CHAPTER VII ORGANIZATION AND MANAGEMENT

7.1 ORGANIZATION FOR THE PROJECT IMPLEMENTATION

The Directorate General of Water Resources Development, the Ministry of Public Works, would be the executing agency for implementation of this project. It would be responsible for the detailed design, supervision and construction of the project works. It would also coordinate all activities of all government agencies and regional administrative organizations in connection with the project implementation.

In the Central Government, the Directorate of Irrigation would have direct responsibility for the project implementation. The Office of Public Works of South Kalimantan would be responsible for the implementation at the provincial level.

Under these government agencies, it is recommended to eatablish the Project Office of the Riam Kanan Irrigation Project for smooth execution of the project implementation. The Project Office would operate all field works such as additional survey and investigation, construction of field offices, land acquisition, the detailed design including preparation of tender documents, and construction supervision including operations of field and laboratory tests. The overall organization of the project implementation is shown in Fig. 5.

It is assumed that the construction of the project works would be executed on the contract basis. Technical guidance services would be required for the smooth execution of all the project works.

7.2 ORGANIZATION FOR OPERATION AND MAINTENANCE OF THE PROJECT

After the completion of the project works, the Riam Kanan Irrigation Project Operation and Maintenance Office would be organized under the provincial public works service. The office would be responsible for operation and maintenance of the diversion weir and the canal network down to the tertiary turnouts.

The Office would consist of one head office and 3 branch offices at the diversion weir site, Banjarbaru and Gambut. The branch offices would have 9 outposts including 2 outposts for O&M of the main irrigation canal. The main office would be responsible for the overall activities necessary for proper operation and maintenance of all project facilities including preparation of overall O&M program, design and construction supervision of maintenance works, budgeting, training of the staff, etc.

The branch office for the diversion weir would be responsible for O&M of the weir and the main irrigation canal including operation road along the main canal. Other two branch offices would deal with

O&M as well as management of the project facilities in the sub-areas. Communication between the head office and three branch offices would be made by wireless system.

As mentioned before, 2 outposts would be responsible for O&M of the main irrigation canal under the branch office for the diversion weir. Other field outposts, each covering about 4,600 ha of paddy field, would have the responsibility for: (1) operation and maintenance of the canal network down to the tertiary turnouts on the secondary and sub-secondary irrigation canals. (2) O&M of the drainage network of the main, secondary and sub-secondary drains and (3) collection of necessary information and data on actual water distribution in the farm from the farmer's associations and transfer of water distribution program prepared by the head office to the associations and personnel concerned.

Total number of staff required would be 40 for the head and branch offices and 130 for the field outposts.

Fig. 6 shows the proposed organization for operation and maintenance of the Project.

7.3 AGRICULTURAL SUPPORT SERVICES

7.3.1 General

In order to attain the expected crop production through the introduction of double cropping a year with irrigation and drainage improvement, it is essential to provide more intensive agricultural support services, in addition to proper operation and maintenance of the project facilities.

For this purpose, further improvement of the present supporting services would be required, particularly for extension services, agricultural cooperative, credit and research works. In addition, it is recommended to establish the farmer's association for proper farm management under the guidance of the government agencies concerned.

7.3.2 Extension Services

As mentioned before, the service area of one PPL (field extension worker) at present ranges widely from 1,000 ha to 14,000 ha. Under these conditions, it would be difficult to expect higher efficiency in his service, especially after the completion of the Project. In this view, it is recommended to increase the number of PPL in order that one PPL would serve about 500 ha of land in which about 500 farmers would be included. PPL would guide and transfer the improved irrigation farming technics to 20 contact farmers selected among 500 farmers, and a contact farmer would transfer new farming technics to his 25 member farmers. If this density of one PPL/500 ha is applied to the project area, total

number of PPL required is estimated at 66 persons. On the other hand, 16 PPL are now working in the project area. Therefore, actual increase in number is 50 persons. It is proposed that additional 50 PPL would be stationed during the next Pelita III. In addition, training of PPL should be strengthened by providing further training facilities and programs.

Further improvement would also be required for equipment and instruments necessary for PPL's activities such as vehicles, soil testing apparatus, visual aids, etc.

Moreover, it is proposed to organize a special section in the rural extension centers for systematic observation of pests and diseases, possible early inspection of outbreak of crop damage due to pests and diseases and for preparation of its protection program.

7.3.3 Agricultural Cooperatives and Credit

In connection with the project implementation, further effort will have to be made for improvement of the present activities of the agricultural cooperatives.

As stated earlier, the number of BUUD/KUD now in operation in the project area is still not sufficient. The increase in number of this cooperative is recommended especially for Desa which does not have BUUD/KUD unit at present. It is proposed at the same time to train the staff for more smooth management of this cooperative.

The present activities of B.R.I. are also limited mainly because of insufficient number of this cooperative in the project area. With the completion of the Project, all lands in the project area would be turned into technical irrigation area which would be the basis for introducing the BIMAS Package Program. The expansion of the area under the BIMAS Program will play an important role in increasing crop production with the Project. In this view, further effort would be required for increase in number of B.R.I. and the expansion of the BIMAS Program. In addition, it is expected that the present low repayment of the credit by the BIMAS farmers would be improved by the increase of crop production under the Project.

7.3.4 Farmer's Association

Practically no farmer's associations exist in the project area at present. With the completion of the Project, the association organized by farmers themselves should be established for proper water management at farm level as well as cooperative works by farmers such as rotational irrigation, plant protection, etc. The main activities of the association would be (1) operation and maintenance of the irrigation and drainage network below the tertiary turnouts, (2) cooperative works for rotational irrigation, and early inspection and protection of pests and disease, (3) extension of improved irrigation farming technics to each farmer, including

exchange of improved seeds, through the management of small-scale demonstration farms and (4) collection of water charge in the future.

Fig. 7 shows the proposed organization of the farmer's association. Generally, an association would be established in one Desa in which about 500 farmers would be involved. The association would have a committee which would consist of a chairman, a secretary, a treasury, a water distributer and about 20 contact farmers. They would be all elected from the member farmers of the association.

For the smooth and efficient operations of the project-wide program, all government agencies concerned and the farmer's associations will have to be well integrated into one workable network, particularly for proper water management.

7.3.5 Research and Pilot Demonstration Scheme

The present agricultural research works being conducted by the Central Research Institute for Agriculture, Kalimantan are mainly concentrated on the tests of local varieties of paddy rice. The present farming and crop-soil-water management by the farmers are not improved yet for further increase of agricultural production. In order to realize the proposed agricultural development, improvement of the present agricultural conditions should be started as early as possible. Under these conditions, it is recommended to organize a Pilot Demonstration Scheme (the Scheme) in the project area.

The main activities of the Scheme would be: (1) tertiary and quaternary development with the construction of the irrigation and drainage facilities as well as road network, as one of the typical model for the future development, (2) organization of the systematic water and farm management as well as the farmer's association, (3) crop demonstration including training and guidance, (4) seed multiplication for smooth distribution of improved seeds, and (5) agronomic and irrigation engineering field experiments.

The selection of the Pilot Demonstration area is made, taking into account the water availability, drainability of the area, soil conditions and good accessibility for transportation and communication. As a result, the Sungai Tabuk area in the sub-area C will be recommendable. The selected area covers about 1,800 ha of land in gross, of which 500 ha to 600 ha in net would be taken up for the Scheme. The area is located about 8 km east from Banjarmasin and linked with the national and provincial roads.

The irrigation water for the Scheme would be supplied from the Martapura by pumping and distributed to the farm plots through the tertiary and quaternary canals. The excess water from the field would be drained out through the field drains and collector drains into the existing stream. In addition to these facilities, some buildings such as office, laboratory, storehouse, living quarters, etc. would be required for operation of the Scheme.

Seed multiplication and basic crop-soil-water experiments will be one of the essential works of the Scheme. For these works, about 5 ha of land would be required in the Scheme area. The seed farm would be used to determine the optimum use of fertilizers and chemicals, to select the most suitable varieties of paddy rice, and to determine the optimum crop water requirements at each growing stage of paddy rice.

The training of the farmers as well as the field extension workers would also be made through demonstration of systematic operations of the irrigation and drainage network at farm level. In this connection, a farmer's association would be organized under the full guidance of all government agencies concerned to establish a systematic crop-water management by farmers themselves.

Crop demonstration is the most effective program for propagation of the improved farming practices such as land preparation, fertilization, plant protection, etc. which are still new to the farmers. This program would be operated by farmers themselves together with the field extension workers under the full technical guidance of the experts.

All programs of the Pilot Demonstration Scheme will have to be carried out under the joint responsibility of the Cooperative Office, Agricultural Extension Offices, Central Research Institute for Agriculture and the Project Office for the successful operation of the Scheme.

CHAPTER VIII ECONOMIC AND FINANCIAL EVALUATIONS

8.1 GENERAL

The economic feasibility of the Project is made by calculating the economic internal rate of return. Sensitivity analysis is also made with respect to changes in paddy yields, market price of paddy, build-up period and the project costs.

Financial evaluation is carried out by analyzing typical farm budget and by repayment analysis. The firm budget analysis is made to sound the viability of the development from the farmer's point of view. The repayment analysis is made to evaluate the repayment capability of the development based on the estimated fund requirements with assumed financial terms of the anticipated loan and the expected revenue from the development.

The indirect benefits from the development which would give the effects on the regional development are also studied briefly.

All the conversions from Rupiah to US dollars are made at the exchange rate of Rp.625 = US$1, and the project life assumed for the economic evaluation is 50 years starting from 1980.

8.2 ECONOMIC EVALUATION

8.2.1 Economic Cost

The economic cost of the Project is shown in Chapter VI, and the annual disbursement schedule is shown in Table 12.

8.2.2 Operation and Maintenance Costs

Operation and maintenance costs of the Project consist of the expenses for the project offices including personnel cost as well as maintenance cost of the project facilities. The O&M costs are estimated at US$805,000 as shown in Table 13.

8.2.3 Project Benefits

Project benefits consist of the direct benefits and the indirect benefits. The direct benefits come from the increment of crop production with the irrigation development and drainage improvement. The indirect benefits are anticipated from the contributions to (1) foreign exchange saving particularly for import of rice, (2) employment opportunity, (3) quality improvement of farm products, (4) environment effects and (5) potentiality for fishery development. However, only the direct benefits are incorporated in the calculation of the economic internal rate of return for the conservative analysis.

The direct benefits are evaluated as the difference of net income from the crop production between the future without-project and the future with-project conditions.

The direct benefits would come out in 1984 and increase year by year. It would attain its maximum level of US$28.48 million in and after the 15th year after the commencement of the Project as shown in Table 14.

8.2.4 Economic Evaluation

The economic internal rate of return of the Project is calculated at 13.5 % based on the estimated economic cost and the direct benefits. This internal rate of return indicates the economic soundness of the Project.

Sensitivity analysis is also made with respect to changes in paddy yields, market price of paddy, build-up period over-run and the project costs. As summarized in Table 15, the proposed development shows the internal rate of return of 8.5 % for the case of 5 years over-run of the build-up period, 25 % decrease in paddy yield and 15 % increase in the construction cost, respectively.

8.3 FINANCIAL EVALUATION

8.3.1 Farm Budget Analysis

For evaluating the project feasibility from the farmer's economy, farm budget analysis is made on typical farm under the future without-project and the future with-project conditions as shown in Table 7 and Table 16.

With the completion of the Project, the annual net reserve or capacity to pay would increase remarkably from the present Rp.1,550 (US$2.5) to Rp.110,120 (USR176.2) per annum. The increased net reserve would offer incentives to the farmers to be involved, and substantial capacity to pay would enable them to pay some charges for the irrigation water.

8.3.2 Water Charge

It is generally recognized that the water charge is the duty of the water users. The charge is used for operation and maintenance of the project facilities including replacement and also for repayment of the project capital.

As seen in Table 12, the annual O&M cost required for the Project is estimated at US$805,000 which is equivalent to about US$25/ha. This corresponds to about 14 % of the capacity to pay that is US$176.2/ha/annum. On the other hand, the annual equivalent

to repayment of the capital cost is estimated at about US$197/ha for foreign currency portion and US$168/ha for local currency portion. These repayments would not be covered obviously with the capacity to pay from the viewpoint of the farmer's economy.

The water charge to be collected from the water users would have to be within a reasonable range in the capacity to pay that could still give sufficient incentive to the farmers. With this view, the prospective water charge is recommended at Rp.16,500 to Rp.17,000/ha/ annum. This prospective water charge would be the project revenue in the financial evaluation on the Project.

8.3.3 Fund Requirement and Repayment

Fund requirement for the project implementation is estimated as the financial cost of the Project as mentioned in Chapter VI. The annual disbursement schedule of the fund requirement is shown in Table 17.

Repayment Capability

For the repayment capability analysis, it is assumed that the fund requirement would be arranged under the following conditions:

(1) Foreign currency portion: This is financed by bilateral or international organizations, with an interest rate of 3 % per annum. Repayment period is 30 years including 10 years of grace period.

(2) Local currency portion: This is financed by the budget allocation of the Government with no interest and no repayment.

With the above assumptions, the analysis is made, preparing the cash flow table shown in Table 18. The table indicates that the expected direct revenue from the water charge could cover the costs for operation and maintenance. The shortage of the amount required for the fund repayment is estimated at US$6,850,000 per annum. Such annual shortage would be subsidized by the Government, because the measurable direct revenue in a form of water charge is practically limited. However, the expected indirect revenue such as the increased tax income and the saving of foreign exchange by reducing import of rice would be a considerable amount. Such indirect revenue could cover most of the amount of repayment.

8.4 INDIRECT BENEFITS AND SOCIO-ECONOMIC IMPACTS

As already discussed, the indirect benefits and favourable socio-economic impacts are anticipated from the implementation of the Project.

8.4.1 Foreign Exchange Saving

The rice production in Indonesia is still insufficient to meet the demand, and it is reported that annual import of rice reached about 1.3 million tons in 1976 (Data from BULOG in May, 1977). With the completion of the Project, paddy production would increase to about 238,700 tons of dry paddy per annum from the present production of 52,000 tons. Out of this increased production, it is expected that the marketable rice would be about 120,000 tons per annum after deducting the local consumption of rice. On this basis, the estimated foreign exchange saving would amount to about US$43 million of foreign exchange expenditures on imported rice.

8.4.2 Employment Opportunities

The intensive land use resulting from year-round supply of irrigation water would increase the employment opportunity. In addition, improvement of the present unemployment in and around the project area would be expected by the project implementation. Besides, the people would gain more experience, technical know-how, skillfulness in the various working fields. These accumulations would provide motive power for the future development in South Kalimantan Province.

8.4.3 Quality Improvement of Farm Products

The present quality of rice in the project area is still at low level due to uneven maturing and low milling coefficient. Such a low quality of rice would be improved through the introduction of improved farming with the construction of irrigation and drainage facilities. This would result in the increase of marketability of rice.

8.4.4 Environmental Effects

The construction of the project works would have a positive effect on the overall ecology of the project area. The health and sanitary conditions would be improved by the drainage improvement and control of seasonal floodings as well as supply of fresh water through the irrigation canals.

Improvement of local transportation system would also be expected by the project implementation and its operation. This would contribute to the improvement of rural economic activities.

8.4.5 Potentiality for Fishery Development

The after-bay (regulating pond) with a water surface area of about 2.8 km^2 could be used for fishery development. The development would contribute to the local supply of animal protein.

CHAPTER IX COMBINED GRAVITY AND PUMP IRRIGATION SCHEME

9.1 GENERAL

As mentioned in Chapter V, there is another water source for agricultural development in the project area, say the river Maluka, which could be used for further increase of irrigation area during the dry season, particularly in the sub-area E from the topographic point of view.

