REPUBLIC OF INDONESIA

BASIC DESIGN STUDY REPORT ON CONSTRUCTION OF PILOT SCHEME FACILITIES IN RIAM KANAN

OCTOBER 1981

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO, JAPAN

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PREFACE

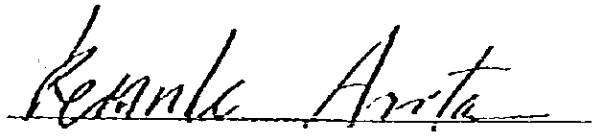
In response to a request of the Government of the Republic of Indonesia, the Japanese Government decided to conduct a survey on the Basic Design for Construction of Pilot Scheme Facilities and entrusted the survey to the Japan International Cooperation Agency (JICA).
The JICA sent to Indonesia a survey team headed by Mr. Yukio KIMURA from August 20th to September 15th, 1981.

The team had discussions with the officials concerned of the Government of Indonesia and conducted a field survey in Sungai Tabuk area, South Kalimantan. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

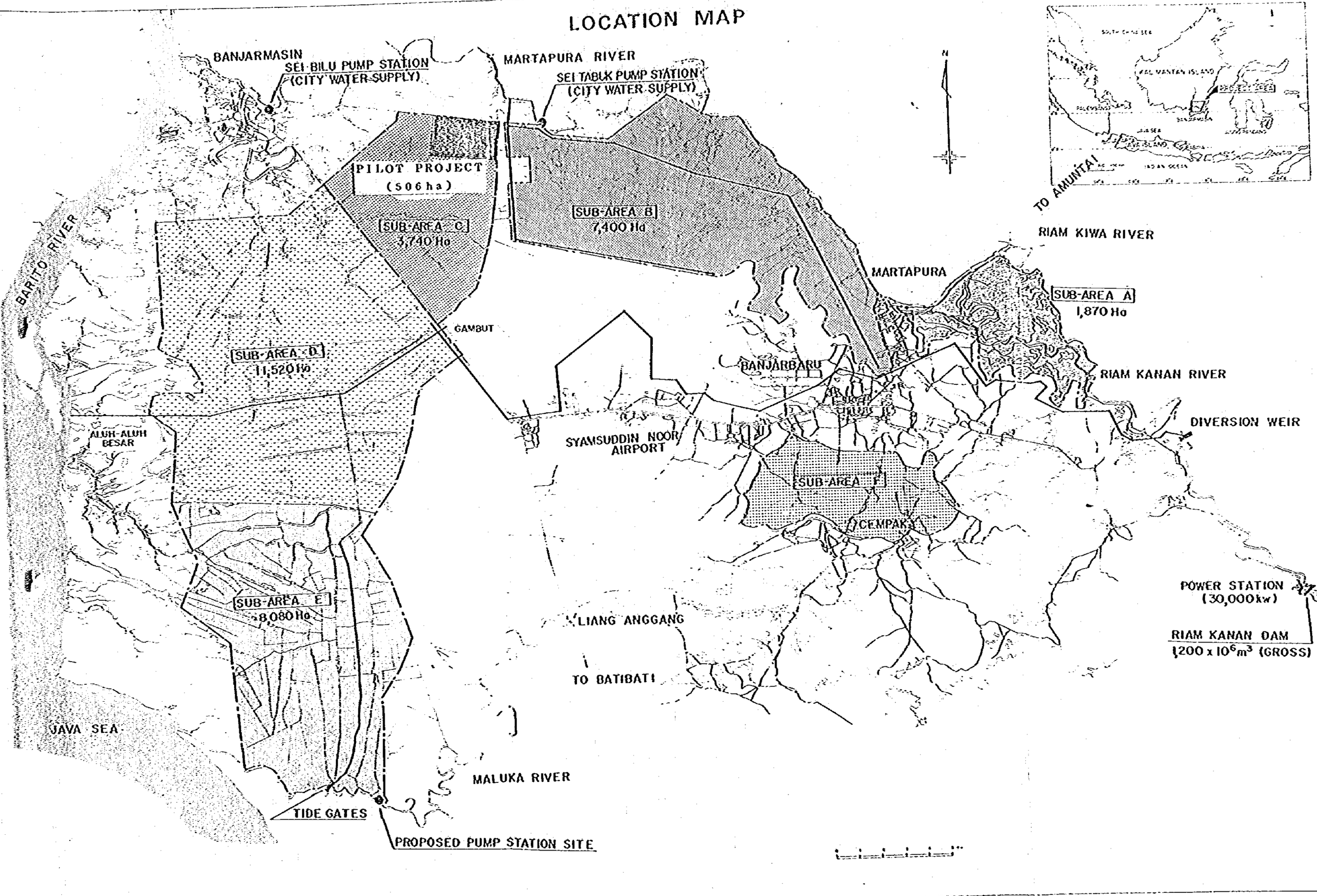
I wish to express my deep appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the team.

October, 1981



Keisuke Arita
President
Japan International Cooperation Agency

LOCATION MAP



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CONCLUSION AND RECOMMENDATION

A. SUMMARY OF CONCLUSION

1. This report presents the results of survey and basic design study on Construction of Pilot Scheme Facilities in Riam Kanan made in accordance with the Summary of Discussions signed between the Directorate General of Water Resources Development, Ministry of Public Works, Government of Indonesia, and the Japan International Cooperation Agency.

2. The objective of the study is to decide the extent of the assistance to be covered by the Grant Aid for the establishment of the Project, through the review and study of the existing detailed design which was prepared by the Government of Indonesia and basic design of the some parts of the Project facilities for which the detailed design has not been completed yet by the Government.

3. The Project area is situated at the northern end of the sub-area C of the Riam Kanan Irrigation Project, around 10 km east from Banjarmasin. Administratively the area belongs to Kota Sungai Tabuk and Kota Gudang Hirang, Kecamatan Sungai Tabuk, Kabupaten Banjar, South Kalimantan. The Project area has 556 ha of gross area, out of which 506 ha are selected as a net irrigation area, and the remaining of 50 ha are to be occupied by residential areas, canals, roads, etc.

4. The Project area extends over the flat alluvial plain developed along the left bank of the Martapura river. The elevation of the Project area ranges from 0m to 1m. The soils in the area are defficient in chemical elements, especially in phosphate and available bases such as Ca, Mg and K, and strong acid in reaction.

5. The climate in the Project area is characterized by the tropical monsoon. The average rainfall is about 2,600 mm/year, but widely varies from year to year ranging between 1,200 mm and 4,300 mm. The monthly mean temperature is about 26°C with little seasonal variation. However daily fluctuation shows a wide range of about 8°C to 12°C. The annual

mean relative humidity is approximately 80% with a seasonal variation of about 10%. The wind velocity is generally low, and no storm damage is expected. The annual evaporation is about 1,370 mm having the daily evaporation of 3.4mm in the rainy season to 4.1mm in the dry season.

6. The amount of water available from the Riam Kanan river to the Martapura river mainly depends on the discharge released from the existing power station. Around 42 m^3/sec of discharge from the power station will be expected including the maintenance flow of 8 m^3/sec for the Martapura river. In addition to this maintenance flow, around 3 m^3/sec of discharge is expected from the Riam Kiwa in the dry season.

7. In the Project area, no technical irrigation system exists at present, except for some canal networks constructed by local people. Paddy rice is the main crop in this area. Monoculture of paddy rice using flood water in the rainy season is predominant throughout the Project area. Paddy seeds are sown during the period from early October to late January. During this period, young seedlings are transplanted two to three times depending on the inundation condition in the fields. The paddy is harvested during the period from early May to late October. The present average yield is estimated to be 1.75 tons/ha of dry paddy.

8. The main concepts of the Project are to provide irrigation and drainage facilities in the Project area with the view of introducing suitable design and construction method to the Riam Kanan Irrigation Project and to establish suitable operation and maintenance and water management on farm level.

9. The basic design of the Project facilities are carried out based on the results of review and study on the existing design made by the Government of Indonesia. In the designing, the boundary of the Project area, location of the pump station, alignment of the pipe-line, location of the farm pond, alignment of drainage canals and alignment for some parts of the farm roads are also taken into consideration as the given

conditions, because preparatory works and the construction of the pump house, drainage canals and their related structures have been done by the Government since 1980.

10. The irrigation system consists of a conducting canal, a pump station with a pipeline, a farm pond, three secondary canals, six tertiary canals and other distributaries with their related structures. Irrigation water will be delivered from the Martapura river to the pump station at Kota Sungai Tabuk by gravity through the 1.4 - km long conducting canal. The water lifted up for 4.3 meters of static head will be carried to the farm pond by the 1.8 - km long pipeline, then, to farm plots by irrigation canals with a total length of around 30 km.

11. The proposed drainage canal system comprises two drainage sluices, two secondary drainage canals, tertiary and quaternary drainage canals. Excess water collected by drainage canals with a total length of 30 km will be drained into the creek located along the northern boundary of the Project area through the drainage sluices to be constructed at the ends of both secondary drainage canals.

12. Other than the irrigation and drainage systems, 12 km of farm roads and some buildings such as a office, a meeting house and a garage will be constructed for the Project.

13. It will require 17 months to complete the Project works after commencement of design works which will take 6 months. All the civil works such as earthworks, masonry works and other structural works should be completed within 6 months of the dry season from May to October. The installation of metal works such as pumps and pipes will be completed after 5 months from the completion of the civil works.

14. The total Project costs required are estimated to be ¥1,049,651,000 (US$4,563,700 equivalent) comprising the Grant Aid portion of ¥760,000,000 (US$3,304,300 equivalent) and the local budget portion of Rp. 787,125,000 (US$1,259,400 equivalent). The main work items to be covered by the Grant Aid are procurement and installation of pump units and ductile cast iron pipes, procurement of construction equipment and construction of irrigation facilities, farm roads and the Project office, while the work items to be covered by the local budget are mainly construction of drainage facilities, a meeting house and garage.

15. The agricultural net incremental benefit through the Project is estimated to be about US$528,000 equivalent per annum at the full development stage.

16. The economic feasibility of the project is evaluated in terms of internal rate of return on the basis of 50-year useful life. The calculated internal rate of return is around 8.5%. This internal rate of return looks rather low as compared with those of usual irrigation projects. The economic viability of the Project will, however, be justified, if the indirect benefits and favourable intangible socio-economic impacts of the Project are taken into consideration.

B. RECOMMENDATION

1. The basic design study for the Project was carried out based on the following topographic maps, some of which have less accuracy;

(1) 1/50,000 scale with 25-m contour interval covering whole project area,

(2) 1/5,000 scale with 1.0-m contour interval covering whole project area, and

(3) 1/1,000 scale with 0.5-m contour interval covering whole project area.

For the successful implementation of the Project, therefore, a supplementary topographic survey is required particularly for the review and study of the existing drainage plan.

2. For the detailed design of the Project facilities, the following survey and investigation are essential;

(1) Preparation of soil profile along the conducting canal and at the suction pit site,

(2) Soil mechanical tests on the samples collected from the proposed borrow pits, and

(3) Observation of tidal fluctuation in the creek which will be used as the main drainage canal for the Project.

3. For the successful achievement of the Project, the land consolidation including the provision of quaternary canals, which will be done by farmers themselves, are quite essential. These works should timely be completed under the guidance of UPP, in accordance with the construction progress of the main Project facilities.

1. INTRODUCTION

1.1 Authority

This Basic Design Study Report on Construction of Pilot Scheme Facilities in Riam Kanan (hereinafter referred to as "the Project") is prepared in accordance with the Summary of Discussions signed between the Directorate General of Water Resources Development, Ministry of Public Works, the Government of Indonesia, and Study Team of Japan International Cooperation Agency for Irrigation Facilities Project on Pilot Scheme in Riam Kanan on September 2, 1981. This report presents the results of field survey and study of the Project.

1.2 Project History

The Government of Indonesia has laid a great emphasis on substantial increases in food production of wide range of crops and promoting transmigration to outer islands in order to relieve population pressure in the densely populated islands, through which the Government intends to raise the production of food stuff and to accelerate a more balanced economic development in the region.

The Riam Kanan Irrigation Project was proposed in the Report on the Barito River Basin Development Plan prepared by Overseas Technical Cooperation Agency (OTCA) in March 1971 as the priority project for agricultural development in South Kalimantan Province, and very preliminary study on the project was made under the said Barito River Basin Development Plan.

The Government of Indonesia requested the Government of Japan to extend technical aid for the feasibility study on the Riam Kanan Irrigation Project, and the Government of Japan decided to take up the feasibility study. Japan International Cooperation Agency was appointed as the executing agency of the Government of Japan, and carried out the feasibility study during a period from July 1978 to September 1979.

In the feasibility report, it was recommended that a pilot demonstration project should be established in the Riam Kanan Irrigation Project area as one of the typical model for the future agricultural development in South Kalimantan.

Following this recommendation, the Government of Indonesia has promoted the Project. Besides, the Government of Indonesia requested the Government of Japan to donate the Grant Aid for the establishment of the Project. The Government of Japan has decided to take up the Grant Aid. In order to decide the extent of assistance to be covered by the Grant Aid, the Basic Design Study Team was despatched to the Project site by the Government of Japan through Japan International Cooperation Agency for 30 days from August 20 to September 18, 1981. During this period, the team had discussions with the Government of Indonesia for the formulation of the Project, and carried out field survey and prerequisite study.

Meanwhile, the Government of Indonesia has started preparatory works and some construction works such as the substructure of pump station and drainage canal, and completed to some extent so far.

1.3 Objective of the Study

The objective of the study is to decide the extent of the assistance to be covered by the Grant Aid for the establishment of the Project, through the review and study of the existing detailed design which was prepared by the Government of Indonesia, and basic design of the some parts of the Project facilities for which the detailed design has not been completed yet by the Government.

1.4 Activities of the Design Study Team

The activities of the Design Study Team broadly consist of field survey and the basic design study of the Project. The field survey includes;

(1) collection of data on hydrology, agronomy, agro-economy, socio-economy, market prices of construction materials, etc. and the previous study and design results,

(2) reconnaissance in the Project area,

(3) topographic survey,

(4) soil mechanical investigation, and

(5) construction material survey.

The basic design study includes;

(1) review and study of the previous study and design,

(2) basic design of the Project facilities,

(3) proposal of O&M organization of the Project,

(4) preparation of construction plan,

(5) construction cost estimates for the Project, and

(6) Project evaluation.

The member of the Design Study Team is listed in Table 1-1.

Table 1-1 JICA Study Team for Irrigation Facilities
Project on Pilot Scheme in Riam Kanan

1.	Leader	Mr. Yukio Kimura Second Economic Cooperation Dept. Economic Cooperation Bureau, Ministry of Foreign Affairs
2.	Irrigation	Mr. Katsunosuke Ueno Regional Planning Div., Planning Dept., Kanto Regional Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries
3.	Project Coordinator	Mr. Katsumi Shiraishi Technical Cooperation Div., Agricultural Development Cooperation Dept., JICA
4.	Irrigation and Drainage	Mr. Syunichi Kikuchi Nippon Koei Co., Ltd.
5.	Facilities Design	Mr. Takaomi Suzuki Nippon Koei Co., Ltd.
6.	Soil Mechanics	Mr. Shigeru Morita Nippon Koei Co., Ltd.

2. GENERAL DESCRIPTION

2.1 Project Area

2.1.1 Location

The Project area is situated at the northern end of the sub-area C of the Riam Kanan Irrigation Project, around 10 km east from Banjarmasin. Administratively the area belongs to Kota Sungai Tabuk and Kota Gudang Hirang, Kecamatan Sungai Tabuk, Kabupaten Banjar, South Kalimantan. The Project area has 556 ha of gross area, out of which 506 ha are selected as a net irrigation area and the remaining of 50 ha are to be occupied by residential areas, canals, roads, etc.

Main transport facilities linking the Project area to prospective market places of Banjarmasin, Banjarbaru and Martapura are roads and navigation in the Martapura river. The national road links Banjarmasin to Amuntai via Banjarbaru and Martapura. This road has double traffic lanes and is well asphalt-paved. An unpaved provincial road runs along the northern boundary of the Project area and connects the Project area to Banjarmasin. The Martapura river is mainly used for the transportation of agricultural products to the said major cities.

2.1.2 Topography and Soils

The Project area extends over the flat alluvial plain developed along the left bank of the Martapura river. The elevation of the Project area ranges from 0 m to 1 m corresponding to 1/8,000 of slope toward the north. Around two-thirds of the area are affected by tidal fluctuation during the period of the spring tide in the rainy season. Furthermore around one-third of the northwestern part of the Project area is inundated for around two weeks even in the neap tide time in the rainy season.

The soils in the Project area are composed of clay to silty clay. They are extremely hard and firmly consolidated in the dry condition, while they become soft and friable in the wet condition. They have a high moisture content capacity and low permeability coefficient. Pedologically, the soils are deficient in chemical elements, especially in phosphate and available bases such as Ca, Mg and K, and strong acid in reaction.

2.1.3 Climate

The climate in the Project area is characterized by the tropical monsoon. The average rainfall is about 2,600 mm/year, but widely varies from year to year ranging between 1,200 mm and 4,300 mm.

About 70% of rainfall occurs in the form of intense local storm during the rainly season which lasts from November to April. In the dry season, particularly during the period of three months from July to September, there are often long spells of draught.

The monthly mean temperature is about 26°C with little seasonal variation. However daily fluctuation shows a wide range of about 8°C to 12°C. The annual mean relative humidity is approximately 80% with a seasonal variation of about 10%. The wind velocity is generally low, and no storm damage is expected. The annual evaporation is about 1,370 mm. The daily evaporation varies from 3.4 mm in the rainy season to 4.1 mm in the dry season.

