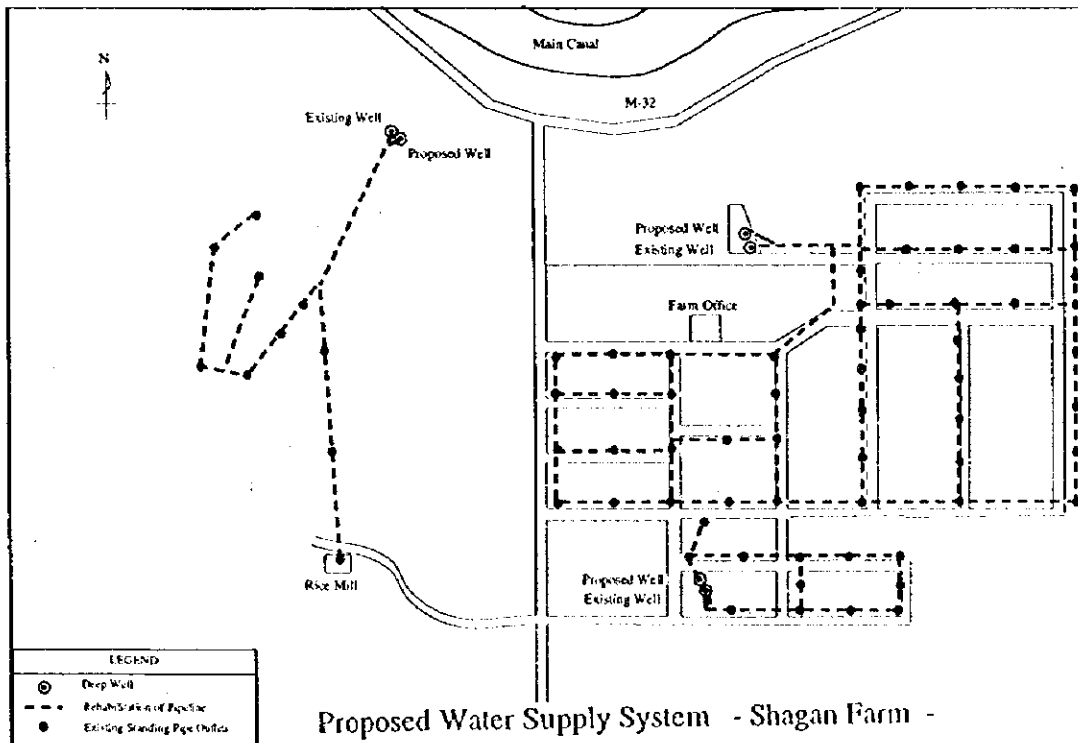


Figure 3.2.8

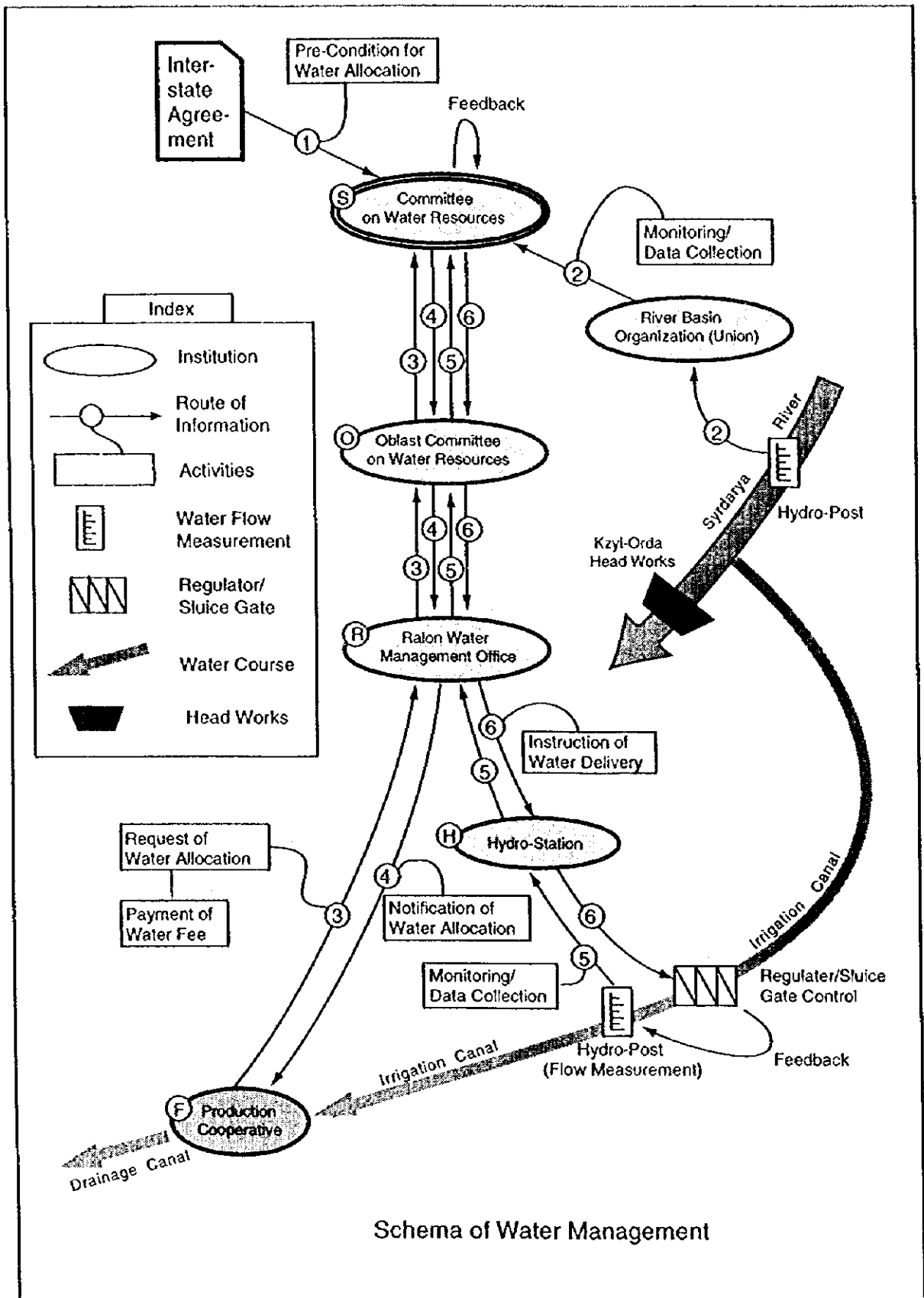