The preliminary study on possibility of pump irrigation scheme in combination with the gravity irrigation scheme using the water available from the Riam Kanan, say combined gravity and pump irrigation scheme, is made as described in this chapter.

9.2 DEVELOPMENT PLAN

The possibility of such a further irrigation development in the sub-area E is studied in two ways. One is to use the water from the Maluka by gravity. The study results indicate that high construction cost would be required for the diversion weir on the Maluka and the main irrigation canal mainly because of very gentle longitudinal slope of the Maluka and the marshy depressions extending in most part of the proposed canal route. This plan is not recommended from the economic point of view. The other plan is to lift up the water in the lower reaches of the Maluka, and this plan would be considered for the study on the further development in the project area.

9.2.1 Available Water from the Maluka

The river Maluka originates from the Meratus mountain and flows westwards towards the Java Sea. The total catchment areas is estimated at about 830 km^2. The river is characterized by three distinct features. The upper stretch (until the crossing point with road connecting Batibati with Banjarbaru) with a length of 22 km is characterized by little flow. The river is not flooded even in the heaviest rainy season owing to its relatively large flow capacity. The middle stretch (until the confluence with the river Penggaaungan) with a length of 34.4 km is characterized by very gentle slope with a small capacity. The surrounding areas are more or less submerged throughout the year. The lower stretch with a length of 13.6 km is characterized by large daily water level fluctuation due to the tidal effect.

As will be discussed in the following sub-chapter, a pump station is proposed to be installed at 11 km upstream from the estuary. Although information on discharge at this point is essential to make the plan, only few information is available at present. It is noted in this context that the amount of available

water in August is inferred by applying the data at the Riam Kanan dam site in the same month, as the maximum water requirement would take place in August. The said data suggest that the probable discharge with 80 % dependability would be 4.8 m^3/sec at the proposed pump site. As for the quality of the river water, it is important to note that there is a remarkable saline water intrusion during low discharge and high tide.

9.2.2 Irrigation Plan

Applying the peak water requirement including rural water supply in the dry season, 1.37 lit/sec/ha, and available water from the river Maluka, the irrigation area in the dry season would be 3,460 ha. This means that the net irrigation area of the sub-area E would be 8,080 ha in the wet season and 3,460 ha in the dry season.

When this combined gravity and pump irrigation scheme is completed, therefore, total irrigation area during the dry season in the project area would be 24,530 ha + 3,460 ha = 27,990 ha, and further increase of crop production could be expected.

9.3 PROPOSED WORKS

9.3.1 Pump Station and Tide Gate

The pump station is proposed to be located at immediately downstream of the confluence with the Penggaaungan where the biggest amount of water throughout the river course would be available for irrigation. Moreover, the site is favourable in view of: (1) the canal alignment from the pump site is most preferable, (2) the site would provide the shortest distance between the pump station and the head reach, and (3) the topographical condition for tide gate construction would be preferable. The delivery head at this site would be 4 m in total with a discharge of 4.8 m^3/sec.

In selecting the size and the number of pump, two basic factors are taken into account. One is the relative difficulty in operation, maintenance and repair which would call for the same capacity and specification for each unit. The other is the seasonal variation of water requirements which would call for four pump units, because the average requirement for the rainy season paddy would be one-quarter of the peak requirements for the dry season paddy.

The pump would be inevitably decided to be of mixed flow type based on the operating characteristics and of vertical shaft type, considering the topography of the pump station and conveniency for maintenance.

Since electric power is not available for the proposed pump station at present, the preliminary design is proposed to be made by adopting diesel engine as motive power until the future electric power supply system would have been planned.

The discharge of each pump, the shaft power, the rotational speed of pump and the diameter of pipe are provisionally determined to be 80 m^3/min, 70 kW, 300 rpm and 800 mm, respectively. The pump house would be double floor type taking into account the wide range of water level fluctuation at the proposed pump site.

The installation of tide gates on the river Maluka at the downstream of the pump station seems essential as the saline water intrusion would occur during the low discharge, and flood water would have to be discharged without causing any backwater effect in the upper reaches by constructing the structure. In addition, the navigation of the river is also taken into consideration in the preliminary design.

For the above, roller gates are proposed to be installed with the dimension and the number of 8 m (height) x 8 m (width) x 3 nos. For the navigation, two sets of gates at the up and the downstreams would be required.

9.3.2 Additional Canal

In connection with the construction of the pump station, an additional irrigation canal (secondary class) would be required for supplying pumped water to the head of irrigation network covering the area to be irrigated during the dry season.

9.3.3 Implementation Schedule

Time required for the implementation of the combined gravity and pump irrigation scheme is estimated at eight years, including project mobilization and the preparatory works, from 1980 to 1987. This means that no additional construction time would be required even if the pump scheme is included in the Project proposed in Chapter VI. If the pump scheme is constructed independently in the future, however, it would take three years for its implementation including the preparatory works such as detailed design and project mobilization.

The construction of the tide gates and pump station would be carried out within last two years, from 1986 to 1987. The proposed implementation schedule is shown in Fig. 8.

9.4 PRELIMINARY EVALUATION

As mentioned before, total irrigation area during the dry season would increase to 27,990 ha through the introduction of the pump irrigation scheme using the river Maluka. The preliminary evaluation on the combined gravity and pump irrigation scheme is made in order to sound tentatively the economic feasibility of the further development of the project area.

9.4.1 Cost Estimates

Economic cost of this scheme is estimated at US$137.66 million. The disbursement schedule is shown in Table 19.

The financial cost for the scheme is estimated at US$201.97 million consisting of US$92.19 million of foreign currency portion and US$109.78 million equivalent of local currency portion.

9.4.2 Direct Benefits

The direct benefits would increase through further increase of double cropping area by introducing the pump scheme into sub-area E. The benefits at the full development stage after the completion of the scheme would be US$31.25 million as shown in Table 20.

9.4.3 Evaluation

The internal rate of return of the combined gravity and pump irrigation scheme is estimated at 13.9 % based on the preliminary estimate of the costs and the benefits. This preliminary evaluation shows an economic soundness for the introduction of the pump irrigation scheme into the project area.

CHAPTER X CONCLUSION AND RECOMMENDATION

10.1 GENERAL

As a result of this feasibility study, it is concluded that the Project with gravity irrigation system from the river Riam Kanan is technically sound and economically feasible with 13.5 % of the internal rate of return.

It is, therefore, recommended to implement the Project as early as possible.

10.2 CONCLUSION

In view of the soil conditions, land suitability, drainability and irrigability of the land, 32,610 ha of land in net in five sub-areas A, B, C, D and E are selected for the Project.

There are two sources of irrigation water for the development. 34 m^3/sec of irrigation water would be available from the Riam Kanan reservoir by gravity, and 4.8 m^3/sec of water would be lifted up from the river Maluka.

The development plan with gravity irrigation system from the river Riam Kanan is selected as the priority project on the basis of comparative study between two alternative development plans, development with gravity irrigation and development with the combination of gravity and pump irrigation.

With the estimated water requirements and the irrigation water available from the Riam Kanan reservoir, 34 m^3/sec, irrigation area in the project area would be 32,100 ha in the wet season and 24,530 ha in the dry season.

In order to divert available irrigation water to the project area, it is planned to construct a concrete diversion weir about 12 km downstream from the Riam Kanan dam and a main irrigation canal with a length of about 48 km.

Along with the irrigation, the drainage improvement would also be carried out mainly to control the seasonal floodings and surface drainage.

For the successful implementation of the proposed development, further efforts should be made by all government agencies concerned for further improvement of the agricultural supporting services as well as establishment of the farmer's association for proper water and farm management by farmers themselves.

Time required for the implementation of the proposed project works is estimated at eight years, including the project mobilization, from 1980 to 1987.

Total construction cost for the project implementation is estimated at US$190.67 million consisting of US$83.79 million in foreign currency and US$106.88 million in local currency.

The combined gravity and pump irrigation scheme also shows economic viability for the development with 13.9 % of the internal rate of return. When this scheme is completed, total irrigation area during the dry season would increase to 27,990 ha, and further increase of crop production would be expected.

10.3 RECOMMENDATION

1. A considerable amount of field works will be required for the next stage of the detailed design of the proposed works for the Project. The major works will be the additional test drilling at the proposed weir site (Mandikapau site), soil mechanical tests of foundation and construction materials and the topographic survey of the proposed canal route (total length of the main, seconary and sub-secondary canals and drains will be about 600 km). For possible early commencement of the development, it is recommended to carry out these major field works as early as possible.

2. The topographic maps of the project area should be revised through additional topographic survey, since the present maps used for this feasibility study are still insufficient for the detailed design of the project works.

3. The river conditions at the site of the diversion weir will be changed by the construction of the weir. It seems to be difficult to analyze these hydraulic change in condition theoretically. A hydraulic model test of the weir is, therefore, required for the detailed design of the weir.

4. Additional installation of a water level recorder will be required for measurement of runoff at the proposed diversion weir site to prepare the water level-discharge relation curve at the site which will be useful for the detailed design of the weir. In addition, the measurement of saline water intrusion into the rivers Martapura and Maluka should be made periodically at least two times a month at flood tide of both spring tide and neap tide. The observation of the water level and periodical runoff measurement at the existing gauging stations should also be continued.

5. It is planned to reclaim about 5,150 ha in gross of the existing rubber plantations and shrub lands under the Project.

For smooth execution of the land reclamation including reallocation of new farm land, it is recommended to survey in detail the present land ownership of the above lands. In addition, cadastral survey will be required to estimate the cost for acquisition of lands to be submerged by the construction of the diversion weir.

6. For successful introduction of double cropping of paddy rice with irrigation and drainage improvement, the present agricultural supporting services in the project area will need a drastic improvement. It is recommended that such a improvement will be completed during the next Pelita III. The Government should take immediate action to study the present problems in providing the services and to make concrete programs for the improvement.

7. In order to make a definite plan of further development of the project area by the pump irrigation scheme, more detailed investigation and study will be required. Particularly, hydrological data and information on the river Maluka are still insufficient. For this, installation of additional meteohydrological stations in the basin and recording of water level and discharge at the proposed site of pump station will be needed.

In addition to hydrological investigation, detailed topographic survey will be required in the sub-area E because the area is not covered by present maps on a scale of 1 to 5,000. Detailed spot-levelling survey will have to be carried out using the preliminary topographic maps on a scale of 1 to 20,000, which are prepared by the team this time.

TABLES

Table 1 Member of Survey Team, Counterpart and Advisory Group

Function	Expert	Counterpart
1. Survey Team and Counterpart		
Team Leader	Mr. Kunio Irie	Ir. Achmad Tamdjid Ir. Rachmat Norlias
Irrigation planning engineer	Mr. Yutaka Murai	Ir. Achmad Sugiharto
Irrigation design engineer	Mr. Kooji Okada	Ir. Masdar Bachtiar
Structural design engineer	Mr. Kenjiro Yatabe	
Land reclamation engineer	Mr. Fumihide Sugihara	Ir. Widagdo
Soil scientist	Mr. Susumu Honma	Ir. H. Moehansyah Umar Baki
Hydrologist	Mr. Shinsuke Hino	Drs. T. Eko Haryanto
Agronomist	Mr. Akio Maeda	Ir. St. Sukamto
Engineering geologist	Mr. Sho Tono	Ir. Djodi Sukarjo Sugondo
Topo-surveyer/design engineer	Mr. Yutaka Nakano	Basari Parijaman
Topographic surveyer	Mr. Teruaki Ono	Supono
Agro-econonist	Mr. Ikuo Koshino	Ir. AOP Dolok S. Fardiani
Liaison officer/economist	Mr. Hajime Kumagai	FX. Agus Susanto
2. Advisory Group		
Leader	Mr. Jimpei Ishizaka	
Irrigation	Mr. Yasumi Yamaguchi	
Irrigation	Mr. Masanari Muneyoshi	
Cooperation planning	Mr. Yasuaki Anazawa	

Table 2 Soil Classification

Order	Sub-order	Great Soil Group	Soil Sub-group	Soil Family	Extent Area (ha)
1. Entisols	1. Psamments	1. Quartzipsamments	1. Aeric Quartzi-psamments	1. Acid, Aquic Quartzipsamments	4,690
			2. Haplaquodic Quartzipsamments	2. Sandy skeletal, Acid, Haplaquodic Quartzipsamments	2,250
	2. Orthents	2. Troporthents	3. Typic Troporthents	3. Sandy skeltal, Acid, Typic Troporthents	3,270
	3. Aquents	3. Fluvaquents	4. Typic Fluvaquents	4. Fine, Acid, Typic Fluvaquents	2,350
			5. Thapto-Histic Fluvaquents	5. Fine, Dysic, Thapto-Histic Fluvaquents	1,890
		4. Hydraquents	6. Sulfic Hydraquents	6. Loamy, Dysic, Sulfic Hydraquents	12,720
	4. Fluvents	5. Tropofluvents	7. Typic Tropofluvents	7. Clayey, Acid, Typic Tropofluvents	3,720
2. Inceptisols	5. Tropepts	6. Dystropepts	8. Typic Dystropepts	8. Loamy skeletal, Acid, Typic Dystropepts	3,170
	6. Aquepts	7. Tropaquepts	9. Aeric Tropaquepts	9. Loamy, Acid, Aeric Tropaquepts	25,830
			10. Typic Tropaquepts	10. Loamy, Acid, Typic Tropaquepts	6,680
			11. Histic Tropaquepts	11. Loamy, Acid, Histic Tropaquepts	4,010
				12. Sandy, Dysic, Histic Tropaquepts	1,100
		8. Haplaquepts	12. Aeric Haplaquepts	13. Clayey, Acid, Aeric Haplaquepts	4,960
			13. Typic Haplaquepts	14. Loamy, Acid, Typic Haplaquepts	1,200
3. Ultisols	7. Ustults	9. Haplustults	14. Typic Haplustults	15. Sandy Skeletal, Acid, Typic Haplustults	5,780
4. Histosols	8. Fibrists	10. Tropofibrists	15. Terric Tropofibrists	16. Dysic, Terric Tropofibrists	2,700
	9. Hemists	11. Tropohemists	16. Terric Tropohemists	17. Dysic, Terric Tropohemists	2,340
	10. Saprists	12. Troposaprists	17. Terric Troposaprists	18. Dysic, Terric Troposaprists	4,120
				Total	92,780

Note: The soil classification is made in accordance with the U.S. Soil Taxonomy System, 1973.

Table 3 Land Classification by Sub-area in ha

Land suitability class	Sub-area						Total
	A	B	C	D	E	F	
Class I	0	0	0	0	0	0	0
Class II	2,930	8,300	6,300	13,720	7,050	400	38,700
Class III	0	1,380	400	2,330	6,290	0	10,400
Class IV	400	3,650	0	4,550	11,590	1,850	22,040
Class V	2,430	8,370	0	0	1,170	9,670	21,640
Total	5,760	21,700	6,700	20,600	26,100	11,920	92,780

Table 4 Selection of the Project Area

	Sub-area					
	A (ha)	B (ha)	C (ha)	D (ha)	E (ha)	Total (ha)
A. Area selected for final delineation of Project Area from land suitability (gross area)						
Class II	2,600	7,800	4,000	11,450	6,650	32,500
Class III	-	1,380	400	2,100	3,550	7,430
Class IV	400	-	-	-	-	400
Sub-total	3,000	9,180	4,400	13,550	10,200	40,330
B. Area selected for final delineation of Project Area from drainability (gross area)						
Category 1	2,300	3,580	1,690	3,970	2,990	14,530
Category 2	300	4,800	2,710	9,580	7,210	24,600
Category 3	400	800	-	-	-	1,200
Sub-total	3,000	9,180	4,400	13,550	10,200	40,330
C. Final Project Area in gross /1	2,200	8,700	4,400	13,550	9,510	38,360
D. Net irrigable area	1,870	7,400	3,740	11,520	8,080	32,610
D-1 Net irrigation area in wet season	1,530	7,230	3,740	11,520	8,080	32,100
D-2 Net irrigation area in dry season	1,480 (340)	5,580 (170)	2,800	8,620	6,050	24,530 (510)
E. Maximum available water for irrigation in the dry season (m^3sec)	2.02	7.65	3.84	11.81	8.28	33.6

/1 : This is determined, excluding the lands which is not irrigated economically, from the potential area delineated through the studies on soils, land suitability and drainability.