2.1.4 Hydrology

The irrigation water source for the Project is the Riam Kanan river, though the discharge of the Martapura will temporarily be pumped up for the irrigation before the completion of the canal system for the Riam Kanan Irrigation Project, of which detailed design is going on under the finance of Overseas Economic Cooperation Fund (Japan).

The amount of water available from the Riam Kanan river to the Martapura river mainly depends on the discharge released from the existing power station, and the discharge from the power station varies with the power demand. According to the information from PLN, 42 m^3/sec of discharge from the power station will be expected as the amount of water available for irrigation in the Riam Kanan Irrigation Project and for the maintenance of the Martapura river. For the maintenance of the Martapura river, 8 m^3/sec of mean drought runoff in full 12 years will have to be released from the diversion weir to be constructed for the Riam Kanan Irrigation Project. In addition to the above maintenance flow, around 3 m^3/sec of discharge is expected from the Riam Kiwa in the dry season.

2.1.5 Agriculture

In the Project area, no technical irrigation system exists at present, except for some canal networks constructed by local people.

The average land holding size per farm household is estimated to be 1.0 ha. Around 70% of total farmers are tenants and small owner farmers cum tenants, and the remainings are owner farmers.

Paddy rice is the main crop in this area, and monoculture of paddy rice using flood water in the rainy season is predominant throughout the Project area. Paddy seeds are sown during the period from early October to late January. During this period, young seedlings are transplanted two to three times depending on the inundation conditions in the fields. The paddy is harvested during the period from early May to late October.

No land preparation such as ploughing, harrowing and puddling is usually practiced, and the use of chemical fertilizers and agricultural chemicals is still insignificant in the area.

The food crops other than paddy rice such as maize, cassave, sweet potato and beans are also grown in small areas, and are mostly for home consumption. The present average yield is estimated to be 1.75 tons of dry paddy per hectare, and the annual production of dry paddy in the Project area is around 900 tons.

The agricultural support services such as extension services, research works, seed multiplication and supply, agricultural credits and cooperatives are still ineffective due to insufficient staffing and facilities.

2.2 Outline of the Project

2.2.1 General

The farmers in the Project area are not familiar to irrigation farming of which knowledge would become essential for the proposed agricultural development. In order to attain the projected target of the agricultural development in the area, it is necessary to establish a well-organized water management system other than the farmers' cooperatives and extension services. In this context, it is recommended that the pilot project be established in advance to the completion of the Riam Kanan Irrigation Project, so that the experiences cumulated through the operation of the Project would be applied to the operation of the Riam Kanan Irrigation Project from its start.

2.2.2 Objective of the Project

The Project will be established with the following purposes:

(1) tertiary development through construction of the irrigation and drainage facilities as well as road network, as a model of future development,

(2) organization of the model for water management body in the scheme area,

(3) demonstration of modernized irrigation farming to the farmers on the irrigated condition, and

(4) field experiments on irrigation engineering matters.

In addition to the above direct objectives, it is also expected that suitable on-farm design and construction method to be obtained through the Project would be introduced to the Riam Kanan Irrigation Project.

2.2.3 Principal Features of the Project

The Project area is broadly divided into six blocks; Block A through Block F, taking into account the topography in the area and the practical operation unit for one tertiary canal.

The irrigation system consists of a conducting canal, a pump station with a pipeline, a farm pond, three secondary canals, six tertiary canals and other distributaries with their related structures. Irrigation water will be delivered from the Martapura river to the pump station at Kota Sungai Tabuk by gravity through the 1.4 - km long conducting canal as shown on DWG No.3. The water lifted up for 4.3 meters of static head will be carried to the farm pond by the 1.8 - km long pipeline, then, to farm plots by irrigation canals with a total length of around 30 km.

The proposed drainage canal system comprises two drainage sluices, two secondary drainage canals, tertiary and quaternary drainage canals and related structures. Excess water collected by drainage canals with a total length of 34 km will be drained into the existing creek located along the northern boundary of the Project area through the drainage sluices to be constructed at the ends of both secondary drainage canals (vide DWG. No.4).

For the smooth operation of the Project, a road network is essential. Two secondary farm roads with a total length of 6.7 km will be constructed along the southern boundary of the Project area and across the Project area in the north-south direction as shown on DWG. No.5. Other than the secondary farm roads, around 5.3 km of tertiary farm roads will be required between the secondary farm roads and individual farm plots.

Three types of building are proposed to be provided for the operation and management of the Project. These are the Project office, meeting house and garage. Out of these the meeting house and the garage will be constructed in a compound near the pump station, and the Project office will be placed at Gambut.

Table 2-1 shows the principal features of the Project.

2.2.4 Government's Activities already Taken

Following the recommendation made in the Feasibility Report on the Riam Kanan Irrigation Project prepared by Japan International Cooperation Agency in 1979, the Government of Indonesia has promoted and completed the following works:

(1) Design work;

- pump house
- bridge
- drainage sluice
- drainage canal
- motor pool and garage
- farm road
- farm pond
- pipeline

(2) Construction work;

- access roads
- foundation of pump station
- 11.2 km of drainage canals (under construction)
- garage, 210 m^2
- drainage sluice (under construction)
- bridges (under construction)
- pump house (under construction)

Table 2-1 Principal Feature of the Project

(1) Net Irrigation Area	506 Ha	
(2) Pump Station		
(a) Conducting canal	1,400 m	
Related structure		
- bridge	8 m	1 No.
- intake gate	2 m x 3	1 No.
(b) Pump and engine		
- type	mixed flow volute pump	
- number and capacity	bore ϕ 600 mm ...	2 Nos.
	bore ϕ 300 mm ...	1 No.
- diesel engine	140 Hp	2 Nos.
	20 Hp	1 No.
(c) Pipeline		
- material	ductile cast iron	
- size	ϕ 900 mm	
- length	1,800 m	
(3) Farm Pond		
- size (width x length x depth)	80 m x 80 m x 1.4 m	
- effective storage	8,800 m^3	
(4) Irrigation Canal		
(a) Secondary canal	3.8 km	
(b) Tertiary canal	7.2 km	
(c) Quaternary canal	18.1 km	
(d) Related structure		
- turnout	6 Nos.	
- division box	22 Nos.	
- culvert	4 Nos.	
- bridge	1 No.	
- Parshall flume	2 Nos.	

(5) Drainage Canal

(a)	Secondary drainage canal	2.1 km
(b)	Tertiary drainage canal	9.1 km
(c)	Quaternary drainage canal	18.4 km
(d)	Related structure	
	- drainage sluice	2 Nos.
	- stoplog	6 Nos.
	- water level recorder (on the creek)	4 Nos.

(6) Farm Road

(a)	Secondary farm road	6.7 km
(b)	Tertiary farm road	5.3 km
(c)	Related structure	
	- cross drain	5 Nos.

(7) Building

(a)	Office	150 m^2 (1 No.)
(b)	Meeting house	150 m^2 (1 No.)
(c)	Garage	210 m^2 (1 No.)

3. BASIC DESIGN OF PROJECT FACILITIES

3.1 General

The basic design of the Project facilities are carried out based on the results of review and study on the existing designs made by the Government of Indonesia, and based on the Record of Discussion dated September 16, 1981 as attached in ANNEX I. In designing, the following matters are also taken into consideration as the given conditions, because preparatory works and the construction of the pump house, drainage canals and their related structures have been done by the Government since 1980.

- boundary of the Project area,
- location and dimension of the pump station, and type of pumps,
- alignment of the pipeline,
- location of the farm pond,
- alignment of the drainage canals, and
- alignment of the farm roads.

3.2 Irrigation Facilities

3.2.1 Irrigation Water Requirements

The detailed study on the irrigation water requirements was made for the Riam Kanan Irrigation Project in 1981, and compiled in "Design Note on Irrigation Water Requirement and Design Discharge of Irrigation Canal". According to the calculation in this Note, the peak water requirement at farm head would be 9.5 mm/day for 5-year return period of drought year. Taking the overall efficiency for secondary and tertiary canals to be 76.5% and 90% respectively, the unit design discharge for respective canal is calculated as follows:

- Secondary canal; 1.45 ℓ/sec/ha
- Tertiary canal; 1.24 ℓ/sec/ha

The design discharge at the head of the IS secondary canal is estimated at 0.608 m^3/sec by using the Tegal Curve parameter. Since the daily pump operation hour is determined to be 20 hours in the peak irrigation period considering the maintenance of the pump and engine, the design discharge of the conducting canal, pump equipment and pipeline is as follows:

$$0.608\ m^3/sec \times \frac{24\ hrs}{20\ hrs} = 0.73\ m^3/sec\ (= 44\ m^3/min)$$

3.2.2 Pump Station

(1) Location

The location of pump station was selected at Kota Sungai Tabuk mainly in consideration of the topography and hydrological regime over the Project area.

(2) Pumping Equipment

According to the original design prepared by the Government, the pump station was designed with two units of pump with a bore size of 600 mm each. However, the monthly requirements vary from 0.15 m^3/sec to 0.61 m^3/sec, and the average water requirement in the rainy season is about one-fourth of the peak water requirement. This uneven discharge can not be managed by the abovementioned pump units, and accordingly the combined pump operation with different size of pump unit is required for the proper and economical irrigation practices. In this context, additional installation of a pump unit with a bore size of 300 mm is recommended as mentioned in the Record of Discussion (ANNEX I). As an alternative plan, however, another combination of pump units was studied mainly in terms of initial investment cost. The study results are shown in ANNEX VI.

Both pump units are of horizontal shaft mixed flow volute type, and have a capacity of 44 m^3/min and 9 m^3/min respectively. These pumps will be driven by 4-cycle water cooled diesel engines of 140 HP and 20 HP respectively.

Main features of pumping equipment are summarized below:

	ϕ 600 mm pump	ϕ 300 mm pump
- Total head	7.4 m	4.5 m
- Static head	4.3 m	4.3 m
- Capacity	44 m^3/min	9 m^3/min
- Type of pump	Horizontal shaft mixed flow volute type	
- Bore	ϕ600 mm	ϕ300 mm
- Check valve	ϕ600 mm	ϕ300 mm
- Butterfly valve	ϕ600 mm	ϕ300 mm
- Type of engine	4-cycle water cooled diesel engine	
- Output of engine	140 HP	20 HP
- Nos. of unit	2 Nos.	1 No.
- Other auxiliary equipment	L.S.	L.S.

(3) Pump House and Suction Pit

The pump house is under construction by the Government following its own design, and is expected to be completed by the end of 1981. The pump house has a floor area of 84 m^2, and its elevation is decided at EL.+ 1.5 m taking into account the flood water level of the Martapura river.

The bottom elevation of suction pit is determined to be EL. - 3.5 m so as to lift up the required discharge even at the lowest river water level and to avoid cabitation.

(4) Conducting Canal

In order to deliver irrigation water from the Martapura river to the pump station, a 1.4-km long conducting canal will be constructed. Since the water level in the river would drop down to EL. - 1.45 m at the spring tide in the dry season, the design water surface elevation at the head of the conducting canal is determined at EL. - 1.45 m.

In order to carry the design discharge of 0.73 m^3/sec, the canal section is so designed as to have 0.95 m of water depth, 3.0 m of bottom width, 1:2.5 of a side slope and 1/20,000 of canal gradient.

A intake gate structure will be provided at the head of the conducting canal to check the water flow in the canal during the period of repair and maintenance of the canal. A wooden bridge will also be constructed at the crossing point with the existing creek for the use of operation and maintenance of the conducting canal.

(5) Pipeline

Single pipeline with a length of 1,800 m will be provided along the existing provincial road in order to deliver the pumped water to the farm pond. Considering that the pumps are of horizontal shaft mixed flow volute type, and that the total head is about 8.0 m, the diameter of the pipe is decided at ϕ900 mm as described in the Record of Discussion (ANNEX II). The ductile cast iron pipe is adopted in consideration of the quick performance of installation of pipes, and durability against abrasion and acid.

(6) Outlet Structures

An outlet structure will be provided at the end of the pipeline nearby the farm pond. The outlet of the pipeline is connected to the IS secondary canal. The discharge control from the outlet structure to the IS secondary canal will be made by a Romjin gate. Excess water at the outlet structure will be released to and stored in the farm pond.

(7) Farm Pond

For the 24-hour irrigation, 20-hour pump operation a day is contemplated for the Project. This operation rule requires a storage for 4 hours. Further considering the difficulty of adjusting the pump discharge as per the irrigation requirement at any time, a farm pond will be needed for the system operation.

The necessary storage capacity is calculated to be 8,800 m^3 (peak water requirement x 4 hr). For this required storage capacity, the farm pond is designed to be 80 x 80 x 1.4 m. The earthen bank with a height of 3.0 m will be constructed for the farm pond. The outlet structure of the farm pond will be equipped with a sluice gate, and two sluice for a double-orifice structure.

3.2.3 Irrigation Canal System

(1) Irrigation canal

The irrigation canals to be constructed for the Project consist of secondary, tertiary and quaternary canals. The IS secondary canal starts from the outlet structure of the pipeline. This canal with a design capacity of 0.608 m^3/sec is of wet mesonry trapezoidal section with an inside slope of 1:1.

After crossing the existing provincial road, the IS secondary canal is bifurcated to ILS and IRS secondary canals. The ILS secondary canal runs westward and the IRS secondary canal runs northward along the existing road. These canals have a design discharge of 0.337 m^3/sec and 0.330 m^3/sec respectively. The ILS secondary canal will serve the western part of 256 ha, while the IRS secondary canal will command the eastern part of 250 ha. Both ILS and IRS secondary canals are unlined and have a trapezoidal section with an inside shope of 1:1.

Seven tertiary canals will be constructed to distribute the water to quaternary canals. The commanding area of a tertiary canal ranges from 86 ha to 27 ha.

The canal gradient will be 1/5,000 to 1/8,000 for secondary canals and 1/3,000 to 1/5,000 for tertiary canals, depending upon the topography along the canal. The water velocity in the canal is rather low; less than 0.35 m/sec in almost all cases. The bottom width of the canals

varies from 1.5 m to 0.4 m, and water depth from 1.2 m to 0.3 m. Freeboards are 0.5 m for IS secondary, 0.4 m ILS secondary and 0.3 m for the remaining canals.

General layout of the canals is shown on DWG No.3, and the schematic water distribution diagram is shown on DWG No.6 and 7. The comparison between the original and modified design of irrigation canals is shown in Table 3-1, and dimension table for each canal section is shown in Table 3-2. Total length of respective canals is shown below:

Canal	Length
- Secondary canal - IS (Wet masonry)	0.1 km
- Secondary canals (Unlined)	3.7 km
- Tertiary canals	7.2 km

(2) Related structures

A number of canal structures are required for irrigation system of the Project. The locations of these structures are shown on DWG No. 3. The number of required structures are listed as follows:

Structures	Number
Parshall flume	2
Turnout	6
Division box	22
Culvert	4
Bridge	1

Parshall flume: To distribute irrigation water correctly to respective secondary canal blocks, Parshall flumes will be provided at the heads of IRS and ILS secondary canals.

Turnout: To divert irrigation water from the secondary canals to the tertiary canals, turnouts will be provided. To regulate a discharge, each turnout will be equipped with a steel gate at the front. To secure necessary water level of the secondary canals, check structures will also be provided at downstream points of the turnouts. The water level at the check structures will be controlled by using steel gates.

Division box: Division boxes will be provided on the tertiary canals to divert irrigation water to quaternary canals. The discharge will be regulated by using a steel gate.

Culvert: Culverts will be constructed at the places where the canals cross the roads for traffic.

3.3 Drainage Facilities

(1) Drainage canal

The drainage canal system consists of secondary, tertiary and quaternary canals. Length of each canal is tabulated below.

Canal	Length
- Secondary drainage canal	2.1 km
- Tertiary drainage canal	9.1 km
- Quaternary drainage canal	18.4 km

These canals are of unlined type and were designed based on the unit design drainage requirement of 5.9 ℓ/sec/ha which was estimated using 3-day consecutive rainfall with a 10-year return period.

(2) Related Facilities

To drain the excess water effectively and protect the Project area from the inundation, the following facilities and works will be made.

Drainage sluices: At the terminal points of both DLS and DRS, drainage sluices will be provided to prevent the back-flowing of water from the existing creek to the Project area during a period of the high tidal water level and the flood season.

Water level recorders: In order to establish the proper operation program for the drainage sluice, two water level recorders will be provided at both inlet and outlet at the drainage sluice, respectively.

Enclosure of the Project area: The Project area will be enclosed with the existing provincial roads running along the north and east boundaries of the area and the embankment of the irrigation and the drainage canals to be provided along the south and the west boundaries of the area, to protect the area against the flood from surrounding areas. The height of embankment will be determined taking into consideration the height of the existing roads which have never been submerged by floods. Excess water in the area will be drained through the drainage sluices during a period of the low tidal water level.

The general layout of drainage canal system including the related facilities is shown on DWG No.4, and schematic drainage diagram is presented on DWG Nos. 8 and 9. Table 3-3 shows the typical sections of the canals.

3.4 Farm Road

The farm roads proposed for the Project area consist of secondary and tertiary roads. The existing provincial roads run both along the east and north sides of the Project area. The SFR-2 secondary farm road will be provided along the ILS secondary canal, and connected to both existing provincial roads. Another secondary farm road will run in the north-south direction through the middle of the area and be connected to the existing road.

Both secondary roads will have an effective width of 4 m, and be metalled with gravels. The total length of the roads is about 6.7 km.

Five tertiary roads will be provided for traffic between the secondary road and the terminal. Most of the roads will basically be constructed along the tertiary irrigation canals. The roads have a total width of 3 m of which 2 m are metalled with gravels. The total length of the roads is 5.3 km.

Five cross drains will be provided at the crossing points with roads. The configulation of the roads and their related structures is shown on DWG No.1.