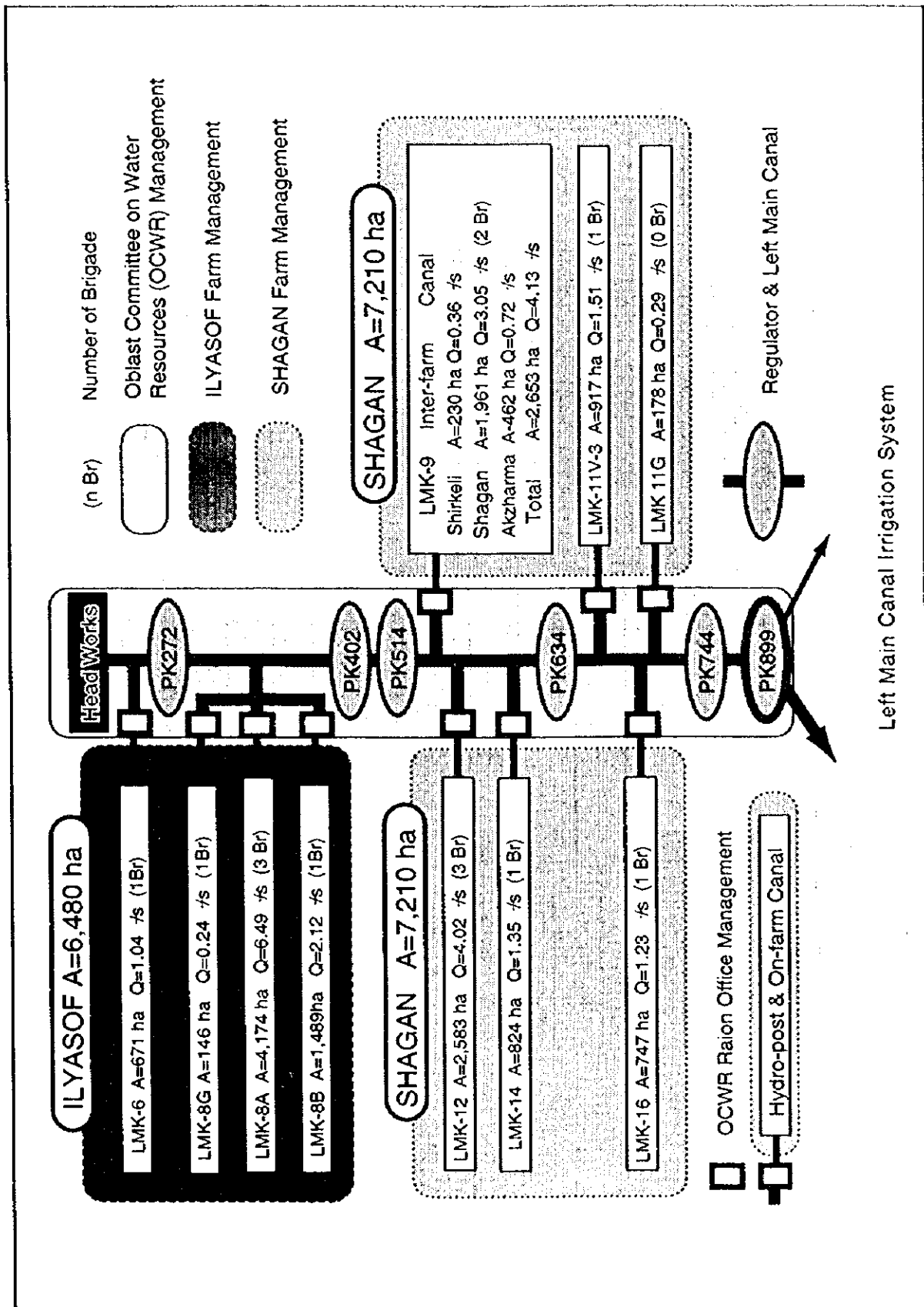
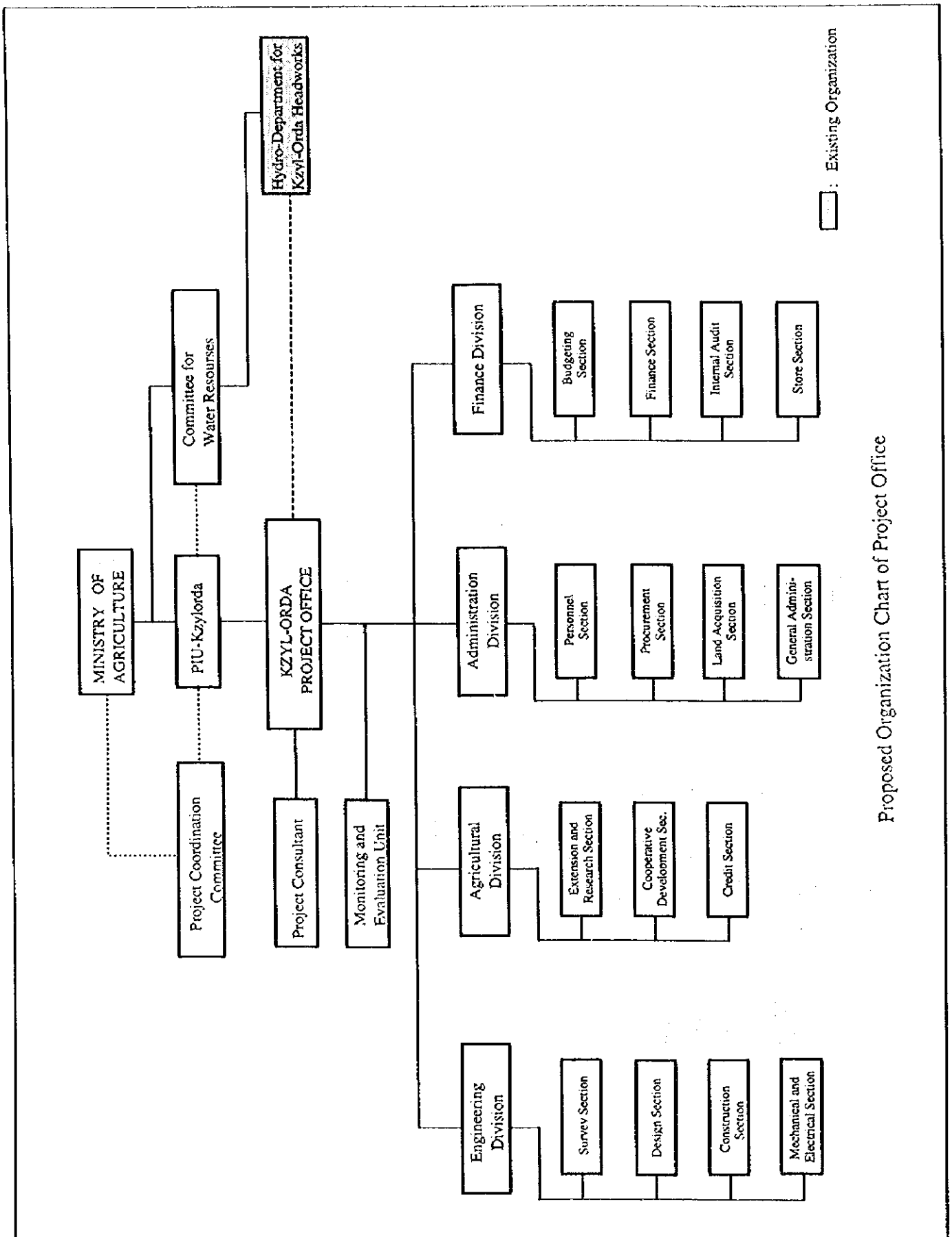