Figures in parentheses show the area to be used for single cropping of dry season paddy.

Table 5 Present Land Use in the Survey Area and the Project Area

Land category	Survey area (ha)	Project area: Sub-area A (ha)	Sub-area B (ha)	Sub-area C (ha)	Sub-area D (ha)	Sub-area E (ha)	Total (A-E) (ha)
Paddy field	40,500	1,200	4,100	3,900	12,200	8,560	29,960
Plantation	4,800 /1	760	200	100	-	-	1,060
Alang-alang area	9,800 /2	-	-	-	-	-	-
Shrub	4,980	90	4,000	-	-	-	4,090
Bush	6,400	-	-	-	-	-	-
Swamp forest	18,200	-	-	-	-	-	-
Swamp grass	700	-	-	-	-	-	-
Others	7,400 /3	150	400	400	1,350	950	3,250
Total	92,780	2,200	8,700	4,400	13,550	9,510	38,360

/1 : This includes rubber and coconut plantations covering 2,500 ha and 2,300 ha, respectively.

/2 : The alang-alang area includes the small-scale clove plantations being under development and upland crop field for cassava, maize, etc.

/3 : Others are primarily defined as infrastructural land including village yard, roads, channels, rivers, etc.

Note : Sub-area F is excluded from the project area because of unsuitable land for economical irrigation development.

Table 6 Planted Area, Damaged Area, Harvested Area and Production of Lowland Paddy in Kabupaten Banjar

Description		Year					
		1973	1974	1975	1976	1977	Average
Planted area	(ha)	49,000	50,100	50,300	51,700	50,200	50,300
Damaged area	(ha)	3,400	800	300	3,800	700	1,800
Harvested area	(ha)	45,600	49,300	50,000	47,900	49,500	48,500
Production	(ton)	91,300	126,500	121,500	108,300	108,800	111,300
Unit Yield	(ton/ha)						
Dry stalk paddy		2.0	2.6	2.4	2.3	2.2	2.3
Dry grain paddy		1.5	2.0	1.8	1.75	1.7	1.75

Data Source : Monografi Daerah 1976. Department of Agricultural Extension Services, South Kalimantan 1977. Annual Report 1973 and 1977. Agricultural Extension Services, Kabupaten Banjar.

Table 7 Present Annual Budget of Typical Owner Farmer

Farm size : 1 ha
Family size : 6 persons

Description	Amount (Rp)
1. Gross Income	
Farm income	
Paddy	145,250
Upland crops	2,000
Livestock income (poultry)	16,500
Miscellaneous	64,220
Total	227,970
2. Out-go	
Farming expenses	
Seeds	1,500
Miscellaneous	150
Livestock expenses	1,650
IPEDA tax, etc.	2,800
Family living expenses	220,320
Total	226,420
3. Balance or Capacity to Pay	Rp.1,550 or US$2.5

Table 8 Present and Proposed Land Use in Each Sub-area

Land Category	Present Land Use (ha)	Proposed Land Use		
		Irrigated paddy field		Land to be occupied by facilities and others (ha)
		Wet season (ha)	Dry season (ha)	
Sub-area A				
Paddy field	1,200	810	945 (340)	50
Plantation	760	650	485	110
Shrub	90	70	50	20
Other lands	150	-	-	150
Sub-total	2,200	1,530	1,480	330
Sub-area B				
Paddy field	4,100	3,660	2,910 (170)	270
Plantation	200	170	130	30
Shrub	4,000	3,400	2,540	600
Other lands	400	-	-	400
Sub-total	8,700	7,230	5,580	1,300
Sub-area C				
Paddy field	3,900	3,650	2,730	250
Plantation	100	90	70	10
Shrub	-	-	-	-
Other lands	400	-	-	400
Sub-total	4,400	3,740	2,800	660
Sub-area D				
Paddy field	12,200	11,520	8,620	680
Other lands	1,350	-	-	1,350
Sub-total	13,550	11,520	8,620	2,030
Sub-area E				
Paddy field	8,560	8,080	6,050	480
Other lands	950	-	-	950
Sub-total	9,510	8,080	6,050	1,430
Total (A - E)	38,360	32,100	24,530 /1	5,750

/1 : This includes 510 ha of land to be used for single cropping in the dry season only.

Table 9 Anticipated Paddy Rice Production

Year		Future With-Project Condition: Cropped Area (ha) Sub-area A	Sub-area B	Sub-area C	Sub-area D	Sub-area E	Total	Production (ton) Sub-area A	Sub-area B	Sub-area C	Sub-area D	Sub-area E	Total	Future Without Project Condition: Cropped Area (ha)	Production (ton)	Production Increment (ton)
1984	W	1,530	2,700	-	-	-		4,000	7,000	-	-	-				
	D	1,870	2,700				8,800	5,200	7,600				23,800	3,450	6,000	17,800
1985	W	1,530	7,230	1,580	-	-		4,400	19,600	4,100						
	D	1,870	7,400	1,580			21,190	6,000	21,800	4,400	-	-	60,300	6,860	12,000	48,300
1986	W	1,530	7,230	3,740	4,670	-		4,700	21,500	10,200	12,100	-				
	D	1,870	7,400	3,740	4,670		34,850	6,400	24,200	11,100	13,100		103,300	14,080	25,300	78,000
1987	W	1,530	7,230	3,740	11,520	2,420		5,000	22,900	11,200	31,300	6,300				
	D	1,730	6,740	3,400	10,460	2,200	50,970	6,200	23,400	11,200	31,000	6,200	154,700	23,970	43,100	111,600
1988	W	1,530	7,230	3,740	11,520	8,080		5,700	24,900	11,900	34,400	21,700				
	D	1,480	5,580	2,800	8,620	6,050	56,630	6,100	21,100	9,700	28,300	17,700	181,500	29,960	56,900	124,600
1989	W	1,530	7,230	3,740	11,520	8,080		5,800	27,100	12,900	36,600	23,900				
	D	1,480	5,580	2,800	8,620	6,050	56,630	6,200	23,100	10,600	30,000	19,800	196,000	29,960	56,900	139,100
1990	W	1,530	7,230	3,740	11,520	8,080		6,100	28,000	14,000	39,900	25,500				
	D	1,480	5,580	2,800	8,620	6,050	56,630	6,700	24,100	11,600	32,800	20,900	209,600	29,960	59,900	149,700
1991	W	1,530	7,230	3,740	11,520	8,080		6,100	28,900	14,500	43,000	27,700				
	D	1,480	5,580	2,800	8,620	6,050	56,630	6,700	25,100	12,100	35,700	22,700	222,500	29,960	59,900	162,600
1992	W	1,530	7,230	3,740	11,520	8,080		6,100	28,900	14,900	44,700	30,100				
	D	1,480	5,580	2,800	8,620	6,050	56,630	6,700	25,100	12,600	37,200	25,000	231,300	29,960	59,900	171,400
1993	W	1,530	7,230	3,740	11,520	8,080		6,100	28,900	14,900	46,100	31,200				
	D	1,480	5,580	2,800	8,620	6,050	56,630	6,700	25,100	12,600	38,800	25,900	236,300	29,960	59,900	176,400
1994	W	1,530	7,230	3,740	11,520	8,080		6,100	28,900	14,900	46,100	32,300				
	D	1,480	5,580	2,800	8,620	6,050	56,630	6,700	25,100	12,600	38,800	27,200	238,700	29,960	59,900	178,800

Note : W : Wet Season
D : Dry Season

Table 10 Estimated Economic and Financial Prices of Farm Products and Inputs

Item	Economic Price (Rp.)	Financial Price (Rp.)
Farm Products		
Dry paddy	180/kg	83/kg
Rice	282/kg	125/kg
Seed (dry paddy)	235/kg	150/kg
Maize		100/kg
Soybean		245/kg
Peanuts		309/kg
Cassava		34/kg
Green bean		259/kg
Farm Inputs		
Urea	156/kg	70/kg
T.S.P.	143/kg	70/kg
KCL	93/kg	185/kg
Insecticide	1,350/lit	900/lit
Fungicide	1,350/lit	900/lit
Rodenticide	3,450/kg	2,300/kg

Table 11 Financial Cost of the Project

(US$1,000)

Work Item	Total	Local Currency	Foreign Currency
1. Preparatory Works	710	280	430
2. Pilot Scheme	700	240	460
3. Civil Works	66,334	52,167	14,167
1) Diversion Weir	2,840	1,428	1,412
2) Main Canala & Related Structures	9,418	6,630	2,788
3) Irrigation Network	22,900	19,337	3,563
4) Drainage Network	17,879	12,382	5,497
5) Farm Road Network	9,830	8,979	851
6) Quaternary Network	290	290	-
7) Land Reclamation	3,177	3,121	56
4. Construction Equipment	36,100	1,720	34,380
5. Land Acquisition	2,223	2,223	-
6. Administration	2,660	2,660	-
7. Engineering Services	6,720	280	6,440
8. Contingencies	75,223	47,310	27,913
1) Physical Continegney	18,061	9,479	8,582
2) Price Contingency	57,162	37,831	19,331
Total:	190,670	106,880	83,790

Table 12 Annual Disbursement of Economic Cost
(US$1,000)

Item	Total	1980	1981	1982	1983	1984	1985	1986	1987
Proposed Project									
1. Base Cost	105,330	-	218	18,425	26,191	23,400	12,881	15,166	9,049
2. Engineering Service	7,190	1,025	1,242	831	1,197	980	857	851	207
3. Contingency	17,890	15	40	2,934	4,192	3,730	2,102	2,993	1,884
Total	130,410	1,040	1,500	22,190	31,580	28,110	15,840	19,010	11,140

Table 13 Operation and Maintenance Costs
(US$1,000)

Item	Amount
1. Personnel Cost	272
2. Equipment and Operation Cost	202
3. Maintenance Cost for Facilities	38
4. Office and General Expenses	293
Total	805

Table 14 Paddy Gross Production Value, Production Cost and Incremental Future With and Without Project

Year	Future With-Project			Future Without-Project			Increment	
	G. P. V. (Rp. 10^6)	P. C. (Rp. 10^6)	N. P. V. (Rp. 10^6)	G. P. V. (Rp. 10^6)	P. C. (Rp. 10^6)	N. P. V. (Rp. 10^6)	(Rp. 10^6)	(US10^3)
1984	4,284	2,684	1,600	1,323	431	892	708	1,133
1985	10,854	6,463	4,391	2,435	793	1,642	2,749	4,398
1986	18,594	10,629	7,965	4,893	1,556	3,337	4,628	7,405
1987	27,846	15,546	12,300	8,097	2,575	5,522	6,778	10,845
1988	32,670	17,272	15,398	10,581	3,192	7,389	8,009	12,814
1989	35,280	17,272	18,008	10,538	3,181	7,357	10,651	17,042
1990	37,728	17,272	20,456	11,078	3,181	7,897	12,559	20,094
1991	40,050	17,272	22,778	11,078	3,181	7,897	14,811	23,698
1992	41,634	17,272	24,362	11,078	3,181	7,897	16,465	26,344
1993	42,534	17,272	25,262	11,078	3,181	7,897	17,365	27,784
1994	42,966	17,272	25,694	11,078	3,181	7,897	17,797	28,475

Note : G. P. V. : Gross Production Value, P. C. : Production Cost, N. P. V. : Net Production Value

Gross Production Value and Production Cost in 1,060 ha of rubber plantation under Future Without-Project are included.

Table 15 Sensitivity Analysis

Case	Decrese in paddy yield (%)	Lowering of paddy price (%)	Build-up period over-run (year)	Increase in project cost (%)	Cost change by technical alternatives (US$1,000)	IRR
I	25	-	-	-	-	10.9
II	-	10	-	-	-	11.3
III	-	-	5	-	-	11.7
IV	-	-	-	15	-	12.1
V	25	10	-	-	-	8.9
VI	25	-	5	-	-	9.5
VII	25	-	-	15	-	9.7
VIII	25	10	5	0	0	8.0
IX	25	-	5	15	-	8.5
X	-	10	5	15	-	8.9
XI	-	-	5	15	-	10.5
XII	-	-	-	-	Benefit - 2,350	12.7
XIII	-	-	-	-	Cost + 4,550	13.1

Table 16 Annual Budget on Typical Owner-farmer
(future with-project)

Farm size : 1.0 ha
Family size : 6 persons

1. Gross Income		
Farm income		
Rainy season paddy		332,000
Dry season paddy		280,120
Miscellaneous income		30,000
Total:		642,120
2. Outgo		
Farming expenses		
Seeds		6,600
Fertilizers	Urea	30,600
	T.S.P.	12,300
	KCL	19,400
Insecticides		6,300
Fungicides		3,200
Rodenticides		800
Farm equipment		29,400
Labour cost		70,000
Miscellaneous		17,400
Sub-Total :		196,000
IPEDA tax, etc.		12,500
Family living expenses		323,500
Total:		532,000
3. Balance or Capacity to Pay		Rp.110,120 or US$176.2

Table 17 Annual Disbursement of Financial Cost
(US$1,000)

Item	Total Cost			1980			1981			1982		
	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.
1. Base Cost	108,727	59,290	49,437	-	-	-	220	220	-	26,885	10,845	16,040
2. Engineering Service	6,720	280	6,440	958	58	900	1,162	32	1,130	777	32	745
3. Contingency	75,223	47,310	27,913	22	22	-	88	88	-	11,778	5,233	6,545
Total	190,670	106,880	83,790	980	80	900	1,470	340	1,130	39,440	16,110	23,330

Item	1983			1984			1985			1986			1987		
	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.
1. Base Cost	32,476	14,567	17,909	18,439	12,846	5,593	11,894	5,900	4,994	11,989	8,669	3,320	6,824	5,243	1,581
2. Engineering Service	1,118	48	1,070	916	38	878	800	33	767	796	32	764	193	7	186
3. Contingency	17,866	8,915	8,951	13,445	9,796	3,649	10,226	6,387	3,839	13,095	9,829	3,266	8,703	7,040	1,663
Total	51,460	23,530	27,930	32,800	22,680	10,120	22,920	13,320	9,600	25,880	18,530	7,350	15,720	12,290	3,430

L.C. : Local Currency

F.C. : Foreign Currency

Table 18 Financial Cash Flow Table
(US$1,000)

Year	Project Capital Arrangement (Foreign Currency)	Cash Outflow			Cash Inflow				Balance of Payment (B) - (A)
		Loan Repayment	O&M Cost	Total Outflow (A)	Project Revenue	Salvage Value of Equipment	Government Subsidy	Total Inflow (B)	
1980	900	-	-	-	-	-	-	-	-
1981	1,130	-	-	-	-	-	-	-	-
1982	23,330	-	-	-	-	-	-	-	-
1983	27,930	-	-	-	-	-	-	-	-
1984	10,120	-	124	124	124	-	-	124	0
1985	9,600	-	295	295	295	-	-	295	0
1986	7,350	-	480	480	480	-	-	480	0
1987	3,430	-	733	733	733	-	-	733	0
1988	.	-	886	886	886	5,950	-	6,836	5,950
1989	101,820 /2	-	886	886	886	-	-	886	0
1990		6,850	886	7,736	886	-	6,850	7,736	0
1991		6,850	886	7,736	886	-	6,850	7,736	0
1992		6,850	886	7,736	886	-	6,850	7,736	0
1993		6,850	886	7,736	886	-	6,850	7,736	0
1994		6,850	886	7,736	886	-	6,850	7,736	0
1995		6,850	886	7,736	886	-	6,850	7,736	0
1996		6,850	886	7,736	886	-	6,850	7,736	0
1997		6,850	886	7,736	886	-	6,850	7,736	0
1998		6,850	886	7,736	886	-	6,850	7,736	0
1999		6,850	886	7,736	886	-	6,850	7,736	0
2000		6,850	886	7,736	886	-	6,850	7,736	0
2001		6,850	886	7,736	886	-	6,850	7,736	0
2002		6,850	886	7,736	886	-	6,850	7,736	0
2003		6,850	886	7,736	886	-	6,850	7,736	0
2004		6,850	886	7,736	886	-	6,850	7,736	0
2005		6,850	886	7,736	886	-	6,850	7,736	0
2006		6,850	886	7,736	886	-	6,850	7,736	0
2007		6,850	886	7,736	886	-	6,850	7,736	0
2008		6,850	886	7,736	886	-	6,850	7,736	0
2009		6,850	886	7,736	886	-	6,850	7,736	0