3.5 Buildings

Three types of building i.e. office, meeting house and garage, will be constructed for the operation and management of the Project. The floor area of each building is as follows:

- Office	150 m^2
- Meeting house	150 m^2
- Garage	210 m^2

The office will be constructed at Kota Gambut located 10-km south from the Project area. A meeting house and a garage will be provided at the north-east corner of the Project area; near the pump house.

Table 3-1

Comparison Table for the Design Modification on Irrigation Canal

Original Design			Basic Design		
Canal name	Bottom width and depth (mm)	Gradient	Canal name	Bottom width and depth (mm)	Gradient
Secondary canal					
IS	1,450 x 1,200	1/2,800	IS	1,500 x 1,200	1/8,000
IRS	600 x 900	1/5,700	IRS	800 x 900	1/5,000
ILS	950 x 1,100	1/9,000	ILS	1,000 x 1,200	1/8,000
ILS-1	950 x 1,000	1/9,000	ILS-1	1,000 x 1,100	"
Tertiary canal					
IRTR	500 x 800	1/6,000	IRTR	500 x 800	1/3,000
IRTR 1	500 x 800	"			
IRTR 1-1	450 x 700	"			
IRTR 1-2	450 x 700	"			
IRTL	500 x 800	1/5,000	IRTL	500 x 800	1/3,000
IRTL 1	450 x 800	"			
IRTL 1-1	450 x 700	"			
ILTRS	500 x 800	1/4,000	ILTRS	500 x 800	1/3,000
ILTRS-1	450 x 800	"			
ILTRS 1-1	450 x 700	"			
-	-	-	ILIR.0	400 x 700	1/3,000
IRTR 1	450 x 800	1/6,000	ILTR 1	"	1/2,000
IRTR 1-1	400 x 700	"	-		
ILTC 1	400 x 700	"	ILTC	500 x 800	1/3,000
ILTC 1-1	400 x 700	"	ILTCR	400 x 700	1/2,000
-	-	-	ILTCL	400 x 700	1/3,000
ILTL 1	550 x 900	1/9,000	ILTL	800 x 900	1/5,000
ILTLL 1	500 x 700	"	ILTLL	400 x 700	1/3,000
ILTLL 1-1	500 x 700	"			
ILTLR 1	400 x 700	"	ILTLR	400 x 700	1/3,000

Table 3-2 Dimension Table for Irrigation Canals

Canal	A (ha)	Q (m^3/sec)	Type	B x H (mm)	I	h (m)	V (m/sec)	L (m)
SECONDARY CANAL								
IS	506.0	0.608	-	1,500 x 1,200	1/8,000	0.705	0.326	80
IRS	163.8	0.229	-	800 x 900	1/5.000	0.599	0.273	780
IJS	255.8	0.337	-	1,000 x 1,200	1/8.000	0.759	0.253	2,100
ILS-1	225.3	0.301	-	1,000 x 1,100	"	0.715	0.245	824
TERTIARY CANAL								
IRTR	81.9	0.120	III	500 x 800	1/3.000	0.448	0.282	1,630
IRTL	81.9	0.120	III	"	"	"	"	1.024
ILTR-0	30.5	0.062	II	400 x 700	1/3.000	0.348	0.240	350
ILTR-1	24.3	0.055	II	"	1/2,000	0.295	0.270	130
ILTC	69.6	0.109	III	500 x 800	1/3,000	0.427	0.276	560
ILTCR	27.3	0.059	II	400 x 700	1/2,000	0.305	0.275	351
ILTCL	42.3	0.079	II	400 x 700	1/3,000	0.392	0.255	150
ILTL	131.4	0.194	-	800 x 900	1/5.000	0.550	0.262	822
ILTLL	44.4	0.081	II	400 x 700	1/3.000	0.397	0.256	470
ILTLR	46.0	0.083	II	"	"	0.402	0.258	955
ILTRS	86.4	0.125	III	500 x 800	"	0.458	0.285	900

Table 3-3 Dimension Table for Drainage Canals

Canal	A (ha)	Q (m^3/S)	V (m/S)	d (m)	b (m)	1:m	1:n	k	I	L (m)
SECONDARY CANAL										
D R S G 1.	260.60	1.538	0.55	0.43	6.10	1:1	1:1	0.030	1/8,000	80
D R S.	196.70	1.161	0.50	0.40	5.40	1:1	1:1	0.030	1/8,000	440
D R S.	186.00	1.098	0.50	0.40	5.40	1:1	1:1	0.030	1/8,000	190
D R S 1.	186.00	1.097	0.50	0.40	5.10	1:1	1:1	0.030	1/8,000	613
D L S G 2.	266.40	1.572	0.55	0.43	6.20	1:1	1:1	0.030	1/8,000	65
D L S.	176.90	1.044	0.50	0.40	4.80	1:1	1:1	0.030	1/8,000	250
D L S.	160.40	0.947	0.50	0.40	4.80	1:1	1:1	0.030	1/8,000	300
D L S.	144.80	0.855	0.50	0.40	4.80	1:1	1:1	0.030	1/8,000	134
TERTIARY CANAL										
D R T R 1.	41.40	0.244	0.33	0.40	1.45	1:1	1:1	0.030	1/2,500	200
D R T R 1.	23.65	0.140	0.28	0.40	0.85	1:1	1:1	0.030	1/2,500	670
D R T L 1.	74.40	0.439	0.43	0.40	2.15	1:1	1:1	0.030	1/6,000	375
D R T L 1-1.	58.00	0.342	0.38	0.40	1.85	1:1	1:1	0.030	1/6,000	220
D R T L 1-2.	34.50	0.204	0.32	0.40	1.20	1:1	1:1	0.030	1/6,000	370
D R T L 1-3.	14.90	0.088	0.28	0.40	0.40	1:1	1:1	0.030	1/6,000	420
D R T L 2.	100.90	0.595	0.48	0.40	2.70	1:1	1:1	0.030	1/7,500	587
D R T L 2-1	778.00	0.460	0.43	0.40	2.30	1:1	1:1	0.030	1/7,500	410
D R T L 2-2	58.50	0.345	0.37	0.40	1.95	1:1	1:1	0.030	1/7,500	370
D R T L 2-3	30.90	0.182	0.33	0.40	1.00	1:1	1:1	0.030	1/7,500	500
D L T R 1.	68.00	0.401	0.40	0.40	2.10	1:1	1:1	0.030	1/5,500	282
D L T R 1-1.	58.04	0.342	0.37	0.40	2.10	1:1	1:1	0.030	1/5,500	310
D L T R 1-1.	58.04	0.342	0.37	0.40	1.95	1:1	1:1	0.030	1/5,500	461
D L T R 1-2.	36.50	0.215	0.32	0.40	1.30	1:1	1:1	0.030	1/5,500	587
D L T R 2.	50.60	0.299	0.35	0.50	1.25	1:1	1:1	0.030	1/5,000	600
D L T R 2-1.	34.00	0.201	0.34	0.50	0.70	1:1	1:1	0.030	1/5,000	313
D L T R 2-2.	18.70	0.201	0.28	0.50	0.30	1:1	1:1	0.030	1/5,000	309
D L T L.	94.20	0.556	0.46	0.40	2.65	1:1	1:1	0.030	1/7,000	-
D L T L 1.	86.30	0.509	0.46	0.40	2.65	1:1	1:1	0.030	1/7,000	310
D L T L 1-1.	70.80	0.418	0.46	0.40	2.65	1:1	1:1	0.030	1/7,000	307
D L T L 1-2.	54.50	0.322	0.37	0.40	1.80	1:1	1:1	0.030	1/7,000	834
D L T L 1-3.	38.50	0.227	0.32	0.40	1.40	1:1	1:1	0.030	1/7,000	315
D L T L 1-4.	23.50	0.138	0.29	0.40	0.80	1:1	1:1	0.030	1/7,000	364

4. CONSTRUCTION PLAN

4.1 General

The construction of the Project facilities is splitted into two categories. One is the construction to be completed in the local budget of the Ministry of Public Works, and another is the construction to be implemented by the Grant Aid of the Government of Japan. The major construction works are listed below;

(1) Grant Aid portion

a) Conducting canal and related structures

b) Inlet structure of pump station

c) Supply and installation of pumps and accessories

d) Outlet pipeline

e) Farm pond

f) Irrigation canals and related structures

g) Farm roads and related structures

h) Water level recorders and stoplogs for drainage canal

i) Project office

(2) Local budget portion

a) Access roads including maintenance

b) Garage and meeting house

c) Pump house

d) Drainage canals and related structures

e) Other miscellaneous works

The construction works of the Grant Aid portion and the major works of the local budget portion shall be carried out on contract basis.

Details of work items and their quantities are shown in ANNEX V.

4.2 Construction Materials and Method

4.2.1 Construction Materials

(1) Borrow pit

Since excavation volume of the farm pond and irrigation canals is negligible small, the most of embankment materials required for the construction of the farm pond, irrigation canals and roads; about 74,000 m^3, will be obtained from 3 places of proposed borrow pits. One of them is located adjacent to the site, and the other two are located about 5 km and 25 km away from the Project site.

(2) Quarry site

Materials such as coarse aggregates for concrete, gravels for metalling and stones for masonry works are available in the Riam Kanan River near Awangbangkal situated in the distance of approximately 60 km from the Project site. Fine aggregates for concrete can be obtained in the Riam Kiwa River near Astambul situated in the distance of about 50 km from the Project site.

(3) Metal works

A fabrication of pipes and the accessories, and a manufacturing of pumps, engines and the accessories will be carried out in a foreign country.

4.2.2 Construction Method

(1) Earthworks

Earthworks for the farm pond, irrigation canals and roads have to be completed within six months of the dry season from May to October so as to meet effective performance and proper quality control. Taking the above requirement into consideration, most of the earthworks will be carried out by equipment. Embankment materials for irrigation canals and farm roads will be transported from borrow pits, but there is no road available for transporting embankment materials in the

Project area. Therefore, the road network will be constructed prior to the construction of irrigation canals.

(2) Structures

Masonry works will be applied for the major structures on irrigation canals. The construction of suction pit of the pump station is the most laborious work in the Project works, since foundation piles should be driven and concrete should be placed at 4 m below mean sea level. A temporary sheathing by sheet pile with dewatering will be essencial.

4.3 Implementation Schedule

It requires 17 months to complete the Project works after commencement of design works. The implementation schedule of the Project is shown on Fig. 4-1.

The design engineer will be assigned 6 months before the commencement of the construction works of the Grant Aid portion for the following works:

(a) Detail design and preparation of tender documents,

(b) Tender calling and awarding, and

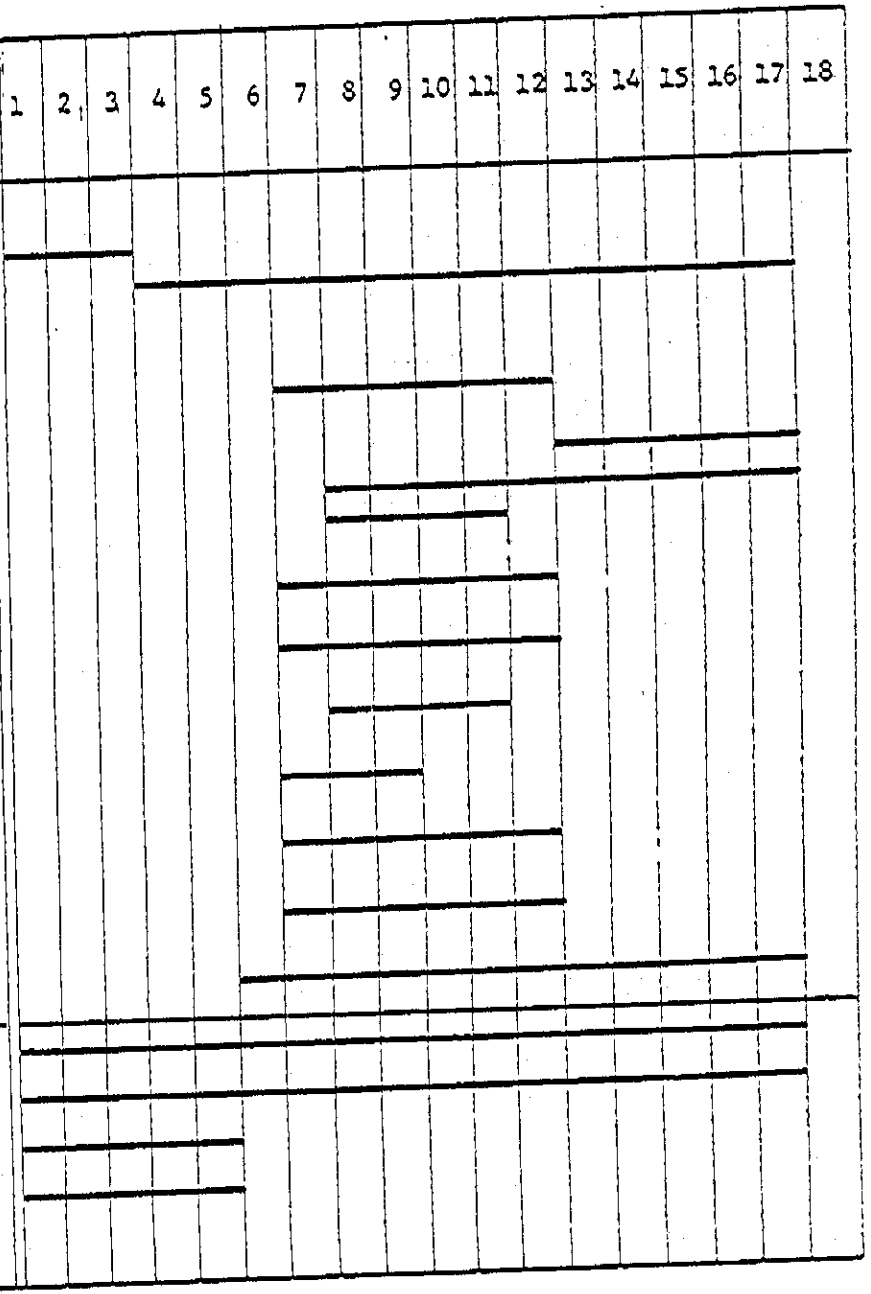
(c) Coordination of the construction works of the Grant Aid portion and of the local budget portion.

The construction works of the Grant Aid portion will be started at the beginning of dry season and completed within a year. All the civil works such as earthworks, masonry works and other structural works should be completed within 6 months of the dry season from May to October. Manufacturing and transportation of pumps and pipes will take six months, and the installation of these metal works will be completed after 5 months from the completion of the civil works.

In the works of the local budget portion, construction of the pump house will be completed before the start of installation of pumps. The other works will be completed simultaneously with the works of the Grant Aid portion.

Fig. 4-1 Implementation Schedule

Source of Revenue	Work Item	Work Quantity
The Government of Japan	1.Engineer Service	
	a.Design & Tender Document	
	b.Construction Supervision	
	2.Construction Works	
	a.Conducting Canal & Inlet St.	L= 1.4Km
	b.Pump Installation	3 Nos.
	c.Pipeline	L= 1.8 Km
	d.Farm Pond	
	e.Irr. Canal & Related St.	
	Secondary Irr. Canal	L= 3.8 Km
	Tertiary Irr. Canal	L= 7.2 Km
	Related Structure	34 Nos.
	f.Drainage Structure	4 Nos.
	Water Level Recorder	
	g.Farm Road	
	Secondary Farm Road	L= 6.7 Km
	Tertiary Farm Road	L= 5.3 Km
	h.Office	A= 150 m²
The Government of Indonesia	1.Maintenance of Access Road	----
	2.Motorpool & Office	----
	3.Pump House	----
	4.Drainage Canal (Sec.&Ter.)	L= 11.2 Km



5. ORGANIZATION AND MANAGEMENT

5.1 Organization for the Project Implementation

The Project implementation is being conducted by the Office of Riam Kanan Irrigation Project under the Provincial Department of Public Works, South Kalimantan. Major functions of the Office of Riam Kanan Irrigation Project with regard to the Project construction are as follows;

a) final arrangement required for construction of the Project facilities,

b) design and construction supervision of all the construction activities down to tertiary system,

c) assistance to farmers in construction of quaternary system,

d) collecting and analyzing the necessary data with regards to the construction of the Project for the implementation of the Riam Kanan Irrigation Project, and

e) accounting and managing of construction works.

The organization of the Office of Riam Kanan Irrigation Project is shown on Fig. 5-1.

5.2 Organization for O&M of the Project

After completion of the Project construction works, a operation and maintenance office is to be established so as to attain the objectives of the Project through proper and efficient operation and management of the Project. After implementation of the Riam Kanan Irrigation Project, the O&M office of the Project will be included in the O&M System of the Riam Kanan Irrigation Project, as shown on Fig. 5-2, as one of field posts.

The O&M office of the Project to be established under the Office of the Riam Kanan Irrigation Project comprises one superintendent, and administrative and technical sections. The administrative section is responsible for accounting and financing, personnel and general affairs and operation and maintenance of vehicles and equipment. The technical section is responsible for the operation and maintenance of the Project facilities as described below;

a) collection of information of cropping schedule from farmer's association and establishment of the water supply schedule,

b) to convince the water supply schedule to farmer's association,

c) operation of the pumps and the farm pond in accordance with the water supply schedule,

d) operation and maintenance of the other Project facilities, and

e) providing periodical guidance to farmer's association in operation and maintenance of tertiary canals down to terminal facilities.

The staff required for the O&M office is 19 persons while the irrigation water is being supplied by the pumps and 12 persons after completion of the Riam Kanan Irrigation Project. The detail of the required staff is shown in Table 5-1.

