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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

IRRIGATION REHABILITATION PROJECT

INDONESIA

August 14, 1968

Projects Department

CURRENCY EQUIVALENTS

Because of the rapid inflation and floating exchange rate of the Indonesian rupiah, all amounts in this report are expressed in U.S. dollars.

WEIGHTS AND MEASURES

Metric Units

1 millimeter (mm)	=	0.039 inch (in
1 meter (m)	=	39.37 in
1 Kilometer (km)	=	0.62 miles
1 cubic meter (m^3)	=	35.31 cubic feet
1 million m^3 (Mm^3)	=	810.7 acre feet
1 m^3 per second (m^3/sec)	=	35.31 cubic feet per second (cusec)
1 kilogram (kg)	=	2.204 pounds (lb)
1 metric ton (m ton)	=	2204 lb
	=	0.98 long ton
1 hectare (ha)	=	2.47 acres

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IRRIGATION REHABILITATION PROJECT

APPRAISAL REPORT

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This report is based on the findings of a mission consisting of Messrs. J.M. Malone and M.D. ffrench-Mullen (of the Bank) and Messrs. R.M. Fagerberg and C.J. Hoffman (consultants to the Bank) which visited Indonesia in March 1968.

INDONESIA

IRRIGATION REHABILITATION PROJECT

SUMMARY

i. The Government of Indonesia has requested an IDA Credit of US$5.0 million to assist in financing the rehabilitation of three existing irrigation systems in the provinces of Central and West Java and the completion of a new irrigation system in Lampung Province, southern Sumatra. The IDA funds would be used to provide technical assistance for the detailed planning of the work to be done and imported equipment and materials to enable the work to be carried out and would cover part of the cost of operating and maintaining the equipment. The total area served would be about 198,000 ha. The project would be the first step in the preparation and implementation of a well planned program for the rehabilitation and subsequent operation and maintenance of Indonesia's neglected irrigation systems.

ii. Because of the urgency of the Indonesian situation the appraisal of the proposed project took place before an engineering study or detailed plan for the execution of the project could be prepared. It will be necessary as soon as possible to retain consultants to make a proper engineering study and detailed plan for the execution of the project. Meanwhile the appraisal mission's estimate of the amount of work to be done is adequate to enable the Government to begin ordering the necessary numbers and types of equipment for each system included in the project as soon as an IDA credit is approved. After the preparation of the first year's work plan by the consultants equipment can be deployed and put to work on the more urgent and obvious tasks without delay.

iii. In spite of a chronic shortage of foreign exchange the Government continues to import large quantities of rice in an effort to prevent hunger in urban consuming centers while attempting to combat the continuing rapid inflation. In this situation, measures to increase domestic rice production are being urgently sought. The basic requirement of rice production is an adequate water supply. Because of the lack of maintenance over the years, however, the existing irrigation schemes can no longer supply the water requirements to the areas they were designed to serve. As a result yields are decreasing. To arrest this deterioration and return yields to their previous levels it is urgently necessary to rehabilitate the irrigation systems. Once this is done considerable further benefits can be obtained from the use of other inputs such as fertilizers, which are not presently economic due to the poorly regulated supply of water to the crop.

iv. The project would consist of the rehabilitation and completion of the irrigation systems over a five-year period and would include technical assistance in the form of consultants' services; the procurement of machinery and equipment and the training of operators and mechanics; and the execution of the project works using the machinery and equipment together with manual labor.

v. The total cost of the project including import duties is estimated at about US$8.8 million. It would be financed by farmers (US$0.3 million), by the Government (US$3.5 million) and by the proposed IDA Credit (US$5.0 million). The proposed credit would cover about 57 percent of the total cost, including the estimated foreign exchange costs (US$4.0 million) and US$1.0 million of the local currency costs.

vi. The project, which would have an economic rate of return of about 50 percent, would lead directly to an increase in production of 39,000 tons of rice annually thereby easing the food shortage and reducing rice imports by about US$6.6 million a year. Equally important, the rehabilitation of the systems, by restoring adequate and timely water supply to the rice crop, would enable farmers to make effective use of fertilizers and pesticides, which would produce an even greater increase in production.

vii. The project has a high economic priority. It would enable the Indonesian Government, who would be the borrower, to make a start with some of the more urgent works of rehabilitation and completion, while drawing up on a sound engineering basis, an expanded program for the future. The project is suitable for an IDA Credit of US$5.0 million.

INDONESIA

IRRIGATION REHABILITATION PROJECT

I. INTRODUCTION

1.01 The Government of Indonesia has requested an IDA Credit of US$5.0 million to assist in financing the rehabilitation of three existing irrigation systems in the provinces of Central and West Java, and the completion of a new irrigation system in Lampung Province, southern Sumatra. The IDA funds would be used to provide technical assistance for the detailed planning of the work to be done and imported equipment and materials to enable the work to be carried out. The total area served would be about 198,000 hectares (see Map 1). The project would be the first step in the preparation and implementation of a well planned program for the rehabilitation and subsequent operation and maintenance of Indonesia's neglected irrigation systems.

1.02 This report is based on the findings of a mission consisting of Messrs. J.M. Malone and M.D. ffrench-Mullen (of the Bank) and Messrs. R.M. Fagerberg and C.J. Hoffman (consultants to the Bank) which visited Indonesia in March 1968.

1.03 The rehabilitation and completion of irrigation systems in Indonesia has been recommended as a matter of the highest priority by both the IBRD Economic Mission and the Asian Development Bank Technical Assistance Mission which visited Indonesia in late 1967. 1/ Because of the urgency of the situation, the appraisal of the proposed project took place before an engineering study or a detailed plan for the execution of the project could be prepared. Engineering data were lacking in most cases, but the Bank's consultants were able to visit some of the more important irrigation systems in Indonesia and, on the basis of personal observation, combined with the few data which were available, to make a "windshield estimate" of the work which has to be done. While it will be necessary as soon as possible to make a proper engineering study and detailed plan for the execution of the project, the mission's estimate is sufficiently accurate to permit the Government to begin ordering the necessary numbers and types of earth-moving equipment for each system included in the project as soon as an IDA credit is approved so that, following a preliminary engineering survey and the preparation of a first year's working plan by consultants, the equipment can be deployed and some of the more urgent and obvious tasks can be started at the beginning of the next dry season in early 1969. At the same time the engineering survey and the preparation of detailed working plans would proceed over another year or two, staying one jump ahead of the actual project works. The consultants would also begin to prepare a second phase project for the rehabilitation of other areas. This second phase could be ready for appraisal in one or two years so that the vital task of irrigation rehabilitation could proceed uninterrupted after the completion of the initial phase.

1/ See the latest Bank economic report on Indonesia, Number AS 132a, dated February 12, 1968, and the report of the Asian Development Bank Technical Assistance Mission to Indonesia to advise on the Production and Availability of Foodstuffs, dated December 30, 1967.

II. BACKGROUND

General

2.01 Comprising more than 3,000 islands, totalling about 190 million ha in area and stretching along the equator for some 5,000 km, Indonesia possesses a wide variety of climates and soils. Its population of 115 million is growing at a rate of about 2.5 percent a year. The island of Java, consisting of only seven percent of the total land area, supports almost 70 percent of the total population and has an average population density of more than 560 per sq km.

Agriculture and the Food Situation

2.02 Agriculture accounts for more than half of Indonesia's national income and provides the livelihood of about 75 percent of the population, but, like most sectors of the economy, per capita agricultural production has been virtually stagnant during the last 30 years. About 50 percent of the total population is largely self-sufficient with respect to food. About 75 percent of the cultivated area of Java is devoted to food production but, in spite of this, the island is not self-sufficient in food, particularly rice, the staple food of the people. Imports from the Outer Islands are unable to fill the deficit. In spite of a chronic shortage of foreign exchange, the Government continues to import large quantities of rice from abroad in an effort to prevent actual hunger in urban consuming centers while holding down the rate of increase of domestic rice prices in order to minimize the continuing rapid inflation.

2.03 In such a situation, measures to increase domestic food production, particularly rice, are being urgently sought. A basic requirement of rice production is an adequate water supply. Because of the lack of maintenance over the years, the existing irrigation schemes can no longer supply the water requirements of the areas they were designed to serve. As a result, yields are decreasing. To arrest this deterioration, it is urgently necessary to rehabilitate the irrigation systems. Once this is done and yields return to normal, considerable further benefits can be obtained from the use of other production inputs which are not presently economic due to the poorly regulated supply of water to the crop.

2.04 The farmers of Java are responsive to improved techniques, inputs and incentives and have demonstrated their ability to maximize their yields, given the means at their disposal. Four basic problems have beset the Government's efforts to increase food production, however:

(a) a lack of foreign exchange to import and the physical means to efficiently distribute the necessary inputs;

(b) the lack of an assured market at remunerative nonfluctuating prices for the farmers' produce, justifying the use of purchased inputs;

(c) the inadequacy of supporting Government services, particularly the provision of agricultural extension and irrigation; and

(d) the absence of a sound credit system for the millions of farmers who are unable to purchase inputs for cash.

The BIMAS Program

2.05 In 1963 the Government began the BIMAS 1/ Program, a mass package program for the intensification of rice production designed to eliminate these bottlenecks. The program provides for extension advice and the application of a package of subsidized inputs of improved seed, fertilizers, insecticides, rodenticides and spraying equipment on credit. It is limited to groups of good farmers in villages where full irrigation is available. Adequate irrigation is a basic prerequisite for BIMAS. After a year with BIMAS, the farmers are able to take advantage of a follow-up program, known as INMAS, in which the same package of subsidized inputs is available to them, but without Government credit or extension advice. The area under BIMAS has increased from 138,000 ha in the 1965/66 wet season to 400,000 ha in 1967/68. In the latter year, the INMAS program covered 375,000 ha. In general, both the BIMAS and INMAS programs have proven successful. The yield benefits that accrue from the BIMAS and INMAS programs, as a result of improved varieties, fertilization and pest control are conservatively estimated to be more than half a ton of rice per ha. In 1967/68 these programs have probably resulted in about a four percent increase of Indonesia's ten million ton total annual rice output. For further information on these programs, see Annex 1.

Irrigation, Drainage and Flood Control

2.06 Since the BIMAS and INMAS program can only operate with optimum efficiency in areas which receive adequate irrigation and are not subject to flooding, a serious constraint on their extension is imposed by the present run-down condition of Indonesia's irrigation, drainage and flood protection systems. Adequate and efficient irrigation is the basic requirement for optimum rice yields and, in consequence, the rehabilitation of the irrigation systems is of paramount importance to Indonesia, especially Java, where the irrigated area of 2.9 million ha comprises one-third of the total cropped area. Of this area, it is estimated that 1.9 million ha requires rehabilitation. All irrigated land in Java grows at least one rice crop each year, accounting for about 75 percent of the total area under wet rice cultivation. During the dry season, enough water is available in an average year to properly irrigate a second rice crop on only about a fourth of the area served during the wet season.

2.07 Until recently virtually no budgetary funds were available for the maintenance or rehabilitation of the irrigation systems. Beginning in 1967, with the allocation of 13 percent of the development budget to irrigation,

1/ Abbreviation for "Bimbingan Massal Swa Sembada Bahan Makanan", literally "mass guidance for self-sufficiency in foodstuffs".

the new Government demonstrated its concern with the state of the irrigation systems in the country. The Government has neither machinery, equipment nor experienced personnel for this work, however, and it will be difficult, if not impossible, even to maintain the present capacity of the irrigation and drainage systems, much less reduce the accumulated backlog of deferred maintenance of the last 30 years with hand labor alone. Furthermore, no engineering study of the problem has been made, nor has any systematic planning preceded the work that has been started. Thus, rehabilitation efforts to date have had little impact on the problem.

2.08 Coupled with the budgetary problem and the lack of planning is the present inefficient organizational set-up for irrigation management. The Ministry of Public Works, acting through its provincial offices, is responsible for the construction, operation and maintenance of irrigation systems from the source of water down to the end of the secondary canal. The responsibility for the construction, operation and maintenance of the tertiary canals and turnouts fall upon village officials, responsible through the district and provincial governments to the Ministry of Internal Affairs. Due to the decentralized form of administration inherent in the Indonesian constitutional framework, the Central Government does little more than the overall planning, coordination and budgeting, while most of the decision-making and initiative in the day-to-day management of irrigation is retained by the provincial governments, whose budgets pay a share of the expenses of the irrigation staff in the field.

2.09 Water management is extremely poor in most irrigation systems, partly because of the need for rehabilitation, but also because of the shortage of funds and trained staff and the division of responsibility between different agencies, with little overall coordination. Moreover, there is widespread corruption in the distribution of irrigation water, beginning at the village level. In spite of these failings, the Ministry of Public Works and particularly its Directorate General of Water Resources Development, with their provincial counterparts, are presently among the most effective and well organized agencies of the Indonesian Government.