/1 : Government subsidy to be allocated for the repayment

/2 : Accumulated capital cost including 3 % of interest per annum within 10 years of grace period

Table 19 Annual Disbursement of Economic Cost

(Combined Gravity and Pump Irrigation Scheme)
(US$ 1,000)

	Total	1980	1981	1982	1983	1984	1985	1986	1987
1. Base Cost	111,160	-	218	18,425	26,191	23,400	12,953	16,923	13,050
2. Engineering Service	7,390	1,025	1,294	831	1,197	980	857	925	281
3. Contingency	19,110	15	48	2,934	4,182	3,720	2,120	3,372	2,719
Total	137,660	1,040	1,560	22,190	31,570	28,100	15,930	21,220	16,050

Table 20 Paddy Gross Production Value, Production Cost and Increment Future With and Without Project

(Combined Gravity and Pump Irrigation Scheme)

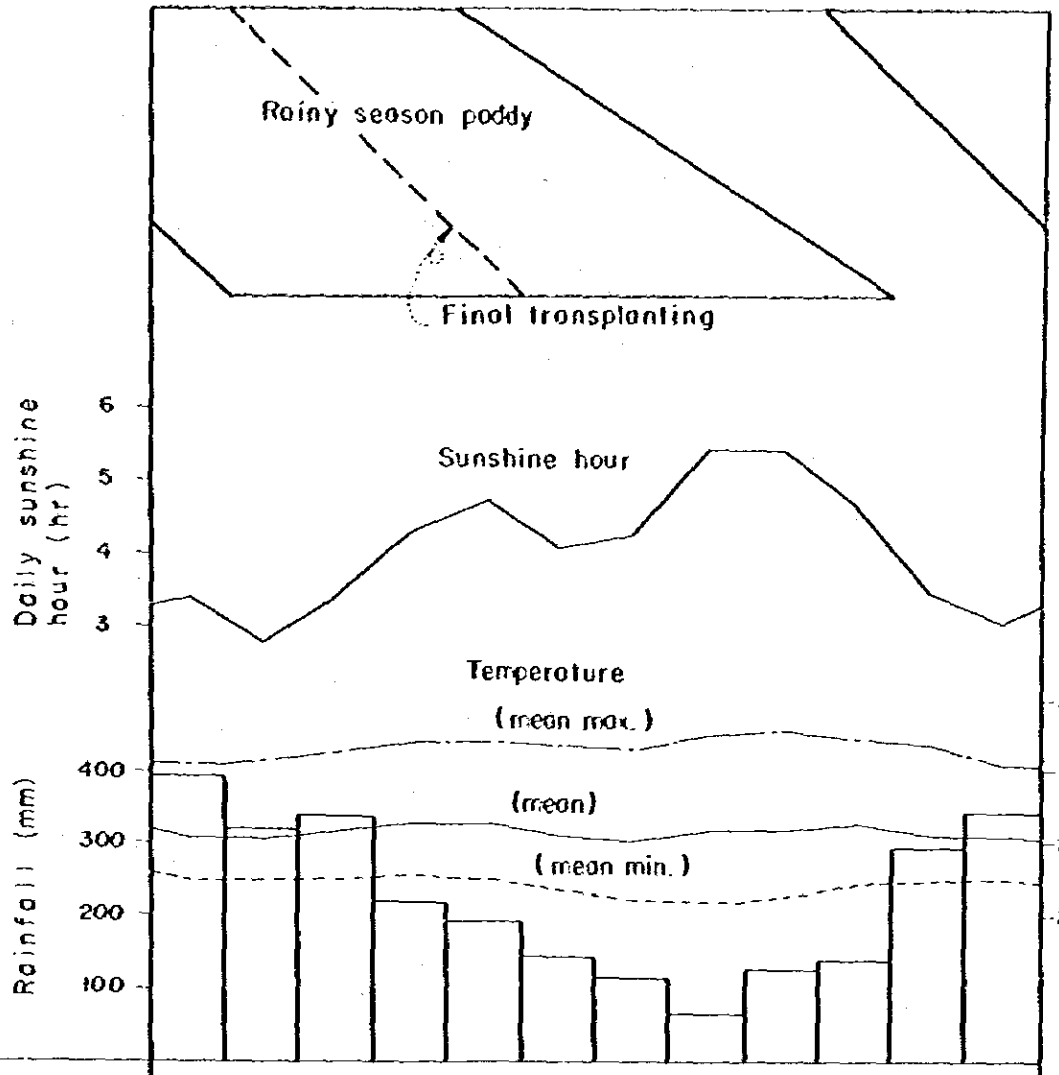
Year	Future With-Project			Future Without-Project			Increment	
	G. P. V. ($Rp. 10^6$)	P. C. ($Rp. 10^6$)	N. P. V. ($Rp. 10^6$)	G. P. V. ($Rp. 10^6$)	P. C. ($Rp. 10^6$)	N. P. V. ($Rp. 10^6$)	($Rp. 10^6$)	(US10^3$)
1984	4,284	2,684	1,600	1,323	431	892	708	1,133
1985	10,854	6,463	4,391	2,435	793	1,642	2,749	4,398
1986	12,594	10,629	7,965	4,893	1,556	3,337	4,628	7,405
1987	27,846	15,546	12,300	8,097	2,575	5,522	6,778	10,945
1988	34,722	18,327	16,395	10,581	3,192	7,389	9,006	14,410
1989	37,512	18,327	19,185	10,538	3,181	7,357	11,828	18,925
1990	40,122	18,327	21,795	11,078	3,181	7,897	13,898	22,237
1991	42,588	18,327	24,261	11,078	3,181	7,897	16,364	26,182
1992	44,316	18,327	25,989	11,078	3,181	7,897	18,092	28,947
1993	45,270	18,327	26,943	11,078	3,181	7,897	19,046	30,474
1994	45,756	18,327	27,429	11,078	3,181	7,897	19,532	31,251

Note : G. P. V. : Gross Production Value, P. C. : Production Cost, N. P. V. : Net Production Value

Gross Production Value and Production Cost in 1,060 ha of rubber plantation under Future Without-Project are included.

FIGURES

Fig. 2 Present Cropping Pattern



Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (mm)	396	318	343	220	193	142	118	66	125	137	290	343
Mean temp. (°C)	25.7	25.6	25.9	26.3	26.4	25.7	25.3	25.9	26.0	26.5	25.9	25.8
Mean max. temp. (°C)	30.7	30.7	31.5	32.2	32.3	31.9	31.7	32.6	33.0	32.6	31.9	30.6
Mean min. temp. (°C)	22.7	22.6	22.7	22.9	22.7	21.9	21.2	21.2	21.4	22.3	22.7	22.8
Relative humidity (%)	87	89	88	87	85	85	83	79	82	82	85	88
No. of rain days	19	16	16	12	11	9	9	8	8	9	15	18
Sunshine hour (hr/day)	3.4	2.8	3.4	4.4	4.8	4.1	4.3	5.5	5.5	4.7	3.5	3.2

Note : 1) In the sub-areas A and B_1 the dry season paddy is grown in small area.

2) Rainfall and temperature shown in this table are the average values for 17 years at Banjarbaru station.

Fig. 3 Proposed Cropping Patterns

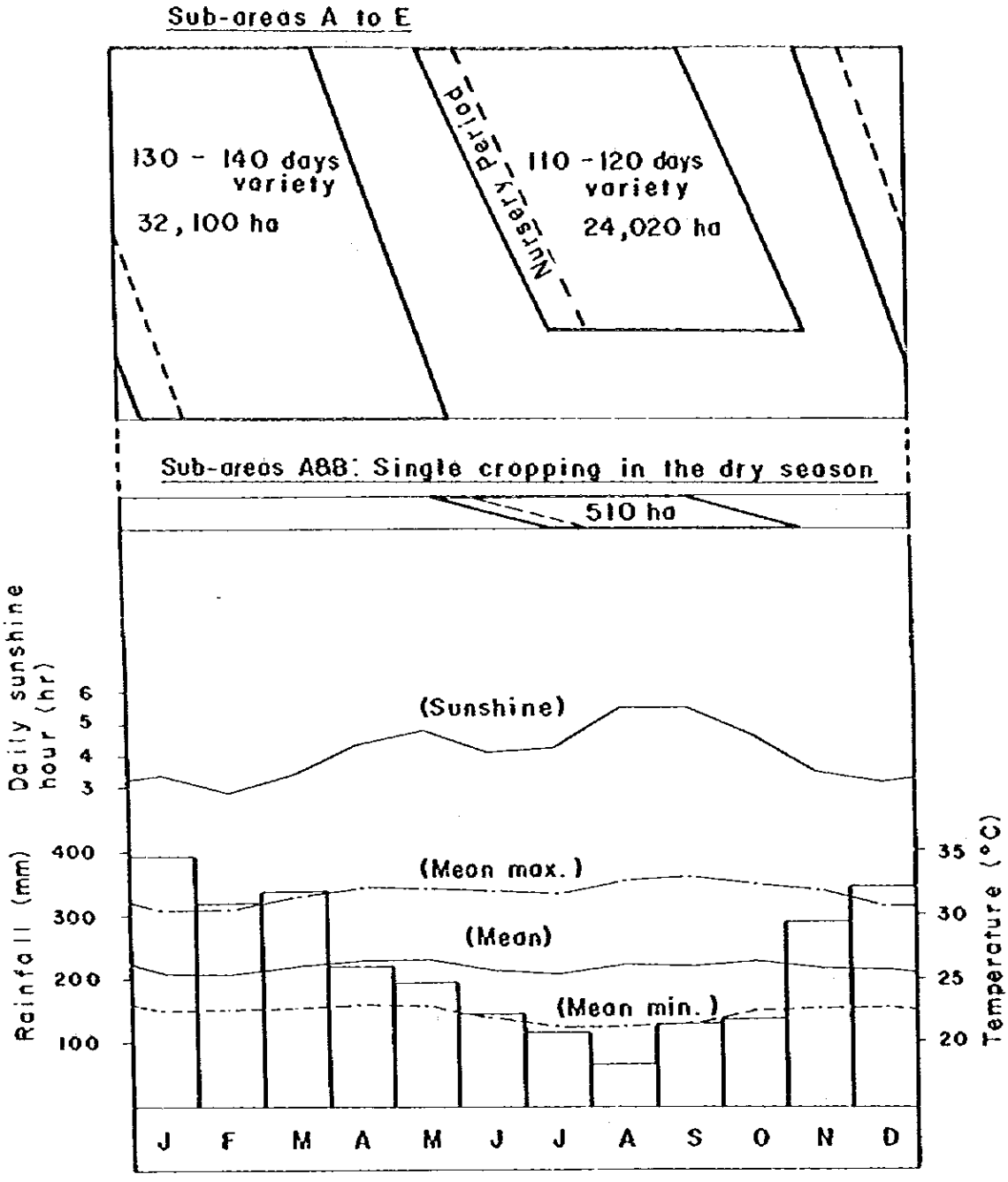


Fig. 4 Implementation Schedule

WORK ITEM	QUANTITY
1. Preparatory Works	
1) Detailed Design	--
2) Office and Quarters	L S
3) Land Acquisition	--
2. Pilot Demonstration Scheme	500ha
3. Head Works	--
4. Main Canal	4,316,000m³
5. Sub-area A	
1) Land Reclamation	850ha
2) Seco. & Sub-seco. Canals	310,000m³
3) Tertiary Canals	46,000m³
4) Farm Roads	137,200m
5) Seco. & Sub-seco. Drains	251,000m³
6) Tertiary Drains	26,000m³
6. Sub-area B	
1) Land Reclamation	4,200ha
2) Seco. & Sub-seco. Canals	921,000m³
3) Tertiary Canals	273,000m³
4) Farm Roads	259,800m
5) Main Drains	2,761,000m³
6) Seco. & Sub-seco. Drains	731,000m³
7) Tertiary Drains	210,000m³
7. Sub-area C	
1) Land Reclamation	100ha
2) Seco. & Sub-seco. Canals	432,000m³
3) Tertiary Canals	129,000m³
4) Farm Roads	86,800m
5) Seco. & Sub-seco. Drains	716,000m³
6) Tertiary Drains	88,000m³
8. Sub-area D	
1) Seco. & Sub-seco. Canals	1,308,000m³
2) Tertiary Canals	429,000m³
3) Farm Roads	278,500m
4) Main Drains	499,000m³
5) Seco. & Sub-seco. Drains	2,646,000m³
6) Tertiary Drains	420,000m³
9. Sub-area E	
1) Seco. & Sub-seco. Canals	820,000m³
2) Tertiary Canals	305,000m³
3) Farm Roads	225,000m
4) Seco. & Sub-seco. Drains	2,270,000m³
5) Tertiary Drains	290,000m³
10. Quaternary Networks	
1) Sub-area A	
2) Sub-area B	
3) Sub-area C	
4) Sub-area D	
5) Sub-area E	