Figure 3.2.9



Left Main Canal Irrigation System

Figure 3.2.10



Proposed Organization Chart of Project Office

Figure 3.2.11

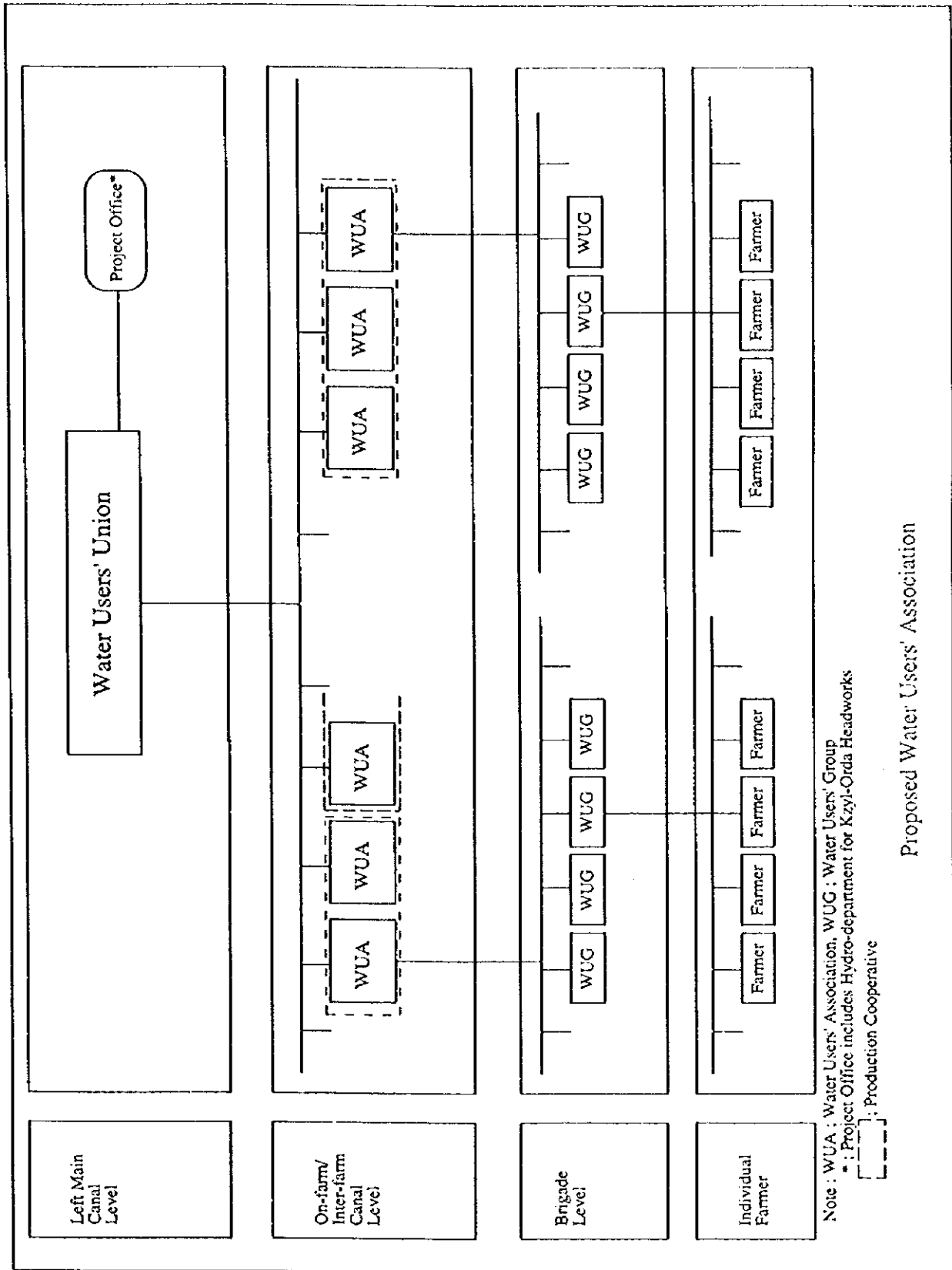
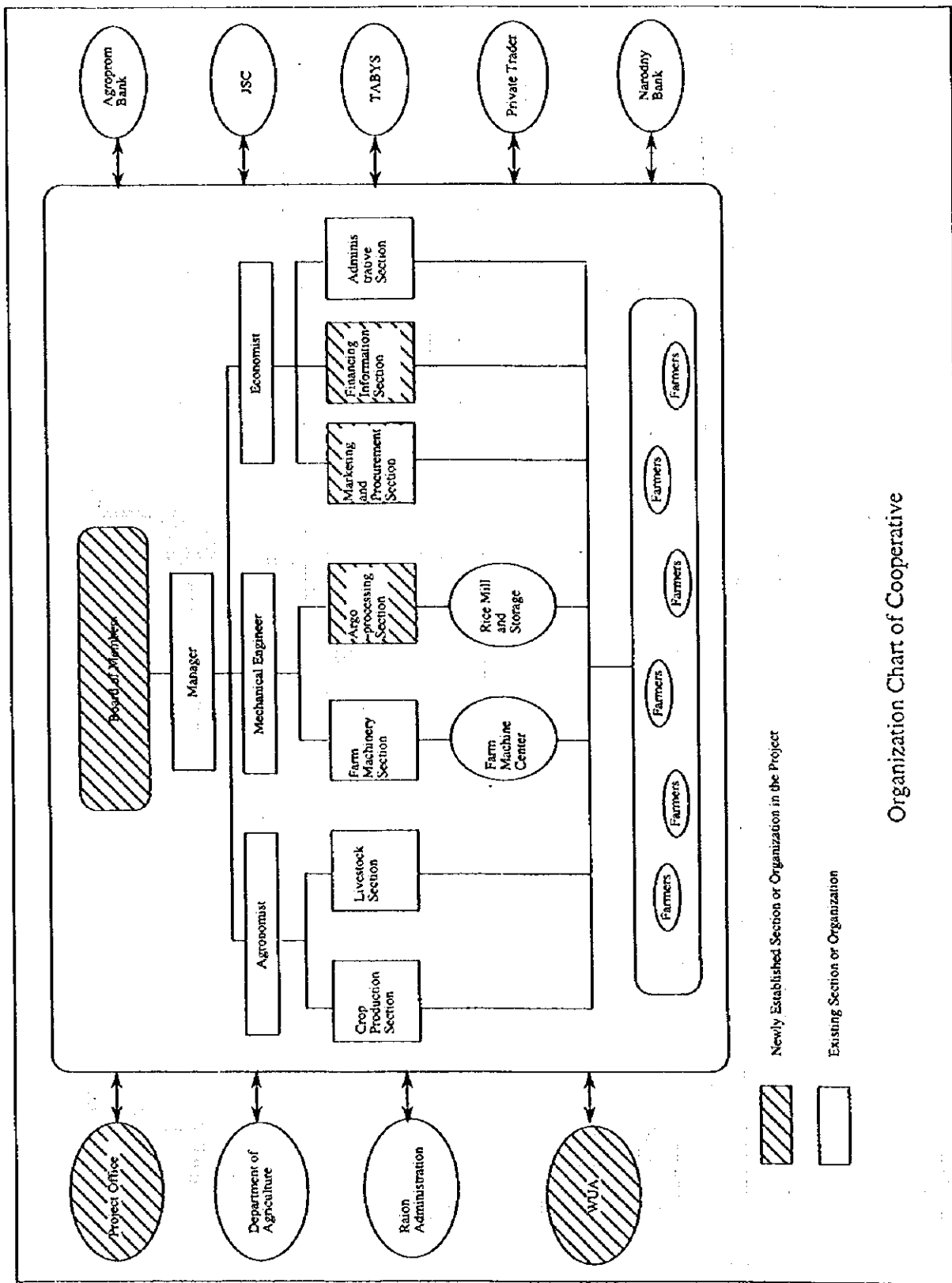


Figure 3.2.12



Organization Chart of Cooperative

Figure 3.3.1

Work Items	Design Start			Phase-I Implementation					Phase-II Implementation			
	1999 1st Year	2000 2nd Year	2001 3rd Year	2002 4th Year	2003 5th Year	2004 6th Year	2005 7th Year	2006 8th Year	2007 9th Year	2008 10th Year		
<b>A. Survey and Design</b>												
(1) Selection of Consultant												
(2) Field Survey												
(3) Detailed Design												
<b>B. Phase-I Implementation</b>												
<b>B-1. Construction of Project Office Building</b>												
(1) Selection of Contractor												
(2) Construction												
<b>B-2. Rehabilitation and Improvement of Irrigation and Drainage Facilities and Rural Infrastructure</b>												
(1) Land Acquisition												
(2) Selection of Contractor												
(3) Construction												
- Headworks												
- Left Main Canal (PK0 - PK402)												
- North Collector												
- Inter-farm / On-farm Canals												
- On-farm Facilities in Iyasev Farm												
- Rural Infrastructure												
- Buildings												
<b>B-3. Procurement</b>												
(1) Office Equipment												
(2) OAM Equipment												
(3) Water Management Equipment												
(4) Rice Mill												
(5) Farm Machinery												
<b>B-4. Project Administration</b>												
<b>B-5. Consulting Services</b>												
<b>C. Phase-II Implementation</b>												
<b>C-1. Rehabilitation and Improvement of Irrigation and Drainage Facilities and Rural Infrastructure</b>												
(1) Selection of Contractor												
(2) Construction												
- Left Main Canal (PK402 - PK899)												
- South Collector												
- Inter-farm / On-farm Canals												
- On-farm Facilities in Shagan Farm												
- Rural Infrastructure												
- Buildings												
<b>C-2. Procurement</b>												
(1) Office Equipment												
(2) OAM Equipment												
(3) Water Management Equipment												
(4) Rice Mill												
(5) Farm Machinery												
<b>C-3. Project Administration</b>												
<b>C-4. Technical Services</b>												
(1) Consultant Services												
(2) Demonstration Farm												
(3) Agricultural Strengthening Programme												

Project Implementation Schedule



***Attachment***

SCOPE OF WORK  
ON  
THE TECHNICAL COOPERATION  
FOR  
THE STUDY  
OF  
KZYL-ORDA IRRIGATION/DRAINAGE  
AND  
WATER MANAGEMENT PROJECT  
IN  
THE REPUBLIC OF KAZAKHISTAN

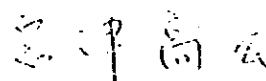
AGREED UPON  
BETWEEN  
MINISTRY OF AGRICULTURE  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

ALMATY, 12 MARCH, 1996



---

Mr. AKHYMBEKOV Serik Shajakhmetovich.  
*Minister of Agriculture  
Republic of Kazakhstan*



---

Mr. Takakimi MIYATSU  
*Preparatory Study Team,  
Japan International  
Cooperation Agency*

## I. INTRODUCTION

In response to the request of the Government of the Republic of Kazakhstan (hereinafter referred to as "GOK"), the Government of Japan (hereinafter referred to as "GOJ") has decided to conduct the Study of Kzyl-Orda Irrigation/Drainage and Water Management Improvement Project (hereinafter referred to as "the Study"), in accordance with relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of GOJ, will undertake the Study in close cooperation with the authorities concerned of GOK.

The present document sets forth the Scope of Work with regard to the Study.

## II. OBJECTIVES OF THE STUDY

The objectives of the Study are;

1. to prepare an overall Master Plan of the Study Area for the improvement of agricultural productivity considering the efficiency of water use, and contribution to the environmental condition of lower basin of Syr Darya river including Aral sea for a long term,
2. to conduct Feasibility Study for the selected Project(s) identified through the Master Plan and,
3. to carry out technology transfer to Kazakhstan counterpart personnel through on-the-job training in the course of the Study.

## III. STUDY AREA

The Study area covers approximately 90,000ha which was irrigated by the left bank canal from existing Kzyl-Orda intake weir on the Syr Darya river.

#### IV. SCOPE OF THE STUDY

In order to achieve this objectives, the Study will consist of following two phases;

##### 1. Phase I

1-1. To collect and analyze relevant existing data and information on the following:

- a. natural condition
- b. socio-economic condition
- c. agriculture
- d. agro-economic condition
- e. agricultural infrastructure
- f. environment
- g. others.

1-2. To review the existing development plans and projects concerning the Study Area.

1-3. To carry out field survey and investigation on the following:

- a. meteorology and hydrology
- b. topology and geology
- c. irrigation and drainage
- d. water management
- e. land use
- f. farmers organization
- g. extension service
- h. agro-economic condition
- i. environment
- j. others.