5.3 Farmer's Association

In order to operate and maintein the Project facilities down from the tertiary turnout and to coordinate a rotational irrigation, farmer's association will be established under the initiation of each village chief, Camat and Bupati, with strong guidance of and consultation with the O&M office as proposed for the Riam Kanan Irrigation Project. The typical organization chart of farmer's association is shown on Fig. 5-3.

The Kabupaten Committee is the advisory and/or supervisor group for operation and management of the farmer's association. Bupati would be the chairman of this committee, who would be responsible to manage the followings:

a) to solve the problems encountered and make the policy for irrigation, and

b) to take care of cooperation between the Kecamatan and/or villages.

The Kecamatan Committee to be headed by Camat would be also the supervisor group. Camat will assist Bupati in supervision,and would be responsible for the followings:

a) to coordinate with Bupati for supervision and to secure Bupati's policy to prevent it from any deviation,

b) to activate the farmers for supporting regular repair and maintenance of the tertiary and quaternary canals, and

c) to support the relationship between the village within the commanding area.

Kepala Desa (village chief) would manage village committee and would have a duty to supervise and execute Bupati's policy on the implementation of proper water management at village level.

A farmer's association would be established in one Desa. The Board of farmer's association envisaged would consist of (i) Water Distributer, (ii) Secretary and Treasury and (iii) Contact Farmers in section.

The Water Distributer Section would have the following functions:

a) to discuss and consult with the contact farmers for deciding annual water supply schedule,

b) to assist the PPL in introducing the new irrigation farming technic and practices,

c) to plan and execute the repair and maintenance schedule on the facilities within the commanding area in cooperation with the contact farmers and farmers,

d) to cooperate with the O&M outpost of the Project office for emergency repair of the facilities under the control of the O&M outpost,

e) to inspect the use of irrigation water by the farmers, and

f) to contact and record actual irrigated lands to be reported by the contact farmers.

The Secretary and Treasury Section would be responsible for the followings:

a) to make financial administration, and

b) to arrange O&M contribution from farmers through the contact farmers.

The Contact Farmers group would have the following functions:

a) to register the farmers who will require water supply and to inform these aspects to the Water Distributer Section,

b) to make sure that all farmers in the area have been informed the days of water supply,

c) to organize and supervise the members on irrigation practices making some corrections, if necessary, and

d) to arrange the operation and maintenance contribution from farmers to be delivered to the Treasure.

Table 5-1. Required Staffs for O&M Office

(Unit: Person)

	Pump Irrigation Stage	Riam Kanan Irrigation Stage
Superintendent	1	1
Administrative Section		
Clerk cum Typist	1	1
Store Keeper	2	1
Mechanic	1	0
Operator	3	1
Driver	2	2
Watchman	2	2
Technical Section		
Irrigation Engineer	1	1
Pump Operator	3	0
Ditch Tender	3	3
Total	19	12

Fig. 5-1 Organization Chart for Project Implementation

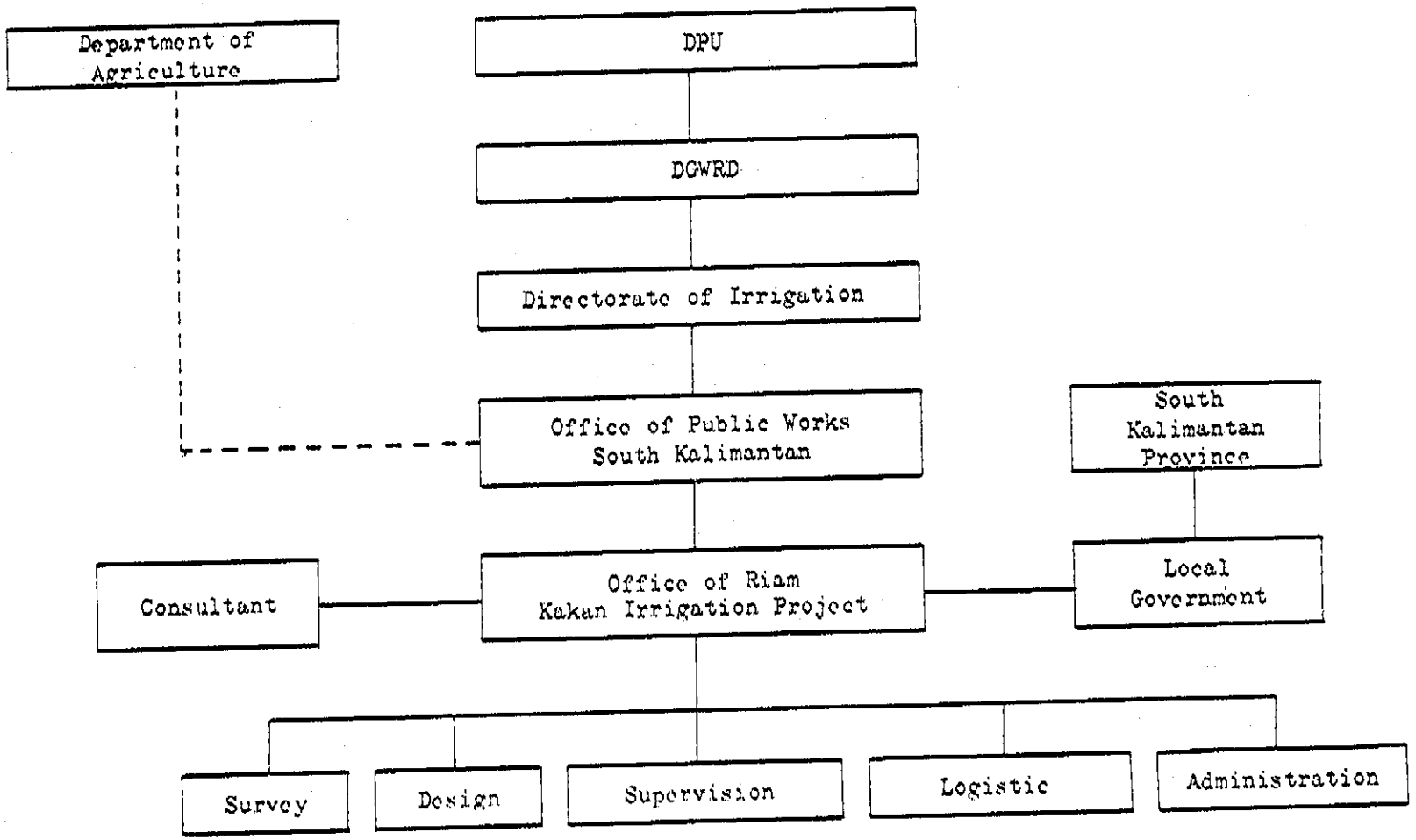


Fig. 5-2 Organization for O&M of the Project

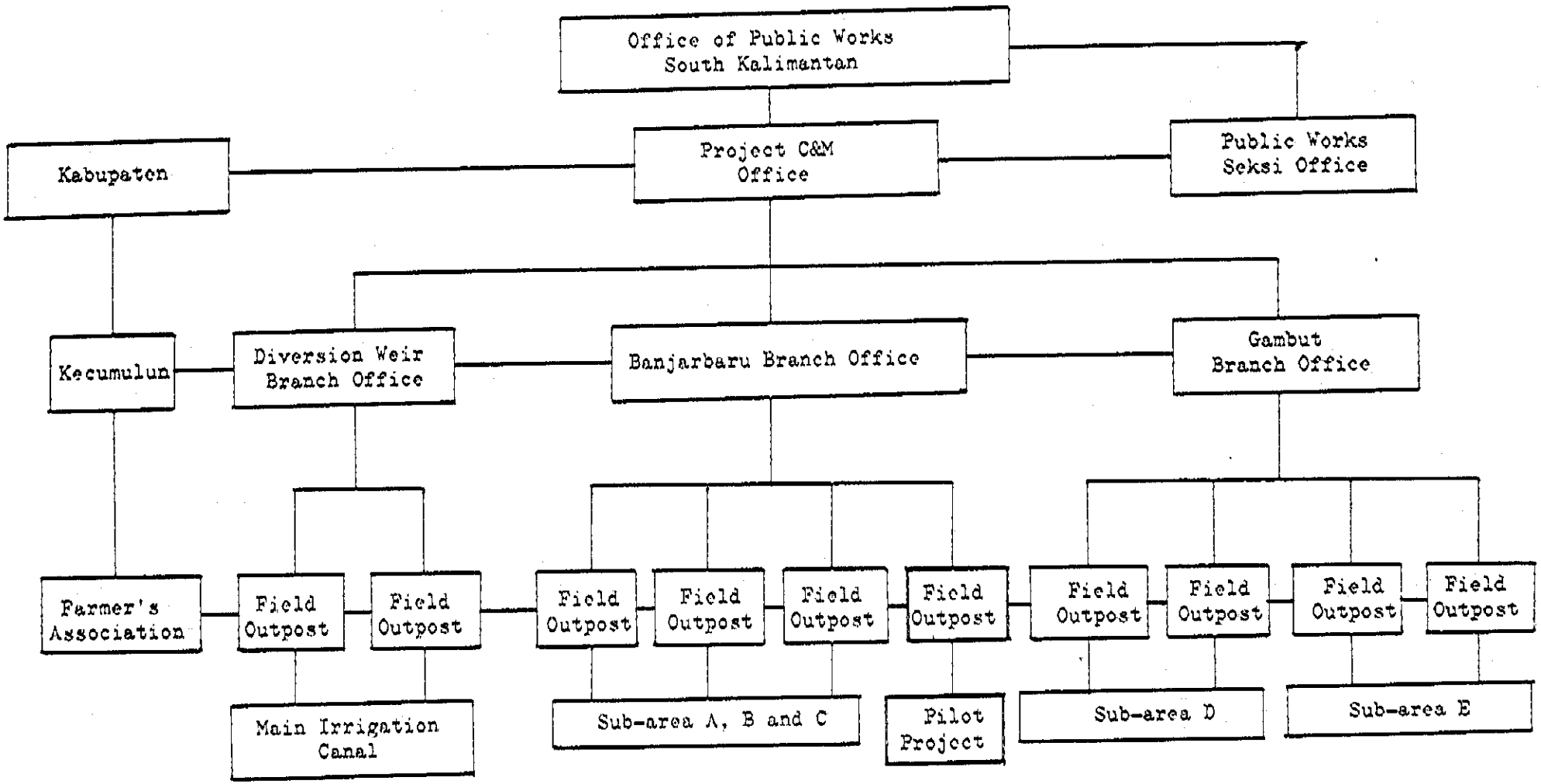
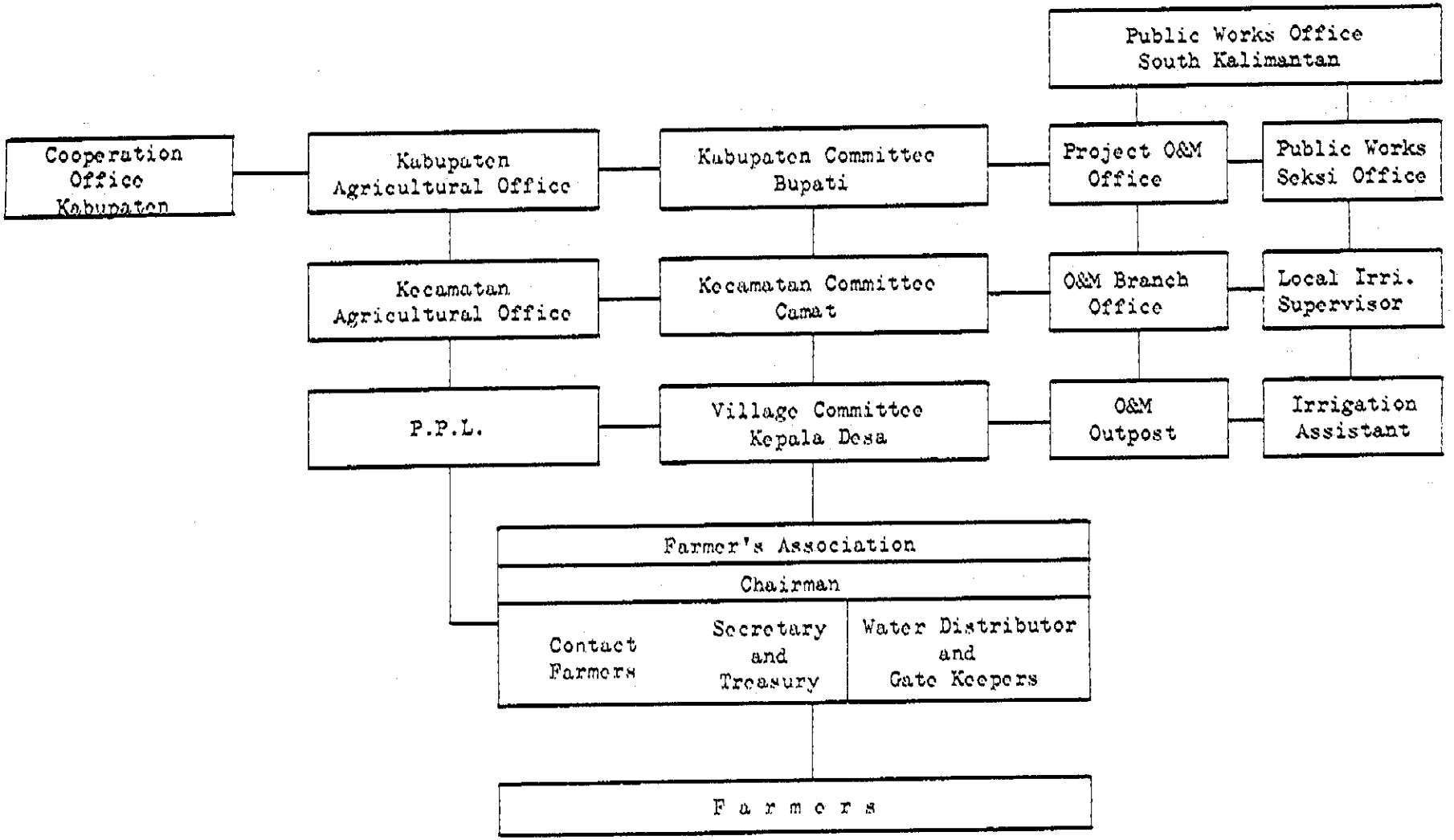


Fig. 5-3 Organization Chart for Farmer's Association



6. COST ESTIMATE

6.1 General

The construction cost is estimated on the basis of the following conditions;

a) The conversion rate used in the estimate is;

Rp 625 = US$1.0 = ¥230

b) All of the construction works of the Grant Aid portion and the local budget portion are to be executed on full contract basis. The machinery and equipment required for the construction works will be provided by the contractors themselves.

c) The construction cost for quaternary canals which would be constructed by the farmers themselves is not included in the estimate.

d) Duties and taxes for the materials and equipment to be imported and the foreign personnel for engineering services are to be exempted and not included in the estimate.

e) Basic unit prices of labour and materials applied are determined referring to the unit prices of the South Kalimantan Province prepared by the Ministry of Public Works and the unit prices in similar projects in Indonesia as of the fiscal year 1981/82.

f) The physical contingencies of 6.0% for the Grant Aid portion and 10% for the local budget portion is included in the estimate. The price contingency, 6.4%, is included for the Grant Aid portion.

6.2 Construction Cost

Unit rate of each work item is estimated based on the basic unit prices of labour and materials and depreciation and operation costs of equipment.

The construction cost is estimated separately for the works of the Grand Aid portion and the local portion on the basis of work quantity calculated based on the preliminary design and the unit rates. The total construction cost of the Project amounts to US$1,563,700 equivalent

comprising the Grant Aid portion; US$3,304,300, and the local budget portion; US$1,259,400. Since the preparatory works and some of the construction works of the local budget portion were commenced in 1980, the amount of US$641,900, about 50% of the total local budget portion, will be consumed by the end of March 1981. The summary of the construction cost of the Project is shown in Table 6-1.

The detail breakdowns of the work quantities, the unit costs and the construction cost are shown in ANNEX V.

The following construction equipment for the construction of quaternary canals shall be purchased under the Grant Aid;

a) Swamp Dozer (7 ton) ..... 1 No

b) Super Swamp Backhoe (0.3 m^3) ..... 2 Nos

c) Vibrating Roller ..... 2 Nos

d) Dump Truck ..... 1 No

e) Spare Parts ..... One lot

The procurement cost of the above equipment is estimated at US$152,100.

Annual disbursement schedule of the Project cost is as follows;

Year	Local Budget Portion	Grant Air Portion	Total
1980/81	270.9	0	270.9
1981/82	371.0	1,342.1	1,713.1
1982/83	617.5	1,962.2	2,579.7
Total	1,259.4	3,304.3	4,563.7

Itemized disbursement schedule is shown in Table 6-2.

6.3 Operation and Maintenance Costs

Operation and maintenance costs comprise personal expenditures, energy cost of pump, O&M cost for vehicles and equipment, and expenditures for maintenance and repairing of the Project facilities, etc. The O&M costs of the Project are estimated for two cases, i.e. the pump irrigation case before the completion of the Riam Kanan Irrigation Project, and the gravity irrigation case after the completion of the said Riam Kanan Irrigation Project.

The approximate operation and maintenance costs of the Project are estimated as follows;

Water Source	Annual Total (10^3 US$)	Annual Per Ha ($/Ha)
Pump	53.1	105
Gravity	29.8	59

The detail of O&M cost estimate is shown in ANNEX V.