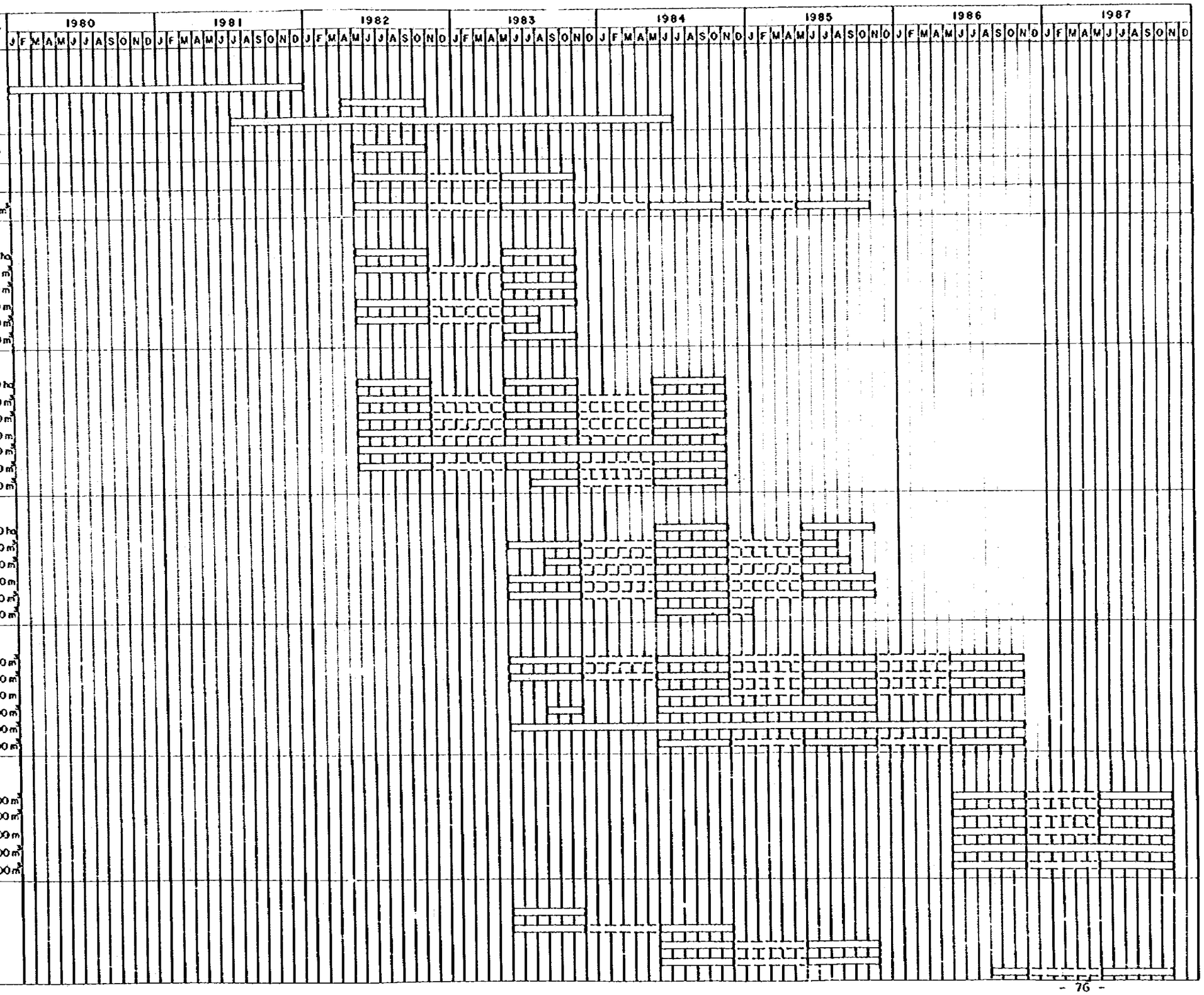


Fig. 5 Organization Chart for Project Implementation

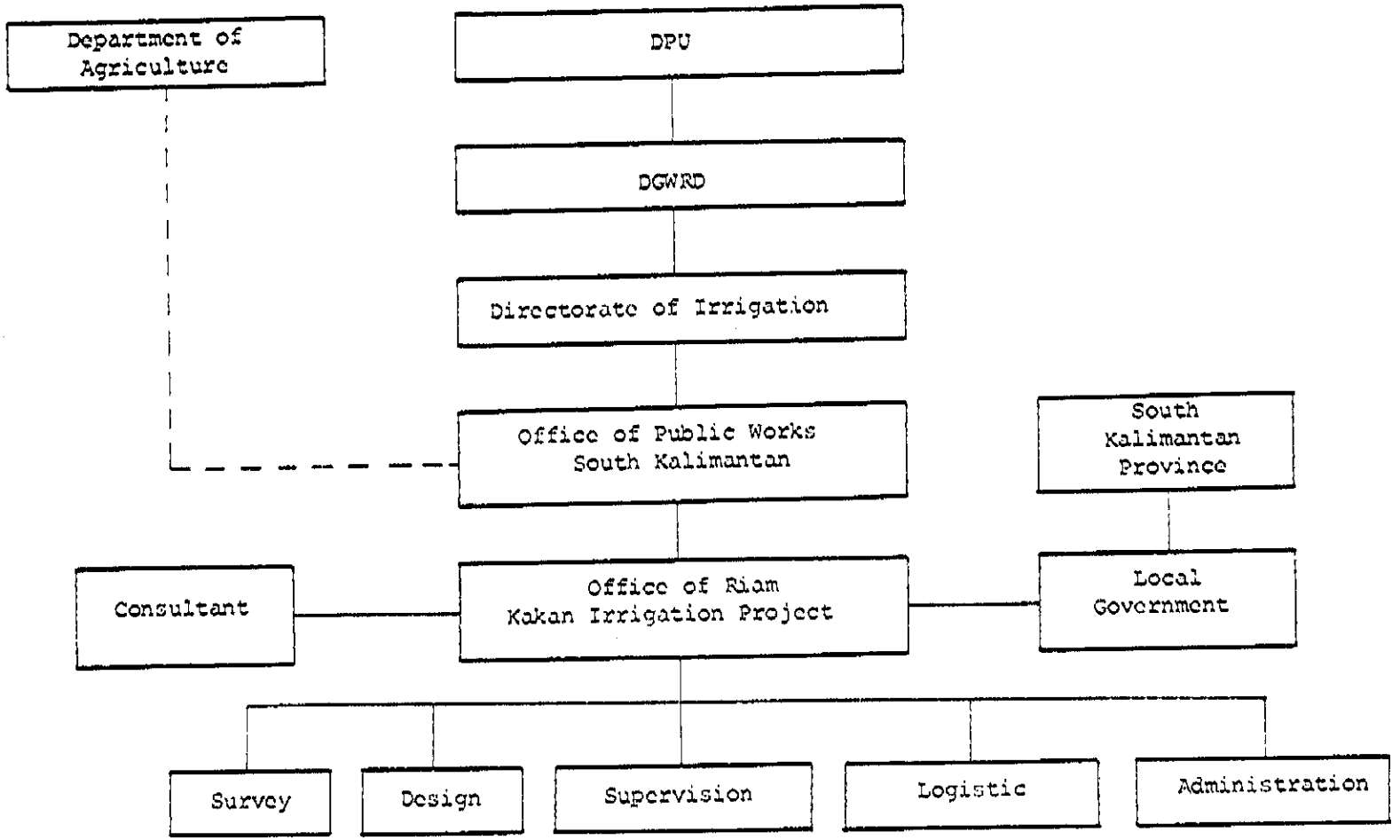


Fig. 6 Organization for O&M of the Project

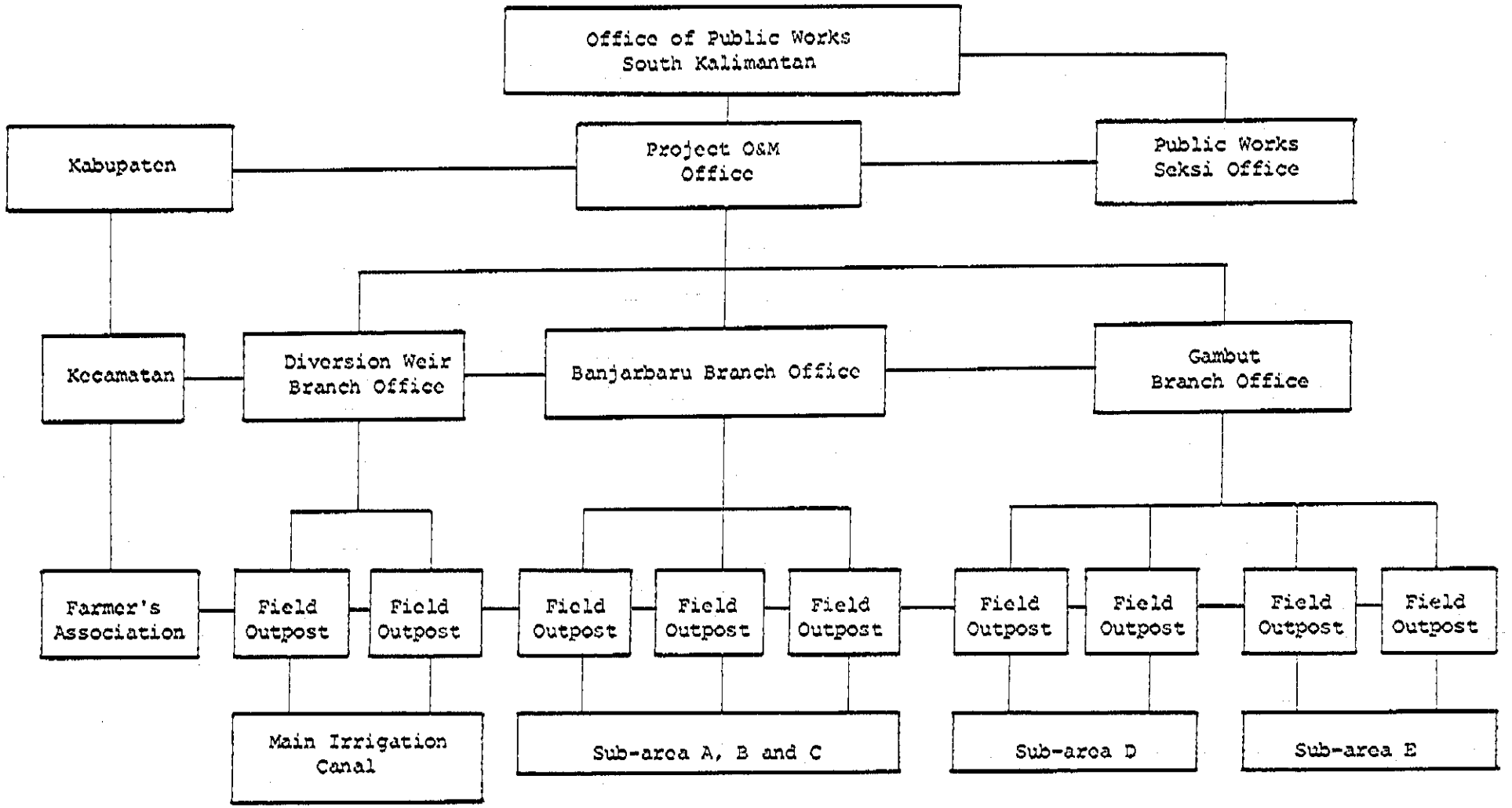


Fig. 7 Organization Chart for Farmer's Association

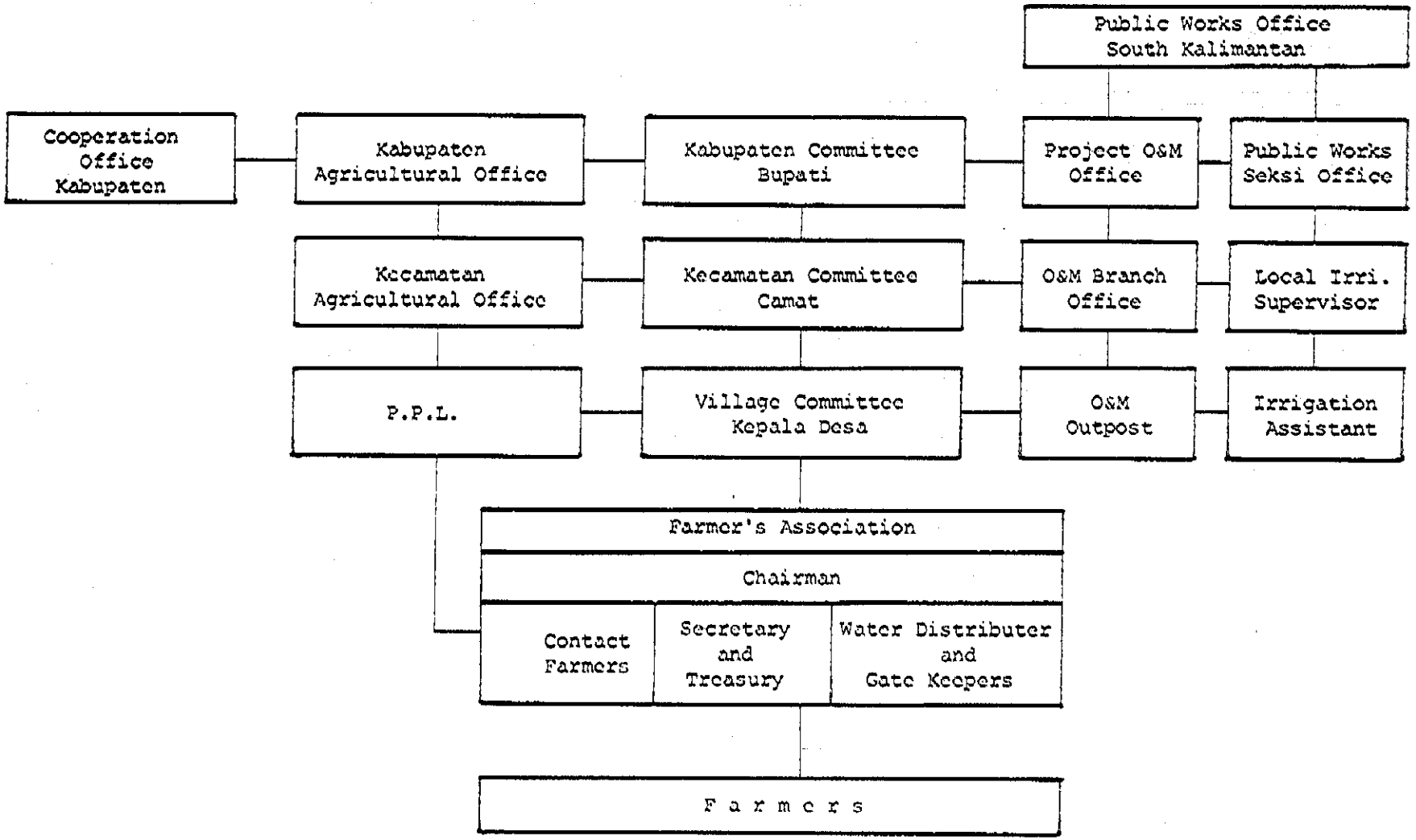
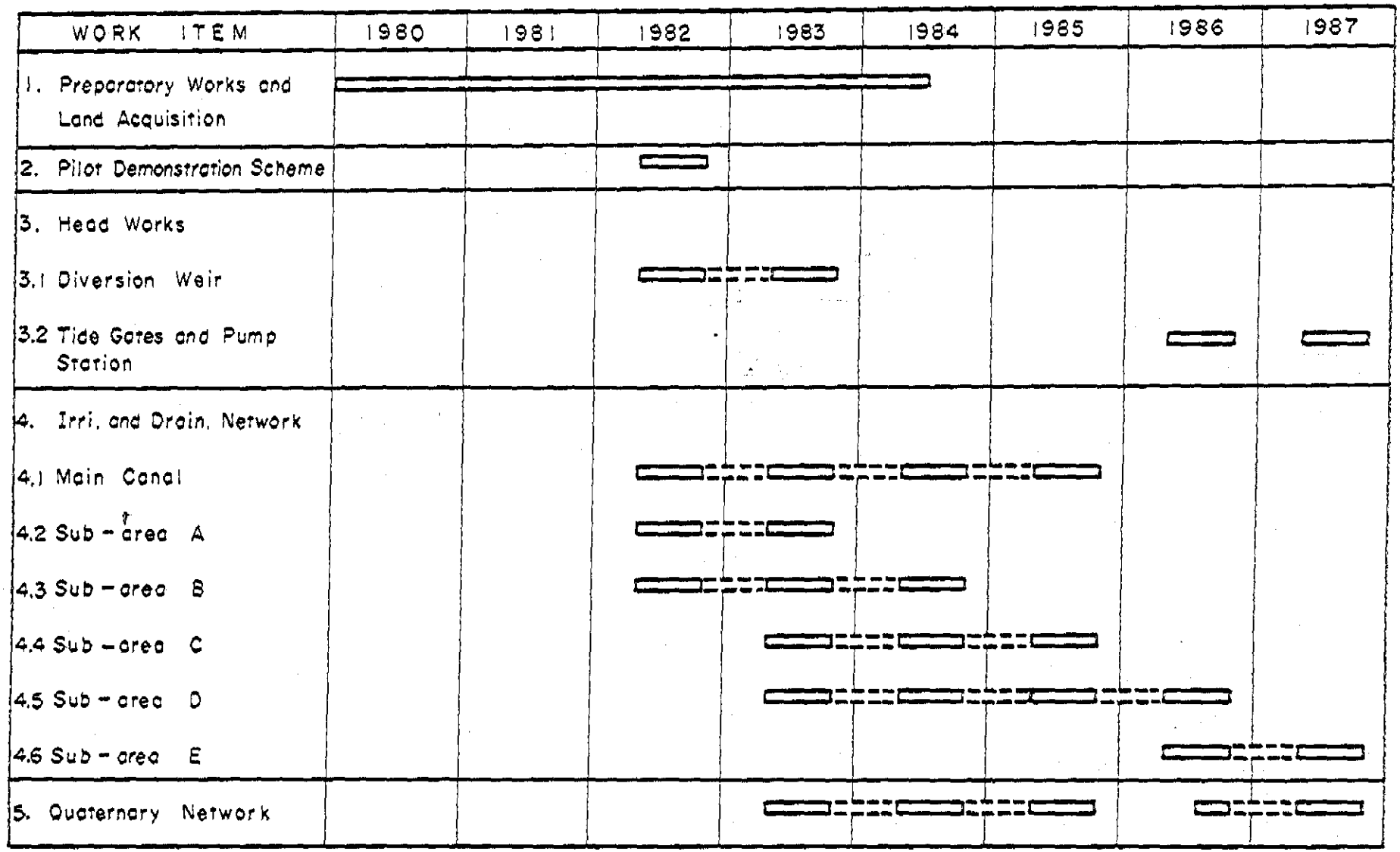
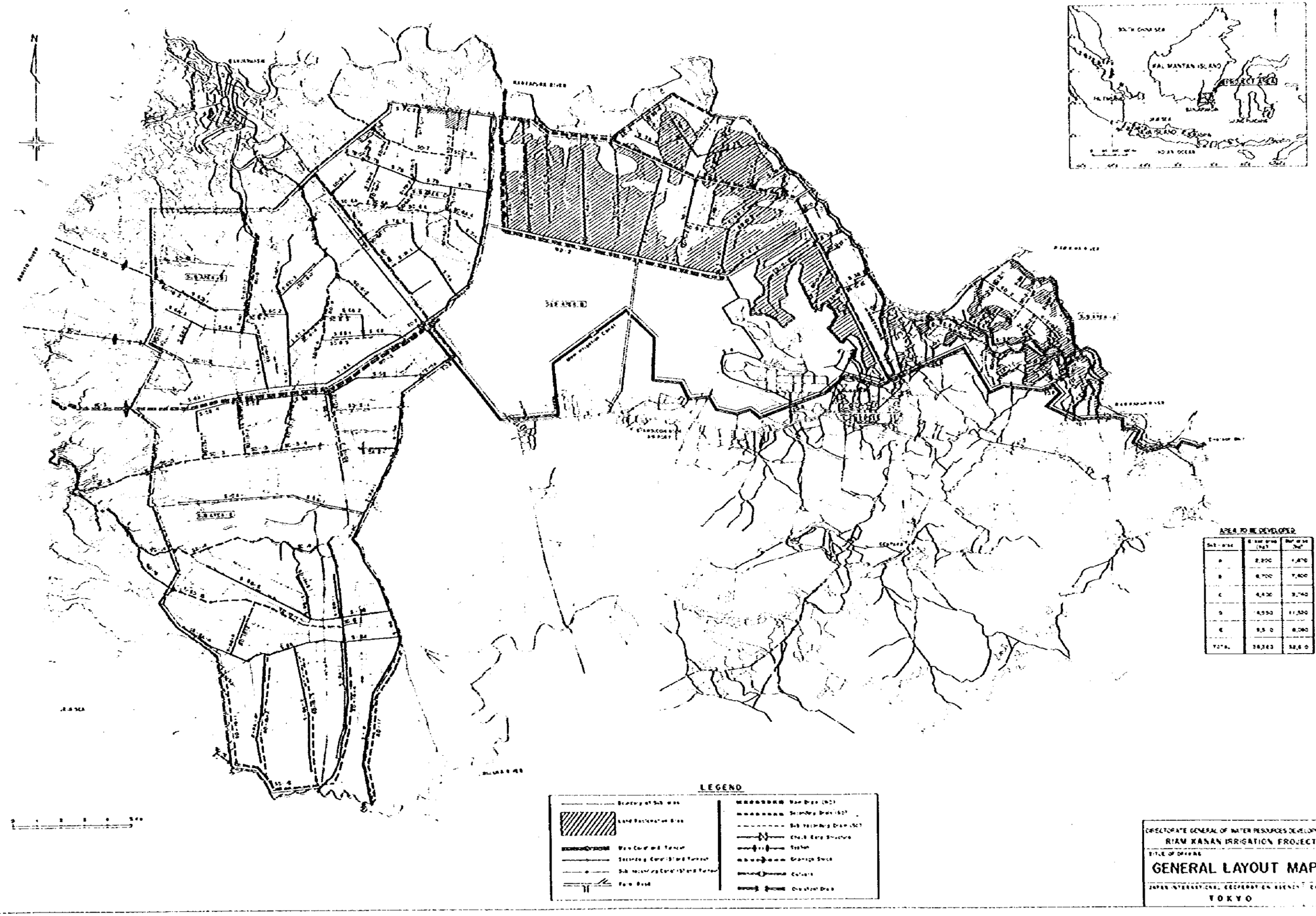