2.10 Apart from illicit payments to village irrigation officials, farmers make no payment for irrigation water, although they are expected to contribute their labor voluntarily for the construction, rehabilitation and maintenance of the tertiary canals. Also, farmers pay a land tax averaging about 5-10 percent of the harvest under which irrigated land pays a higher tax than non-irrigated land, although there is no systematic use of revenues generated by this tax for irrigation purposes. As a comparison, an adequate provision for irrigation operation and maintenance would be about four percent of the harvest. In a recent cabinet decision, the Government decided to institute a new system for charging the costs of operation and maintenance to farmers. Legislation is now being drafted to implement this decision.

Transmigration

2.11 In addition to the recent efforts to intensify rice production in Java, the Government has for many years pursued a policy of extending

rice production by resettling landless or unemployed Javanese and demobilized servicemen on the Outer Islands. Rice production on the Outer Islands now accounts for 40 percent of the total and the area harvested has been increasing at a rate of three percent annually. Because the new settlers from Java are usually unfamiliar with the dry-land shifting cultivation indigenous to these islands and because the Government is anxious to increase rice production for export to Java, a number of schemes have been started to provide irrigation water to the new settlement areas.

III. THE PROJECT AREAS

A. General Description

3.01 The project areas comprise four irrigation systems covering some 198,000 ha as follows:

Scheme	Location	Area (000 ha)
East Semarang	Central Java	42
Rentang	West Java	91
Tjisedane	West Java	40
Way Seputih	South Sumatra	25
Total:		198

Of the four systems, three (East Semarang, Rentang and Tjisedane) are long established systems on the northern, alluvial plains of Central and West Java, and one, Way Seputih, is a new system under construction in a transmigration area in southern Sumatra (see Map 1). The schemes in Java were selected because they are the largest, most important existing irrigation systems in Indonesia. At Way Seputih, 10,000 families have been settled, the major capital works of the weir and most of the primary canals have been completed and 1,000 ha of land are already receiving water. A relatively small additional investment would have the effect of bringing another 24,000 ha of land under irrigation.

Climate, Topography and Soils

3.02 The schemes are situated in the wet, humid, insular tropics, south of the equator with a distinct wet season from November/December to April/May and a dry season for the remainder of the year. The schemes in Java are situated on the flat estuaries of rivers. The Way Seputih scheme is situated on a gently undulating peneplain. The soils are very suitable for wet rice cultivation and with good land and water management and the application of a nitrogenous fertilizer, are capable of producing good yields of rice.

Population, Land Tenure and Communications

3.03 The Way Seputih scheme has a ratio of population to cultivated land of less than five persons per ha, while the Java schemes have a density of more than ten. Way Seputih is a transmigration settlement which is under direct Government management pending the completion of the irrigation system, following which the titles to the farms of two and one-half hectares, of which one hectare will be irrigated land, will be handed over to the settlers. All land in the Java schemes is freehold and is farmed either by the owner, on a share cropping basis or by tenants paying a fixed rent. Land rents are equivalent to about half a ton of rice per ha and the average holding is about two-thirds of a hectare. While all the schemes have good access to the urban consuming centers, the road systems within the schemes are inadequate.

Cropping Patterns and Yields

3.04 The cropping pattern on Way Seputih differs from that on the Java schemes. The latter are designed primarily for the production of wet rice with irrigation while, at Way Seputih, each farm is designed to provide the farmer with one ha of irrigated land and one and one-half ha of land suitable for dry farming on which maize, root and tree crops can be grown. On the Java schemes, a dry season crop of irrigated rice, of about 40,000 ha, is presently being cultivated. In the present state of the irrigation systems, this crop is not getting sufficient water and yields are accordingly depressed. Similarly, the wet season rice crops suffer generally from water stress, which results in about a 15-20 percent reduction in yield, save for those areas near headworks which receive adequate water. More than sufficient water is available in the wet season at the intake of each scheme, but this cannot be moved to the field because the canals are silted up through lack of maintenance. Yield data supplied for each scheme varied considerably. Yields in Java are estimated presently to average 1.35 m tons of rice per ha in the wet season, and 1.1 m tons in the dry season. In Way Seputih the yield of rainfed rice is about one ton per ha.

Marketing, Credit and Transportation

3.05 The producer sells his crop either as stalk paddy 1/ or as rice, after retaining sufficient for his own requirements. Stalk paddy is transported from the field to the farmer's house by those harvesting the crop, either on their backs, on carry poles, by bicycle or by cart. Transport from the farm to the rice mill is by similar means. There is adequate road and rail transport from the schemes to the consuming centers.

3.06 There is a conspicuous lack of credit facilities available to the peasant farmer, together with a lack of an assured market for his crop

1/ Stalk paddy, or padi kering, consists of the head of rice, cut off by hand, with about 15 cm of the stalk left attached, so that the paddy can be tied in bundles and slung over carrying poles. Stalk paddy, when dry, contains about 50 percent milled rice by weight.

at remunerative, non-fluctuating prices. If a farmer is fortunate enough to be selected for a BIMAS project, he gets seven months' credit for the BIMAS inputs and subsequently can obtain inputs from the INMAS program. There is no other institutional source of credit available to him. Under BIMAS, interest rates are three percent per month, less than the average rate of inflation, which has recently been about 10 percent per month.

Supporting Services

3.07 In general, the supporting services available to the farmer are poor and inadequate. The supply of fertilizers and insecticides is limited by lack of foreign exchange. The extension services in agriculture and irrigation are short of adequately trained and experienced staff and of tools with which to work. The effectiveness of those available is further reduced by a lack of transportation coupled with poor roads within the schemes.

3.08 A more detailed discussion of agriculture in the project areas is contained in Annex 1.

B. The Irrigation System

3.09 With the exception of the Way Seputih system, which is still under construction, the irrigation systems in the project areas have been in operation for many years, some of them for more than a century. Before World War II they were properly managed and maintained and were extremely productive. While the lack of maintenance combined with a rapid increase in the rate of siltation and flooding, occasioned by severe deforestation and erosion in the catchment areas, has been the main factor in the physical deterioration of these systems since the war, the absence of effective irrigation management has been equally responsible for their loss in productivity.

Water Supply

3.10 All of the systems depend on direct diversion of river flows during both the wet and dry seasons. Storage capacity is virtually nonexistent except in the Semarang area (45 million m^3) where it is of only minor consequence. The diversion rates and designed capacities of the systems are based on the approximate water requirement formula of one liter/sec/ha for the area served during the wet season. This is a reasonable average requirement for rice production under the continuous flooding type of irrigation used in Indonesia. There is more than enough water available to fully irrigate all the systems in the wet season but not in the dry season, when the average water available for irrigation is only about 15 percent of the total designed capacities of the systems.

Loss of Capacity

3.11 Insufficient information was available to confirm the official estimates of reduction in canal capacities. However, it was obvious that

many of the canals were badly silted up and in some areas there was evidence of flooding or the danger of floods. In some areas, the operation of the systems appeared to be influenced by the condition of the tertiaries. When the tertiaries had not been properly maintained, the water level in the primary and secondary canals had to be raised unduly high to force water through the silted-up tertiaries. This has reduced the amount of water that could be by-passed to fields at the lower ends of the canals and has resulted in more rapid siltation of the primaries and secondaries themselves.

3.12 Most of the irrigation structures and mechanical devices, such as gates, have been neglected for many years and in some cases are no longer operative, so that there is no adequate means of controlling the distribution of the water in the system. A number of gates have been sabotaged, obviously many years ago, and can no longer be closed or even adjusted. These structures will have to be repaired at the same time as the canals are cleared of silt.

3.13 In some areas there have been efforts to maintain canal capacities by the hand removal of silt. In none of the Java areas was there any earthmoving equipment earmarked specifically for irrigation. When local funds recently became available for maintenance of the irrigation systems, an immediate start was made with the use of hand labor on an ad hoc basis but without systematic planning of the works. Most of the canal cleaning to date has been at or near the system headworks, rather than in the secondaries and tertiaries, thus creating settling basins in the primary canals.

3.14 It is evident that the three critical shortages affecting the rehabilitation effort, as well as the effort to complete the Way Seputih system, are the lack of budget funds, which has been remedied somewhat since 1967; the lack of equipment to speed up the work, permit a reduction in the backlog of deferred maintenance, and operate in places which hand labor cannot reach; and the lack of planning and programming of the work to be done.

IV. THE PROJECT

A. General Description

4.01 The project for which IDA assistance is required is the rehabilitation of the East Semarang, Rentang and Tjisedane irrigation systems in Java and the completion of the Way Seputih irrigation system in Sumatra. These systems are basically sound and there is adequate water available in the wet season at the points of diversion for the areas served. The project would include the following:

(a) Technical Assistance: an engineering study by consultants of the rehabilitation problem in the areas concerned, the

drawing up of a detailed plan for the execution of the project as well as rules for the future operation and maintenance of the systems and the preparation of further projects for irrigation rehabilitation in other areas.

(b) Training and Procurement: the training of operators and mechanics and the procurement of earthmoving machinery and equipment, spare parts, repair shops and materials.

(c) Execution of Project Works: the rehabilitation and completion of the systems included in the project over a five-year period using the earthmoving machinery and materials purchased together with manual labor. Most of the work would go on during the dry season and would not interfere with crop production.

(d) Pilot Area for Improved Irrigation Management: the Way Seputih irrigation system would be set up as a pilot area for improved irrigation management (see para 5.04).

Technical Assistance

4.02 In view of the urgency of the need for rehabilitation and completion of the major irrigation systems in Indonesia, combined with the lack of experienced personnel in the Directorate General of Water Resources Development in both planning and execution of irrigation rehabilitation and in the operation and maintenance of dredgers, draglines and tractors used in such work, it is essential to provide for the services of experienced engineering consultants to assist the Government in planning and implementing the project. These consultants would be employed by the Government and would work with the Director General of Water Resources and the engineering staff responsible for irrigation. The consultants would make an engineering survey and inventory of the systems included in the project on the basis of which they would prepare a detailed plan for their rehabilitation and subsequent operation and maintenance, redesigning them wherever necessary. On the basis of these plans, they would assist the Government in supervising the execution of the project. They would set up, and supervise initially, maintenance schedules and accounting and control systems for equipment, materials, spare parts and supplies and would provide in-service training to supervisory project staff in the operation and maintenance of the equipment and the irrigation systems. Finally, in early 1969, they could begin to prepare a further project for the rehabilitation of other high priority irrigation areas. This project could probably be appraised in 1969/1970. The consultants' work would require a total of about 33 man-years; suggested staffing and draft terms of reference are given in Annex 2.

Project Works

4.03 Assuming that the consultants began their work in September-October of 1968, a preliminary field survey and inventory of all the systems plus a detailed plan of operation for the first year's work could be ready before the beginning of the dry season in April 1969 when equipment could be on site and work on some of the more urgent

and obvious tasks could commence. In the Way Seputih area, the detailed engineering is already satisfactory and would permit construction to proceed on the basis of the existing plans.

4.04 Even in the absence of an engineering study of the amount of rehabilitation work to be done it was possible for the Bank's consultants to make a rough estimate of the quantities of excavation involved, sufficiently accurate, however, to permit the procurement of the apropriate numbers and types of standard earth-moving machinery and equipment required for each system. These quantity estimates also permit a rough calculation of the cost of the project works in each system (equipment operation and direct labor). These latter estimates would have to be revised by the project consultants on the basis of their engineering study and detailed plan of operation when they became available. This revision, however, would not affect the equipment requirements.

4.05 The project works which would be carried out over a five-year period, are described in detail in Annex 3 and are summarized below:

Length of Canals (km)	East Semarang	Rentang	Tjisedane	Way Seputih	Total
Primary	68	119	88	49	324
Secondary	93	545	105	78	821
Tertiary	200	700	200	150	1,250
Total:	361	1,364	393	277	2,395
Number of Structures	181	393	119	105	798
Total Excavation Required (m^3 millions)	2.2 a/	3.7	2.4 b/	3.3	11.6
Estimated Total Cost (US$ millions)	1.4	1.8	1.4	2.3	6.9

a/ Includes 1.3 million m^3 estimated silt removal required to rehabilitate an old inland waterway used as a drainage channel.

b/ Includes 0.4 million m^3 annual canal maintenance over the last three years of the five-year period.

Equipment and Service Facilities

4.06 The Ministry of Public Works has hardly any earthmoving equipment available for irrigation use. Furthermore, the little equipment available is used on a single shift due to lack of operating funds. Assurances were obtained during negotiations that all equipment financed under the project would be utilized at the optimum rate. An understanding was reached that the equipment would be in operation a minimum of 2000 hours each year, either on a double shift or a single shift with a bonus incentive. While this is a heavy schedule, it would make the optimum use of the minimum amount of equipment required for each irrigation system, which otherwise would be doubled.