Table 6-1 Summary of the Construction Cost of the Project

	Item	Local budget portion	Grant Aid portion	Total
(1)	Preparatory works	Rp. 21,562,500	¥ 0	¥ 7,935,000
(2)	Civil works	433,250,000	573,321,000	732,757,000
(3)	Land acquisition	115,062,500	0	42,343,000
(4)	Engineering services	0	80,500,000	80,500,000
(5)	Equipment	6,250,000	34,983,000	37,283,000
(6)	Administration	175,937,500	0	64,745,000
(7)	Contingencies	35,062,500	71,185,000	84,088,000
	Total	787,125,000	759,989,000	1,049,651,000
		US$(1,259,400)	US$(3,304,300)	US$(4,563,700)

Table 6-2 Annual Disburcement of Financial Cost

(US$1,000)

	Total cost			1980/1981			1981/1982			1982/1983		
	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C
1. Base cost	3,848.1	1,203.3	2,744.8	270.9	270.9	-	1,573.1	371.0	1,202.1	2,004.1	561.4	1,442.7
2. Engineering service	350.0	-	350.0	-	-	-	140.0	-	140.0	210.0	-	210.0
3. Contingency	365.6	56.1	309.5	-	-	-	-	-	-	365.6	56.1	309.5
Total	4,563.7	1,259.4	3,304.3	270.9	270.9	-	1,713.1	371.0	1,342.1	2,579.7	617.5	1,962.2

7. PROJECT EVALUATION

7.1 Economic Evaluation

7.1.1 General

In order to ascertain the Project viability, the economic feasibility of the Project is evaluated in terms of internal rate of return (IRR). In the calculation of IRR, the economic cost is estimated based on the study results in Chapter 6 hereof. The Project benefit is estimated referring to the study results in the Feasibility Report on the Riam Kanan Irrigation Project.

7.1.2 Economic Cost

The economic cost for the implementation of the Project includes costs for (1) preparatory works, (2) construction of project facilities, (3) procurement of O & M equipment (first procurement only), (4) engineering services, (5) physical contingency and (6) sunk cost already paid by the Government of Indonesia in 1980/81. In addition to the above costs, the construction cost for the on-farm development works, which will be constructed by farmers themselves, are also counted in the evaluation. This cost is estimated to be Rp 1,312,500 equivalent to US$2,100 applying the opportunity cost for labor of 300 Rp/day/laborer.

The annual disbursement of the economic cost is summarized as follows (for detail, vide Table 7-1):

1980	227.6	x	10^3	US$
1981	1,674.7		"	
1982	2,409.6		"	
Total	4,311.9	x	10^3	US$

7.1.3 Annual Operation and Maintenance Costs

All the O & M costs estimated in Chapter 6 hereof are taken into account in the evaluation.

7.1.4 Replacement Costs

Some of the facilities have shorter useful life than the civil works, and require replacement at a certain time within the Project useful life. The following table shows the replacement costs and the useful lives of these facilities:

Items	Useful life (years)	Replacement cost (US$)
1. Generator for office use	5	19,130
2. Wooden houses	25	195,000
3. Wooden bridges	10	53,040

7.1.5 Project Benefit

The agricultural benefit through the Project is estimated for the cases of "with Project" and "without Project" to know the net incremental benefit in the full operation stage of the Project. The benefit will come out after completion of the total construction works. The full benefit will be attained during the build-up period of seven years. The following table summarizes the increase of annual net incremental benefit upto the full development stage (for the details, vide Table 7-2 through 7-6).

	Annual net incremental benefit (US$)
1983	-17,804
1984	172,499
1985	237,825
1986	701,301
1987	382,689
1988	455,841
1989	498,753
1990	528,129

In addition to the above, the salvage value of the irrigation pumps, which will not be used and displaced after the completion of irrigation facilities under the Riam Kanan Irrigation Project, is counted as the Project benefit in 1986.

7.1.6 Evaluation

For the economic evaluation of the Project, the cost and benefit stream is firstly prepared as shown in Table 7-7, then, IRR is calculated. The calculated IRR is around 8.5%. This IRR looks rather low as compared with those of usual irrigation projects. The economic viability of the Project will, however, be justified, if the belowmentioned indirect benefits and socio-economic impacts are taken into consideration.

7.2 Indirect Benefits and Socio-Economic Impacts

In addition to the direct benefit stipulated in the economic evaluation, substantial secondary direct benefits steming from the project outputs and induced by project inputs and favourable intangible socio-economic impacts are expected from the implementation of the Project.

7.2.1 Introduction of Advanced Irrigation Technics to the Other Projects

Through the operation of the Project, the experiences on the water management will much be cumulated and employed in the other projects in South Kalimantan. In addition to the above benefit, it is also expected that the suitable design and construction method will be obtained and introduced not only to the Riam Kanan Irrigation Project but also to the other projects. This will result in economical implementation of the projects.

7.2.2 Increase of Employment Opportunity to Local People

Employment opportunity to the local people will be increased by the Project implementation, and a fabourable impact will be given to the regional economy. Furthermore, the employee will be able to gain more experience, technical know-how, skillfulness in the various working fields. These accumulations would be applied to the future development in the region.

7.2.3 Improvement of Local Transportation

The local transportation will be improved much by the construction of the operation and maintenance roads along the irrigation canals. The extended road system will enhance the economic activity in and around the Project area.

7.2.4 Improvement of Environmental Sanitation

The construction of the Project works would have a possitive effect on the overall ecology of the Project area. The health and sanitary conditions would become better with drainage improvement as well as fresh water through the irrigation canals.

Table 7-1 Annual Disbursement of Economic Cost

(US$1,000)

	Total	1980/1981	1981/1982	1982/1983
1 Base cost	3,755.8	227.6	1,534.7	1,993.5
2 Engineering service	350.0	-	140.0	210.0
3 Contingency	206.1	-	-	206.1
Total	4,311.9	227.6	1,674.7	2,409.6

Table 7-2 Projected Increase in Yield of Paddy under the Project

Condition[1]	Weight (%)		Initial Year[2]	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
1. Level-up of farmers' cultivation technics	65	Projected progress of development (%)	30	45	55	60	65	75	85	100
		Effect on crop production (%)	19.5	29.3	35.8	39.0	42.3	48.8	55.3	65.0
2. Level-up of operation technics of on-farm facilities	30	Projected progress of development (%)	0	30	45	55	70	100		
		Effect on crop production (%)	0	9.0	13.5	16.5	21.0	30.0		
3. Stabilization of soil and land conditions	5	Projected progress of development (%)	0	30	60	100				
		Effect on crop production (%)	0	1.5	3.0	5.0				
Total		Integrated effect on crop production increase	19.5	39.8	52.3	60.5	68.3	83.8	90.3	100.0

/1: This shows the conditions to be improved under the Project which would affect the increase of crop production.

/2: Cultivation of paddy under the Project is commenced at the end of initial year.

Table 7-3 Increase in the Unit Yield of Paddy

	Build-up Period (year)						
	1st	2nd	3rd	4th	5th	6th	7th
A. Projected progress of increase to target yield (%) /1	39.8	52.3	60.5	68.3	83.8	90.3	
B. Target yield with the Project							
Dry season paddy (ton/ha)	4.5	4.5	4.5	4.5	4.5	4.5	
Rainy season paddy (ton/ha)	4.0	4.0	4.0	4.0	4.0	4.0	
C. Anticipated unit yield without the Project (ton/ha) /2	1.75	1.75	1.80	1.80	1.90	1.90	
D. Anticipated yield (B - C) x A + C							
Dry season paddy (ton/ha)	2.8	3.2	3.4	3.6	4.1	4.2	
Rainy season paddy (ton/ha)	2.6	2.9	3.1	3.3	3.7	3.8	

/1: See Table 7-2

/2: The anticipated unit yield of paddy rice without the Project is expected to increase by efforts which will be made under the Pelita III and BIMAS/INMAS Programs. Considering the prevailing constraints in the project area, the expected yield increase would be very small under the condition without the Project.

Table 7-4 Economic Price of Dry Paddy

		/1
1.	International market price (F.O.B. Bangkok)	Rp.256,250/ton (US$410/ton)
2.	Transportation cost	
	Bangkok to Surabaya	Rp.8,100
	Surabaya to Banjarmasin	Rp.10,650
3.	Port handling charge and warehouse cost	Rp.5,000
4.	Transportation cost including handling charge	
	Banjarmasin to Banjar	Rp.2,300
5.	Selling price of rice at ex-mill gate	Rp.282,300
6.	Selling price of dry paddy (value of 1-ton day paddy) Rp.282,300 x 0.68	Rp.191,960
7.	Milling charge	-Rp.12,000
8.	Handling and transportation cost	
	Farm gate to mill	-Rp.450
9.	Economic farm gate price of dry paddy	Rp.179,510 : Rp.180,000

/1: Projected price for 1980 to 1905 in 1978 constant US Dollars.

US$1 = Rp.625

Table 7-5 Economic Production Cost for One Crop
Paddy Production per Ha

Future With-Project

Seeds	25 kg x Rp.235/kg	5,875
Fertilizers		
Urea	250 kg x Rp.156/kg	39,000
T.S.P.	100 kg x Rp 143/kg	14,300
KCL	60 kg x Rp.93/kg	5,580
Agro-Chemicals		
Insecticide	4 lit. x Rp.1,350/lit.	5,400
Fungicide	2 lit. x Rp.1,350/lit.	2,700
Rodenticide	0.2 kg x Rp.3,450/kg	690
Equipment		
Rotary weeder	2 sets	3,900
Threadle thresher	1 set	12,200
Winnower	1 "	2,450
Knap-sac type mist duster	1 "	36,560
Labour		
Rasing of seedling	30 man-day x 750 Rp/man-day	22,500
Field preparation	50 " x 520 "	26,000
Transplanting	50 " x 750 "	37,500
Weeding	55 " x 450 "	24,750
Fertilizing & spraying	24 " x 300 "	7,200
Water management	6 " x 300 "	1,800
Harvesting	30 " x 750 "	22,500
Threshing, drying & transportation	15 " x 450 "	6,750
Miscellaneous		27,345
	Total:	305,000

... to be continued

Future Without-Project

Seeds	10 kg x 150 Rp/man-day	1,500
Labour		
Preparation of seedling	8 man-day x 750 Rp/man-day	6,000
Field preparation	35 " x 520 "	18,200
Transplanting	35 " x 750 "	26,250
Weeding	20 " x 450 "	9,000
Harvesting	35 " x 750 "	26,250
Threshing, drying & transportation	15 " x 450 "	6,750
Miscellaneous		9,050
	Total:	103,000

Economic Prices of Farm Products and Inputs

Item	Unit Price (Rp./kg or lit.)
Rice	282
Dry paddy	180
Seed (Dry paddy)	235
Urea	156
T.S.P.	143
KCL	93
Insecticide	1,350
Fungicide	1,350
Rodenticide	3,450

Table 7-6 Paddy Gross Production Value, Production Cost and Incremental Future with and without Project

	Future without project condition		Future with project condition		Production increment	Future without project condition			Future with project condition			Increment	
	Cropped area (ha)	Production (ton)	Cropped area (ha)	Production (ton)	(ton)	G.P.V. (RP10^3)	P.C. (RP10^3)	N.P.V. (RP10^3)	G.P.V. (RP10^3)	P.C. (RP10^3)	N.P.V. (RP10^3)	(RP10^3)	(US$)
1979 R	527	922				165,960	55,967	111,679					
D													
1980 R	527	922				165,960	54,281	111,679					
D													
1981 R	527	922				165,960	54,281	111,679					
D													
1982 R	527	922				165,960	54,281	111,679					
D													
1983 R	527	922	-	1,416	494	165,960	54,281	111,679	254,880	154,330	100,550	-11,129	-17,804
D			506										
1984 R	527	922	506	1,315	2,012	165,960	54,281	111,679	528,120	308,660	219,460	107,781	172,449
D			506	1,619									
1985 R	527	948	506	1,467	2,239	170,640	54,281	116,359	573,660	308,660	265,000	148,641	237,825
D			506	1,720									
1986 R	527	948	506	1,568	2,441	170,640	54,282	116,359	610,020	308,660	301,360	185,001	296,001
D			506	1,821									
1987 R	527	1,001	506	1,669	2,742	180,180	54,281	125,899	673,740	308,660	365,080	239,181	382,689
D			506	2,074									
1988 R	527	1,001	506	1,872	2,996	180,180	54,281	125,899	719,460	308,660	410,800	284,901	455,841
D			506	2,125									
1989 R	527	1,054	506	1,922	3,145	189,720	54,281	135,439	755,820	308,660	447,160	311,721	498,753
D			506	2,277									
1990 R	527	1,054	506	2,024	3,247	189,720	54,281	135,439	774,180	308,660	465,520	330,081	528,129
D			506	2,277									
1991 R	527	1,054	506	2,024	3,247	189,720	54,281	135,439	774,180	308,660	465,520	330,081	528,129
D			506	2,277									

Table 7-7 Cost Benefit Stream

		Cost				Benefit		
		Initial Investment	O/M cost	replacement cost	Total	Increment	Salvage value	Total
1980	-1	227,600			270,900			
1981	0	1,674,700			1,713,100			
1982	1	2,409,600			2,579,700			
1983	2		53,147		53,147	17,804		17,804
1984	3		53,147		53,147	172,499		172,499
1985	4		53,147		53,147	237,825		237,825
1986	5		53,147	19,130	72,277	296,001	405,300	701,301
1987	6		29,816		29,816	382,689		382,689
1988	7		29,816		29,816	455,841		455,841
1989	8		29,816		29,816	498,753		498,753
1990	9		29,816		29,816	528,129		528,129
1991	10		29,816	72,170	101,986	528,129		528,129
1996	15		29,816	19,130	48,946	528,129		528,129
2001	20		29,816	72,170	101,986	528,129		528,129
2006	25		29,816	214,130	243,946	528,129		528,129
2011	30		29,816	72,170	101,986	528,129		528,129
2016	35		29,816	19,130	48,946	528,129		528,129
2021	40		29,816	72,170	101,986	528,129		528,129
2026	45		29,816	19,130	48,946	528,129		528,129
2031	50		29,816		29,816	528,129		528,129

Note: For the period for 1992 to 2031, the year is not shown in which the replacement cost would not be needed.

REFERENCES

1. Feasibility Report on the Riam Kanan Irrigation Project, Japan International Cooperation Agency, September 1979.

2. Report on the Preliminary Survey for the Technical Cooperation on the Riam Kanan Pilot Scheme in Indonesia, Japan International Cooperation Agency, April 1981.

3. Design Note on Design Criteria for Riam Kanan Irrigation Project, Nippon Koei Co., Ltd., 1981.

4. Design Note on Irrigation Water Requirement and Design Discharge of Irrigation Canal for Riam Kanan Irrigation Project, Nippon Koei Co., Ltd., 1981.

5. Technical Note on Additional Soil Survey and Study for Detailed Design for Riam Kanan Irrigation Project, Nippon Koei Co., Ltd., 1981.

6. Preliminary Report on Additional Geological Investigation for Detailed Design for Riam Kanan Irrigation Project, Nippon Koei Co., Ltd., 1981.

ANNEXES

SUMMARY OF DISCUSSIONS BETWEEN THE JAPANESE STUDY TEAM AND THE AUTHORITIES CONCERNED OF THE REPUBLIC OF INDONESIA ON THE CONSTRUCTION OF PILOT SCHEME FACILITIES IN RIAM KANAN

In response to the request by the Government of Indonesia, the Government of Japan has sent, through the Japan International Cooperation Agency (JICA), a team to carry out a prerequisite study for the construction of Pilot Scheme facilities in Riam Kanan (hereinafter referred to as "the Project") for 30 days from August 20, 1981 to September 18, 1981.

The team visited the Project site in South Kalimantan, had a series of discussions and exchanged views with the authorities concerned.

Both parties have agreed as per attachments.

September 2, 1981

YUKIO KIMURA
Leader
JICA Study Team for
Irrigation Facilities
Project on Pilot Scheme
in Riam Kanan

Y. SUDARYOKO
Director of Irrigation
for Director General of Water
Resources Development
Ministry of Public Works

ATTACHMENTS

1. The objective of the Project is to provide irrigation facilities on the Pilot Scheme area with the view of introducing suitable design or construction method to Riam Kanan irrigation project and establishing suitable operation, maintenance and water management on farm level.

2. The Project Site is located at Sungai Tabuk Kota and Gudang Hirang in Kecamatan Sungai Tabuk, Kabupaten Banjar South Kalimantan Province, and the net irrigable area of the Project is some 506 Ha.

3. The Government of Japan will provide the facilities, equipment and services as listed in Annex within 760 million yen (¥ 760,000,000).

4. The Government of Indonesia will take necessary measures:
   a) to provide data and information necessary for the design and construction of the Project.
   b) to secure lands necessary for the implementation of the Project.
   c) to bear all the expenses, other than those to be borne by the grant aid, necessary for the construction of the Project.
   d) to ensure prompt unloading and customs clearance in Indonesia of imported materials and equipment.

necessary for the construction of the Project and also to facilitate the internal transportation of the same.

e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Indonesia on the occasion of the supply of goods and services necessary for the construction of the Project.

f) to provide and accord necessary permissions licenses and other authorization required for the construction of the Project.

ANNEX

Items requested by the Government of Indonesia of which cost will be borne by the Government of Japan.

1. Construction of Irrigation Facilities

   a. Water intake facilities (Conducting canal, Pipe line, Farm pond, Pump and related equipment)

   b. Irrigation canal network (Secondary canal, Tertiary canal)

   c. Inspection road network (Secondary inspection road, Tertiary inspection road)

   d. Office

2. Equipment

   Construction machinery

3. Engineering Service

RECORD OF DISCUSSION

The Japan International Cooperation Agency dispatched the team (namely JICA Study Team for Irrigation Facilities Project on Pilot Scheme in Riam Kanan) to carry out a prerequisite study for the construction of Pilot Scheme facilities in Riam Kanan (hereinafter, referred to as "the Project") for 30 days from August 20, 1981 to September 18, 1981.

On September 16, the discussion meeting was held and the team reported the study results as mentioned on "Summary".

On the discussion meeting, the comments were given to the team as mentioned in Record of Discussion.