Fig. 8 Implementation Schedule for Combined Gravity and Pump Irrigation Scheme



DRAWINGS



DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

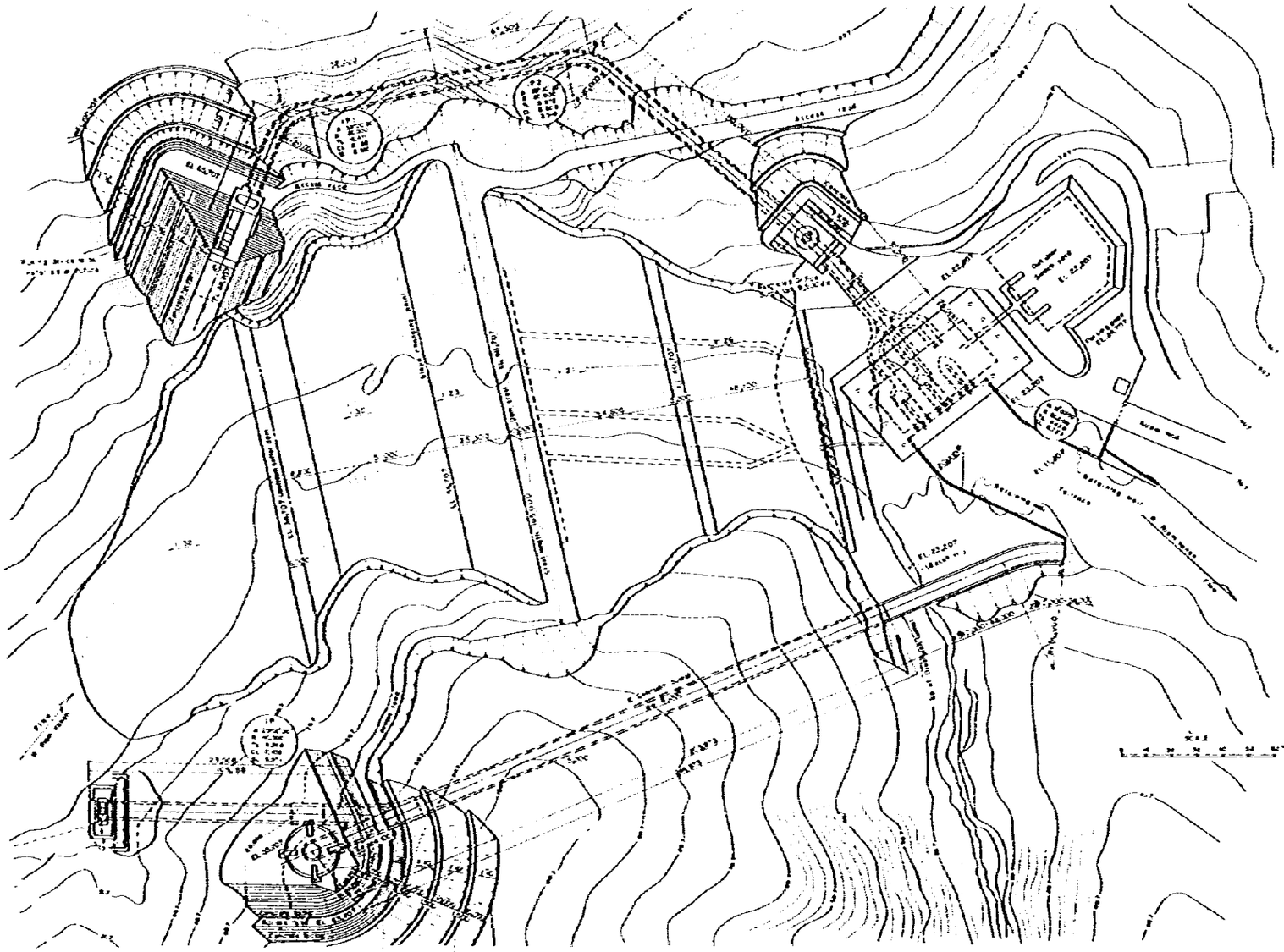
RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING

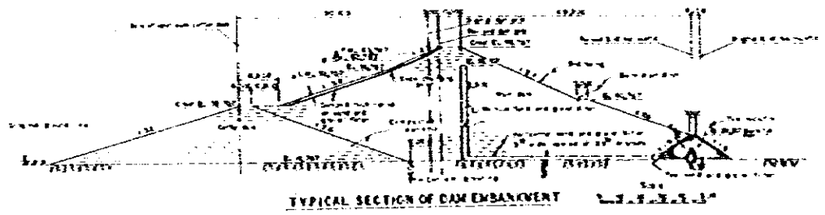
GENERAL LAYOUT MAP

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO



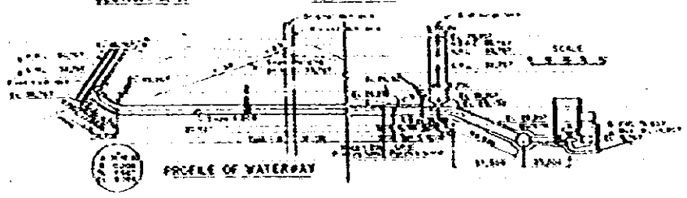
PLAN



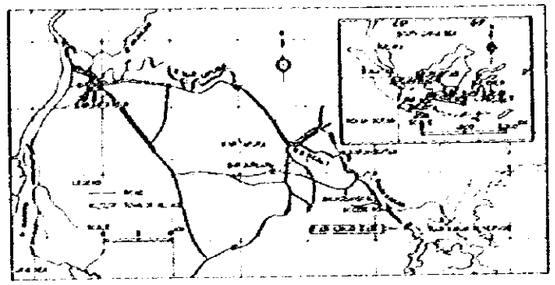
TYPICAL SECTION OF DAM EMBANKMENT

SECTION A-A

SECTION B-B



PROFILE OF WATERWAY



Main Features of the Riam Kanan Multi-purpose Dam Project

1. RESERVOIR

Catchment area	1,043 km²
Total storage capacity	1,200,000,000 m³
Submerged area	92 ha²
High water level	El 60.70?
Low water level	El 50.70?
Flood water level	El 65.70?

2. DIVERSION

Coffer dam, type	Earthfill
Coffer dam, height	28 m
Coffer dam, volume	240,000 m³
Diversion tunnel, length	332 m
Diversion tunnel, discharge	340 m³/sec

3. MAIN DAM

Type	Homogeneous earthfill
Height	57 m
Volume	670,000 m³
Crest elevation	66 m

4. SPILLWAY

Service spillway	Morning glory tunnel type, Discharge capacity 500 m³/sec
Emergency spillway	Open channel type, Discharge capacity 830 m³/sec

5. POWER GENERATION

Gross head, maximum		43.5 m
Gross head, minimum		41.5 m
Rated head		38.8 m
Discharge, maximum		87 m³/sec
Installed capacity	(initial)	20,000 kw
	(final)	30,000 kw
Average annual output		155,600,000 kwh
Turbine, type		Francis, vertical shaft
Generator, type		Semi-umbrella

6. 70kv TRANSMISSION LINE

Circuit	(initial)	Single
	(final)	Double
Conductor		ACSR 120 mm²
Length		52 km
Tower		92 numbers of double circuit type, steel tower

Note: The elevation of this drawing indicates the new elevation of BP System. The new elevation of TP System is 0.707m higher than the original elevation of BP System.

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING

GENERAL LAYOUT OF RIAM KANAN DAM

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO

DRG No. 2

LEGEND

- Alluvium, colluvium, terrace deposits (al / ter) — Quaternary
- Quartz Sandstone (quartz ss) — Tertiary
- Tuffaceous Sandstone (tss) — Cretaceous
- Pyroxenite (px) — Cretaceous
- Peridotite (pt) — Cretaceous
- Tuffaceous Sandstone — Jurassic

- River
- Road
- Path
- Weir sites proposed for the study
- Bridge
- Cut grass
- Floating rocks
- Soil
- Pit
- Sampling site of gravel
- Pit sample
- Open pit for mining of rock
- Rock sampling site
- Strike and dip
- Joint
- Boundary of geology
- Cross section
- Fault
- Reservoir
- Disturbed soil sampling site
- Core boring site

N

CROSS SECTION

Weir site A

Weir site B

RIAM KANAN RIVER

KEC KARANG INTAN

SCALE

0 500 1000m

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

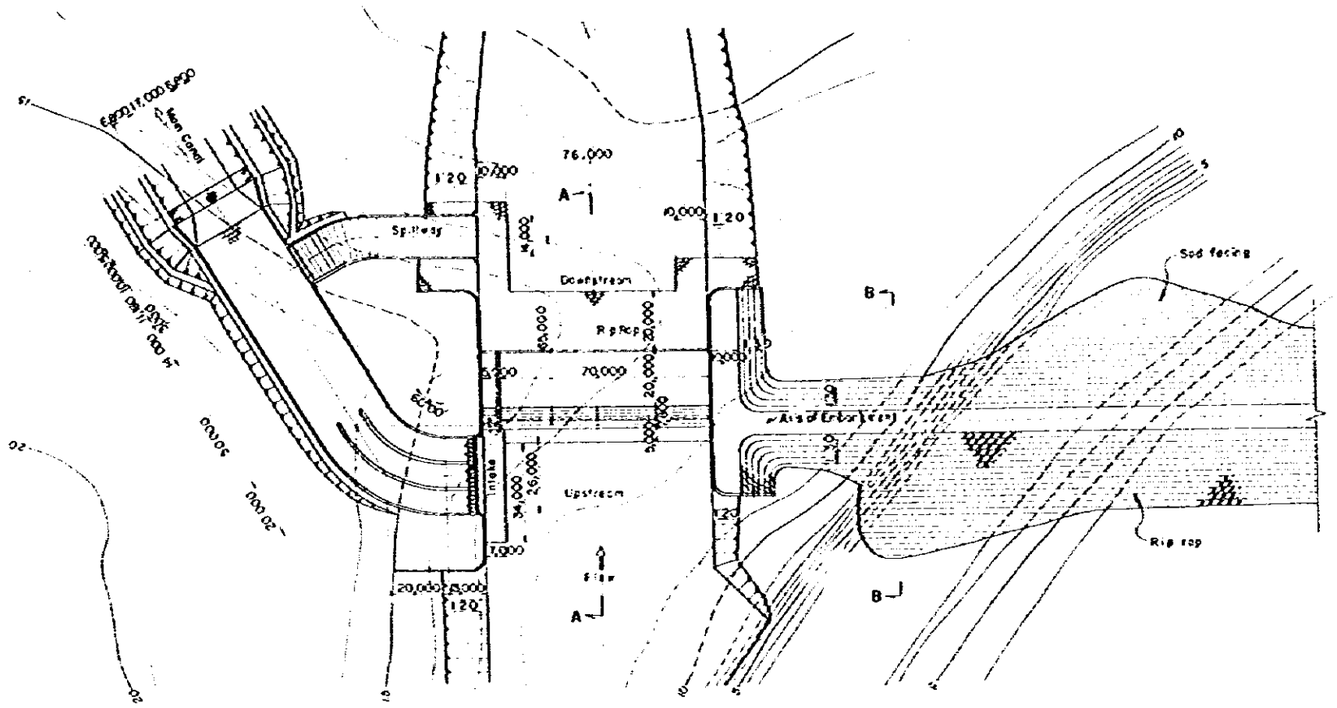
TITLE OF DRAWING:

DETAILED GEOLOGICAL MAP AT DIVERSION WEIR SITES

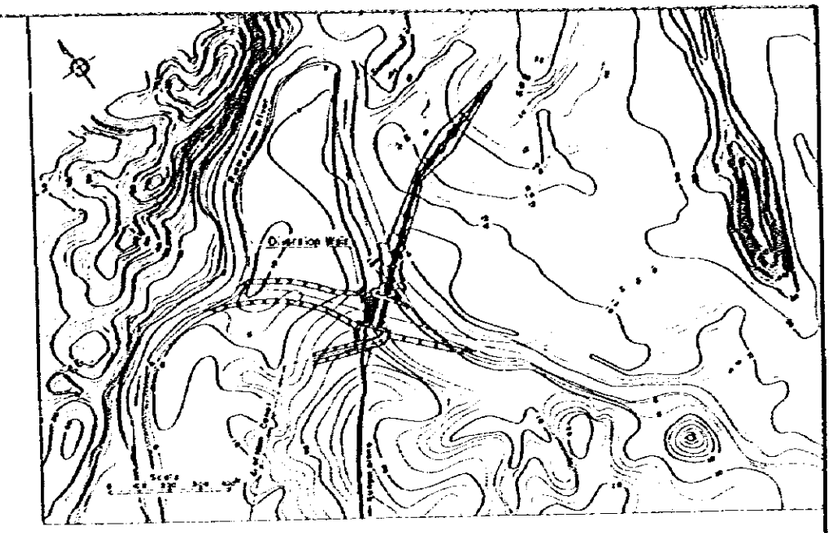
JAPAN INTERNATIONAL COOPERATION AGENCY

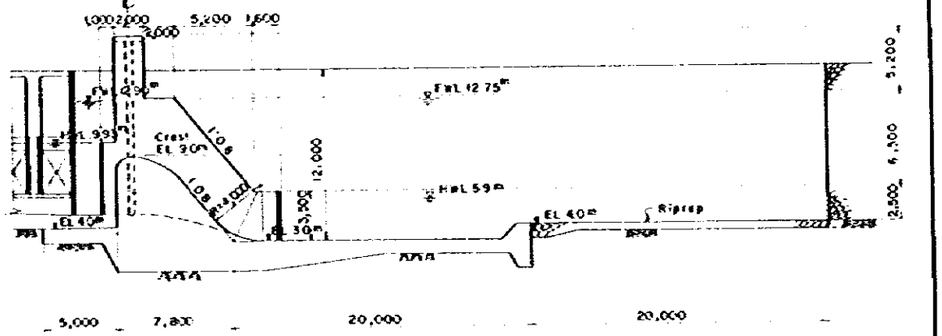
TOKYO

DWG NO 3

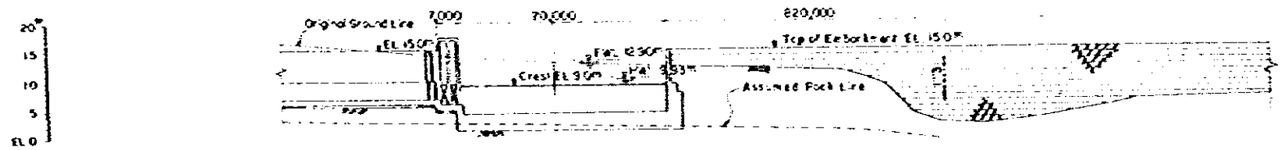


PLAN OF WEIR (SCALE - A)

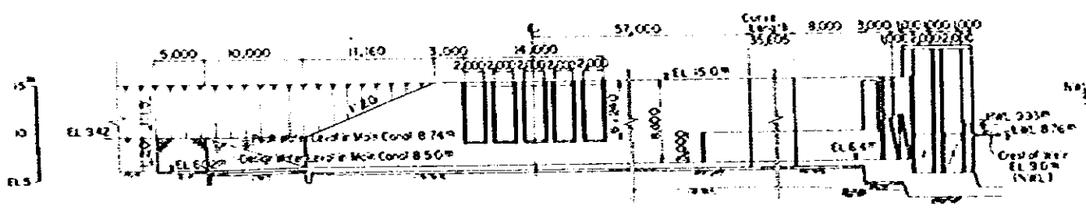


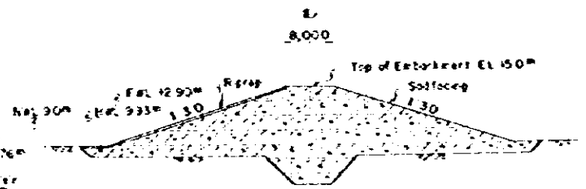


SECTION A-A (SCALE - B)

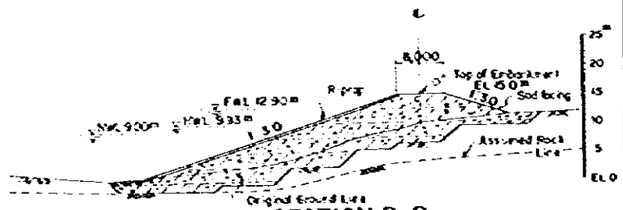


ELEVATION (VERTICAL SCALE - C, HORIZONTAL SCALE - A)

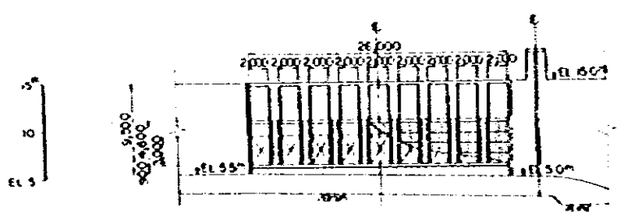




TYPICAL SECTION OF EMBANKMENT (SCALE - C)



SECTION B-B (SCALE - C)



INTAKE (SCALE - D)

SCALE - A 0 10 20 30 40 50m

SCALE - B 0 5 10m

SCALE - C 0 5 10 15 20m

SCALE - D 0 5 10m

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

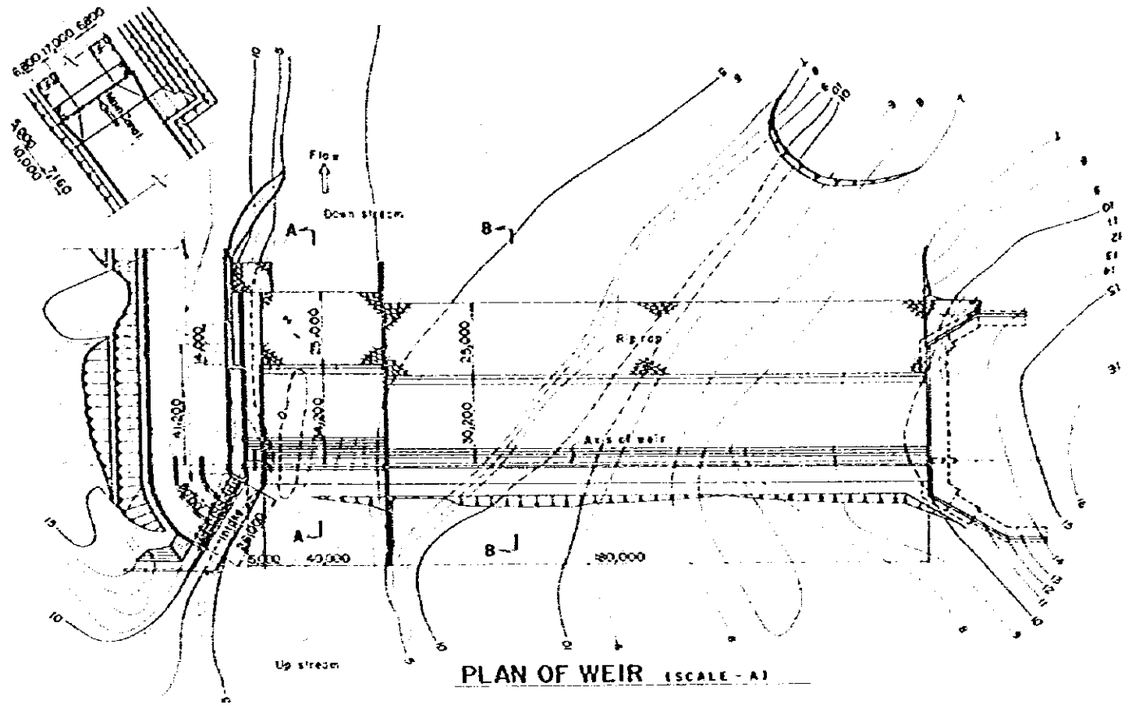
TITLE OF DRAWING

LAYOUT OF DIVERSION WEIR(ALTERNATIVE Site-A)

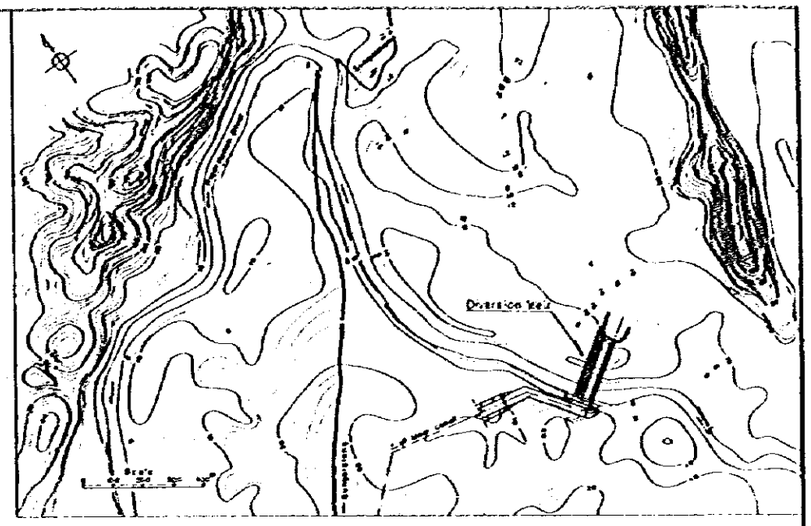
JAPAN INTERNATIONAL COOPERATION AGENCY

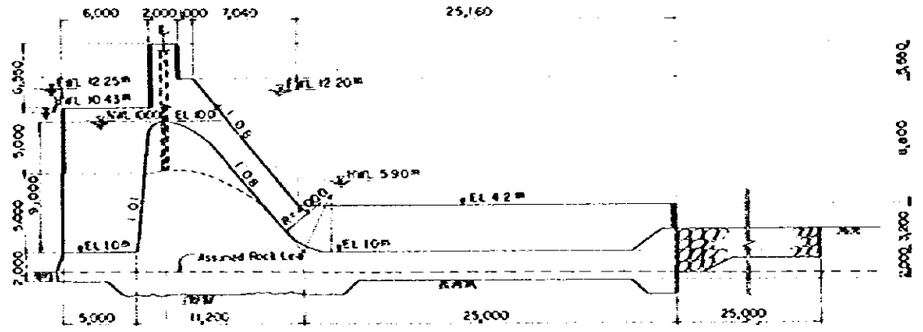
TOKYO

DWG No. 4

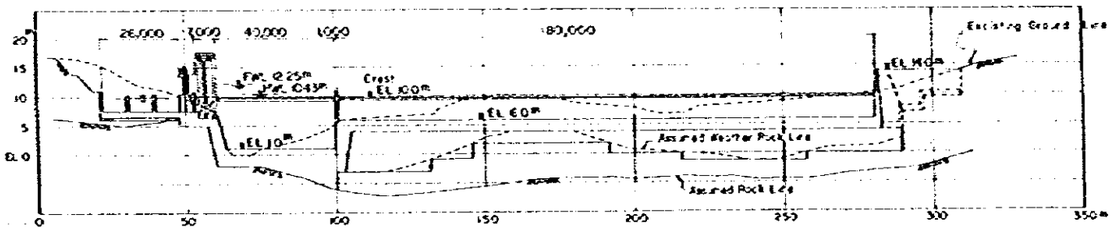


PLAN OF WEIR (SCALE - A)

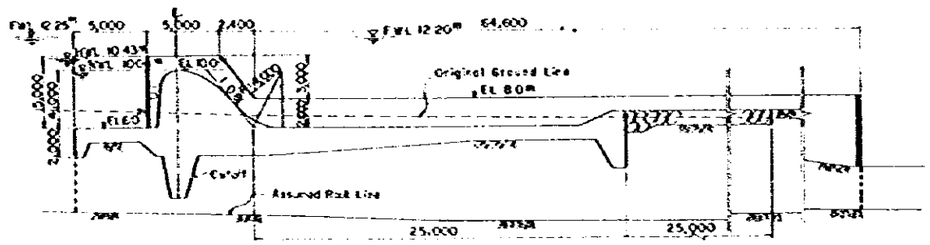




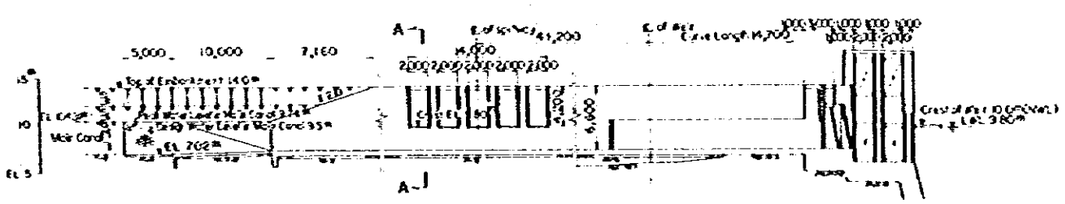
SECTION A-A (SCALE - B)

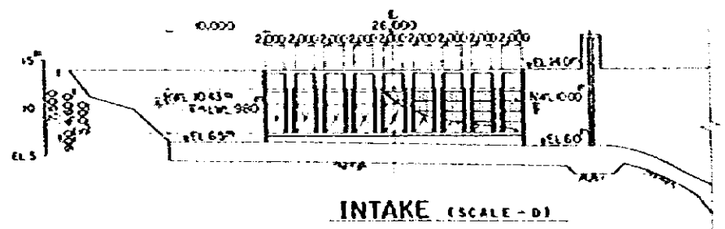


ELEVATION (VERTICAL SCALE - C, HORIZONTAL SCALE - A)

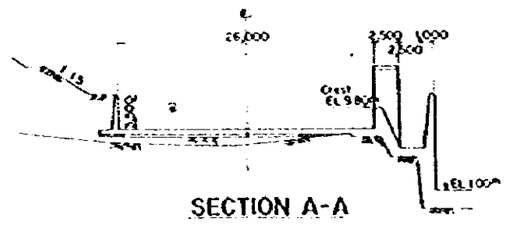


SECTION B-B (SCALE - B)





INTAKE (SCALE - D)