4.07 Assuming that the earthmoving equipment would operate at least 2,000 hours a year and that a substantial share of the work would continue to be done by hand, particularly in the tertiaries, execution of the project works over a five-year period would require four dredgers, eight draglines, eight bulldozers, four scrapers, 30 dump trucks and three motor graders. In addition, the project would need ancillary equipment, such as inspection cars, equipment transporters, concrete mixers, compressors, pumps, etc. It is estimated by the Ministry of Public Works that imported materials, such as steel, chains, wire mesh, etc., required to repair hydraulic structures would cost about US$475,000. These estimates were accepted after examination in the field. To ensure adequate maintenance of the equipment, provision is made in the project cost estimates for spare parts and repair facilities. Each irrigation system would have a fully equipped mobile repair shop and each of the three provincial public works repair shops would receive additional equipment. A detailed list of equipment is given in Annex 3, Table 1.

4.08 The successful tenderers for the supply of field and workshop equipment would be required to undertake the training of a sufficient number of equipment operators and mechanics, immediately following the delivery of equipment to each scheme or to the workshops. It is necessary that the training take place at the job site and not at a central school to minimize wastage of trainees on the completion of training. The training provided must be such that the operators are not only efficient at their job but are also capable of undertaking any maintenance normally carried out by the operator when in the field. In the case of mechanics, they must be trained to strip, maintain and repair the project equipment and be taught the use of the workshop equipment supplied. The duration of training would be two to three months. This initial training would be supervised by the consultants who would themselves set up in-service training programs within the Ministry of Public Works.

B. Project Costs

4.09 The total project during the five-year period is roughly estimated at about US$8.8 million equivalent. Details are given in Annex 4, Table 1 and are summarized below.

	Foreign Exchange Cost	Local Cost Inc. Duties	Total Cost
	(US$ thousands)		
1. Machinery & Equipment including Spares.	2,026	757	2,783
2. Materials.	365	110	475
3. Operation and Maintenance of Machinery and Equipment	-	1,356	1,356
4. Direct Labor	-	1,035	1,035
5. Consultants' Services	1,250	417	1,667
6. Contingencies	360	1,100	1,460
Total:	4,001	4,775	8,776

4.10 Foreign exchange costs amount to US$4.0 million, 46 percent of the total. The cost of imported machinery and equipment is based on normal sources of supply and includes a 20 percent allowance for spare parts and the training of operators and mechanics. The cost of materials is based on information supplied by the Ministry of Public Works. The cost of consultants' services is based on a team of six or seven men provided by a consulting firm working for five years at an all-in cost of approximately US$50,000 per man year, 75 percent payable in foreign currency.

4.11 A contingency of approximately 10 percent was added to foreign costs to allow for price escalation. In view of the very rough nature of the estimates of the quantity of work to be done, a contingency of about 30 percent has been added to local costs, which are expressed in US dollars because of the rapid inflation and floating exchange rate of the rupiah. The overall average allowance for contingencies is 20 percent. To the extent that rupiah costs respond less than proportionately to possible future devaluations of the exchange rate, the estimate may be on the high side. The cost estimates include import duties amounting to about US$500,000.

Financing

4.12 The US$8.8 million total cost of the project would be met from the following sources:

	Foreign Exchange Cost	Local Cost	Total Cost	Percentage
	US$ millions			
Proposed IDA Credit	4.0	1.0	5.0	57
Farmers' Voluntary Labor	-	0.3	0.3	3
Government Development Budget	-	3.5	3.5	40
Total:	4.0	4.8	8.8	100

The borrower of the proposed US$5.0 million IDA credit would be the Government of the Republic of Indonesia, which would finance the project through the annual development budget. The proposed credit would finance the foreign exchange costs of the project, and US$1 million (20 percent) of the local costs. Rehabilitation of the tertiary canals would be achieved by voluntary self-help labor at an imputed cost of US$274,000. The remainder of the cost would be met by the Government.

Expenditures

4.13 The estimated annual expenditures (including contingencies) on the project are as follows: (further details are given in Annex 4, Table 2).

	Year 1	2	3	4	5	Total a/
	US$ thousands					
1. Machinery and Equipment	3,232	-	-	-	-	3,232
2. Materials	233	98	83	71	65	548
3. Cleaning of Tertiaries	63	63	49	49	49	274
4. Direct Labor on Force Account	364	197	174	164	156	1,056
5. Operation & Maintenance of Machinery and Equipment	365	360	363	363	292	1,743
6. Consultants' Services	614	615	231	232	231	1,923
Total: a/	4,871	1,333	900	879	793	8,776
of which, Foreign Exchange	2,850	490	230	220	210	4,000
Foreign Exchange Percentage	59	37	26	25	26	46

a/ Inconsistencies due to rounding.

Procurement and Disbursement

4.14 All imported machinery, equipment, materials and supplies would be obtained by international competitive bidding. Assurances were obtained that the Government would retain a consulting firm, acceptable to the Association, whose duties and terms and conditions of employment would be agreed between the Government and the Association, as a condition of effectiveness of the proposed credit. (See para 4.02).

4.15 Withdrawals from the credit account would cover, against documents, 100 percent of the cif cost of identifiable imported goods and services, totalling about US$4.0 million, and, against certificates, an agreed percentage of the cost of operating and maintaining the equipment financed out of the proceeds of the credit.

4.16 The Government would establish and maintain for the project appropriate separate accounts. Assurances were obtained during negotiations that these accounts would be audited annually by an independent auditor mutually acceptable to the Government and the Association.

V. ORGANIZATION AND MANAGEMENT

Directorate General of Water Resources Development

5.01 Execution of the project would be the responsibility of the Directorate General of Water Resources Development within the Ministry of Public Works (see organization chart). The present Director General and the three provincial Directors of Public Works are capable and hard-working, and their staffs are among the best of any of the government services in Indonesia. The Directorate General consists of four directorates (the Directorate of Irrigation, the Directorate of Rivers and Swampy Areas, the Directorate for Survey and Planning and the Directorate for Logistical Affairs) and the Institute of Water Resources Development, a group of engineers and hydrologists working closely with the various government consulting engineering firms and the Engineering Faculty in Bandung.

5.02 The Directorate General of Water Resources Development in Djakarta would be responsible for procurement, training, studies and planning with the advice of the consultants. The responsibility for the actual day-to-day work of rehabilitation in the field would have to be delegated to the three provincial Directors of Public Works. The manager of each irrigation system in the project, who would be responsible for the execution of the project works in the field, would report directly to his Provincial Director of Public Works.

5.03 In view of the present lack of coordination in the field between the provincial Public Works Departments, who are responsible for diversion structures and primary and secondary canals, and the district and village authorities, who are responsible for the tertiaries, it is essential that

responsibility for the rehabilitation of the entire systems to be included in the project be unified, so that the voluntary efforts of the villagers can be coordinated with the other project works. Assurances were obtained during negotiations that district authorities would be responsible to and follow instructions from the provincial Directors of Public Works in all matters relating to the project, particularly the rehabilitation of the tertiary canals.

Irrigation Management

5.04 The present unsatisfactory system of irrigation water management in Java should be improved. However, the system has been established in its present form for more than a hundred years and it would not be practicable to attempt to change it until a thorough study has been made. Nor are the field irrigation staff ready to assume the increased burden of managing the systems in their entirety. In Sumatra, however, there is no well-established structure for irrigation management, and it should be possible to build improvements in management into the new irrigation systems being constructed there. As part of the project, therefore, the Way Seputih irrigation system would be set up as a pilot area for improved irrigation management, with the provincial Department of Public Works responsible for the construction and management of the entire system, including the tertiary canals. In the meantime the consultants would study the existing system of water management in Java and would recommend improvements for introduction as early as possible.

Recovery of Costs

5.05 There is no uniform method of recovering the costs of irrigation maintenance and rehabilitation from the beneficiaries. Farmers have generally contributed labor during the dry season for the maintenance of the tertiary systems and, in some areas, have made cash contributions for the purchase of materials needed to repair small structures. However, in the absence of any noticeable effort on the part of the Government to rehabilitate the primaries and secondaries, the farmer's willingness to contribute his labor has understandably diminished. Moreover, political dissidents in the villages have been urging farmers not to cooperate with the Government and to refuse to do any work on the irrigation systems unless they are paid in full for their labor. Finally, although part of the land tax revenues are supposedly earmarked for irrigation in many areas, the salaries of the large staffs employed by the village and district authorities have accounted for almost the entire amount of tax revenue retained at the local level. In view of the recent lack of irrigation maintenance and the need for rehabilitation that has resulted, this situation is unsatisfactory. The ideal method of recovering the costs of irrigation would be through a water charge paid by the farmer, and the authorities must begin now, even if only in a small way, to make routine provisions for the future maintenance of the irrigation systems, in order to prevent a recurrence of the present situation. An adequate average provision for the routine operation and maintenance of the irrigation systems would be about US$8 per ha, or approximately 50 kg of rice per ha, if the maintenance of the tertiaries is done by the farmers themselves. This is roughly 5 percent

of the farmers' net income after rehabilitation. As mentioned in paragraph 2.10, the Government has recently decided to begin collecting money from farmers after the rehabilitation of their irrigation systems, to defray the costs of operation and maintenance of the systems. The exact details have not yet been worked out; however, during negotiations assurances were obtained that farmers using the systems included in the project would make a substantial contribution towards the cost of the operation and maintenance of the systems. The Government would make up any shortfall from its general budget revenues. For the Way Seputih system, the Government would institute, on an experimental basis, the collection of charges which, upon completion of the system, would enable the recovery of the full costs of operation and maintenance.

Supporting Services

5.06 Assurances were obtained during negotiations that in the part of each irrigation system rehabilitated or completed each year under the project, the Government would provide adequate supporting services, including the BIMAS package of input and extension services. This package would be made available for the first wet season crop following rehabilitation and would be made available thereafter for the duration of the project. In areas where full irrigation is available during the dry season, the package would be made available for both wet and dry season crops.

VI. INCREASE IN PRODUCTION AND FARMERS' INCOMES

6.01 The project would lead to an increase in rice production of about 39,000 m tons annually, or about 15 percent of the present level, as shown below: (Details are given in Annex 5).

A.	Area presently receiving irrigation (ha)	170,500
	Present rice yield (kg/ha)	1,350
	Rice yield expected after rehabilitation	1,500
	Increase	150
B.	Area presently rainfed (ha)	26,500
	Present rice yield (kg/ha)	1,000
	Rice yield expected after irrigation	1,500
	Increase	500
C.	Increase in rice production (metric tons)	
	Rehabilitation	26,000
	Completion	13,000
	Total:	39,000

In projecting these increases no account has been taken of any inputs other than improved supply of water to the crop. 1/ Moreover, no account has been taken of the future decline in production which would take place without the project. Except for a small extension of the Tjisedane system, the increased production in the Javanese rehabilitation areas would result entirely from more efficient irrigation, both in quantity and timeliness of application, and improved surface drainage, reducing flood losses. At Way Seputih, the increase would be entirely due to the supply of irrigation water to an area presently producing rainfed upland rice.

6.02 This increased production would result in foreign exchange savings of about US$6.6 million a year by reducing the need for imported rice. This compares favorably with the project's total foreign exchange cost of only US$3.5 million.

Prices and Farm Incomes

6.03 For a number of years the price of rice in Indonesia has been kept at an average level considerably below world prices by the importation and distribution of rice to consumers at less than cost. In recent months the price of domestic rice has risen rapidly and now has generally approached world price levels in major markets. The present farm-gate price is US$160 per metric ton, while the price of imported rice, cif Djakarta, has risen above US$200 a ton. In this report a price of US$170 per m ton, cif Djakarta, is used to value the economic benefits. This price is less than current world prices, which have risen sharply, due to a world-wide shortage of rice partly attributable to the war in Viet Nam, and is in line with the projected long-run peacetime average of US$140 a ton fob Bangkok, which is equivalent to about US$170 a ton, cif Djakarta.

6.04 The present net return per hectare from rice, after deducting land taxes and all on-farm production costs, including family labor, is about 0.75 m tons of rice in the rehabilitation areas and 0.45 m tons in Way Seputih. Thus, excluding subsistence, the net rice production per family is about half a ton per year, equivalent to about US$80 at farm-gate prices. About US$150 is derived from other crops, livestock and the return to the family's labor, both on the farm and off, making the total family income roughly US$230 a year, including subsistence.