1-4. To formulate Master Plan of the Study Area for the improvement of agricultural productivity considering the efficiency of water use, and contribution to the environmental condition of lower basin of Syr Darya river including Aral sea for a long term, which includes the following:

- a. improvement of irrigation and drainage system
- b. improvement of water management system
- c. improvement of farming system

- d. management and maintenance
  - e. rough cost estimation
  - f. preparation of implementation plan
- 1-5 To prepare environmental conservation plan and conduct Initial Environmental Evaluation (IEE), if necessary
- 1-6. To select priority project(s) for the Feasibility Study in the Phase II.
2. Phase II
- 2-1. To prepare topographic map covering priority project(s), if necessary
- 2-2. To implement the Feasibility Study for selected priority project(s) which includes the following:
- a. collection of data and information through additional field survey
  - b. formulation of the detailed agricultural development plan
  - c. preparation of environmental conservation plan and conduct Environmental Impact Analysis (EIA), if necessary
  - d. preparation of preliminary design of facilities
  - e. formulation of operation and maintenance plan
  - f. preparation of the implementation schedule
  - g. cost estimation
  - h. economic and financial analysis of project(s)
  - i. overall evaluation
  - j. recommendation

## V. STUDY SCHEDULE

The Study will be carried out in accordance with the attached tentative schedule. (See ANNEX)

## VI. REPORTS

JICA shall prepare and submit the following reports in English to GOK. Timing of submission for each report might be changed according to the Study schedule.

### 1. Inception Report

Thirty (30) copies at the commencement of the Study.

2. Progress Report (1)

Thirty (30) copies at the end of the Phase I field study in Kazakhstan.

3. Interim Report

Thirty (30) copies at the commencement of the Phase II field study in Kazakhstan.

4. Progress Report (2)

Thirty (30) copies at the end of the Phase II field study in Kazakhstan.

5. Draft Final Report

Thirty (30) copies after the Phase II home office work. GOK will provide JICA with its comments on the Draft Final Report within one (1) month after receipt of the Draft Final Report.

6. Final Report

Sixty (60) copies within two (2) month after the receipt of the GOK's comments on the Draft Final Report.

## VII. UNDERTAKING OF GOK

To facilitate smooth conduct of the Study, GOK shall take necessary measures;

1. To facilitate smooth conduct of the Study, GOK shall take necessary measures;

- (1) to secure the safety of the Japanese study team,
- (2) to permit the members of the Japanese study team to enter, leave and stay in Kazakhstan for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,
- (3) to exempt the members of the Japanese study team from taxes, duties, fees, and other charges on equipment, machinery and other materials brought into Kazakhstan and out for the conduct of the Study,
- (4) to exempt the members of the Japanese study team from income tax and charges of any kind imposed on or in connection with any payment, salary or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study,
- (5) to provide necessary facilities to the Japanese study team for remittance as well as utilization of the funds introduced into Kazakhstan from Japan in connection with the implementation of

- the Study,
- (6) to secure permission for entry into private properties or restricted areas for the implementation of the Study,
  - (7) to secure permission for the Japanese study team to take all data and documents (including maps, photographs) related to the Study out of Kazakhstan,
  - (8) to provide medical services as needed. Its expenses will be chargeable on members of the Japanese study team.
2. GOK shall bear the claims, if any arises, against the members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct of the part of the members of the Japanese study team.
  3. Ministry of Agriculture (hereinafter referred to as "MOA") shall act as counterpart agency to the Japanese study team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.
  4. MOA shall, at its own expense, provide Japanese study team with the following, in connection with other organizations concerned:
    - (1) available data and information related to the Study,
    - (2) counterpart personnel,
    - (3) suitable office space with office equipment in MOA or MOA Regional agency,
    - (4) Credentials or identification cards, and
    - (5) appropriate number of vehicles with drivers.

#### VIII. UNDERTAKING OF GOJ

For the implementation of the Study, JICA shall take the following measures;

- (1) to dispatch the study team to Kazakhstan at its own expense, and
- (2) to pursue technology transfer to Kazakhstan counterpart personnel in the course of the Study.

#### IX. CONSULTATION

JICA and MOA shall consult with each other in respect of any matter that may arise from or in connection with the Study.

#### X. TRANSLATION

The Scope of Work is prepared on both Russian and English. In case any doubt arises in interpretation, the English text shall prevail.

→ III



## TENTATIVE SCHEDULE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
Work in Kazakhstan																								
Work in Japan																								
Submission of Report	△ Ic/R			△ P/R(1)							△ It/R				△ P/R(2)							△ Df/R	△ Df/R	
Phase	◀ Phase I ▶									◀ Phase II ▶													▶	

(Remarks)

- Ic/R : Inception Report
- P/R (1) : Progress Report (1)
- It/R : Interim Report
- P/R (2) : Progress Report (2)
- Df/R : Draft Final Report
- F/R : Final Report
- ⊙ : Comments on Df/R by Kazakhstan side

*Handwritten mark*

MINUTES OF MEETING  
ON  
SCOPE OF WORK  
FOR  
THE STUDY  
OF  
KZYL-ORDA IRRIGATION/DRAINAGE  
AND  
WATER MANAGEMENT PROJECT  
IN  
THE REPUBLIC OF KAZAKHSTAN

The Preparatory Study Team (hereinafter referred to as "the Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA"), and headed by Mr. Takakimi MIYATSU, visited Kazakhstan from February 29 to March 14, 1996 for the purpose of discussing and confirming the Scope of Work for The Study of Kzyl-Orda Irrigation/Drainage and Water Management Project (hereinafter referred to as "the Study").

The Team had a series of discussions with the officials concerned of Ministry of Agriculture (hereinafter referred to as "MOA") and other organizations concerned on the Scope of Work for the Study. The list of

participants of the meeting is attached in the ANNEX.

As the result of the discussions, the Team and MOA agreed the Scope of Work for the Study and also agreed to report to the authorities of their respective Government on the following understanding.

1. Framework of the Study,

1-1. Water Use

The objective of the Study is to reduce the water use in the Study area, therefore the efficiency of water use should be carefully planned particular in irrigation/drainage system, water management/farming system.

1-2. Study Area

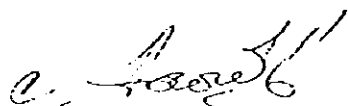
Approximately 90,000ha which was irrigated by the left bank canal from existing Kzyl-Orda intake weir on the Syr Darya river.

2. MOA shall provide necessary numbers of counterpart personnel who are qualified governmental officials during the Study in Almaty and Kzyl-Orda by its own expenses.
3. MOA shall Make necessary arrangement/procedures to concerned government agencies and organizations for the preparation and use of topographic maps of the Study areas on a request of the Japanese Study Team.
4. MOA shall support the implementing agency for Environment Impact Assessments if necessary, according to Kazakhstan's laws and regulations. The Japanese Study Team shall provide MOA with basic data and information on environmental issue in the course of the Study.
5. MOA shall provide necessary office space for the Study team in Almaty and Kzyl-Orda, but considering present situation of insufficient office-spaces and equipment in Kazakhstan, MOA requested support and the Team promise to convey this request to the Government of Japan.
6. MOA requested the counterpart training in Japan. The Team promised to convey its request to the Government of Japan.

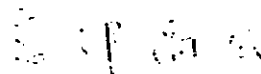
7. MOA requested that JICA provide equipments for use during the Study:
- vehicle
  - set of personal computer
  - copy Machine
  - and other equipment necessary for the Study

The Team promised to convey its request to the Government of Japan.

Almaty,  
12 March, 1996



Mr. AKHYMBEKOV Serik Shajakhmetovich.  
*Minister of Agriculture*  
*Republic of Kazakhstan*



Mr. Takakimi MIYATSU  
*Preparatory Study Team.*  
*Japan International*  
*Cooperation Agency*

*Handwritten mark*

## LIST OF PARTICIPANTS

### 1. Kazakhstan Side

#### Ministry of Agriculture

Mr. KARIBZHANOV Zhanibech Salimovich Vice Prime Minister

Mr. AKHYMBEKOV Serik Shajakhmetovich Minister for Agriculture

Mr. Shotanov Ermik Lagembaevich Director, Project  
Implementation Unit (PIU)

Mr. KARIBZHANOV Oleg Fazylovich Vice Director, PIU

Mr. AMEDJANOV Paizen Technical Coordinator, PIU

Mr. NENADOV Vlagimir Ecology Expert, PIU

### 2. Japanese Side

#### Preparatory Study Team

Mr. Takakimi MIYATSU Leader

Mr. Osamu NISHIKAWA Member

Mr. Hiroyuki MOAEZONO Member

Mr. Takeshi GOTO Member

Ms. Kumiko IKAWA Member

Mr. Tsuyoshi YOCHI Member

Mr. Kozo ITO Member

MINUTES OF MEETING  
ON  
INCEPTION REPORT  
FOR  
THE STUDY  
ON  
KZYL-ORDA IRRIGATION/DRAINAGE AND  
WATER MANAGEMENT PROJECT

In accordance with the Scope of Work (S/W) for the Study on the Kzyl-Orda Irrigation/Drainage and Water Management Project (the Study) agreed upon between the Government of Kazakhstan (GOK) through the Ministry of Agriculture (MOA) and the Japan International Cooperation Agency (JICA) on March 12, 1996, the JICA Study Team submitted the Inception Report on August 20, 1996 to MOA.