Both parties have agreed as per attachment.

September 16, 1981.

S. KIKUCHI
JICA Study Team
Irr. and Drainage Engineer

Ir. GATOT SOENARJO
Chief of Sub.Directorate of
Project Operation
Directorate of Irrigation
Directorate General of
Water Resources Development
Ministry of Public Works.

T. SUZUKI
JICA Study Team
Facilities Design Engineer

S. MORITA
JICA Study Team
Soil Mechanic Engineer

ATTACHMENT 1

D A F T A R H A D I R

R a p a t : Basic Design Report untuk Pilot Scheme Proyek Irigasi Riam Kanan

T a n g g a l : 16 September 1981

J a m : 10.00 WIB

Pimpinan Rapat : Direktur Irigasi

T e m p a t : Ruang Sidang Direktorat Irigasi Jakarta

No.	N A M A	J A B A T A N
1.	Gatot Soenarjo	Ka Sub Dit Binlak. I
2.	Bambang Sigit	Ka Si II Sub Dit Binlak. I
3.	Bambang Prayitno	Staf Bag. ABLN Ditjenair
4.	Soekarso Djunaedi	Ka Si Pengendalian
5.	A. Tamdjid	Ka Bag Air DPU Kal-Sel
6.	Sunarno	Ka Si Cantek Irigasi
7.	M. Yuasa	Colombo Plan Expert
8.	Masaharu Matsui	Colombo Plan Expert
9.	Ryonosuke Goto	Assistant Resident Representative JICA Jakarta
10.	S. Kikuchi	Nippon Koei
11.	Suzuki	Nippon Koei
12.	S. Morita	Nippon Koei
13.	T. Iwai	Colombo Plan Expert
14.	Kartiansyah Achmad	Staf Air DPU Kal-Sel

ATTACHMENT - 2

(1) Record of Discussion

1. Farm Pond:
   It is agreed that an appropriate size of a farm pond shall be provided at the Project site.

2. Hydraulic profile from Martapura River to a farm pond is requested.

3. Separation of Pump facility and pipe line will be considered by introducing a stand structure.

4. Sediment excavation method in the conducting canal has to be considered. For manpower excavation an intake gate may be required at the head of conducting canal.

5. Installation of 4 Nos. of automatic water level recorder at the drainage outlets (inside and outside) has been agreed.

6. Present drainage condition of the Project area has to be described.

7. As for Item-7, the sentence has been agreed to revise:
   "For this project an earth canal is applied. The materials obtained from paddy field will be used for the canal and the farm road embankment as much as possible".

8. Item-8 and Item-11 are deleted.

9. Item-10: Operation and Maintenance cost for pump and pipe line system will be revised.

10. Drawing No.10 and 11 will be revised.

(2) Time Schedule

In accordance with Record of Discussion, the final Report will be prepared in Japan. By the end of October, this report will be submitted to Government of Indonesia through the JICA Office.

SUMMARY

1. During the period for Aug. to Sept. 1981, the Japan International Cooperation Agency (J.I.C.A.) dispatched the Study Team for "Construction of Pilot Scheme Facilities in Riam Kanan". This is a summary of the study report which is prepared to give a study result obtained during this period.

2. In 1979, the Feasibility Report on the Riam Kanan was prepared. As one of the results of the study, it was recommended to organize pilot demonstration scheme in the irrigation project area. In responce with this recommendation the Government of Indonesia has promoted the Project.

3. The total project cost of about U.S.$4,563,700 consists of the Grant Aid and the local budget: U.S.$3,304,300 (72%) and U.S.$1,259,400 (28%), respectively.

4. The objective of the Project is to provide irrigation and drainage facilities in the Pilot Scheme area with a view to introduction of suitable design or constraction method to Riam Kanan Irrigation Project and to establishing suitable operation/maintenance and water management on farm level.

5. Expected effects of this project are summarized as follows:

   (1) It is confirmed that suitable design and construction method are applied through the actual construction and the operation/maintenance of the Pilot Scheme.

   (2) The potentiality of introducing a double cropping a year into this area could be confirmed by the construction and operation of the irrigation and drainage system.

6. Financial plan for this project is shown in Table 1.

conversion rate: RP 625 = U.S.$1 = ¥230

7. For this project, are earth canal is applied. The materials obtained from paddy field can be used for the canal and the farm road embankment is made by the cost of the borrow-pit materials.

8. The construction of suction pit is rather difficult, because this work is carried out mainly below the water level. Then sheet piles will be needed.

9. Concerning the pump and the cast iron pipe, about six to seven monthes will be consumed for manufacturing, shipping, handling and inland transportation.

10. Operation and maintenance cost for pump and pipe line system is about Rp. 22 million/annum.

11. In order to reduce the operation cost for pumps, it is recommended to extend the electric distribution line and to apply the motor instead of the diesel engine.

12. Major points on design modification are shown in Table 2.

13. The new drawings prepared by the team are made in order to show the basic plan.

14. For the preparation of detail design, checking of the leveling survey will be needed.

Table 1 FINANCIAL COST OF THE PROJECT

(U.S.$1,000)

Work Item	Local Currency ( ): Consumed	Foreign Currency	Total
1. Preparatory Works	34.5	-	34.5
2. Civil Works			
1) Access road	249.2 (110.6)	-	249.2 (1
2) Motor pool	145.0 (51.5)	-	145.0
3) Conducting canal	-	245.1	245.1
4) Inlet structure	-	105.8	105.8
5) Pump station			
.House & fundation	38.7 (38.7)	-	38.7
.Pump & related equipment	-	550.0	550.0
6) Pipe-line	-	550.8	550.8
7) Outlet structure	-	25.8	25.8
8) Irrigation canal			
.Secondary canal	-	183.5	183.5
.Tertiary canal	-	292.9	292.9
9) Drainage canal			
.Secondary canal	91.7 (91.7)	-	91.7
.Tertiary canal	138.6 (125.4)	10.3	148.9
10) Farm road			
.Secondary road	-	306.5	306.5
.Tertiary road	-	135.4	135.4
11) Office	30.0	20.0	50.0
Sub Total	727.7 (417.9)	2,426.1	3,153.8
3. Land acquisition	184.1 (81.7)	-	184.1
4. Engineering service	-	350.0	350.0
5. Equipment	10.0	152.1	162.1
6. Administration	281.5 (142.3)	-	281.5
7. Contingencies			
.Physical cont.	56.1	150.0 (6.2%)	206.1
.Price cont.	-	226.1 (9.3%)	226.1
TOTAL	1,259.4 (641.9)	3,304.3	4,563.7

Table 2

Comparison table for design modification

	Object	Original design	Present design	Remarks
1.	Irrigation area	527 ha	506 ha	
2.	Conducting canal	L = 2.0 KM	L = 1.4 KM	
3.	Intake canal	L = 1.8 KM	cancel	
4.	Pump			
	- numbers of pump, bore	ϕ600 2 Nos	ϕ600 2 Nos ϕ300 1	Horizontal Mired Flow Volute pump
	Prime mover	diesel(190 HP)2 Nos	diesel (190HP)2 Nos diesel (25HP)1	
5.	Pipe line	ϕ1000 L = 1.8 KM	ϕ900 L = 1.8KM	Ductile cast iron pipe
6.	Farm pond	V = 32,000 m^3	cancel	
7.	Office			
	- main office	600 m^2	150 m^2	
	- pump house	91	91	
	- garage	300	300	
	- meeting house	150	150	
	- laboratory	80	cancel	
	- staff house	400	cancel	

Scope of works

The scope of works which will be carried out by the Ministry of Public Works is shown as below.

A: Grant Aid portion.

1. Pump and pipe line system.

a) Conducting canal

l = 1,400 m

excavation V = 49,300 m^3

b) Pump and engine.

mixed flow volute pump

bore ϕ600mm ---- 2 Nos

bore ϕ300mm ---- 1 No

diesel engine 190 Hp --- 2 Nos

25 Hp --- 1 No

c) Pipe line

ductile cast iron pipe ϕ900mm

l = 1,800 m

2. Irrigation canal

total length l = 11.0 km

embankment V = 40,170 m^3

related structure turnout --- 5 Nos.

division box 22 Nos.

culvert --- 4 Nos.

bridge --- 1 No.

Parshall flume 1 No.

3. Farm road

total length l = 12.0 km

embankment V = 34,600 m^2

related structure crossdrain - 2 Nos.

4. Office

area about -- 150 m^2

5. Drainage canal structure

B: Local budget portion.

1. Drainage canal

total length l = 15.3 km

related structure

2. Motor pool and meeting house
3. Pump house
4. Access road

Concerning the engineering survice and equipments which would be donated, the Grand Aid is also allocated for them.
Break down of the equipments are as follows.

1.	Swamp Dozer (7t)	-- 1 No.
2.	Super swamp Backhoe (0.3 m^3)	-- 2 Nos.
3.	Vibrating Roller	-- 2 Nos.
4.	Station vagon	-- 1 No.
5.	Spair parts	-- 1 set

Monthly Rainfall

Station: Banjarmasin

Unit: mm

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1960	488	497	289	419	273	139	210	15	241	18	338	421	3,348
1961	488	431	284	297	163	115	130	10	63	33	179	215	2,408
1962	529	535	397	332	144	151	161	69	145	263	437	344	3,507
1963	533	780	747	84	110	51	65	101	1	-	325	335	3,132
1964	331	377	358	383	176	85	80	93	139	285	228	197	2,732
1965	319	248	327	174	137	69	-	2	39	38	105	383	1,841
1966	400	373	270	233	128	60	62	96	68	152	234	430	2,506
1967	273	400	192	80	141	34	45	47	52	97	58	151	1,570
1968	222	203	286	444	81	90	65	15	52	78	133	239	1,908
1969	94	147	354	120	75	9	11	12	-	49	76	282	1,229
1970	321	320	253	212	178	65	167	122	130	136	167	526	2,597
1971	116	x	244	166	107	35	44	152	225	171	357	222	
1972	367	264	223	67	85	32	4	24	-	60	208	238	1,572
1973	520	309	595	192	164	88	114	180	260	78	266	496	3,262
1974	179	461	281	145	161	70	53	83	212	154	197	175	2,171
1975	347	255	220	104	99	43	108	269	262	250	292	335	2,584
1976	312	365	283	210	20	132	39	2	31	387	311	441	2,533
1977	312	216	376	163	18	137	17	46	15	26	208	382	1,916
Mean	341.7	363.6	332.2	212.5	125.6	78.1	80.9	74.3	120.9	133.8	228.8	322.9	2,415.3

ANNEX II
Table 2

Monthly Mean Temperature

Station: Syamsudin Noor

Unit: °C

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1960	26.2	25.9	26.0	27.0	26.7	26.4	26.0	26.5	26.7	27.9	26.2	26.7
1961	25.9	26.1	25.0	27.1	27.5	26.2	26.2	27.6	27.2	27.1	27.0	26.7
1962	25.9	25.7	26.5	26.8	27.4	26.5	26.4	26.0	26.9	26.6	26.8	26.4
1963	26.1	25.7	27.2	27.0	28.0	27.4	26.6	26.4	27.6	28.7	27.8	26.8
1964	26.5	26.5	26.8	27.1	27.4	27.1	25.8	26.4	27.8	26.0	26.4	28.2
1965	28.2	25.8	25.9	26.1	26.5	26.6	25.8	26.6	27.0	27.7	27.5	26.5
1966	26.2	26.2	26.2	26.6	27.1	26.7	26.3	26.8	27.4	27.5	26.6	25.9
1967	26.1	26.2	26.8	26.5	26.9	26.7	26.2	26.2	27.3	27.9	27.6	26.6
1968	25.9	26.1	26.1	27.1	27.0	27.0	26.3	26.3	27.1	26.6	26.7	26.0
1969	26.5	26.4	26.8	27.4	27.0	26.6	26.2	26.1	27.3	27.5	26.9	26.0
1970	26.1	26.5	26.7	26.9	26.9	26.5	26.0	26.0	26.1	27.0	26.5	25.7
1971	25.7	25.2	25.9	26.4	26.8	25.9	25.6	25.6	25.9	26.3	25.4	25.8
1972	25.8	26.0	26.2	26.3	26.8	26.5	26.2	26.7	26.9	27.7	27.0	26.3
1973	26.9	27.0	26.7	26.9	27.6	26.3	26.7	26.2	25.9	26.7	25.8	26.2
1974	26.1	24.9	26.4	26.9	26.4	25.8	25.1	25.8	25.7	26.2	25.9	25.6
1975	25.9	26.0	25.7	26.7	26.0	26.2	25.4	25.1	25.9	26.1	26.1	26.1
1976	25.9	25.9	26.2	26.3	26.9	25.7	26.0	26.0	26.8	26.5	26.3	26.1
1977	26.1	26.1	26.4	27.0	27.0	26.2	25.7	25.8	26.7	27.4	27.2	26.2
Mean	26.2	26.0	26.3	26.8	27.0	26.5	26.0	26.2	26.8	27.1	26.7	26.3

Monthly Mean Relative Humidity

Unit: %

Station: Syamsudin Noor

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1960	84	87	87	84	85	80	84	80	78	72	86	84
1961	86	88	93	83	82	82	73	67	67	72	78	70
1962	88	83	85	85	83	83	80	74	76	72	83	85
1963	83	86	83	78	78	75	75	73	67	64	74	82
1964	85	84	83	83	81	79	81	74	81	85	84	82
1965	85	85	87	84	83	79	73	67	63	69	76	82
1966	84	84	85	86	81	81	75	76	70	77	82	80
1967	85	84	82	84	82	79	78	81	68	73	77	85
1968	87	85	86	84	84	83	85	82	75	80	82	86
1969	84	84	86	82	83	80	76	69	69	73	80	86
1970	87	84	84	82	85	84	78	78	82	80	79	86
1971	87	85	84	81	78	80	82	84	85	77	87	83
1972	83	83	85	83	80	78	73	65	60	70	78	81
1973	83	82	85	85	83	84	82	82	84	79	84	84
1974	82	88	83	82	79	82	83	79	84	85	88	89
1975	84	86	86	84	85	82	85	79	83	82	82	84
1976	84	84	83	82	78	81	78	73	72	80	85	85
1977	85	87	84	83	81	82	75	75	71	71	77	85
Mean	85	85	85	83	82	81	79	75	74	76	81	83

Monthly Mean Wind Velocity

Station: Banjarbaru (L.M.G.)

Unit: Km/hr

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1974	-	3.9	-	3.7	4.0	3.4	3.8	4.7	4.1	3.8	4.6	3.7
1975	3.1	3.7	3.6	3.0	2.9	2.8	2.3	2.6	1.7	1.4	1.0	2.4
1976	-	1.7	1.9	1.9	1.4	1.4	2.4	2.7	2.4	0.8	1.6	2.4
1977	2.5	2.2	2.0	1.8	2.1	2.3	3.7	3.0	4.2	-	-	-
Mean	2.8	2.9	2.5	2.6	2.6	2.5	3.1	3.1	3.1	2.0	2.2	2.8

ANNEX II
Table 5

Monthly Evaporation

Unit: mm

Station: Banjarbaru (L.M.G.)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1975	96.4	61.1	111.6	62.9	71.5	109.3	93.8	124.8	108.1	110.9	109.2	106.0	1,165.6
	(3.1)	(2.2)	(3.6)	(2.1)	(2.3)	(3.6)	(3.0)	(4.0)	(3.6)	(4.0)	(3.6)	(3.4)	
1976	114.7	102.0	114.8	107.2	113.9	107.7	117.6	153.5	150.8	112.7	104.6	108.1	1,407.6
	(3.7)	(3.5)	(3.7)	(3.7)	(3.7)	(3.6)	(3.8)	(5.1)	(5.0)	(3.9)	(3.5)	(3.5)	
1977	113.5	77.7	131.1	124.2	121.4	113.2	138.8	121.8	165.8	107.7	121.8	97.5	1,534.5
	(3.3)	(2.8)	(4.2)	(4.1)	(3.9)	(3.8)	(4.5)	(3.9)	(5.5)	(6.7)	(4.1)	(3.1)	
Mean	108.2	80.3	119.2	98.1	102.3	110.1	116.7	133.2	141.6	143.8	111.9	103.7	1,369.1
	(3.5)	(2.9)	(3.8)	(3.3)	(3.3)	(3.7)	(3.8)	(4.3)	(4.7)	(4.6)	(3.7)	(3.3)	(3.8)

( ) shows mean daily evaporation.

Total Population in the Project Area

Village: GUDANG HIRANG

Nos	Rukun Tetangga (RT)	The number of house	House-hold	TOTAL POPULATION											TOTAL
				Children			Adults			Oldmen			Total		
				Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	
1.	RT.I	22	26	12	12	24	18	16	34	2	2	4	32	30	62
2.	RT.II	27	35	30	39	69	33	38	71	3	3	6	66	80	146
3.	RT.III	19	22	20	20	40	24	19	43	3	2	5	47	41	88
4.	RT.IV	12	15	34	35	69	43	37	80	5	5	10	82	77	159
5.	RT.V	22	26	26	32	58	33	33	66	5	5	10	64	70	134
6.	RT.VI	23	25	32	21	53	23	24	47	3	1	4	58	46	104
7.	RT.IX	38	45	26	21	47	36	24	60	1	5	6	63	50	113
8.	RT.X	35	36	37	42	79	50	45	95	3	4	7	90	91	181
9.	RT.XI	18	20	25	16	41	26	26	52	6	5	11	57	47	104
10.	RT.XII	12	16	28	22	50	28	33	61	5	3	8	61	58	119
	Grand Total	228	266	270	260	530	314	295	609	36	35	71	620	590	1.210

Data Source: VILLAGE CHIEF OF GUDANG HIRANG

Banjarmasin, May, 31, 1981
IDENTIFICATION - D.U.