6.05 As a result of the project, the net return per hectare in Java would increase by roughly 20 percent, while in Way Seputih it would double. Thus, since subsistence production and other income are about two-thirds of the total, family incomes would increase by about seven percent in Java and 35 percent in Way Seputih. Detailed costs of production are given in Annex 5.

1/ If the BIMAS package were applied to all these areas a minimum additional yield increase of 0.5 m tons/ha would be obtained.

VII. ECONOMIC JUSTIFICATION

7.01 The project, which would increase food production and reduce imports, is of high economic priority. The net economic benefits of the project consist of the projected increase in the production of rice, valued at the cif price of imported rice, US$170 a ton, less the additional production, processing and transportation costs necessary to obtain the increase. Details of costs and benefits, year by year, are shown in Annex 6.

7.02 In view of the assurances to be obtained regarding provisions for the maintenance of the irrigation systems included in the project, it is very unlikely that the new Government would permit them, once rehabilitated, to revert to their present condition. However, assuming for simplicity's sake that the systems were not maintained but were allowed to gradually fill with silt, so that benefits would decrease and finally disappear altogether fifteen years after the completion of the project, the internal rate of return to the economy on the investment cost of the project would still be about 50 percent. The rates of return on individual systems would range from 37 percent to 71 percent.

7.03 These high rates of return reflect the nature of the investment, i.e., eliminating the backlog of deferred maintenance and thus breaking the bottleneck which has been steadily choking off rice production in these areas. If, as is expected, the Indonesian authorities will not allow the systems to revert to their present condition, but will henceforth embark on an effective program of irrigation maintenance in these areas, the benefits would continue indefinitely and the return to the economy would be even higher. On the other hand, even if the execution of the project fell behind schedule for some reason, say due to failure to achieve the machine operation target of 2000 hours a year, the rate of return would still be high.

7.04 Equally important, however, is the fact that, once these areas are provided with adequate irrigation and drainage systems, it will then become economically feasible to employ other modern inputs, such as those contained in the BIMAS package. In this way the direct benefits of the project may lead to other even greater benefits by making it worthwhile and possible for farmers to use a variety of purchased inputs to complement the irrigation water and further increase their yields.

VIII. CONCLUSIONS AND RECOMMENDATIONS

8.01 In view (a) of the urgent and high priority need for the rehabilitation of the irrigation systems and the prevention of their further deterioration, and (b) of the fact that the equipment requirements can be estimated reasonably well in advance of engineering studies, the appraisal of the proposed project did not await the kind of information which is normally available at a more advanced state of project preparation; much of this information will become available only after the proposed credit

is signed. The project would enable the Indonesian Government to make an early start with some of the more urgent works of rehabilitation and completion while drawing up an expanded program for the future. The project is suitable for an IDA credit of US$5.0 million.

8.02 Among others, assurances were obtained during negotiations that:

(a) Any equipment to be financed under the project would be utilized at the optimum rate (para 4.06);

(b) As a condition of effectiveness, the Government would retain a consulting firm, acceptable to the Association (para 4.14);

(c) Project accounts would be audited annually by an independent auditor mutually acceptable to the Government and the Association (para 4.16);

(d) District authorities would be responsible to and follow instructions from the provincial Directors of Public Works in all matters relating to the project, particularly the rehabilitation of the tertiary canals (para 5.03);

(e) In each district included in the project, a substantial contribution would be made by the farmers toward the cost of irrigation operation and maintenance, and the Central and Provincial Governments would make up any shortfalls by provision from their own budget revenues (para 5.05);

(f) In Way Seputih a water charge would be instituted on an experimental basis which would permit the full recovery of the costs of operation and maintenance of the irrigation system (para 5.05); and

(g) In the part of each irrigation system rehabilitated or completed during each successive dry season, the BIMAS package would be made available (para 5.06).

August 14, 1968

INDONESIA

IRRIGATION REHABILITATION PROJECT

AGRICULTURE

A. BIMAS and INMAS

1. Low rice yields are the principal problem of peasant agriculture in Indonesia. The present estimated yield is 1.35 m tons of rice per hectare, equivalent to half a ton per acre. These low yields are of particular importance in Java with its dense rural population and small size of individual rice holding. There is substantial evidence that on at least 1.9 million ha of irrigated rice in Java yields have fallen over the past thirty years, as a result of the deterioration of the irrigation systems through lack of maintenance, and these yields are still slowly falling. In Java, there is no idle rice land which could be brought into cultivation to offset declining yields. The problem is therefore how to increase productivity per hectare.

2. A prerequisite for optimum rice yields is an adequate supply of water in sufficient quantity at the right time. Yields can then be further increased by the application of further inputs such as improved varieties, fertilizers, insecticides, fungicides, rodenticides, and adequate extension advice.

3. With the aim of increasing productivity per hectare the Indonesian Government has developed a scheme to increase rice production on areas where there is an adequate water supply throughout the growing season of the crop, popularly known as the BIMAS scheme. The scheme involves extension advice and the application of a package of inputs consisting of seed of improved varieties, 75 kg per ha of urea, 50 kg per ha of double superphosphate or 100 kg per ha of fused magnesium phosphate, 2½ liters of Endrin per ha, 100 gm per ha of zinc phosphide and spraying equipment, financed by a crop loan for seven months at an interest rate of three percent per month. The package is only applied to selected groups of farmers who have rice land that is adequately watered. Extension advice is given by agricultural students, theoretically at a rate of one for every 50 ha. The students have more than made up in their enthusiasm for what they lack in experience, and their advice has been generally well received by farmers.

4. BIMAS developed from the "Paddy Centra" program which was organized in 1960 to increase rice yields in Java and which was abandoned in 1964. The lessons learned in this failure were taken into account by the organizers of BIMAS, namely the need to concentrate inputs where land and water conditions were most promising. The under-lying idea behind BIMAS is that with proper care and attention plus adequate irrigation, the package of inputs will result in increasing yields by one m ton of rice per ha. This theory was tested in numerous field trials which confirmed its technical soundness. As the area under BIMAS has been expanded to 400,000 ha in the 1967/68 wet season, the expected increased yield has decreased somewhat owing to greater variation in soils and irrigation efficiency as the area expanded. In consequence, a minimum increase in yield of half a ton of rice per ha, as a result of BIMAS inputs, has been assumed in this report.

5. The composition of the BIMAS package and its application in each Province is the responsibility of a Provincial committee, chaired by the Dean of the Faculty of Agriculture of the Provincial University. Other members include representatives of agriculture, public works, local government and credit organizations but not marketing.

6. In order to demonstrate to farmers the benefits of BIMAS, the policy has been to provide any one group of selected farmers with BIMAS for one year and then to move to another area. Since 1967, groups of farmers who have received BIMAS can then participate in the follow-up program, which is known as INMAS. In this program, the package of inputs remains the same as for BIMAS, the cost of the fertilizers being subsidized, as in BIMAS, by Government, but without Government credit for the package and without extension advice. The INMAS program is a logical step forward following BIMAS, credit, where necessary, being supplied from sources other than Government. There is no need for specific extension advice as the lessons are demonstrated to the farmer in the BIMAS program. If necessary, the farmer can always obtain advice from the normal district extension service. Yields from the INMAS program are similar to that for BIMAS. The area under INMAS in 1967/68 wet season was 375,000 ha.

7. The effect of the BIMAS and INMAS programs for the 1967/68 wet season should be at least 400,000 m tons of rice, an increase of four percent on an estimated crop of ten million m tons.

8. There is no doubt that provided the irrigation systems in Java were rehabilitated and BIMAS followed by INMAS were applied throughout, following rehabilitation, the present shortfall of rice

could be turned at least into self-sufficiency. The yield benefits of BIMAS and INMAS cannot, however, be applied on a large scale to the irrigation systems in their present state without losing some of the potential yield increase because of water stress in the crop.

B. Agriculture in the Project Areas

Climate, Topography and Soils

9. The schemes are situated in the wet, humid, insular tropics, south of the equator with a distinct wet season from November/December to April/May and a dry season for the remainder of the year. The Way Seputih and East Semarang schemes are located in the 2,000 - 3,000 mm rainfall belt, the remainder in the 1,000 - 2,000 mm zone. Rainfall in the wettest month, January, is 300-400 mm falling to 25-80 mm in August. The schemes in Java are situated on the flat estuaries of rivers, and contain alluvial and hydromorphic alluvial soils, there being some black cotton soils in the East Semarang scheme. The soils are very suitable for wet rice cultivation and with good land and water management and the application of a nitrogenous fertilizer are capable of producing good yields of rice. The Way Seputih scheme is situated on a gently undulating peneplain; the soils are an easily cultivated red-yellow podsolic sandy-silt, with a sub-soil that becomes more impermeable with time, under irrigation. These soils will produce good crops of rice with adequate irrigation water and good field lay-out. The application of fertilizers will be necessary for optimum yields of rice as well as for dry farming crops of maize, roots and tree crops. The soils would also benefit from the incorporation of crop residues and farmyard manure.

Population, Land Tenure and Communications

10. The Way Seputih scheme has a ratio of population to cultivated land of less than five persons per ha, while the Java schemes have a density of more than ten. Way Seputih is a transmigration settlement which is under direct Government management pending the completion of the irrigation system, following which the titles to the farms of 2½ ha, of which 1 ha will be irrigated land, will be handed over to the settlers. All lands in the Java schemes are freehold and are farmed either by the owner, on a share cropping basis or by tenants paying a fixed rent. Land rents are equivalent to about one ton of stalk paddy per ha. The average holding size is two thirds of a hectare. The road systems within the schemes are inadequate both in quantity and quality as are the means for getting about the schemes, other than on foot.

Cropping Pattern and Yields

11. The cropping pattern on Way Seputih differs from that on the Java schemes. The latter are designed primarily for the production of wet rice with irrigation while, at Way Seputih, each farm is designed to provide the farmer with 1 ha of irrigated land and 1-1/2 ha of land suitable for dry farming on which maize, root and tree crops can be grown. On the Java schemes, a dry season crop of rice of about 40,000 ha is presently being cultivated. In the present state of the irrigation systems, this crop is not getting sufficient water and yields are accordingly depressed. The question arises as to whether the cultivation of a dry season crop of swamp rice is the best use that can be made of the limited irrigation water available. The soils on all the Java schemes are suited to the cultivation of irrigated crops of maize, legumes, vegetables, melons, etc., all of which would require less irrigation water per ha than rice. Similarly, in Way Seputih, the growing of crops, other than rice, in the dry season would permit a larger area to be irrigated. With Government's preoccupation with rice production, such a development might occur once the domestic rice market is fully supplied by wet season crops. Similarly, the wet season rice crops suffer generally from water stress, which results in about a 15-20 percent reduction in yield, save for those areas near headworks which receive adequate water.

12. The main, wet season rice crop is planted in November to January, depending on the rains. Because of the danger of flooding, the planting season may extend to late March. This spreading of the planting season undoubtedly depresses yields, as late planted crops suffer from lack of water. The spreading of the harvest also aggravates the pest and rat control problems.

13. As a result of the BIMAS program, farmers are generally aware of the benefits that will accrue from the use of recommended varieties, nitrogenous and phosphatic fertilizers, insecticides and rodenticides. This program is only being applied to very limited areas on each scheme included in the project, however, because a prerequisite is an efficient irrigation system.

14. The Javanese peasant is a skilled rice cultivator and goes to infinite pains to prepare his land, plant and tend his crop. Under present conditions he is unable to obtain the yields which the land is capable of producing because of lack of sufficient water in the field at the right time. This deficiency also prevents him from taking advantage of the still greater yields that he could obtain by using fertilizers, insecticides, etc. Yield data supplied for each scheme varied considerably. Yields in Java are estimated presently to average 1.35 m tons of rice per ha in the wet season, and 1.1 m tons in the dry season. The yield of rainfed rice in Way Seputih is about one ton per hectare.

Marketing, Credit and Transportation

15. It is estimated that over 70 percent of the paddy produced in Indonesia is hand-pounded, 20 percent is milled in rice hullers and ten percent in rice mills. The Government's policy is to reduce the amount of hand-pounded paddy thereby reducing the ten percent losses incurred in this method of milling. The producer sells his crop either as stalk paddy or as rice, after retaining sufficient for his own requirements. The crop is stored at his house and losses arising from such on-farm storage are estimated to be as high as 20 percent. Many rice mills are in need of repair and adjustment and a feature of rice in country markets is the high percentage of brokens. The rice mills would benefit from modernization, centralization and improvement of drying facilities, particularly in regard to seed paddy and early harvested wet season crops.