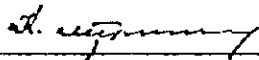
The meetings were held two times between MOA and JICA Study Team on August 21 and 26, 1996. Both meetings chaired by Mr. Karibzhanov Oleg F., Deputy Director of Project Implementation Unit (PIU) of MOA, were held at the meeting room of MOA in Almaty based on the Inception Report.

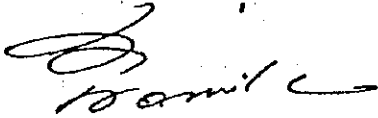
In the first meeting, Mr. Ito, Leader of the Advisory Team of JICA, explained the purpose and schedule of the JICA Study Team. Further, upon the request of the Chairman, Mr. T. Tomita explained the content of the Inception Report and the Report was fully accepted by MOA.

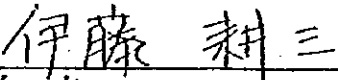
The followings are the main subjects discussed and agreed upon between MOA and the JICA Study Team through the meetings.

- (1) MOA will arrange the following matters for the JICA Study Team:
  - (a) Provision of following counterpart personnel;
    - Team Leader of the counterpart group, and
    - Aerial Photo / Topographic Survey / Mapping Expert.
  - (b) Provision of office space with furniture in Almaty, which should be enough for 10 persons for the period from early September to mid October 1996 and 30 persons for the period from mid October to mid November 1996.
  - (c) Assistance in arranging the organization for the aerial photo shooting and mapping to be done under the sub-let contract.
- (2) MOA will ask the Kzyl-Orda Regional Government to arrange the following matters:
  - (a) Provision of following counterpart personnel;
    - Irrigation and Drainage Engineer,
    - Agriculture / Extension / Landuse Expert,
    - Soil / Environmental Expert,
    - Hydrologist,
    - Water Management Expert,
    - Geohydrologist,
    - Farmers' Organization / Rural Society Expert,
    - Agro-economist, and
    - Design / Cost Estimate Expert.

- (b) Provision of office space with furniture in Kzyl-Orda, which should be enough for 20 persons for the period from early September to mid October 1996.
- (c) Assistance in arranging the organizations for the following field works and office works to be done under the sub-let contracts;
- Flora and fauna survey,
  - Geohydrological survey,
  - Water quality analysis,
  - Soil survey,
  - Soil mechanical test,
  - Canal route survey, and
  - Farm household survey.
- (3) The minutes of meeting is prepared in both Russian and English. In case discrepancy between them arises in interpretation, the English text shall prevail.

  
Kadishan Otarov  
Deputy Minister of Agriculture

  
Toshihiro Tomita  
Team Leader,  
JICA Study Team

  
Kozo Ito  
Leader of Advisory Team,  
JICA

## LIST OF PARTICIPANTS

### Ministry of Agriculture

Mr. Amangeldy S. Taskuzhin, Administration Head of External Economics Relations  
Mr. Karibzhanov Oleg F., Deputy Director of PIU  
Mr. Amedjanov Paizen A., Technical Coordinator, PIU  
Mr. Hehadov Vlagimir V., Environment Specialist, PIU  
Mr. Zakirjanov Farig S., Procurement Specialist, PIU

### JICA Advisory Team

Mr. Kozo Ito, Team Leader

### JICA Study Team

Mr. Toshihiro Tomita, Team Leader  
Mr. Osamu Ishiyama, Co-Team Leader / Irrigation and Drainage Expert  
Dr. Genshichi Wada, Agronomist, Extension / Landuse Expert  
Mr. Tetsunari Gejo, Soil Expert / Environmentalist  
Mr. Shigehiko Shino, Aerial Photo and Topographic Survey  
Mr. Yutaka Niikawa, Coordinator  
Ms. Hisako Yamaguchi, Interpreter



MINUTES OF MEETING  
ON  
PROGRESS REPORT (I)  
FOR  
THE STUDY  
OF  
KZYL-ORDA IRRIGATION/DRAINAGE AND WATER MANAGEMENT PROJECT

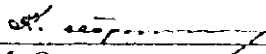
In accordance with the Clause VI-2 of the Scope of Work (S/W) for the Study on the Kzyl-Orda Irrigation/Drainage and Water Management Project (the Study) agreed upon between the Government of Kazakhstan and the International Cooperation Agency (JICA) on March 12, 1996, the JICA Study Team submitted the Progress Report (I) on November 6, 1996 to the Ministry of Agriculture (MOA).

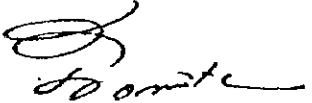
The meeting was held between MOA and the JICA Study Team on November 11, 1996. The meeting chaired by Mr. Otarov K. M., Deputy Minister of Agriculture, was held at his office room based on the Progress Report (I).

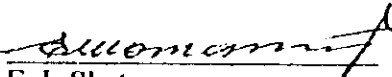
Upon the request by the chairman, Mr. T. Tomita, Leader of JICA Study Team, explained the major findings of the JICA Study team and the basic concepts for the development plan to be considered in the Study, which are mentioned in the Progress Report (I), and the Report was basically accepted by MOA.

The followings are the main subjects discussed between MOA and the JICA Study Team through the meeting.

- (1) MOA requested to include the drinking water supply system and rehabilitation of farm road network in the components of the priority project mentioned in Chapter 5 of the Progress Report (I).
- (2) Farm management system should be studied referring to those in Japan for a small-scaled farming and U.S.A. for a large-scaled farming.
- (3) The operation and maintenance (O&M) of the Kzyl-Orda headworks will be made by the Government by its budget through the Committee of Water Resources, while O&M of the main canal down to the on-farm facilities and all the collectors (drains) will be managed under the full responsibility of the proposed Water Users Association (WUA).

  
K. M. Otarov  
Deputy Minister of Agriculture  
Republic of Kazakhstan

  
T. Tomita  
Team Leader,  
JICA Study Team

  
E. I. Shotanov  
Head of Project Implementation Unit

## LIST OF PARTICIPANTS

### Ministry of Agriculture

Mr. K.M. Otarov	Deputy Minister
Mr. E.I. Shotanov E	Director, PIU
Mr. P.A. Amezhanov	Technical Coordinator, PIU

### JICA Study Team

Mr. T. Tomita	Team Leader
Mr. O. Ishiyama	Co-Team Leader / Irrigation and Drainage Expert
Mr. T. Gejo	Soil / Environment Expert
Mr. K. Ozaki	Geo-hydrologist
Dr. D. Schuy	Agro-economist
Mr. N. Nagai	Design Cost Estimate Expert

**MINUTES OF MEETING  
FOR  
THE INTERIM REPORT  
ON  
KZYL-ORDA IRRIGATION/DRAINAGE  
AND WATER MANAGEMENT PROJECT**

In order to discuss the study results mentioned in the Interim Report which was prepared by the Study Team of the Japan International Cooperation Agency (JICA) in accordance with the Scope of Work (S/W) for the captioned project agreed upon between the Government of Kazakstan and JICA on March 12, 1996, a meeting was held with His Excellency Zh. S. Karibzhanov, Deputy Prime Minister of the Republic of Kazakstan on June 2, 1997. The list of attendants of the meeting is attached hereto.

The meeting was opened and chaired by His Excellency Karibzhanov. Upon the request by the chairman, Mr. T. Miyatsu, Leader of Advisory Team of JICA, explained the procedure of the study and his mission to the JICA Study Team. After this, Mr. T. Tomita, Team Leader of the JICA Study Team explained the contents of the Interim Report, and the Report was basically accepted by MOA and the Government.

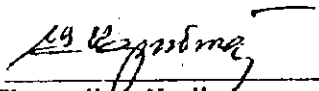
The followings are the main subjects discussed and agreed upon between MOA and the Government and the JICA Study Team through the meeting:

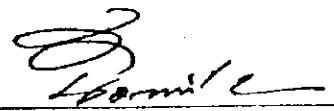
- (1) Most of farm lands in the Study Area were common properties of production cooperatives (farms) when Phase-I Study was made in the last year, but these lands had been distributed to private family farms by April 1997. Taking into consideration this new land ownership situation, the farmers' organizations such as agricultural cooperatives and water users' associations, which should be appropriate to the new situation, should be proposed by the Study Team in the Phase-II Study.
- (2) The construction cost for the priority project will be estimated in detail applying the unit prices in August 1997. The cost thus estimated will be allocated to the foreign and local currency portions, considering the future bidding system for the construction work, i.e., international competitive bidding (ICB).
- (3) MOA and the Government agreed to take up the Stage-I Development Project mentioned in Chapter 8 of the Interim Report for the Phase-II Study (feasibility study).
- (4) MOA will provide the Study Team with the following counterpart personnel and office accommodations:
  - (a) Counterpart personnel
    - Team Leader,
    - Irrigation and Drainage Engineer,
    - Agronomist,


- Soil/Environmental Expert,
- Hydrologist,
- Water Management Expert,
- Sociologist,
- Agro-economist,
- Design/Cost Estimate Engineer,
- Mapping Expert.