ANNEX III
Table 2

Total Population in the Project Area

Village: SUNGAI TABUK TOWN

Nos	Rukun Tetangga (RT)	The number of house	House-hold	TOTAL POPULATION												TOTAL
				Children			Adults			Oldmen			Total			
				Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	
1.	RT 4	33	35	-	-	54	-	-	81	-	-	8	56	87	143
2.	RT 5	49	51	-	-	83	-	-	83	-	-	46	97	115	212
3.	RT 6	32	31	-	-	53	-	-	67	-	-	6	63	63	126
4.	RT 7	19	18	-	-	47	-	-	27	-	-	12	41	45	86
5.	RT 8	22	20	-	-	43	-	-	30	-	-	16	38	51	89
6.	RT 9	23	23	-	-	41	-	-	25	-	-	13	43	36	79
	Grand Total	178	178	-	-	321	-	-	313	-	-	101	338	397	735

Data Source: ASST OF VILLAGE CHIEF OF SUNGAI TABUK KOTA

Banjarmasin, May. 31. 1981
IDENTIFICATION - D.U.

Landowner

Village: GUDANG HIRANG

Area(Farm Site) \ Village	RT.I	RT.II	RT.III	RT.IV	RT.V	RT.VI	RT.IX	RT.X	RT.XI	RT.XII	TOTAL	
10 Ha	-	-	-	-	-	-	-	-	-	-	-	person
5 - 10 Ha	-	-	-	-	-	-	-	-	-	-	-	"
3 - 5 Ha	-	1	-	-	-	3	3	3	-	-	10	"
2 - 33 Ha	-	-	-	1	-	2	4	16	-	-	23	"
1 - 2 Ha	8	4	2	5	3	3	6	35	1	7	74	"
0.5 - 1 Ha	13	12	4	4	3	9	27	46	8	6	132	"
0 - 0.5 Ha	9	11	6	11	2	9	21	21	1	6	97	"
Grand Total	30	28	12	21	8	26	61	121	10	19	336	persons

Tenant Farmer

Village: GUDANG HIRANG

Area(Farm Site) \ Village	RT.I	RT.II	RT.III	RT.IV	RT.V	RT.VI	RT.IX	RT.X	RT.XI	RT.XII	TOTAL	
5 Ha	-	-	-	-	-	-	-	-	-	-	-	person
4 - 5 Ha	-	-	-	-	-	-	-	-	-	-	-	"
3 - 4 Ha	-	5	-	-	-	-	15	14	-	-	34	"
2 - 3 Ha	-	-	-	3	-	6	12	49	-	-	70	"
1 - 2 Ha	16	9	5	10	6	7	12	71	2	14	152	"
0.5 - 1 Ha	13	13	5	9	4	10	28	47	8	7	144	"
0 - 0.5 Ha	9	12	7	11	3	9	22	20	2	6	101	"
Grand Total	38	39	17	33	13	32	89	201	12	27	501	persons

Data Source: VILLAGE CHIEF OF GUDANG HIRANG

Banjarmasin, May 31, 1981
Identification - D.U.

Landowner

Village: SUNGAI TABUK

Area	Village RT 4	RT 5	RT 6	RT 7	RT 8	RT 9	TOTAL	
10 Ha	-	-	-	-	-	-	-	person
5 - 10 Ha	-	1	-	-	-	-	1	"
3 - 5 Ha	-	1	-	1	1	4	7	"
2 - 3 Ha	1	2	-	-	1	2	6	"
1 - 2 Ha	10	5	6	10	4	8	43	"
0.5 - 1 Ha	12	20	4	7	5	9	57	"
0 - 0.5 Ha	9	10	6	5	-	5	35	"
Grand Total	32	39	16	23	11	28	149	persons

Tenant Farmer

Village: SUNGAI TABUK

Area	Village RT 4	RT 5	RT 6	RT 7	RT 8	RT 9	TOTAL	
5 Ha	-	-	-	-	-	-	-	person
4 - 5 Ha	-	6	-	-	-	-	6	"
3 - 4 Ha	-	5	-	5	5	17	32	"
2 - 3 Ha	3	7	-	-	3	6	19	"
1 - 2 Ha	21	10	11	19	7	15	83	"
0.5 - 1 Ha	15	25	5	6	7	9	67	"
0 - 0.5 Ha	10	11	6	7	-	7	41	"
Grand Total	49	64	22	37	22	54	248	

Data Source: ASST OF CHIEF VILLAGE
SUNGAI TABUK

Banjarmasin, May 31, 1981
Identification - D.U.

Rice Production and Consumption in Kalimantan

Year	East Kalimantan (1,000 ton)	Central Kalimantan (1,000 ton)	West Kalimantan (1,000 ton)	South Kalimantan (1,000 ton)	Total (1,000 ton)
1971	- 55	- 3	- 40	+ 48	- 50
1972	- 58	- 9	- 41	+ 77	- 31
1973	- 81	- 2	- 41	+109	- 15
1974	- 56		- 23	+ 31	- 28
1975	- 53	- 6	- 28	+ 36	- 51
1976	- 67	- 8	- 36	+ 64	- 47

Note: Minus figures in this table mean shortage of rice, and plus figures show surplus of rice.

Data source: BAPPEDA in South Kalimantan

Rice Production and Consumption in South Kalimantan

Year	Production (1,000 ton)	Consumption (1,000 ton)	Surplus (1,000 ton)
1971	253	205	48
1972	286	209	77
1973	323	213	109
1974	326	275	51
1975	318	282	36
1976	330	266	64
1977	348	290	58

Data source: BAPPEDA in South Kalimantan

Comparison Table for Design Modification

Object	Original design	Basic design	Remarks
1. Irrigation area	527 ha	506 ha	
2. Conducting canal	L = 2.0 Km	L = 1.4 Km	
3. Intake canal	L = 1.8 Km	cancel	
4. Pump			
- numbers of pump, bore	ϕ 600 2 Nos	ϕ 600 2 Nos ϕ 300 1 No.	Horizontal Mixed Flow Volute Pump
Prime mover	diesel (190HP) 2 Nos	diesel (140HP) 2 Nos diesel (20HP) 1 No.	
5. Pipe line	ϕ 1,000 L = 1.8 Km	ϕ 900 L = 1.8 Km	Ductile cast iron pipe
6. Farm pond	V = 32,000 m^3	V = 8,800 m^3	
7. Building			
- main office	600 m^2	150 m^2	
- pump house	84 m^2	84 m^2	
- garage	210 m^2	210 m^2	
- meeting house	150 m^2	150 m^2	
- laboratory	80 m^2	cancel	
- staff house	400 m^2	cancel	
8. Irrigation canal	11,100 m	11,000 m	

Financial Cost of the Project

(U.S. $1,000)

Work Item	Local Budget (): Consumed	Grand Aid	Total
1. Preparatory works	34.5	-	34.5
2. Civil works			
1) Access road	249.2 (110.6)	-	249.2
2) Motor pool	145.0 (51 5)	-	145.0
3) Conducting canal	-	272.2	272.2
4) Inlet structure		119.9	119.9
5) Pump station			
. House & fundation	38.7 (38.7)	-	38.7
. Pump & related equipment	-	400.0	400.0
6) Pipe line	-	650.0	650.0
7) Farm pond	-	154.6	154.6
8) Irrigation canal			
. Secondary canal	-	117.8	117.8
. Tertiary canal	-	150.5	150.5
. Related structure	-	65.7	65.7
9) Drainage canal			
. Secondary canal	91.7 (91.7)	6.3	98.0
. Tertiary canal	138.6 (125.4)	19.3	157.9
10) Farm road			
. Secondary road	-	348.7	348.7
. Tertiary road	-	167.7	167.7
11) Office	30.0	20.0	50.0
Sub Total	727.7 (417.9)	2,492.7	3,220.4
3. Land acquisition	184.1 (81.7)	-	184.1
4. Engineering service	-	350.0	350.0
5. Equipment	10.0	152.1	162.1
6. Administration	281.5 (142.3)	-	281.5
7. Contingencies			
. Physical cont.	56.1	150.0	206.1
. Price cont.	-	159.5	159.5
TOTAL	1,259.4 (641.9)	3,304.3	4,563.7

Standard Cost for the Compensation of trees

Nomer	Tree Name (Indonesian)	Tree Name (English)	Unit Price (Rp)
1.	Kelapa	Coconut	10.000,-
2.	Cengkih	Clove	750,-
3.	Limau	Lemon/Orange	7.500,-
4.	Mangga	Mangoo	1.450,-
5.	Kedondong		2.500,-
6.	Rambutan		2.250,-
7.	Jambu Air		750,-
8.	Asam	Acid	2.600,-
9.	Sirsak	Zurzak	750,-
10.	Pinang		1.000,-
11.	Pisang	Banana	-
12.	Karet	Rubber	1.000,-
13.	Nenas	Bineappte	50,-
14.	Ketapi		2.600,-
15.	Kueni		2.600,-
16.	Laus	Bust	-
17.	Savo		1.500,-
18.	Kopi	Coffee	1.500,-
19.	Belimbing	Fruit	1.000,-
20.	Lombok	Chile	-
21.	Petai		2.000,-
22.	Durian	Durian	6.500,-
23.	Cempedak		1.950,-
24.	Kapuk	Kapok	-
25.	Binjai		2.600,-
26.	Bambu	Bamboo	1.000,-
27.	Blangkasua		1.500,-
28.	Ubi Kayu	Bust	-
29.	Rambai		2.500,-
30.	Hambavang		2.600,-

Nomer	Tree Name (Indonesian)	Tree Name (English)	Unit Price (Rp)
31.	Jambu Mente		750,-
32.	Jengkol		3.000,-
33.	Nangka		2.500,-
34.	Kasturi		2.600,-
35.	Ramania		2.600,-
36.	Mundar		2.600,-
37.	Rumbia	Bust	1.450,-
38.	Pepaya	Pepaya	500,-

Market Price of Materials

No.	Item 2	Unit	Unit Price (Rp)
1.	Sand for concrete	m^3	5,000.-
2.	Gravel for concrete	"	7,500.-
3.	Cobble stone	"	6,000.-
4.	Cement (portland)	kg	75.-
5.	Brick	piece	35.-
6.	Nail	kg	750.-
7.	Paint for timber	"	2,000.-
8.	Oil paint	lit	500.-
9.	Timber plate for form	m^3	70,000.-
10.	Sawn timber	"	94,000.-
11.	Ply wood	piece	3,000.-
12.	Iron wood	m^3	180,000.-
13.	Key	couple	12,500.-
14.	Glass	m^2	11,850.-
15.	Hinge	couple	900.-
16.	Asbestor	piece	5,000.-
17.	Steel	kg	800.-
18.	Reinforcement bar	"	700.-
19.	Bolt	"	600.-

Excluded transporation cost but No. 1, 2, 5 only included transportation cost.

Labor Wages 1 (One) Day -- 8 Hours

No.	Item	Unit	Unit Price (Rp)
1.	Foreman	day	2,500.-
2.	Skilled labor	"	2,000.-
3.	Common labor	"	1,500.-
4.	Operator	"	2,500.-
5.	Aistan operator	"	1,400.-
6.	Carpenter	"	2,000.-
7.	Mason/brick layer	"	2,000.-
8.	Steel bar bender	"	1,800.-
9.	Painter	"	1,800.-
10.	Electrician	"	2,000.-

Breakdown of Operation and Maintenance Cost

Unit: 10^3Rp

Item	Unit	Unit Price	Pump Irrigation Stage Q'ty	Pump Irrigation Stage Amount	Ream Kanan Irri. Stage Q'ty	Ream Kanan Irri. Stage Amount
1. Personal Expenditure						
Superintendent	M.Y	720	1	720	1	720
Clerk/Typist	"	480	1	480	1	480
Store Keeper	"	192	2	384	1	192
Mechanic	"	480	1	480	0	0
Operator	"	300	3	900	1	300
Driver	"	300	2	600	2	600
Watchman	"	192	2	384	2	384
Irrigation Eng.	"	480	1	480	1	480
Pump Operator	"	300	3	900	0	0
Ditch Tender	"	192	3	576	3	576
Sub-Total			19	5,904	12	3,732
2. Pump Operation Cost						
ϕ600 Pump	Hr	3,300	2,000	6,600	0	0
ϕ300 Pump	Hr	2,190	2,000	4,380	0	0
Sub-Total				10,980		0
3. O & M Cost on Facilities						
Conducting Canal	L.S	-	-	890		0
Farm Pond	L.S	-	-	540		0
Other Facilities	L.S	-	-	13,000		13,000
Sub-Total				14,430		13,000
4. Other Miscellaneous	L.S.	-	-	1,903		1,903
Total				33,217 (US$53,147)		18,635 (US$29,816)

PRICE SCHEDULE

Item No.	Works	Unit	Quantity	Local Budget Portion		Grand Aid Portion		Total (US$)	Remarks
				Unit Price	Amount (US$)	Unit Price	Amount (US$)		
1	PREPARATORY WORKS	L.S			34,500			34,500	
2	CIVIL WORKS				249,200			249,200	
1)	Access Road	L.S			145,000			145,000	
2)	Motor Pool	L.S						272,200	
3)	Conducting Canal								
	i) Stripping	m^3	5,300			1.6	8,480		
	ii) Excavation	"	49,300			3.2	157,760		
	iii) Disposal of Excavated Materials	L.S					39,440		
	iv) Intake Gate	L.S					66,564		
4)	Inlet Structure	L.S					119,900	119,900	
5)	Pump Station				38,700			38,700	
	i) Pump House & Foundation	L.S					400,000	400,000	
	ii) Pumps & Related Equipment	L.S					650,000	650,000	
6)	Pipeline	L.S					154,600	154,600	
7)	Farm Pond								
8)	Irrigation Canal							117,800	
	i) Secondary Canal								
	Stripping	m^3	3,900			1.6	6,240		
	Excavation	"	860			1.6	1,376		
	Embankment	"	23,400			4.3	100,620		
	Canal Lining, etc.	L.S					9,564		
	ii) Tertiary Canal							150,500	
	Stripping	m^3	9,090			1.6	14,544		
	Excavation	"	160			1.6	256		

N. K. Form No. 2118

PRICE SCHEDULE

Item No.	Works	Unit	Quantity	Local Budget Portion		Grand Aid Portion		Total (US$)	Remarks
				Unit Price	Amount (US$)	Unit Price	Amount (US$)		
	Embankment	m^3	28,820			4.3	123,926		
	Others	L.S					11,774	65,700	
	iii) Related Structure						6,500		
	No.1 Turnout	L.S					7,500		
	No.2	L.S					3,300		
	No.3	"					5,000		
	No.4, No.5, No.6	"					4,600		
	Parshall Flume	Nos	2			2,300	2,800		
	Culvert	"	1			700	3,000		
	Division Box Type II	"	2			1,500	16,000		
	Type III	"	10			1,600	17,000		
	Type IV		10			1,700			
9)	Drainage Canal						6,300	98,000	
	i) Secondary Canal	L.S			91,700		19,300	157,900	
	ii) Tertiary Canal	L.S			138,600				
10)	Farm Road							348,700	
	i) Secondary Farm Road						7,936		
	Stripping	m^3	4,960			1.6	44,640		
	Sheet laying	m^3	6,200			7.2	213,409		
	Embankment	m^3	49,630			4.3	82,712		
	Gravel metaling	m^3	7,385			11.2		167,700	
	ii) Tertiary Farm Road						5,056		
	Stripping	m^3	3,160			1.6	40,248		
	Sheet laying	m^3	5,590			7.2	86,860		
	Embankment	m^3	20,200			4.3			

N. K. Form No. 2116

PRICE SCHEDULE

Item No.	Works	Unit	Quantity	Local Budget Portion		Grant Aid Portion		Total (US$)	Remarks
				Unit Price	Amount (US$)	Unit Price	Amount (US$)		
	Gravel metaling	m^3	3,175			11.2	35,560		
		L.S			30,000		20,000	50,000	
11)	Office								
					727,700		2,492,700	3,220,400	
	Sub total								
								184,100	
					184,100				
3	LAND ACQUISITION	L.S							
							350,000	350,000	
4	ENGINEERING SERVICE	L.S							
					10,000		152,100	162,100	
5	EQUIPMENT	L.S							
					281,500			281,500	
6	ADMINISTRATION COST	L.S							
7	CONTINGENCIES				56,100		150,000	206,100	
	i) Physical Contingency				-		159,500	159,500	
	ii) Price Contingency								
					1,259,400		3,304,100	4,563,700	
	GRAND TOTAL								
					(¥289,662,000)		(¥759,989,000)	(¥1,049,651,000)	
					(Rp787,125,000)				

N. K. Form No. 2118

Alternative Study on Pumping Station

In designing, two pump units of ϕ600mm and one unit of ϕ300mm were adopted in accordance with the Record of Discussion dated on September 16, 1981. As an alternative study, another combination of pump units was studied mainly in terms of initial investment cost. In this study, the sizes of pipeline and farm pond are examined for the selected pump units. The following table shows the alternatively proposed plan.