16. There is a conspicuous lack of credit facilities available to the peasant farmer together with a lack of an assured market for his crop at remunerative, non-fluctuating prices. If a farmer is fortunate enough to be selected for a BIMAS project, he gets seven months' credit for the BIMAS inputs and subsequently can obtain inputs from the follow-up program. There is no other institutional source of credit available to him. Interest rates are three percent per month under BIMAS. There is no doubt that given adequate market incentives, irrigation facilities and credit to purchase fertilizer and other inputs, a major breakthrough in rice production could be achieved under present conditions.

17. Stalk paddy is transported from the field to the farmer's house by those harvesting the crop, either on their backs, on carry poles, by bicycle or by cart. Transport from the farm to the rice mill is by similar means. There is adequate road and rail transport from the schemes to the consuming centers.

Supporting Services

18. In general, the supporting services available to the farmer are poor and inadequate. The supply of fertilizers and insecticides is limited by lack of foreign exchange. The extension services in agriculture and irrigation are short of adequately trained and experienced staff and of tools with which to work. The effectiveness of those available is further reduced by a lack of transportation coupled with poor roads within the schemes.

19. Both the Central Agricultural Research Institute and the Soils Research Institute require strengthening both in trained staff and financially to enable applied research work on all aspects of the rice crop to be intensified, particularly rice breeding, field testing of promising varieties and the production of seed paddy, fertilizer requirements of the major soil types and the economics of pest and rodent control.

May 24, 1968

INDONESIA

IRRIGATION REHABILITATION PROJECT

CONSULTANTS' SERVICES

1. The Government would as soon as possible retain a firm of consultants for the duration of the project. The duties and services rendered by the consultants would be as follows:

(a) To review and analyze the design of the existing irrigation systems, to redesign the systems where necessary and to propose detailed procedures, equipment needs, material requirements and cost estimates required for the rehabilitation of each of the three schemes in Java and for the completion of the Way Seputih scheme.

(b) To advise on and supervise the rehabilitation work, in direct association with Provincial Directors of Public Works.

(c) To study and advise on management, operation and maintenance of each scheme and to make recommendations for improving these functions and for recovering the costs of operation and maintenance; and to assist in implementing desired changes.

(d) To advise on and to review organizing, managing, equipping and operating mobile and fixed workshops in each of the three Provinces, to make recommendations for improvement and to assist in implementing desired reorganizations.

(e) To organize and supervise in-service training of personnel at all levels, both in the field and in the workshop, and in spare parts and material stores.

(f) To devise, organize and supervise suitable accounting systems, for the work of rehabilitation, including operation of workshops, equipment and maintenance and spare parts and material procurement, stocking and disbursement.

(g) To identify other irrigation schemes in urgent need of rehabilitation, particularly on Java, review each scheme, redesign same as may be necessary and submit detailed plans for their rehabilitation together with estimates of equipment, materials and costs with an economic appraisal of each scheme.

(h) To establish stream rating surveys and measuring stations and to initiate techniques for assessing, measuring and recording flows in rivers, canals and drainage channels for each of the schemes in the project, including the setting up of recording stations and training local personnel in their use, as well as for schemes identified for future rehabilitation.

2. Because of the urgent need to assist Indonesia in increasing its rice production, it will be necessary to proceed with the purchase of basic equipment, such as small dredgers, draglines, crawler tractors, etc., before the consultants have had time to review the systems in detail, if a start is to be made on the more obvious rehabilitation work in the 1969 dry season, which extends from April to November. In consequence, the consultants will have to be in the field in October/November 1968 if they are to have sufficient time to prepare a preliminary plan for the rehabilitation work to be undertaken by the equipment in the 1969 dry season.

3. All the rehabilitation work on the systems will perforce have to be carried out in the dry season if there is to be no interference with rice production in the main crop season. After the first year, it should be possible to utilize certain of the equipment in the wet season on cleaning drainage outlets, dikes, etc., without interfering with rice production.

4. The consultants will decide on the number and types of staff required to carry out their assignment. However, it is considered essential that their staff in the field should include, for the duration of the project, an operation and maintenance expert with broad experience of surface irrigation systems and an experienced economist. A technical engineer with experience of earthmoving machinery and workshop operation is also essential as well as a design engineer experienced in surface irrigation works.

May 24, 1968

INDONESIA

IRRIGATION REHABILITATION PROJECT

PROJECT WORKS

1. The estimates of the work required for the various systems were prepared on the basis of very limited data and verbal information. The Mission's observations contributed to the estimate of the condition of the canals and structures for the portions of the systems visited. The estimates represent, at best, only an educated guess of the magnitude of the work required.

2. The selection of the amount and kinds of equipment for handling the work and the means for performing the excavations were based on the expected magnitude of the job, on the sizes of the canals and drainage channels to be cleaned, on the accessibility and working space for operating the equipment and on the availability of workers for doing the excavation by hand labor. The amount of equipment allotted to each area was determined from the type of operation expected to be employed and on the total silt, etc. to be removed. It was contemplated that the machines would be put to efficient use on a double shift basis, with at least ten hours per day and a 200 day per year operating schedule. This would require trained and skilled operators and competent supervisory direction of the work together with good operation and maintenance and repair facilities.

3. Quantity estimates were based on stated lengths of each of the various sized canals in the system and on the estimated amount of silt deposit now in each of the canals or on estimated rates of silt deposition supplied. Other work items were estimated from observed conditions and on the basis of facts and figures provided by the Directorate of Irrigation as to the work requirements for constructing flood control dikes and revetments, making structure repairs or replacements, etc.

4. Unit prices for machine excavations were determined from a breakdown of hourly equipment charges, operator and supervisory personnel costs, administrative overhead costs, etc. Unit prices for hand labor were determined from prevailing wage rates, or from cost evaluations based on Food for Work programs, self help programs, etc.

5. A brief description and estimate of the earthwork program for each of the Project areas follows: (A list of equipment is contained in Table 1.)

A. The East Semarang Systems

6. The area is located in the Province of Central Java on the plain between the rivers Tuntang and Serang (see Map 2). There are two sub-divisions of this area, Sedadi (22,600 ha) and Glapan (20,000 ha).

7. The Sedadi unit diverts its water from the Serang River whose average daily flow is 27 m^3/second in the wet season and 4 m^3/second in the dry season. There are 22,600 ha of land irrigated in the wet season and no land irrigated in the dry season. Water was first applied to the land in 1859.

8. The Glapan system diverts from the Tuntang river, whose average daily flow is 27 m^3/second in the wet season and 4 m^3/second in the dry season. The total irrigated area of Glapan is 20,000 ha during the wet season and 4,000 ha during the dry season. Water was first applied to land in Glapan Timur in 1853 and Glapan Barat in 1875. This Project comprises some of the oldest irrigated land on Java.

9. There is a total of 68 km of primary canals, 93 km of secondary canals and 200 km of tertiary canals. For the purpose of this report the primary and secondary canals were estimated to have only 30 percent of their original capacity. There is an estimated 755,000 m^3 of silt removal required in primary and secondary canals, including 130,000 m^3 of excavation by hand labor. The tertiary system is estimated to require 100,000 m^3 of excavation. It is estimated that 1,300,000 m^3 of excavation will be necessary to enlarge a waterway channel, used as a drainage outlet.

B. The Rentang System

10. The Rentang System is located in the north-eastern portion of West Java (see Map 3). The system receives its water from the Tjimanuk River, whose average daily flow is 250 m^3/second in the wet season and 5-10 m^3/second in the dry season. Water was first placed on the land in 1914, and the system was one of the more productive rice areas of Java before its deterioration. The irrigated area comprises 91,000 ha. The deterioration of the system has resulted in flood damage to large areas of rice planting as well as endangering life in the city of Indramaju.

11. The regulating controls of the diversion dam are in poor condition and do not control flood flows, thus endangering the entire dam. The present system of using stop logs with lifting chains is not only dangerous but basically too slow a control for passing flood flows. The present condition of the stop logs and chains is such that it is

almost impossible to raise or lower the water surface in cases of emergency. They must be replaced by a more reliable control system.

12. Canal freeboards did not appear to be badly encroached, but flows have obviously been restricted by silt deposits. Control devices on turnouts were in poor condition and the system flow appeared to be restricted by structure design.

13. The Tjipelang primary canal's original capacity was 31 m^3/second but it is now estimated to have a capacity of 20 m^3/second or 65 percent and the full technical irrigated area has been reduced from 35,000 ha to 22,500 ha. The Sindupradja primary canal's original capacity was 56 m^3/second but it is now estimated to have only 45 percent of the capacity or 25 m^3/second thus reducing the irrigated area from 56,000 ha to 33,500 ha.

14. There is a total of 119 km of primary canal, 545 km of secondary canal and an estimated 700 km of tertiary canal. For rehabilitation of the system it is estimated that 3,675,000 m^3 of excavation over a five-year period will be required, including 350,000 m^3 of excavation by manual labor on the tertiary system.

C. The Tjisedane System

15. The Tjisedane System is located on the northern coast of West Java only 40 km from Djakarta (see Map 4). Water was first placed on the land in 1932. The ultimate development envisions 40,000 ha of which 33,500 ha are now being irrigated. An additional 6,500 ha can be added to the present system by removal of an earth slide in one of the primary canals, construction of 4 km of new canal and cleaning 4 km of the existing primary canal. Of the 6,500 ha, 4,000 ha are presently being irrigated by water from another source. By extending the Tjisedane system, water for 4,000 ha can be released for other development and an additional 2,500 ha of land can be brought in.

16. Water is diverted from the Tjisedane River and the average daily flow is 60 m^3/second in the wet season and 18 m^3/second in the dry season. The diversion dam is 122.5m long and regulates the river flow by use of ten 10m x 9m lift gates. There is a total length of 88 km of primary canal (including the 4 km of new construction) varying in capacity from less than 5 m^3/second to 24 m^3/second. In addition there is an estimated 105 km of secondary canals and an estimated 200 km of tertiary canals.

17. The canal system was estimated to be 30 percent silted with an average loss of 40 percent of canal capacity. To rehabilitate the system will require removal of 1,236,000 m^3 of silt, 34,000 m^3 new construction and an annual program of 380,000 m^3 of silt removal to maintain the system. By use of two draglines and one dredger, the rehabilitation of the earth sections of canal can be completed in a two-year period and the equipment will be sufficient for a continuing program of maintenance for three additional years. Gates on the dam need repair in the form of wheels, bearings, and skin plates. There is need for a standby generator to provide power to the lift gates.

D. The Way Seputih System

18. This system is located in Lampung Province in southern Sumatra and receives its water from the Way Seputih river (see Map 5). The project is now under construction and designed to serve the settlement of transmigrants from Java. The total area to be irrigated under the present design is 25,000 ha. The design capacity of the primary canal is 25 m^3/second and the average daily flow of the river is 60 m^3/second in the wet season and about 4.5 m^3/second in the dry season. The present system is so far using only 1.0 m^3/second to irrigate about 1,000 ha.

19. Most of the previous excavation work has been done by hand labor with help of some earthmoving equipment. The work on the project began in 1956. The diversion dam and intake were finished four years ago. The main canal construction has been completed for 15 km. Sufficient equipment has been requested to construct 4.5 km of primary canal and 7 km of secondary canal entailing the moving of 650,000 m^3 of excavation in one season. This construction would serve 2,000 ha of land.

20. To complete the system 29.5 km of primary canal and 71.0 km of secondary canal must be constructed. The total system will require 3,310,000 m^3 of excavation including an estimated 100,000 m^3 of tertiary canal excavation.