(b) Following office space with necessary furniture:

- Office space in Almaty, which should be enough for 10 persons for the period from May 26 to July 31, 1997 and 20 persons from August 1 to September 19, 1997.
  - Office space in Kzyl-Orda, which should be enough for 20 persons for the period from May 28 to July 31, 1997 and 10 persons from August 1 to August 31, 1997.
- (5) Comments from other agencies concerned will be issued to the study Team by the end of June 1997, and these comments will be considered in preparation of the Progress Report (II), if required.
- (6) This minutes of meeting is prepared in both Russian and English. In case discrepancy between them arises in interpretation, the English text shall prevail.

  
 Zhananibek Karibzhanov  
 Deputy Prime Minister  
 Republic of Kazakstan

  
 Toshihiro Tomita  
 Team Leader,  
 JICA Study Team

  
 Takakimi Miyatsu  
 Leader of Advisory Team,  
 JICA

### **The Proposal to the Project for Rehabilitation of Intake Facilities to Left Main Canal in Kzyl-Orda Headworks**

The substantial change of aquatic fauna in the Syr Darya river has been caused by anthropological influence on hydrological regime of the river basin. It's been happened the substantial impoverishment of native fauna in terms of quality and quantity. At present, 48 species of fish live in the Syr Darya river basin. Out of them, only 26 of species are native and remaining species are acclimatizer.

As mentioned in the above paragraph, the Syr Darya lost proper fishing condition after the regulation of river discharge. The fishing is carried out in the most of reservoirs and few lakes in the river basin. The good fishing place are located in Karakum, Chardara and Arnasay lakes systems [1].

The flow of the Syr Darya river between the Chardara Dam and Kzyl-Orda Headworks is one of extensive regulated plot. Fish production is not large in South Kazakstan Oblast. In addition, the data in the Chardara reservoir shows bad indexes for the growth of fish species in aquatic fauna.

A level of natural fish reproductions is not high due to the low hydrological regime caused by the water intake of irrigation. Number of fish has increased when the young and adult fishes are flown out from the diversion structure of Chardara dam and fish way of the Kyzylkum canal. A total of catching fish in South Kazakstan Oblast in 1988-91 was from 100 tons to 241 tons according to data provided by farms. A major variety of fishing is bream [2].

According to the data of fish inspection in Kzyl-Orda Oblast, total catching fish decreased from 4,185.5 tons in 1990 to 790.4 tons in 1996. Fish catch has been carried out in the delta around reservoirs or fish breeding farms.

In 1995, the total amount of fish catch was 617.3 tons, while the amount from natural reservoirs was 256.2 tons. In 1996, the total amount of fish catch was 790.3 tons, of which natural reservoir including the Syr Darya river was 235.5 tons. Therefore, the annual fishing productivity is approximately 235.5 tons in the Syr Darya river.

At present, the fish productivity on area of the Syr Darya river between the Chardara Dam and the Kzyl-Orda Headworks is low because the hydro-electric power station at Chardara regulates the river discharge and irrigation takes the water. One of the biggest diversion is the intake of Left Main Canal in the Kzyl-Orda Headworks, are built for water supply to irrigation systems. The capacity of intake is around 200 m<sup>3</sup>/sec and supplies water to around 30% of whole irrigation area in oblast.

The fresh water from the Chardara power station is average 550-700 m<sup>3</sup>/sec. The Kzyl-Orda left bank intake takes in 30-40% of total discharge of the Syr Darya river. The damage to the fish production is brought not only by strait fall of adult and young fish to the intake facility but, also by deterioration of natural and reproduction conditions. According to the experts estimation, reduction of fishing productivity is around 50% at minimum and amount to 200-300 tons of fish production per year.

Fish protection facilities is one of the measures for reducing damage on falling fish in the intake facilities. The another damage related to the natural resources is diminished by other compensations measures, as new construction or rehabilitation of the existing fish breeding pond, etc.

The rehabilitation of existing Kzyl-Orda Headworks should not change hydraulic condition in the river comparing to present condition. Main damage after the rehabilitation of intake facilities will be falling of adult fish, young fish and eggs into diversion without the changing hydrological regime.

According to the existing law, all diversions works taking water from fish reservoirs must be provided with fish protection devices. However, as shown by special investigation, no efficient fish protection devices exist on diversion work with big volume of water using (more than 20 m.cub/sec). For instance, the fish protection device of gravity facility in downstream of Ili river is not providing 100% of fish protection against their falling into diversion. (According to the law, the acceptable percent is around 70%) [3]. Construction of fish protection devices on big diversion works (more than 100 m.cub/sec.) is very expensive and complicated in terms of the design, construction, operation and maintenance. In addition, the fish protection devices reduce only a part of damage. In this case, ecological approach for fish protection should be considered in the construction of diversion works. Based on the result of investigation for clarifying the condition of aquatic fauna around the diversion, it is proposed to recommend some measures of reducing possible damage and to define the rational ways of using compensation payment [4].

In Kzyl-Orda Oblast, damage of fish which falls into the diversion work or efficiency of existing fish protection devices has not been estimated during many years. So, it can't be possible to clarify the damage to fish caused by the intake of Left Main Canal.

Before the rehabilitation of intake of Kzyl-Orda Headworks, the full estimation of its possible damage and efficiency of construction of the fish protection devices (FPD) would be necessary at full range through the monitoring by scientific research work. The work needs one or two crop seasons at least.

So, we propose the following way on this study stage.

- To put a cost for carrying out compensation measures in scale of one -third of total damage (proportional to volume of irrigation) for 10 years, that is estimated at approximately US\$ 1 million dollars.
- To put a cost for taking scientific researching works which clarify a possible damage and efficient way of its reducing, quantity of compensation and their optimal using.

### Conclusion

1. The fish productivity in the area of Syr Darya river between the Chardara Dam and the Kzyl-Orda Headworks is reducing because of anthropological influence on hydrological regime of the basin and fish falling into irrigation diversion works.
2. Rehabilitation of intake facilities for the Left Main Canal in the Kzyl-Orda Headworks doesn't substantially improve the hydrological regime and function of diversion . As a result, it will continue to make damage to the adult, young fish and fish egg caused by their fall into diversion.
3. Lack of data makes difficulty to estimate possible damage caused by diversion's function after the rehabilitation.
4. According to the existing law, all diversions works taking water from fish reservoirs must to be equipped with the fish protection devices. As mentioned by special researching at present time, however, enough efficiency of FPD was not observed on the diversion works with big volume of water (more than 100 m.cub/sec). Scientific research is possible not only to estimate possible damage after rehabilitation of the intake but also to clarify the sums of costs for compensation. Based on the result of investigation to clarify the

condition of aquatic fauna around the diversion work, it is proposed to recommend some measures of reducing possible damage and to define the rational ways of using compensation payment.

5. On this stage, it is proposed to put the project cost of compensation measure in a scale of one-third from total damage in this area of the river for the period 10 years (US\$ 1,000,000 ), and sums of US\$ 15-20 thousand dollars for carrying out the necessary works for scientific researching.

#### Literature :

1. Salihov T.V. Vundcettel M.F. The composition of basin aquatic fauna of the Syr Darya river in condition of anthropological influence . The biological base of fishing in reservoirs Middle Asia and Kazakstan. Reports XIX conferences. Ashhabad. Publishing house: Ylim, 1986, 26-27 pages
2. Report of scientific researching institute of Fish: "To research condition for raw material supply in reservoirs of Kazakstan, carry out industrial forecast of fish catch in lakes, rivers and reservoirs and also fish production in 1993" Part: Chardara, Bugun reservoirs, river Syr Darya. Chief S. Yakubovskiy Kazak scientific institute of Fish, Almaty, 1992, 90 pages.
3. SN and P from 2.06.87
4. Report of scientific institute of Fish "To carry out scientific methodological recommendation for make up ecological and economical on the basis of fishing compensation measures on hydro energetic construction" Final. 1981-85. Chief Master of chemical science, master of agriculture science Fil S.A Scientific research institute of Fish of Ukrain. I g.r.81065197. Kiiiv, 1986, 121 pages.

Director, Kazak Scientific Researching Institute of Fish  
H.Ismuhanov

Senior officer of Scientific Laboratory of Ecology and Bioresources  
A.Terechenko

MINUTES OF MEETING  
FOR  
PROGRESS REPORT (II)  
ON  
KZYL-ORDA IRRIGATION/DRAINAGE  
AND WATER MANAGEMENT PROJECT

In order to discuss the survey and study results mentioned in the Progress Report (II) which was prepared by the Study Team of the Japan International Cooperation Agency (JICA) in accordance with the Scope of Work (S/W) for the captioned project agreed upon between the Government of Kazakstan (GOK) and JICA on March 12, 1996, a meeting was held with the Ministry of Agriculture (MOA) on September 16, 1997. The list of attendants of the meeting is attached hereto.

The meeting was opened and chaired by Mr. A. T. Taskuzhin, Administration Head of External Economic Relations. Upon the request by the chairman, Mr. T. Tomita, Team Leader of the JICA Study Team, explained the contents of the Progress Report (II), and the Report was basically accepted by MOA.