	Alternative Plan	Original Plan	
		ϕ600	ϕ300
1. Pump Station			
- Total head	9.1 m	7.4 m	4.5 m
- Static head	4.0 m	4.3 m	4.3 m
- Capacity of pump	18.5 m^3/min	44 m^3/min	9 m^3/min
- Type of pump	Horizontal shaft mixed flow volute type		
- Bore	ϕ400mm	ϕ600mm	ϕ300mm
- Check valve	ϕ400mm	ϕ600mm	ϕ300mm
- Butterfly valve	ϕ400mm	ϕ600mm	ϕ300mm
- Type of engine	4-cycle water cooled diesel engine		
- Output of engine	72 HP	140 HP	20 HP
- Nos. of units	3 Nos.	2 Nos.	1 No.
- Other auxiliary equipment	L.S.	L.S.	L.S.
- Pump house	102 m^2	84 m^2	
2. Pipeline			
- Length	1,800 m	1,800 m	
- Material	Ductile cast iron	Ductile cast iron	
- Size	ϕ800mm	ϕ900mm	

	Alternative Plan	Original Plan	
		ϕ600	ϕ300
3. Farm Pond			
- Size	80x80x1.1 m	80x80x1.4 m	
- Effective storage	7,000 m^3	8,800 m^3	
- Width of top embankment	2 m	2 m	

The initial investment cost was estimated on the basis of the conditions mentioned in Chapter 6 of this Report. Direct investment costs of the original plan and alternative plan are compared as follows:

Unit: US$

	Alternative Plan	Original Plan
1. Pump Station		
- Pumps, engines and other auxillary equipment	365,000	400,000
- Pump house and foundation 1/	54,000	38,700
2. Pipeline		
- Metal works	507,000	625,000
- Civil works 2/	23,000	25,000
3. Farm pond		
- Civil works 3/	91,000	104,300
Total	1,040,000	1,193,000

Note: 1/ ; Excluding suction pit.
2/ ; Excluding outlet structure.
3/ ; Excluding related structures.

DRAWINGS

T.B.M IV
+.0942

T.B.M III
+0.686

GATE No.2

T.B.M. II
+0.562

T.B.M I / B.M.RK. E 48
+0.464

GATE No I

MARTAPURA

STOPLOG

CONDUCTING CANAL

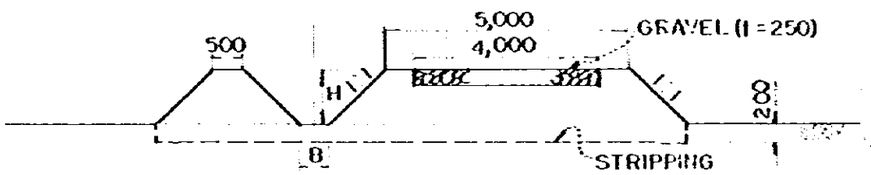
INLET STRUCTURE

PUMP STATION

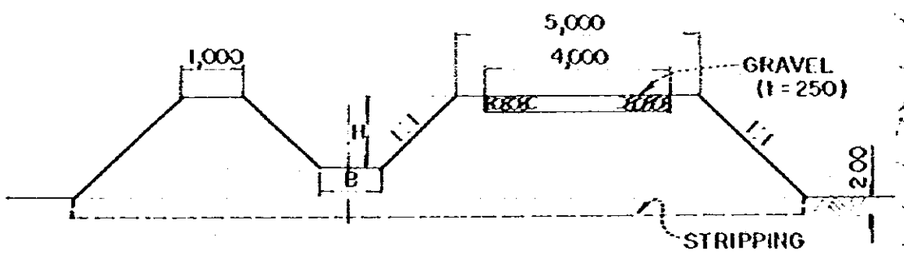
T.B

T.B.M V
+0532

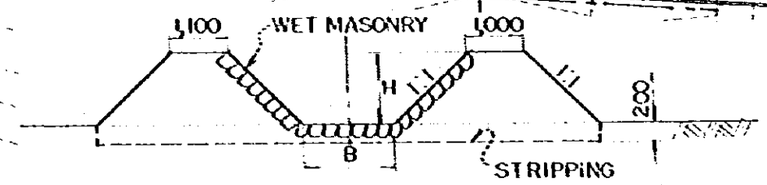
T.B.M VI
+0.810



TYPICAL CLOSS SECTION TERTIARY IRRIGATION CANAL WITH SECONDARY FARM ROAD



TYPICAL CLOSS SECTION OF SECONDARY IRRIGATION CANAL WITH SECONDARY FARM ROAD



TYPICAL CLOSS SECTION OF SECONDARY IRRIGATION CANAL (IS)

MARTAPURA RIVER

GATE No.2

T.B.M. II
+0.562

T.B.M I / B.M. RK. E 48
+0.464

GATE No.1

STOPLOG

CONDUCTING CANAL

INLET STRUCTURE

PUMP STATION

T.B.M 0 / B.M RK III
+0.963

N

bonbou I

PIPE LINE
D=900mm

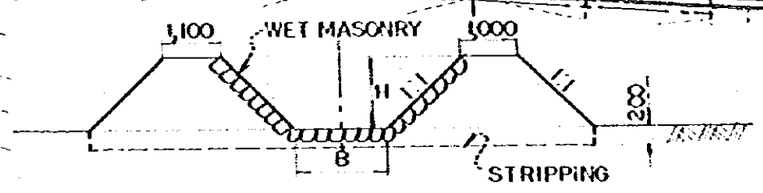
T.B.M V
+0.532

bonbou II

OUTLET STRUCTURE

FARM POND 100x100m

T.B.M VI
+0.810



TYPICAL CLOSS SECTION OF SECONDARY IRRIGATION CANAL (IS)

SCALE
0 100 300 500m

REMARKS

- PIPE LINE
- SECONDARY IRR. CANAL
- TERTIARY IRR. CANAL
- QUATERNARY IRR. CANAL
- SECONDARY DRAINAGE CANAL
- TERTIARY DRAINAGE CANAL
- QUATERNARY DRAINAGE CANAL
- SECONDARY FARM ROAD
- TERTIARY FARM ROAD
- TURNOUT
- DIVISION BOX
- CULVERT
- BRIDGE
- PERSHALL FLUME
- CROSS DRAIN

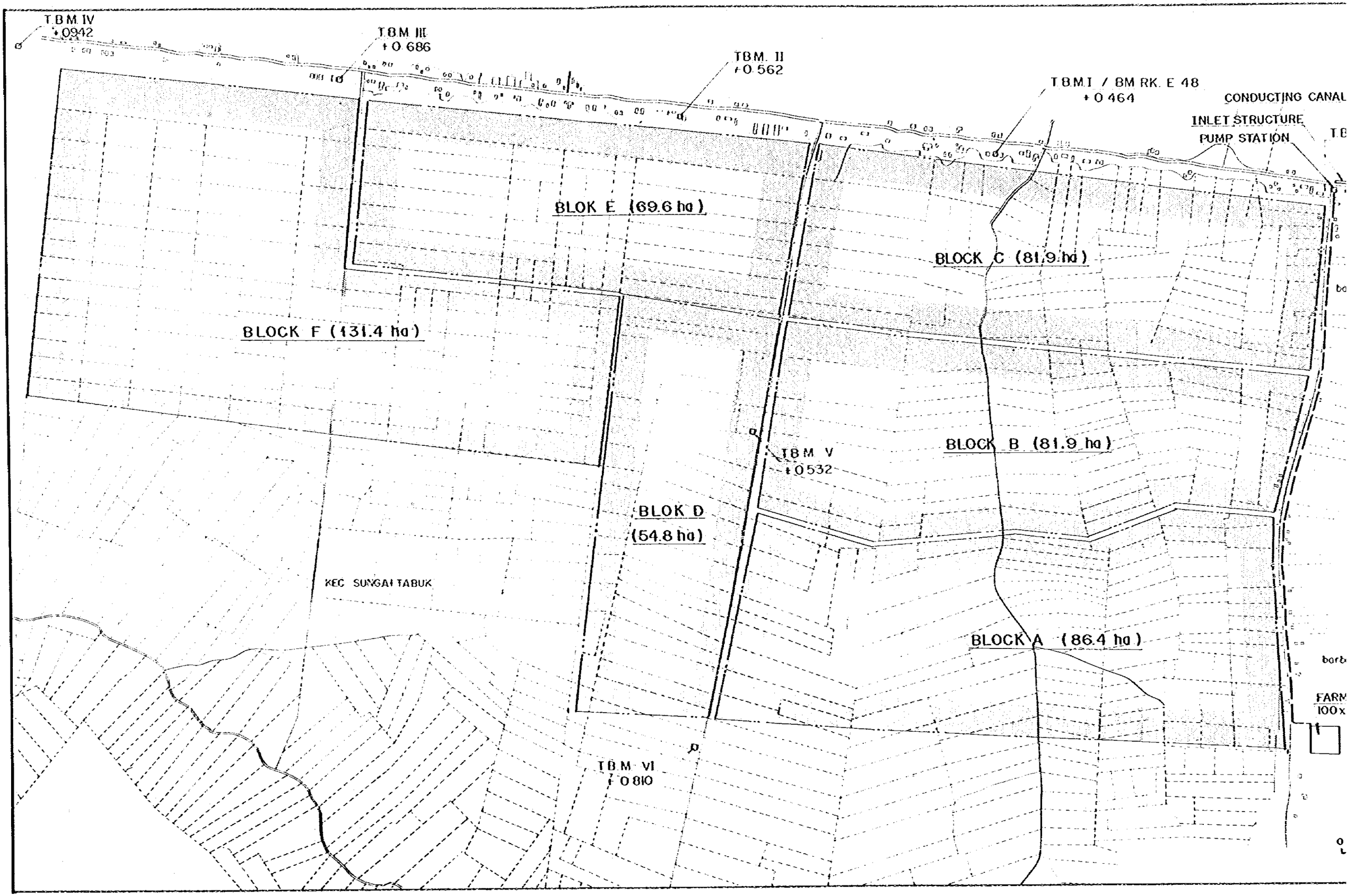
CONSTRUCTION OF PILOT SCHEME FAQLITIES IN RIAM KANAN

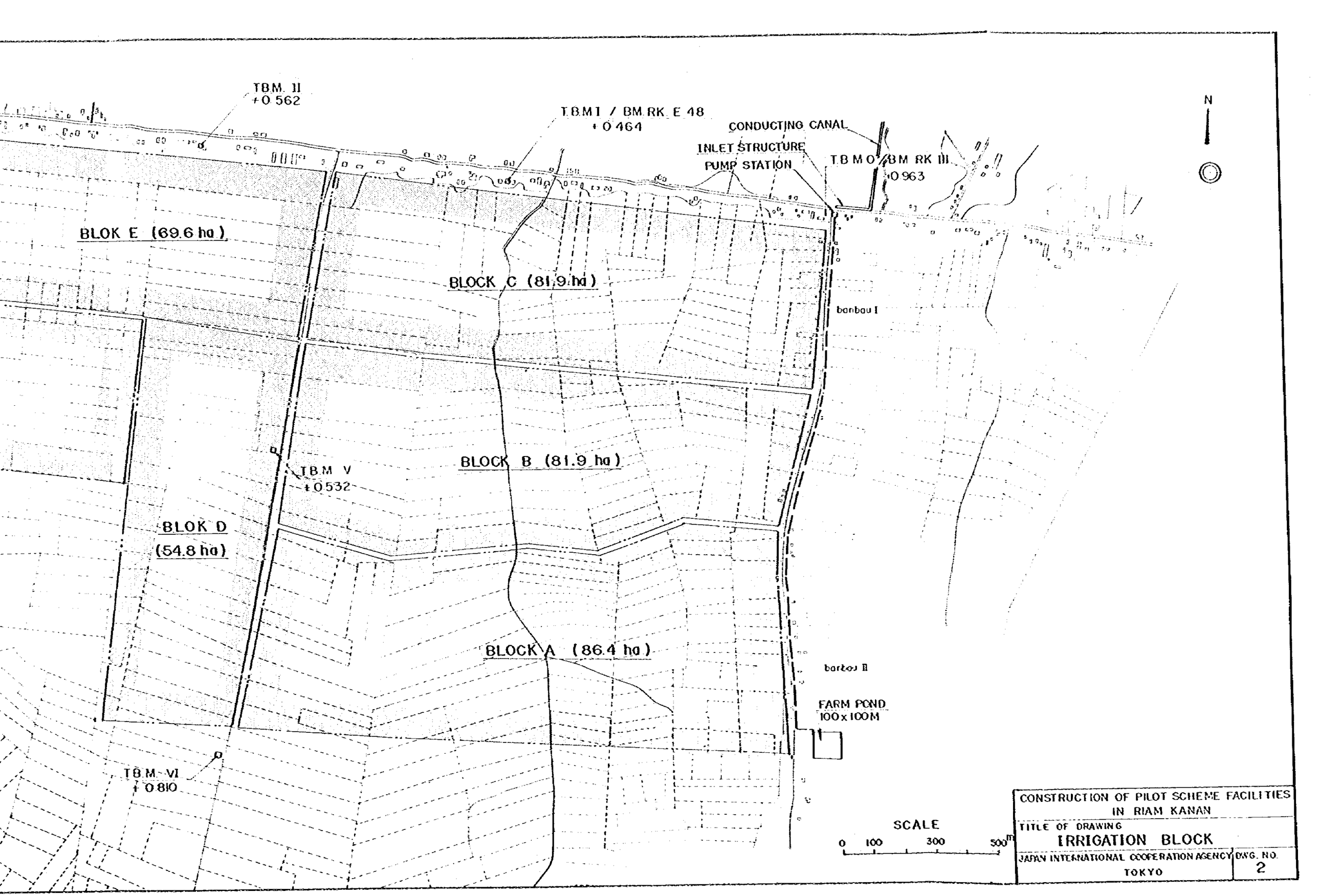
TITLE OF DRAWING

GENERAL LAYOUT MAP

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO

DWG. NO. 1


T.B.M. IV
+0942
T.B.M III
+0.686
T.B.M. II
+0.562
T.B.M.I / BM RK. E 48
+0.464
CONDUCTING CANAL
INLET STRUCTURE
PUMP STATION
BLOK E (69.6 ha)
BLOCK C (81.9 ha)
BLOCK F (131.4 ha)
T.B.M V
+0532
BLOCK B (81.9 ha)
BLOK D
(54.8 ha)
KEC SUNGAI TABUK
BLOCK A (86.4 ha)
T.B.M VI
+0.810


T.B.M. II
+0.562
T.B.M I / B.M.RK. E 48
+0.464
CONDUCTING CANAL
INLET STRUCTURE
PUMP STATION
T.B.M. / B.M. RK III
+0.963
N
BLOK E (69.6 ha)
BLOCK C (81.9 ha)
banbau I
BLOCK B (81.9 ha)
T.B.M V
+0.532
BLOK D
(54.8 ha)
BLOCK A (86.4 ha)
barbau II
FARM POND
100 x 100M
T.B.M VI
+0.810
SCALE
0 100 300 500m
CONSTRUCTION OF PILOT SCHEME FACILITIES
IN RIAM KANAN
TITLE OF DRAWING
IRRIGATION BLOCK
JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO
DWG. NO.
2

T.B.M IV
+0942

T.B.M III
+0.686

T.B.M. II
+0.562

T.B.M I / B.M RK. E 48
+0.464

MARTAPURA RIV

STOPLOG

CONDUCTING CANAL

INLET STRUCTURE
PUMP STATION

T.B

PIPE LINE

ILTLR

ILT.CL

ILTCR

IRTR

ILTLL

ILTL

ILTC

ILTR.I

T.B.M V
+0532

IRTL

IRTR

ILS.I

ILTR.O

IRS

barb

ILS

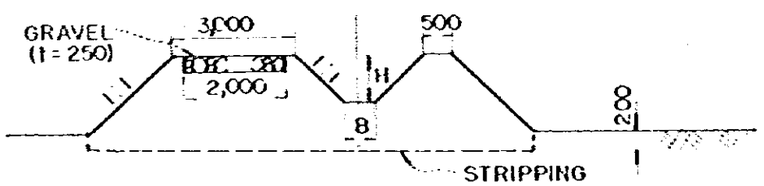
ILTRS

F.P.

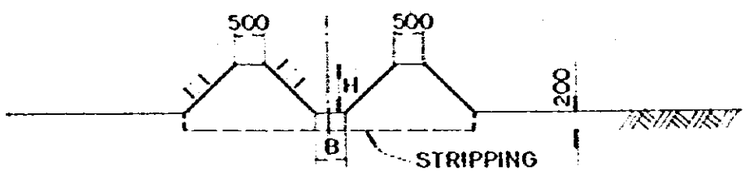
IS

T.B.M VI
+0.810

REC. SUNGAI TABUK



TYPICAL CLOSS SECTION OF TERTIARY
IRRIGATION CANAL WITH TERTIARY FARM ROAD



TYPICAL CLOSS SECTION OF
TERTIARY IRRIGATION CANAL

MARTAPURA RIVER

STOPLOG

T.B.M. II
+0.562

T.B.M I / B.M RK E 48
+0.464

CONDUCTING CANAL

INLET STRUCTURE
PUMP STATION

T.B.M 0 / B.M RK III
+0.963

N

ILT. CL

ILTCR

IRTR.

PIPE LINE

banbou I

ILTC.

ILTL

ILTR.1

T.B.M V
+0.532

IRTL.

IRTR

ILS.1

ILTR.0

IRS

barbar II

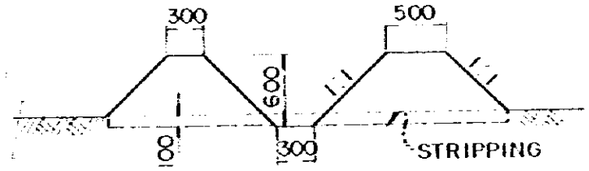
ILS

ILTRS.

F.P.

IS

T.B.M VI
+0.810



TYPICAL CLOSS SECTION OF
QUARTERNARY CANAL

REMARKS

- PIPE LINE
- SECONDARY CANAL
- TERTIARY CANAL
- QUATERNARY CANAL
- TURNOUT
- DIVISION BOX
- CULVERT
- BRIDGE
- PERSHALL FLUME

SCALE
0 100 300 500m

CONSTRUCTION OF PILOT SCHEME FACILITIES IN RIAM KANAN

TITLE OF DRAWING
IRRIGATION CANAL NETWORK

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO

DWG NO.
3