May 24, 1968

INDONESIA

IRRIGATION REHABILITATION

LIST OF EQUIPMENT
(all amounts US$)

Item of Equipment	Unit Cost CIF Djakarta Including 20% Spare Parts	E. Semarang	Rentang	Tjisedane	Way Seputih	Total Number of Pieces of Equipment	Total Cost CIF Djakarta	Import Duty Rate	Import Duty Cost	Inland Delivery to Job Site	Cost Including Duty and Inland Delivery
DREDGER - 8" cutter	100,000	100,000	200,000	100,000	-	4	400,000	10%	40,000	80,000	520,000
DRAGLINES											
5/8 c.y. w/40' Boom	40,000	-	-	40,000	-	1	40,000	20%	8,000	8,000	56,000
3/4 c.y. w/55' Boom	48,000	48,000	48,000	48,000	96,000	5	240,000	20%	48,000	48,000	336,000
1 c.y. w/70' Boom	58,000	58,000	58,000	-	-	2	116,000	20%	23,200	23,200	162,400
TRACTOR-DOZER											
Crawler - 120 Hp/winch	43,000	43,000	43,000	43,000	-	3	129,000	20%	25,800	25,800	180,600
Crawler - 160 Hp	53,000	-	-	-	212,000	4	212,000	20%	42,400	42,400	296,800
Crawler - 160 Hp w/Push plate/Ripper	53,000	-	-	-	53,000	1	53,000	20%	10,600	10,600	74,200
PULL SCRAPERS											
12 - 17 c.y.	24,000	-	-	-	96,000	4	96,000	20%	19,200	19,200	134,400
DUMP TRUCKS											
3.5 c.y. w/8 Ton Hoist	7,000	84,000	42,000	42,000	42,000	30	210,000	10%	21,000	42,000	273,000
PATROL-MOTOR GRADER											
Tandem drive - 120 Hp	29,000	29,000	29,000	-	29,000	3	87,000	20%	17,400	17,400	121,800
INSPECTION CARS											
4 x 4 3/4 Ton	3,600	7,200	10,800	7,200	7,200	9	32,400	40%	12,960	6,480	51,840
EQUIPMENT TRANSPORTER											
Tractor Lowboy Diesel - 25T	30,000	30,000	-	-	30,000	2	60,000	10%	6,000	12,000	78,000
CONCRETE MIXER											
250 L - Gas	4,200	8,400	8,400	4,200	8,400	7	29,400	20%	5,880	5,880	41,160
COMPRESSORS											
105 CFM/with Tools	4,800	9,600	9,600	4,800	9,600	7	33,600	10%	3,360	6,720	43,680
PUMPS											
3" intake - 4" Discharge	3,000	6,000	6,000	3,000	3,000	6	18,000	10%	1,800	3,600	23,400
MOBILE SHOP											
4 x 6 - 2 Ton Complete	30,000	30,000	30,000	30,000	30,000	4	120,000	30%	36,000	24,000	180,000
STATIONARY SHOP											
Mechanical Equipment	50,000	50,000	-	50,000	50,000	3	150,000	20%	30,000	30,000	210,000
MATERIALS	-	60,000	110,000	80,000	115,000		365,000	10%	36,500	73,000	474,500
TOTAL:		563,200	594,800	452,200	781,200		2,391,400		388,100	478,280	3,257,780
TOTAL IMPORT DUTY - INLAND DELIVERY		200,760	206,320	162,340	296,960						
TOTAL ALL COSTS		763,960	801,120	614,540	1,078,160		2,391,400		388,100	478,280	3,257,780

ANNEX 3
Table I

ANNEX 4
Table 1

INDONESIA

IRRIGATION REHABILITATION

PROJECT COST ESTIMATE
(all amounts in US$ '000)

	Foreign Exchange Costs	Local Currency Costs	Total Cost Excluding Contingencies	Contingencies	Total Cost Including Contingencies
Machinery and Equipment (including spares and service)					
Dredgers	400	120	520	80	600
Draglines	396	158	554	91	645
Tractors	394	158	552	90	642
Scrapers	96	38	134	22	156
Trucks	210	63	273	42	315
Graders	87	35	122	20	142
Inspection Cars	32	19	52	9	61
Equipment Transporters	60	18	78	12	90
Concrete Mixers	29	12	41	7	48
Compressors	34	10	44	7	51
Pumps	18	5	23	4	27
Mobile Repair Shops	120	60	180	31	211
Stationary Repair Shops	150	60	210	34	244
Total:	2,026	757	2,783	449	3,232
Materials and Supplies	365	110	475	73	548
Operation and Maintenance of Machinery and Equipment	-	1,356	1,356	387	1,743
Direct Labor					
Force Account	-	822	822	234	1,056
Tertiary Canals	-	213	213	61	274
Total:	-	1,035	1,035	295	1,330
Consultants' Services	1,250	417	1,667	256	1,923
Total Excluding Contingencies	3,641	3,675	7,316		
Contingencies	360	1,100		1,460	
Total Including Contingencies	4,001	4,775			8,776
Percentage	46	54	83	17	100

Note: Discrepancies due to rounding.

August 2, 1968

INDONESIA

IRRIGATION REHABILITATION

SCHEDULE OF EXPENDITURE INCLUDING CONTINGENCIES
(all amounts in US$'000's)

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
East Semarang:						
Machinery and Equipment	796	-	-	-	-	796
Materials	45	15	12	9	9	90
Cleaning of Tertiaries	9	9	9	9	9	45
Direct Labor on Force Account	73	35	29	26	26	190
Operation of Machinery and Equipment	49	48	48	48	48	240
Total:	972	107	98	92	92	1,361
Rentang:						
Machinery and Equipment	763	-	-	-	-	763
Materials	105	23	20	12	6	165
Cleaning of Tertiaries	31	31	31	31	31	157
Direct Labor Force Account	159	48	39	33	25	304
Operation of Machinery and Equipment	105	105	105	105	35	456
Total:	1,163	207	195	181	97	1,845
Tjisedane:						
Machinery and Equipment	593	-	-	-	-	593
Materials	48	26	17	15	15	120
Cleaning of Tertiaries	22	22	9	9	9	72
Direct Labor on Force Account	70	51	43	42	42	247
Operation of Machinery and Equipment	66	63	66	66	66	326
Total:	799	162	135	132	132	1,358
Way Seputih:						
Machinery and Equipment	1,080	-	-	-	-	1,080
Materials	35	35	35	35	35	173
Direct Labor on Force Account	63	63	63	63	63	315
Operation of Machinery and Equipment	145	144	144	144	144	721
Total:	1,323	242	242	242	242	2,289
All Systems:						
Machinery and Equipment	3,232	-	-	-	-	3,232
Materials	233	98	83	71	65	548
Cleaning of Tertiaries	63	63	49	49	49	274
Direct Labor on Force Account	364	197	174	164	156	1,056
Operation of Machinery and Equipment	365	360	363	363	292	1,743
Total:	4,257	718	669	647	562	6,853
Consultants' Services	614	615	231	232	231	1,923
Total Cost:	4,871	1,333	900	879	793	8,776

Note: Discrepancies due to rounding.

August 2, 1968

INDONESIA

IRRIGATION REHABILITATION PROJECT

PRODUCTION, INPUTS AND FARMERS' INCOME

1. The yield data supplied for these schemes showed considerable variation, and as a result, it has been necessary to conservatively estimate the present rice yields per hectare, which are 1.35 m tons per ha of rice for wet season crops, 1.1 m tons per ha for dry season crops, and 1.0 m tons per ha for the rainfed crops in Way Seputih. Once the schemes are rehabilitated it is estimated that they should produce average yields of 1.5 m tons of rice per ha in the wet season and 1.35 m tons per ha in the dry. The application of the BIMAS inputs should result in average yields of not less than 2 m tons of rice per ha in the wet season and 1.75 m tons per ha in the dry.

2. Bearing in mind the current area being planted to rice in the dry season and the limited water available, it is considered that the increase in production in the dry season crop can be discounted when calculating the changes in yield and in production following rehabilitation and for the table only wet season crop yields have been used.

Increases in Yield

3. The rehabilitation of the three schemes in Java and the completion of Way Seputih, totalling 198,000 ha will lead to an increase in production of rice of the order of 15 percent and to an increase of 53 percent, if the BIMAS inputs are added following rehabilitation. The increase in production in Java will result from more efficient irrigation, both in quantity and time of application, while in Way Seputih, the increase will be entirely due to the supply of adequate irrigation water to an area presently producing upland rice or other crops. The changes in yields and production following rehabilitation are illustrated below:

Table 1

AREA, YIELDS AND PRODUCTION

Present Production

Scheme	Area ha ('000's)	Yields Rice m tons/ha	Production Rice m tons ('000's)
1. East Semarang	42.0	1.35	57.0
2. Rentang	91.0	1.35	123.0
3. Tjisedane	37.5	1.35	51.0
	2.5	1.00	2.5
4. Way Seputih	24.0	1.00	24.0
	1.0	1.50	1.5
TOTAL:	198.0		259.0

Production After Rehabilitation

1. East Semarang	42.0	1.5	63.0
2. Rentang	91.0	1.5	137.0
3. Tjisedane	40.0	1.5	60.0
4. Way Seputih	25.0	1.5	37.5
TOTAL:	198.0		297.5
Total Benefit of Rehabilitation:			38.5

Production After Rehabilitation with BIMAS Inputs

1. East Semarang	42.0	2.0	84.0
2. Rentang	91.0	2.0	182.0
3. Tjisedane	40.0	2.0	80.0
4. Way Seputih	25.0	2.0	50.0
TOTAL:	198.0		397.0
Gross Benefit of Rehabilitation Plus BIMAS Inputs			138.0

Inputs and Costs of Production

4. It is estimated that the cost of production at farm-gate for an owner-cultivator producing rice on the schemes under consideration is equivalent to 44 percent of the gross value of the crop which, on the average yield in Java of 1.35 m tons per ha, results in a net return to the owner-cultivator of 0.75 m tons per ha. In Java, the additional harvesting cost following rehabilitation amounts to ten percent of the increase in production, and, with a yield increase of 0.15 m tons per ha, the additional net return to the farmer is 0.135 tons per ha. In Way Seputih, the cost of production at farm-gate is equivalent to 55 percent of the gross value of the crop, the net return to the farmer being 0.45 m tons of rice per ha; after rehabilitation, the additional harvesting cost is equivalent to ten percent, as in Java, and the additional net return to the farmer is 0.45 m tons per ha. If the BIMAS inputs are added following rehabilitation, the farm-gate production cost will fall to only 40 percent of the gross value of the crop in both Java and Way Seputih, giving an overall net return of 1.2 m tons of rice per ha. Details are given in Table 2.

5. In Java, the schemes are farmed by two basic types of farmers, the owner-cultivator and the share cropper. In share cropping, the harvest is shared on a basis of 50:50. The landlord provides the land, seed, fertilizers, insecticides, rodenticides, and pays the land tax; the share cropper provides all other services and the crop at harvest is divided as stalk paddy. At Way Seputih, the scheme will be farmed by owner-cultivators. In the following tables, the estimated costs of production of rice for both types of farmer are given together with the net return per hectare:

Table 2

COST OF PRODUCTION
(in rice equivalents)

	JAVA			WAY SEPUTIH
	Owner-Cultivator Rice kg/ha	Share Cropper Rice kg/ha	Landowner Rice kg/ha	Owner-Cultivator Rice kg/ha
Present Situation:				
Gross Return	1,350.0	675.0	675.0	1,000.0
Cost of Production:				
Nursery	30.0	17.5	12.5	30.0
Land Preparation	175.0	175.0	-	175.0
Transplanting	30.0	30.0	-	30.0
Weeding	62.5	62.5	-	62.5
Irrigation	37.5	37.5	-	37.5
Bird Scaring	19.0	19.0	-	19.0
Harvest (10%)	135.0	135.0	-	100.0
Total Cost:	489.0	476.5	12.5	454.0
Land Tax	100.0	-	100.0	100.0
Total Cost Including Tax	589.0	476.5	112.5	554.0
Net Return per Hectare	761.0	198.5	562.5	446.0
After Rehabilitation:				
Gross Return	1,500.0	750.0	750.0	1,500.0
Cost of Production (see above)	489.0	476.5	12.5	454.0
Add. Harvest Costs (10%)	15.0	15.0	-	50.0
Total Cost:	504.0	491.5	12.5	504.0
Land Tax	100.0	-	100.0	100.0
Total Cost Including Tax	604.0	491.5	112.5	604.0
Net Return per Hectare	896.0	258.5	637.5	896.0
After Rehabilitation with BIMAS Inputs:				
Gross Return	2,000.0	1,000.0	1,000.0	2,000.0
Cost of Production (see above)	489.0	476.5	12.5	454.0
Add. Costs:				
Fertilizers	77.5	25.0	52.5	77.5
Pest Control	38.0	15.0	23.0	38.0
Rodent Control	27.0	25.0	2.0	27.0
Transport of Inputs	0.5	-	0.5	0.5
Interest on Inputs	16.5	-	16.5	16.5
Add. Harvest Costs (10%)	65.0	65.0	-	100.0
Total Cost:	713.5	606.5	107.0	713.5
Land Tax	100.0	-	100.0	100.0
Total Cost Including Tax	813.5	606.5	207.0	813.5
Net Return per Hectare	1,186.5	393.5	793.0	1,186.5

6. The estimated cost of transport to the mill and milling charges are equivalent to two and three and three-quarters percent of the crop respectively, the miller retaining the bran and fine brokens.

7. Some difficulty was experienced in obtaining information on the taxes paid by farmers. The tax paid by all cultivators was devised by the Central Government and is known as I.P.D. It is administered by the Province for the benefit of the Province. The tax collected is divided up between the Province, a Regional Development Bank, or some such organization, the District and the Village. In South Sumatra and Central Java the respective allocations are ten percent, ten percent, 40 percent and 40 percent. In West Java, the District receives only 20 percent and the Village's share is increased to 60 percent. The amount of the annual tax is determined by the Provincial legislature each year as are the proportions allocated to the District and Village. Similarly, the tax received at the Village and District levels can be allocated to various works each year. No fixed allocations appear to be made for the maintenance of irrigation systems. As from this year, the tax is to be paid in cash. The rate of tax is determined by the class of land, first quality paddy land paying more. The rates in each area vary, but are usually five to ten percent of the value of production. Tax is also collected on other cultivated land, unproductive land and house lots.