The followings are the main subjects discussed and agreed upon between MOA and the JICA Study Team through the meeting:

- (1) For the comments which were issued by the Ministry of Ecology and Bioresources (MOEB) and the Committee on Water Resources (CWR) of MOA on the contents of the Interim Report submitted by JICA to GOK in May 1997, the Study Team explained as follows, and MOA agreed on the explanation:

- (a) Comments from MOEB

(Comment)

*To provide economic comparative study between open fields drain and closed ones.*

(Reply)

In Paragraph (1) of Sub-section 4.6.2 of the Progress Report (II), the results of comparative study is briefly mentioned, which was made from both technical and economical viewpoints. The result of cost comparison among three drainage methods, i.e., the open drain method, the lateral under-drainage method and the vertical under-drainage methods, will be presented in the Draft Final Report.

(Comment)

*To make evaluation of the environmental impact of drainage water discharged from the massive.*

(Reply)

The environmental impact of drainage water from the massive is mentioned in Paragraph (4) of Sub-section 4.12.2 in the Progress Report (II).

(Comment)



*To consider the construction of storage facilities and agro-chemicals and procurement of equipment for their application under the project according to the required norm.*

(Reply)

These costs are counted in the cost estimate of the storage facilities and agricultural machinery mentioned in Section 5.4 of the Progress Report (II).

(Comment)

*To provide irrigation water requirements (irrigation rate) for agricultural crops. According to the report, the contribution of the ground waters (at their high mineralization) is very big (from 19 to 77%) to the total water requirement of crops.*

(Reply)

The groundwater contribution to the water requirement for upland crops is recalculated based on the further detailed data collected in this study period. The result of calculation shows that the rate of groundwater contribution is in the range from 17 to 50%, which seems reasonable. Moreover, all upland crops will be planted immediately after the plantation of paddy, when the groundwater has been diluted to the level of irrigation water (1,000 to 2,000 ppm).

(Comment)

*It is necessary to evaluate the present conditions of the existing rows of forests and observation well and to consider their improvement, if required.*

(Reply)

According to the Oblast Office of the Committee on Forest and Hunting, the plantation of seedlings requires irrigation water for the first 4 years. Because of this and shortage of budget, this office is limited to planting the seedlings only in and around the settlement areas, but not around the farm lands.

As for the groundwater observation wells, there are 372 observation wells which are in good conditions. In addition to these wells, 30 wells were newly drilled and 20 wells were rehabilitated by the Study Team. For proper observation of groundwater conditions, this number is judged enough.

(Comment)

*On the page No.73 it is mentioned that land preparation should be made by the farmers themselves. It is correct if it is talked about annual leveling, nevertheless capital leveling should be considered under the project.*

(Reply)

In the report, it is pointed out that most of plots of paddy fields are not properly leveled, and accordingly water depths in the plots are uneven, resulting in low yield and difficult drainage. This unfavorable field conditions will be rectified by so-called annual leveling, not by the capital leveling, if the farmers are well trained in farming practices. Therefore, this type of land leveling is not included in the project work.

(Comment)

*It is necessary to consider under the project the introduction of automatic and telemechanics system of hydrotechnical structures operation.*

(Replay)

In this project, the automatic and telemechanics system is not considered, because of less availability of technician and spare parts for such a high technics system at present, even in near future. For the future water management in the project area, therefore, the radio communication system is proposed as mentioned in Paragraph (3) of Sub-section 4.9.1 of the Progress Report (II), and the cost required for this system is included in the project cost mentioned in Section 5.4 of the Progress Report (II).

(Comment)

*In the Table on page 74, there is mistake in items of columns which indicate figures "with project" and "without project" conditions.*

(Reply)

This is a careless mistake and will be corrected in the Draft Final Report..

(Comment)

*Explanations are necessary for Table on page 99 and Table 4.10 for the judgement. For example, for environmental items, concerning erosion and siltation emergence of the Syr Darya river downstream of the Kzylorda Headworks under the implementation of the project.*

(Reply)

The necessary explanations will be made in the Draft Final Report.

(Comment)

There are some discrepancies in the above mentioned tables in regard with toxic substance in irrigation massive.

(Reply)

All the discrepancies in said tables will be corrected in the Draft Final Report.

(b) Comment form CWR

(Comment)

*It should be noticed that issues regarding monitoring of water in irrigation and drainage canals of different categories and issues on economic and water management relations between water users organization, farmers, peasant organizations and state management organizations were not properly considered in the report.*

(Reply)

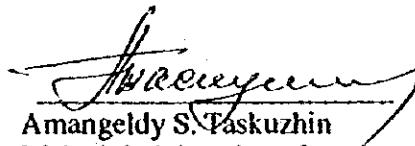
These matters are detailed in Sections 4.9 and 4.11 of the Progress Report (II).

(2) MOA has a idea to establish other Project Implementation Unit (PIU) for the Kzyl-Orda Project than the present PIU which was established for the World Bank projects, when

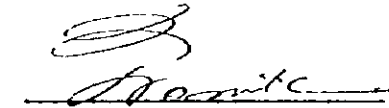
the project implementation is started. This thing should be recommended in the Draft Final Report.

- (3) MOA has no objection that in the financial analysis made in Section 7.3, the farmers' obligation for repayment of the project cost is limited to 70% of the cost required for the construction of on-farm facilities mentioned in Section 5.4.
- (4) The breakdown of construction cost estimate including the unit prices for the major work items will be mentioned in the Draft Final Report.
- (5) If there are any comments from other ministries on the Progress Report (II), these will be informed to the JICA Study Team within 15 days from September 16, 1997, and these comments will be incorporated in the Draft Final Report, if these comments are appropriate in conformity with S/W.

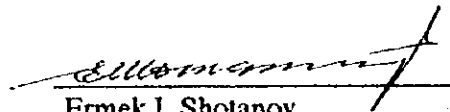
Almaty, September 16, 1997



Amangeldy S. Taskuzhin  
Main Administration of  
External Economic Relations,  
Ministry of Agriculture



Toshihiro Tomita  
Team Leader,  
JICA Study Team



Ermek I. Shotanov  
Head of Project Implementation Unit,  
Ministry of Agriculture

## LIST OF PARTICIPANTS

### 1. Ministry of Agriculture

Mr. A. S. Taskuzhin	Main Administration of External Economic Relations
Mr. E. I. Shotanov	Director, Project Implementation Unit (PIU)
Mr. O.F. Karibzhanov	Deputy Director, PIU
Mr. P. A. Amezhanov	Technical Coordinator, PIU

### 2. JICA Study Team

Mr. T. Tomita	Team Leader
Mr. O. Ishiyama	Co-Team Leader / Irrigation and Drainage Expert
Dr. G. Wada	Agronomist, Extension / Land Use Expert
Mr. T. Gejo	Soil Expert / Environmentalist
Mr. K. Mitsunobu	Water Management Expert
Dr. D.F. Schuy	Agro-Economist
Mr. N. Nagai	Design / Cost Estimate Expert
Mr. Y. Niikawa	Coordinator

MINUTES OF MEETING  
FOR  
DRAFT FINAL REPORT  
ON  
KZYL-ORDA IRRIGATION/DRAINAGE  
AND WATER MANAGEMENT PROJECT

In order to discuss the study results mentioned in the Draft Final Report which was prepared by the Study Team of the Japan International Cooperation Agency (JICA) in accordance with the Scope of Work (S/W) for the captioned project agreed upon between the Government of Kazakstan (GOK) and JICA on March 12, 1996, a meeting was held with the Ministry of Agriculture (MOA) on December 18, 1997. The list of attendants of the meeting is attached hereto.

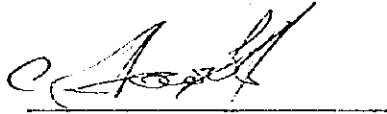
The meeting was opened and chaired by Mr. Serik Ahymbekov, Minister of Agriculture. In the opening speech, the chairman expressed GOK's appreciation to JICA for its technical assistance extended to GOK. Then, upon the request by the chairman, Mr. T. Ogawa; Leader of Advisory Team, explained the procedure of the study and his mission to the Study Team. After this, Mr. T. Tomita; Team Leader of the JICA Study Team, explained the contents of the Draft Final Report, and the Report was basically accepted by MOA.

The followings are the main subjects discussed and agreed upon between MOA and the JICA Study Team through the meeting:

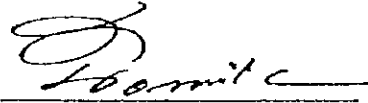
- (1) The reply of the JICA Study Team to the comments which were issued by the Committee on Water Resources (CWR) and Committee on Land Resources Management (CLRM) of MOA, and Ministry of Economics and Trade (MOET) on the contents of the Progress Report (II) submitted by JICA to GOK on September 10, 1997, is as shown in Attachment, and MOA agreed on the reply.
- (2) Upon the request of JICA, MOA agreed that the Final Report will be open to any persons and organizations who are interested in this project.
- (3) Comments from GOK will be issued to the Study Team within one month from date mentioned below, and these comments will be considered in preparation of the Final Report, if any.

(4) This minutes of meeting is prepared in both English and Russian. In case discrepancy between them arise in interpretation, the English text shall prevail.

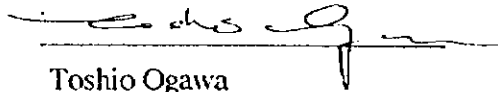
Akmola, December 19, 1997



Serik Ahymbekov  
Minister of Agriculture



Toshihiro Tomita  
Team Leader,  
JICA Study Team



Toshio Ogawa  
Leader of Advisory Team  
JICA



## LIST OF PARTICIPANTS

1. Ministry of Agriculture
  - Mr. S. Ahymbekov Minister of Agriculture
  - Mr. K. Otarov Deputy Minister of Agriculture
  - Mr. R. Azimov Deputy Minister of Agriculture
  - Mr. A. Taskuzhin Main Administration of External Economic Relations
  - Mr. E. Shotanov Director, Project Implementation Unit (PIU)
  - Mr. P. Amezhanov Technical Coordinator, PIU
  
2. JICA Advisory Team
  - Mr. Toshio Ogawa Team Leader
  
2. JICA Study Team
  - Mr. T. Tomita Team Leader
  - Mr. O. Ishiyama Co-Team Leader / Irrigation and Drainage Expert
  - Mr. T. Gejo Soil Expert / Environmentalist
  - Mrs. S. Kainy Interpreter

1. Comments from CWR

(Comment)

*Operation of gates for water diversion into Zhanadarya Canal in winter conditions.*

(Reply)

According to the Scope of Work agreed upon between GOK and JICA, the command area of the Zanadarya Canal is out of the Study Area, and therefore the water diversion to this canal was not dealt with in the Study.

(Comment)

*Budget for rehabilitation and improvement of Kzyl-Orda fish breeding pond, because construction of fish protection facilities on the intakes of the Left Main Canal, Right Main Canal and Zhanadarya river is not effective.*

(Reply)

Based on the recommendation from the Ministry of Ecology and Bioresources (MOEB), the amount of US\$ 1,000,000 was included in the project cost mentioned in Section 2.3.2 of the Draft Final Report.

(Comment)

*Replacement of automatic remote control system for head gates of the dam and LMC gates to the up-date system.*

(Reply)

The cost for the replacement of existing gates to the automatic remote control system was counted in the project cost mentioned in Section 3.3.4 of the Draft Final Report.

(Comment)

*Rehabilitation of the emergency spillway on the LMC PK-862 with discharge of 30 m<sup>3</sup>/sec (presently, 12 m<sup>3</sup>/sec ), on the LMC Right Branch Canal PK518 with discharge of 60 m<sup>3</sup>/sec (presently, 20 m<sup>3</sup>/sec) .*

(Reply)

For the canal safety, it is better to provide more number of spillways than less number with a big discharge capacity. In the Project Area, therefore, it is proposed to provide 17 spillways of over-flow type immediately upstream of all regulators and at certain places where spill-out facilities are required from the hydraulic viewpoint. The design discharge of the spillway is generally taken to be the difference of discharges between the upstream and downstream of the spillway.

(Comment)

*Enforcement of the right slope of the LMC Right Branch Canal from PK318 - PK518 damaged due to the spring water from the Syr Darya river.*

(Reply)

In the master plan study, it was recommended to provide concrete lining on the slope with sand drain under the lining. Since the rehabilitation of the Right Branch Canal



is included in the Stage-II project, it is recommended to study this matter in detail based on the result of detailed field survey when the feasibility study or detailed design of the Stage-II project is conducted.

(Comment)

*Rehabilitation of the hydro-posts on the LMC outlets (existing commercial-based posts of 33) and provision of up-to-date water measuring devices.*

(Reply)

Improvement of all the hydro-posts along the LMC is included in the Stage-I project.

(Comment)

*Rehabilitation of the LMC Right Branch Headworks on which emergency situation occurs annually during vegetation period.*

(Replay)

The rehabilitation of the Right Branch Headworks including the replacement of all gates and inlet approach is proposed in the Stage-I project.

(Comment)

*Methods of rehabilitation or cleaning of field ditches and outlets affected by siltation and vegetation due to lack of prevention works since the beginning of construction.*

(Reply)

The rehabilitation work consisting of excavation and earthfill will be done by farmers themselves spending their own fund collected as water charge.

(Comment)

*To work out recommendations or proposals on utilization of rice straw left on fields after harvesting.*

(Reply)

All rice straw will be mixed in soil by ploughing to improve the soil fertility and structure. This thing will be mentioned in the Final Report.

## 2. Comments from CLRM

(Comment)

*The scale 1:25,000 of soil survey and soil classification for irrigation area is small.*

(Reply)

It is understood that the soil map on a scale of 1:25,000 has an enough accuracy for the use of feasibility study, because the study area mainly consists of rice rotation area, and therefore the soil type is almost same over the area.

(Comment)

*It seems reasonable to adjust ameliorative and ecological conditions of the project area to three existing landscape (269,267 and 485 according to the Landscape Map of the Republic of Kazakhstan, scale 1:25,000) through calculation of the respective*

*coefficients of the environmental conditions. For example, coefficient of pollution for irrigation water, landscape conversion coefficient under water application, etc.*

(Reply)

Even after employing the above-mentioned landscape map, our feasibility level study result on the agricultural development will not change from that in the Draft Final Report, because we have fully taken into consideration the results of environmental and ecological surveys and topographical conditions. Therefore, as recommended in the letter form CLRM, it is proposed to make such classification in the implementation stage, namely in the detailed design stage.

(Comment)

*It is necessary to take into attention that since 10.09.97, the Terenozek Raion had been renamed in to Syrdarya Raion in accordance with the Presidential Decree of the RK.*

(Reply)

It was informed that the change was made not only for the name of raion but also for the boundary of the Syrdarya raion. This change especially for the boundary will affect the explanation made in the Draft Final Report particularly in Section 2.5 "Development Priority and Implementation Program", which was prepared in October 1996, though the result of the development priority will definitely not change. Considering this matter, it is agreed to put remark in the Final Report that the names and boundaries of Terenozek and Syrdarya raions are those used before issuing the Presidential Decree of the RK dated September 10, 1997.

(Comment)

*It is desirable to include representatives of the Land Resources Committee into the proposed inter-ministerial coordination committee and also to correct name of the Committee and its subordinate bodies in the report in accordance with the GOK Resolution No. 1135 dated 18.07.1997.*

(Reply)

The Ministry of Agriculture, in which the Land Resources Committee is included, is proposed to be included in the inter-ministerial coordination committee as the member, as mentioned in Section 3.4 of the Draft Final Report.

As for the names of the committee and its subordinate bodies, the JICA Study Team is ready to change after getting the copy of GOK Resolution No. 1135, if the names are fit to their functions intended by the JICA Study Team.

(Comment)

*It is necessary to clarify the names of soils (old-meadow) in accordance with the Systematic List and in relation with the basic diagnostic soil identifications for plain area of the Republic of Kazakstan.*

(Reply)

In the field survey period, the Systematic List was not available to the JICA Study Team. If this list is available to the JICA Study Team during its stay in Almaty; until December 23, 1997, the Team will review the list and the clarify the names of the soils in the Final Report.

### 3. Comments from MOET

(Comment)

*The project decision on complete lining of all the inter-farm structures (LMC-6, 8, 12, 14, 16, 9, 11V and 11G) in order to decrease filtration is not enough argued, because this decision will lead to increase of filtration in the "irrigation field". High groundwater table under rice irrigation system mainly relates to rice cultivation practice due to necessity of sustaining definite water level in rice checks. It seems that the project costs for canal lining will not be justified. Lining will result in erosion (scouring) and increasing of filtration.*

(Reply)

The meaning of the comment is not clear. In any case, the lining of irrigation canals is planned to reduce the seepage loss from the canals and to protect the canals from erosion, because the soils in the Study Area is very permeable and erosive. Moreover, the economic feasibility of the project is still high even after provision of lining, and the inflow of river water to the Aral Sea will increase by 21% as mentioned in Section 2.2.11 of the Draft Final Report due to realization of irrigation water saving through canal lining and improvement of water management system.

(Comment)

*The issues on organization of irrigation/drainage systems and water management in the Study Area should be considered more thoroughly, not less than in two alternatives. The first variant - concentration of agricultural production in the large state enterprises with the application of grass-crop rotation system, as it is proposed in the project, the second - concentration of agricultural production in individual cooperatives, peasant (family) farms with the specific cultivation system (example - Japan).*

(Reply)

The proposed organization of O&M and water management is shown in Figure 3.2.11. According to this Figure, the organization consists of four tiers, i.e., Left Main Canal level, inter-farm/on-farm canal level, brigade level and individual farmer level. This proposed organization is applicable to the present large farm system employing the first tier to third tier. While, in the stage of completion of farm distribution to individual farmers, the organization will be extended to the fourth tiers. Thus, it is understood that the proposed organization can be applicable to the present large farm system to individual small farm system.







JICA