8. As an illustration, in Indramaju, the tax paid was claimed to be about ten percent of production per ha and the tax rates in 1967 were as follows:

Class of Land	Tax Kg Dry Stalk Paddy Per Ha
1st	200
2nd	175
3rd	150
4th	125
5th	100
6th	75

There was provision for exemption from tax following a disaster, such as a flood, or a reduction in tax following a bad crop.

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INDONESIA

IRRIGATION REHABILITATION

ECONOMIC COSTS AND BENEFITS
(all amounts in US$ '000's)

Year	East Semarang Net Benefits 1/	East Semarang Costs 2/	Rentang Net Benefits 1/	Rentang Costs 2/	Tjisedane Net Benefits 1/	Tjisedane Costs 2/	Way Seputih Net Benefits 1/	Way Seputih Costs 2/	All Systems Net Benefits 1/	All Systems Costs 2/
1	-	887	-	1,080	-	732	-	1,191	-	3,890
2	161	106	347	205	381	160	303	240	1,192	711
3	321	97	694	194	887	134	606	240	2,508	665
4	482	91	1,041	180	887	131	908	240	3,318	642
5	642	91	1,388	97	887	131	1,211	240	4,128	559
6	803	-	1,735	-	887	-	1,514	-	4,939	-
7	675		1,258		643		1,347		3,923	
8	562		824		421		1,196		3,003	
9	458		434		222		1,060		2,174	
10	377		130		67		954		1,528	
11	297		-		-		848		1,145	
12	233						757		990	
13	161						669		830	
14	112						605		717	
15	56						530		586	
16	-						469		469	
17							424		424	
18							378		378	
19							333		333	
20							303		303	
Internal Rate of Return (percent)	37		56		71		47		51	

1/ Assuming a price of US$170 per m ton of milled rice, cif Djakarta.
2/ Excluding import duties.

N.B. The benefits decrease annually after the completion of the project. It is assumed that no maintenance is performed on the canals and that the annual rate of siltation is seven per cent of the cross-section area.

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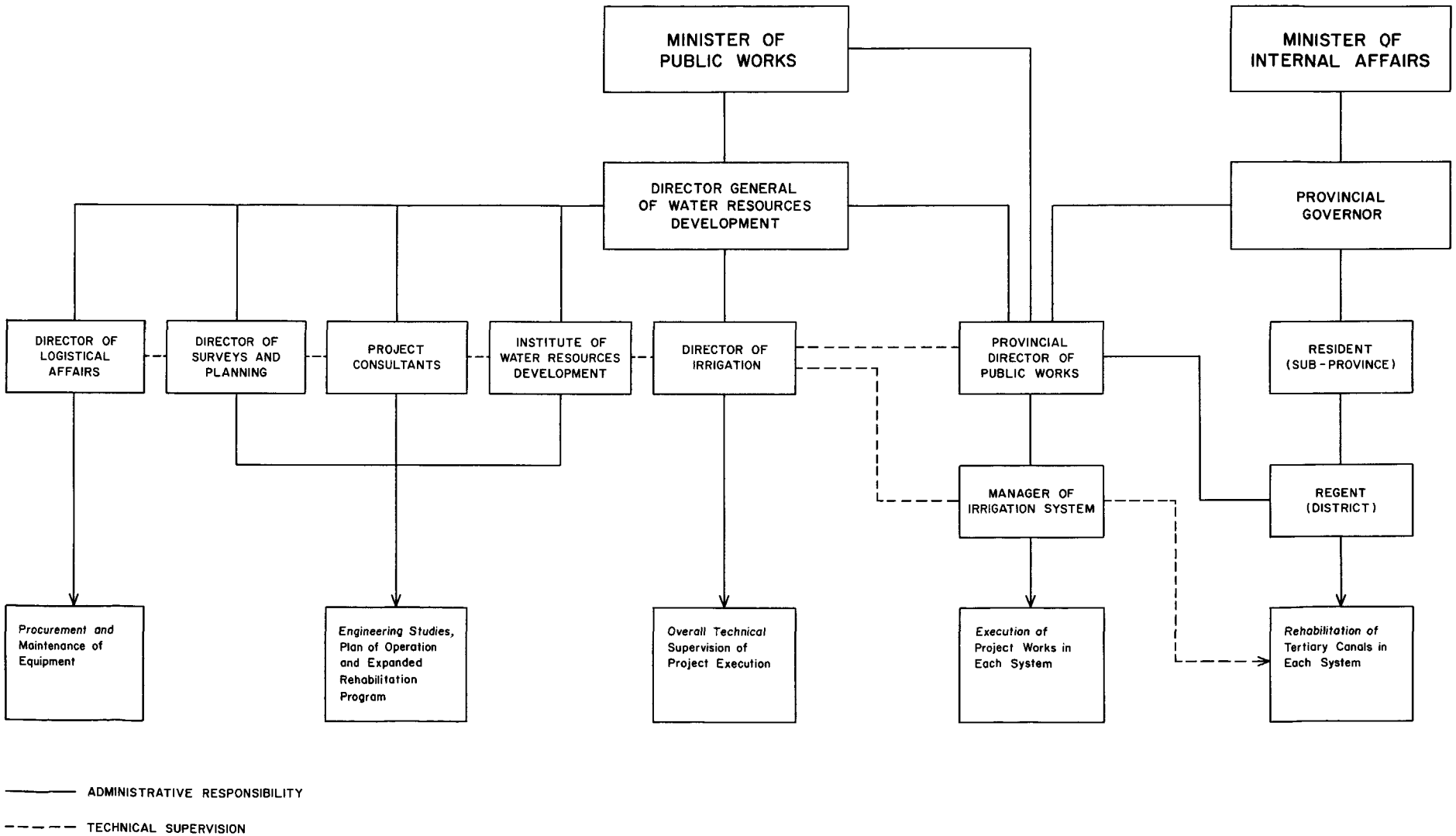
ANNEX 6

INDONESIA: IRRIGATION REHABILITATION

ORGANIZATION CHART



May 1968

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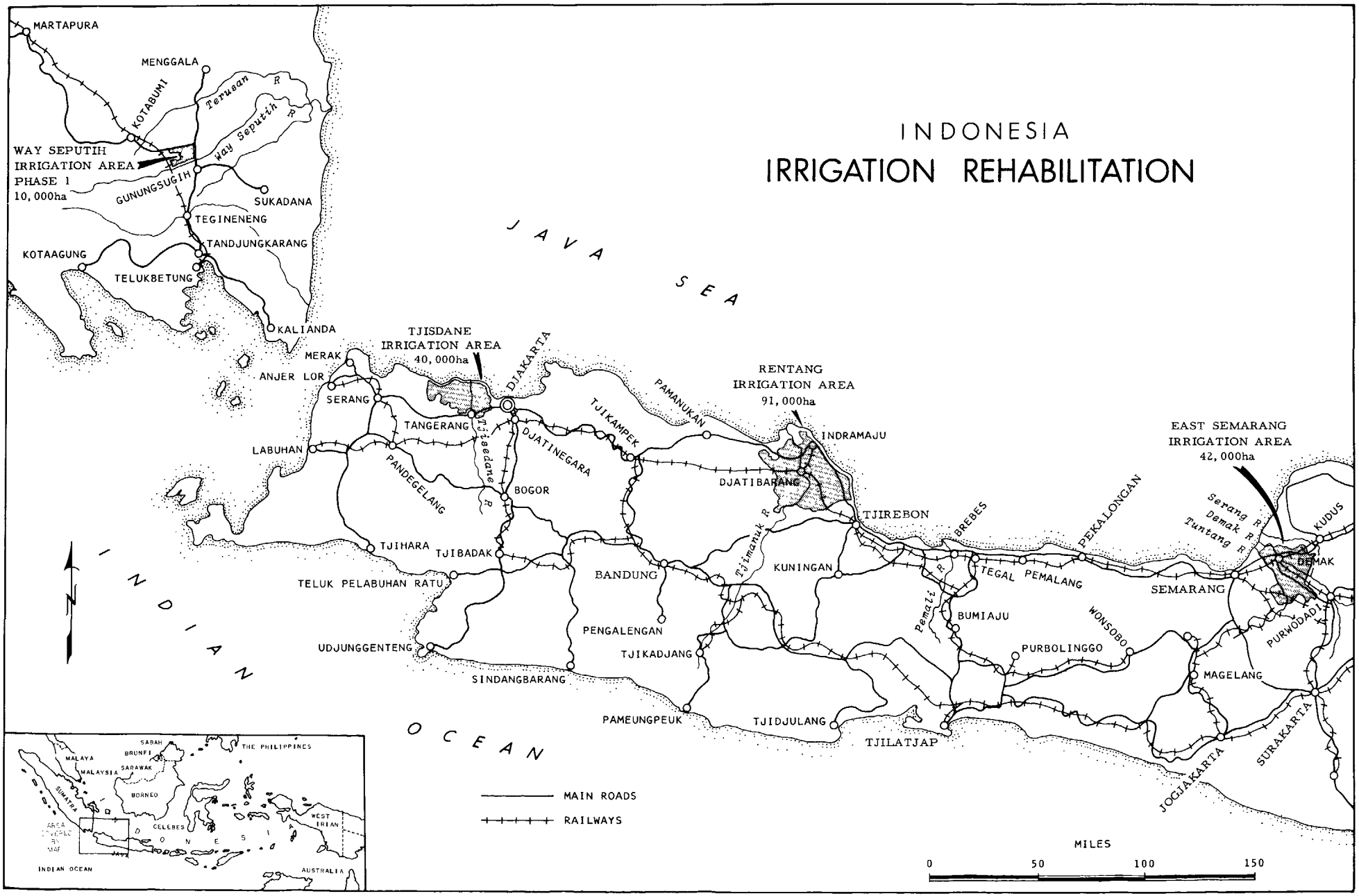

MAY 1968

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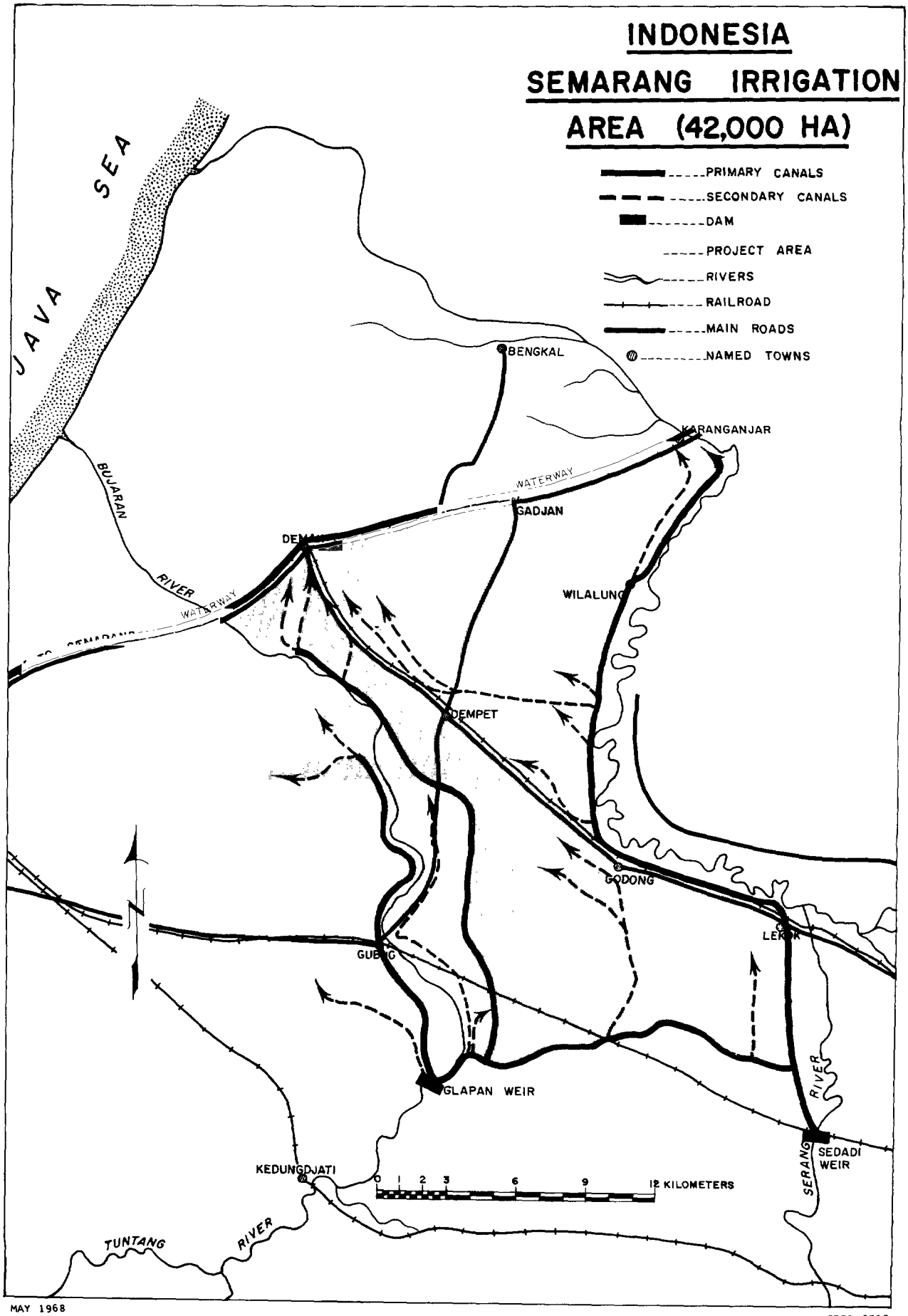

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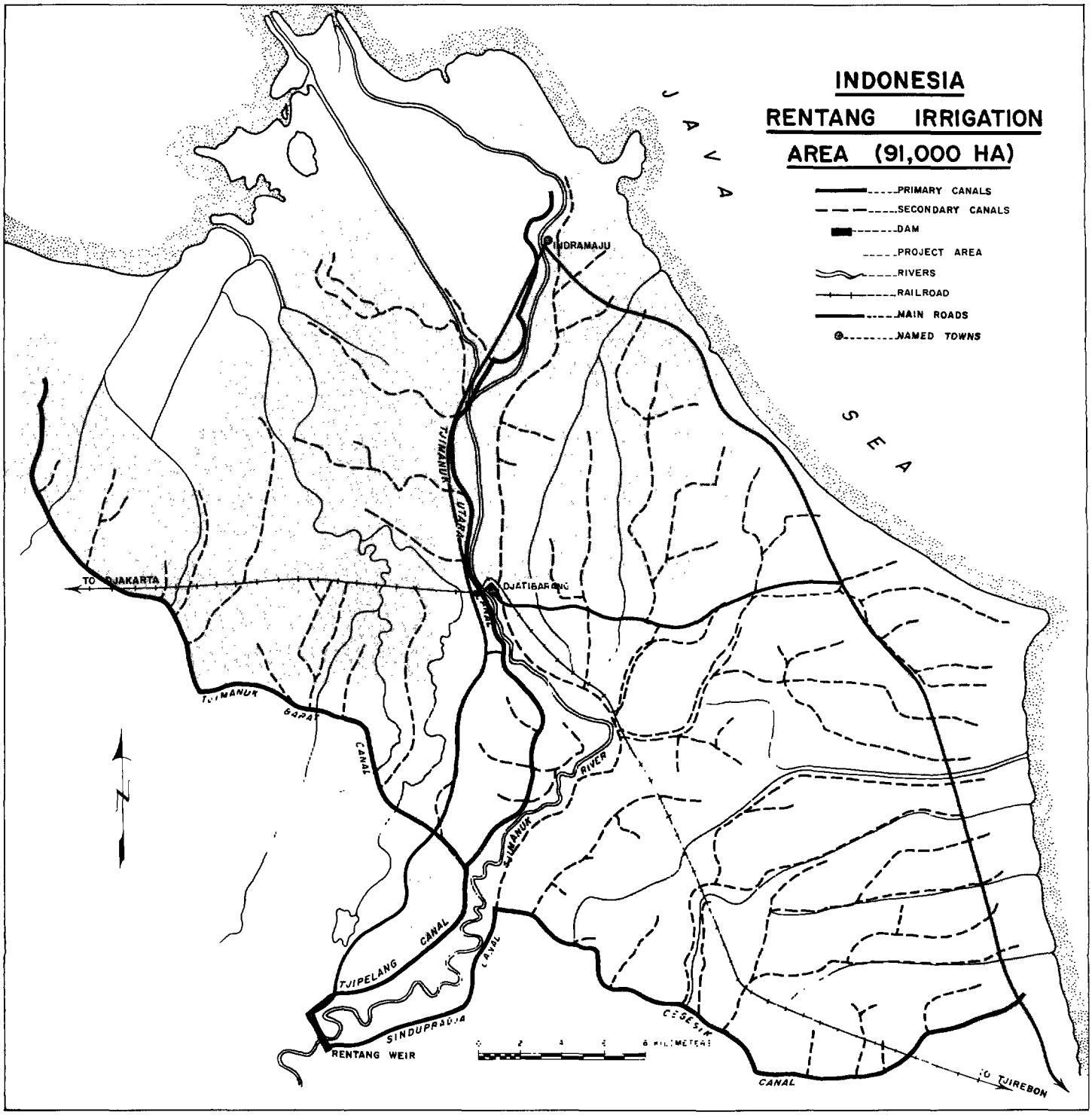

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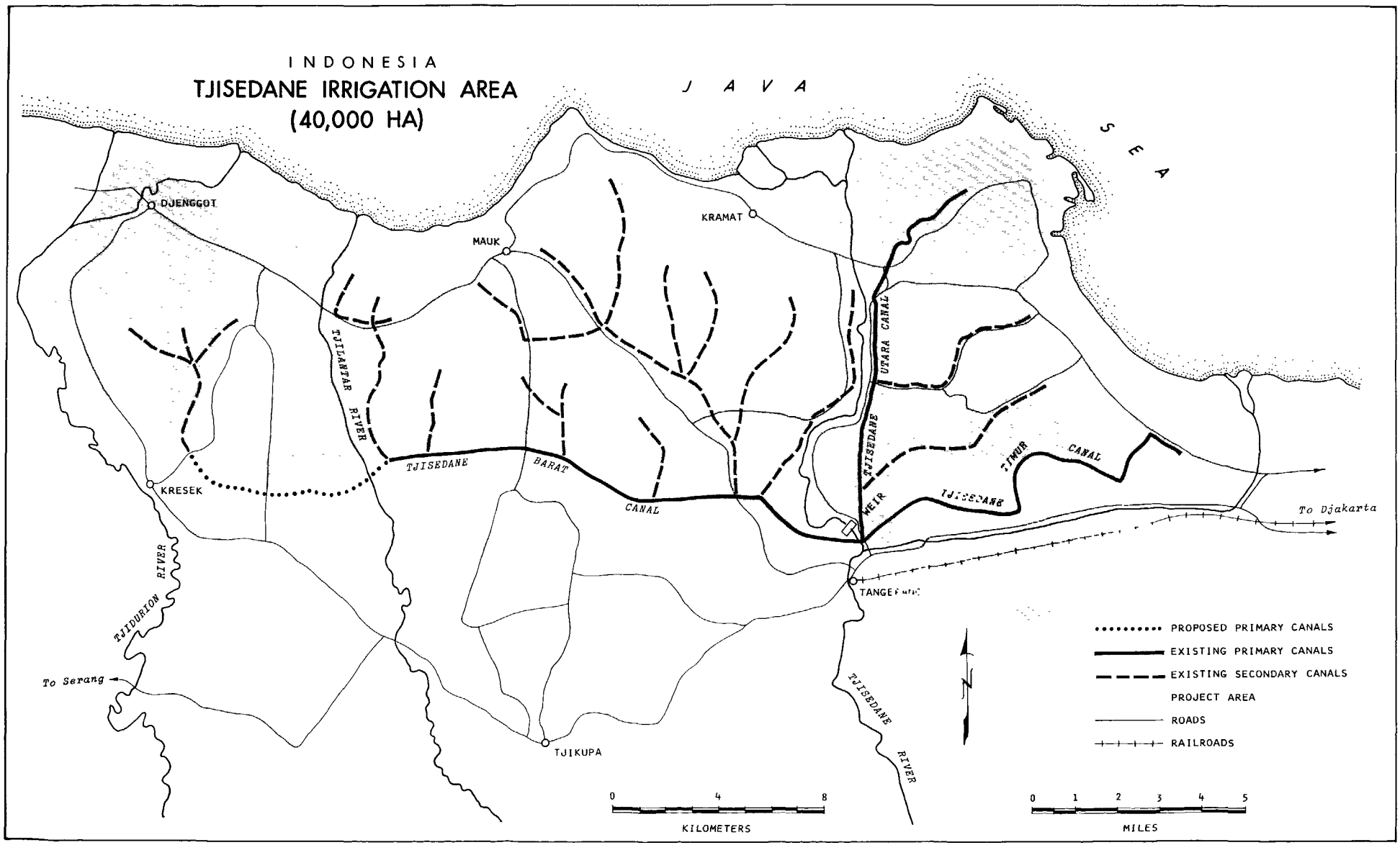

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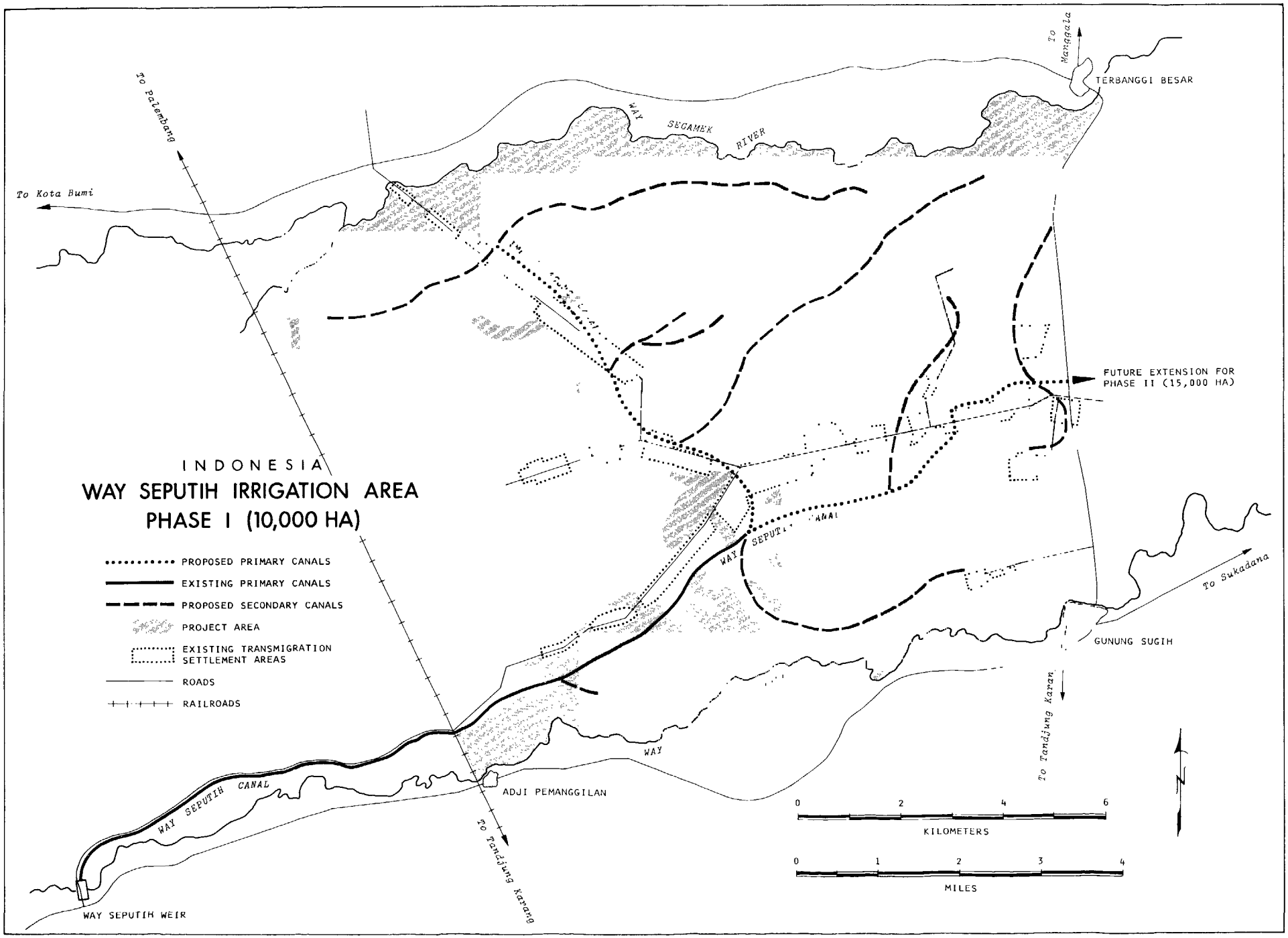

MAY 1968

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