SECTION A-A

SCALE - A 0 10 20 30 40 50m

SCALE - B 0 5 10m

SCALE - C 0 10 20m

SCALE - D 0 5 10m

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

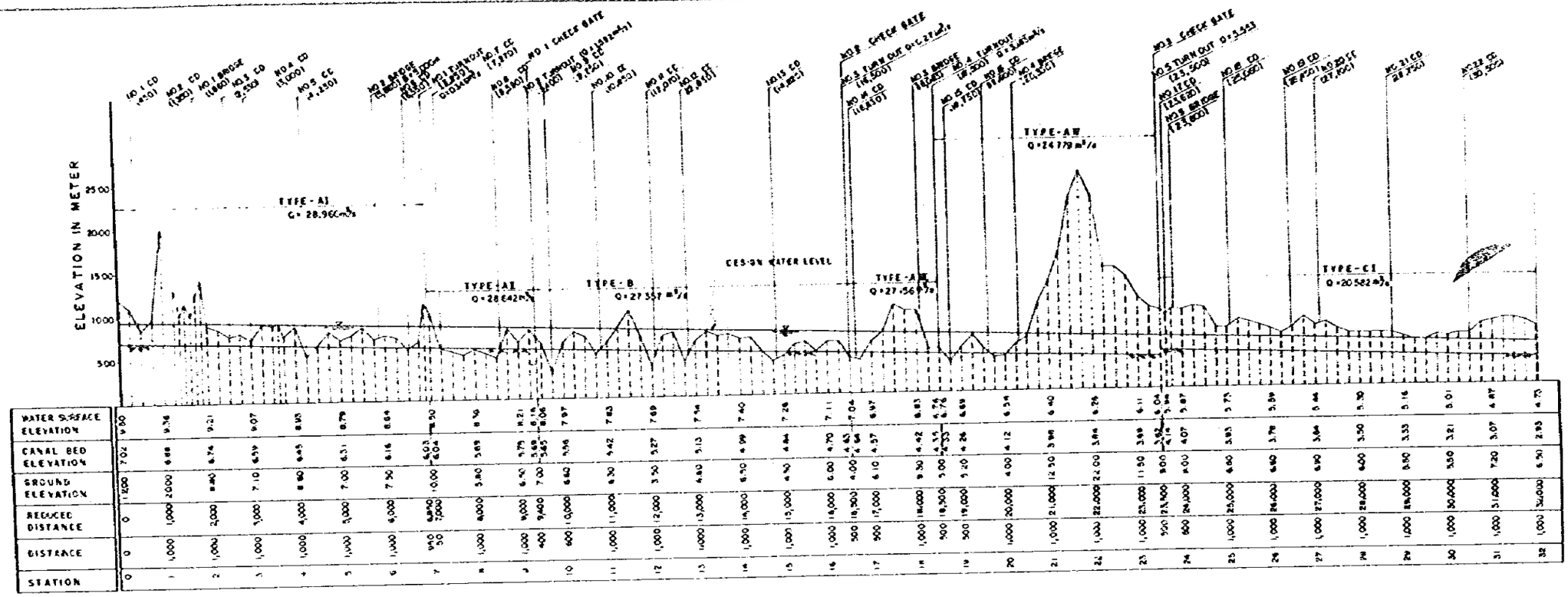
TITLE OF DRAWING

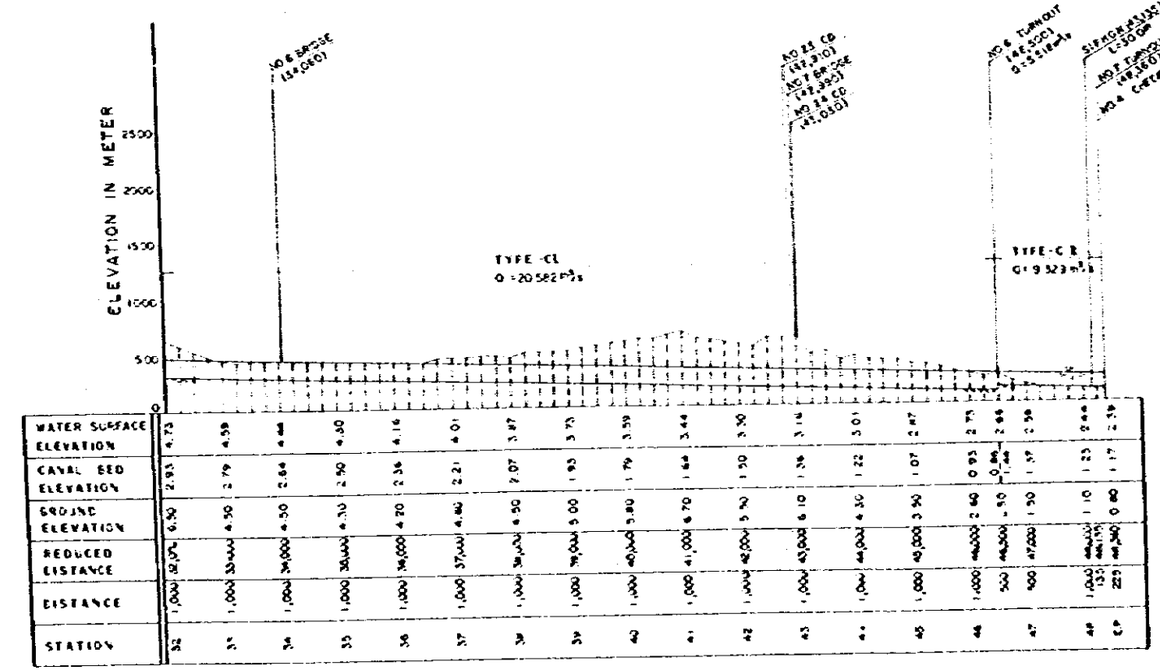
LAYOUT OF DIVERSION WEIR (ALTERNATIVE Site-B)

JAPAN INTERNATIONAL COOPERATION AGENCY

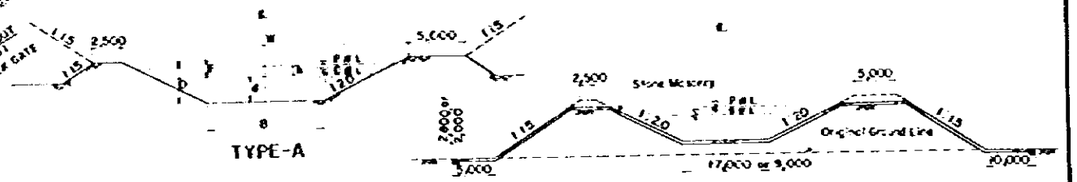
TOKYO

DWG NO. 5





Note
P W L ; Peak water level
D W L ; Design water level
C D ; Cross drain



OVERSHOOT DRAIN (No 7+320.0m ~ No 7+620.0m)
(No 36+100.0m ~ No. 36+400.0m)

DIMENSIONS OF MAIN CANAL

TYPE	Discharge (m³/s)	Velocity (m/s)	B (m)	d (m)	F (m)	D (m)	h (m)	R (m)	I (m)
A-1	28.96 (34.00)	0.53	17	2.48	0.92	3.40	0.24	30.60	7,000
A-2	28.64 (33.70)	0.53	17	2.47	0.92	3.40	0.23	30.60	-
B	27.36 (32.15)	0.52	17	2.41	0.89	3.30	0.23	30.20	-
A-3	27.16 (31.95)	0.52	17	2.40	0.90	3.30	0.23	30.20	-
A-W	24.78 (29.15)	0.52	15	2.42	0.78	3.20	0.23	27.80	-
C-1	20.58 (24.21)	0.56	9	1.80	0.60	2.40	0.18	18.60	-
C-2	9.55 (10.98)	0.78	6	1.22	0.68	2.10	0.12	16.40	-

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

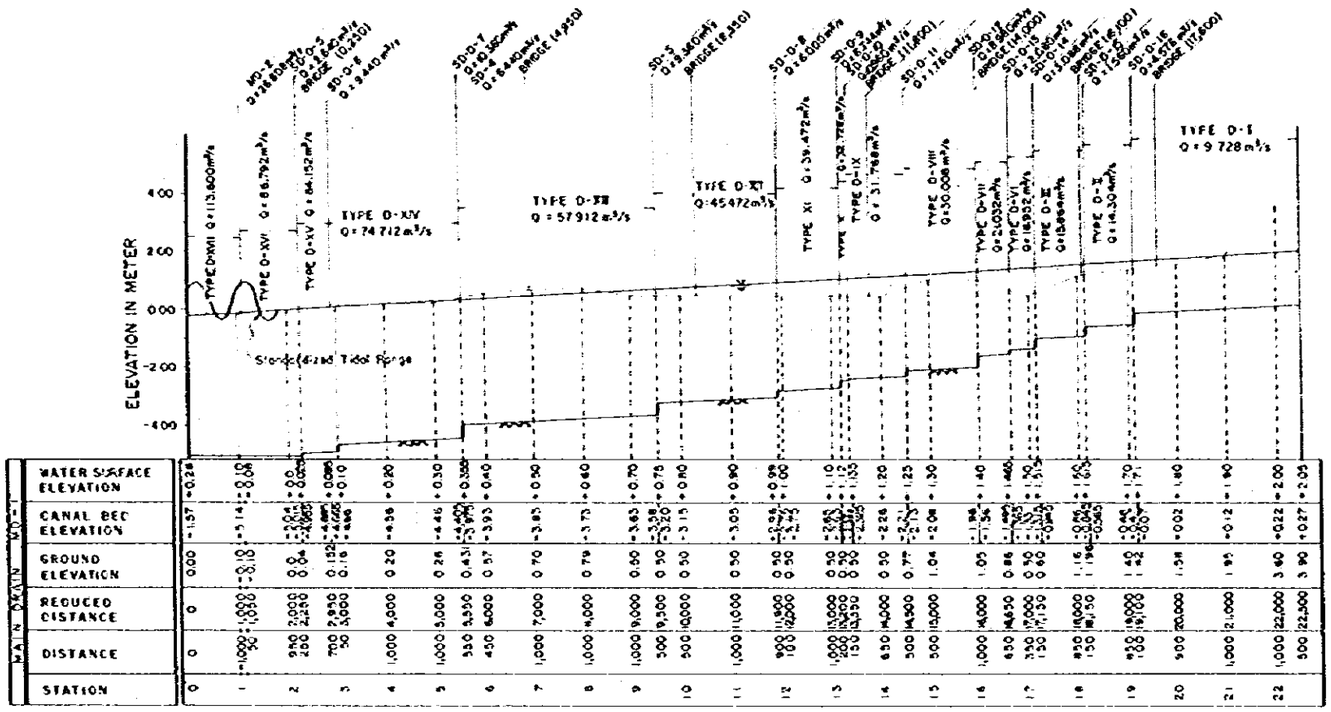
TITLE OF DRAWING

MAIN IRRIGATION CANAL PROFILE & TYPICAL CROSS SECTION

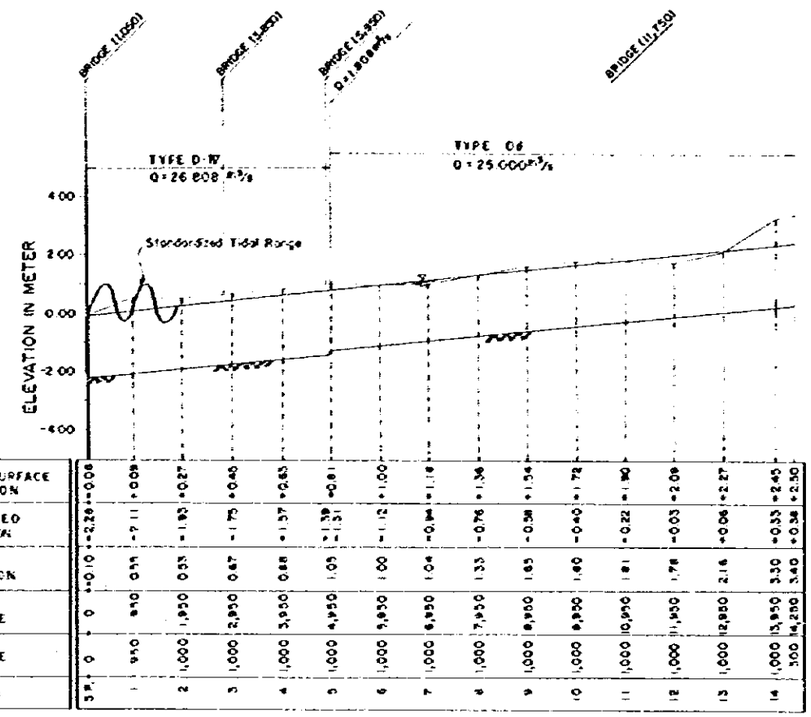
JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO

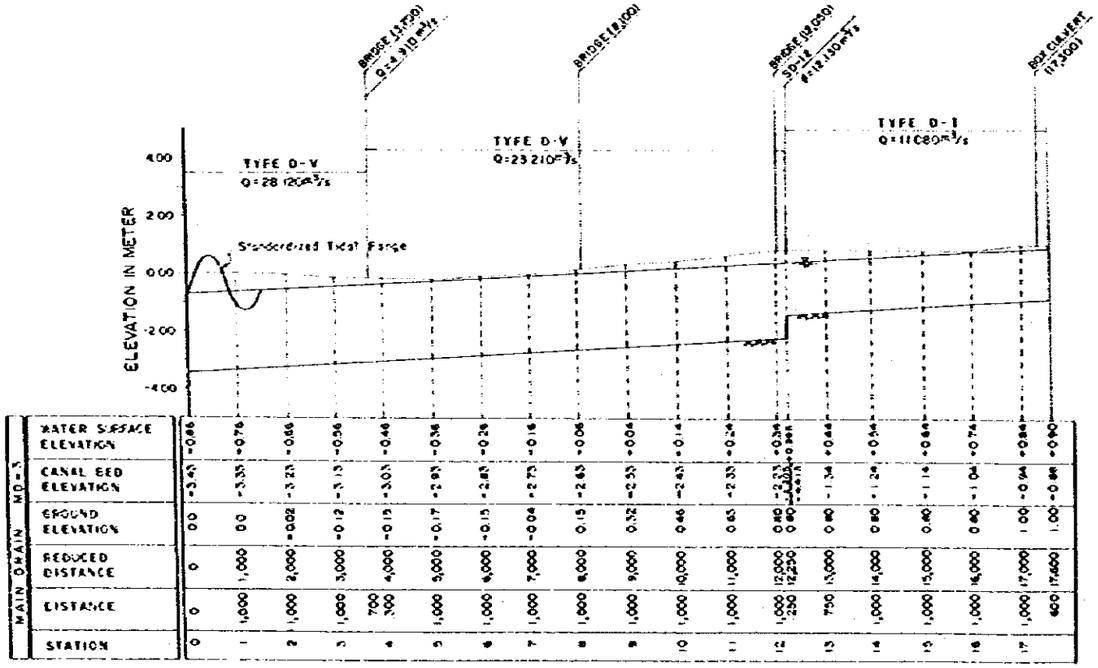
DWG. No. 6



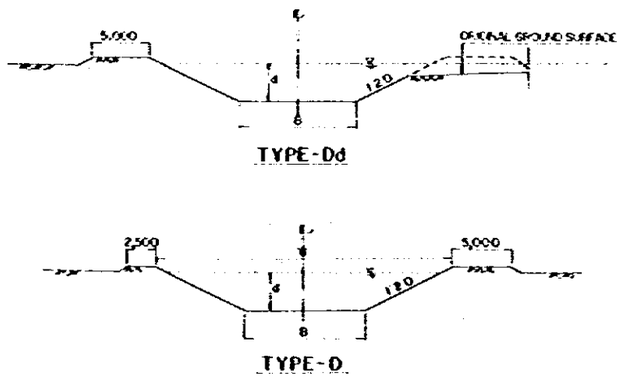
MAIN DRAIN MD-1																							
WATER SURFACE ELEVATION	+0.26	+0.14	+0.08	+0.08	+0.08	+0.10	+0.20	+0.30	+0.30	+0.40	+0.50	+0.40	+0.70	+0.70	+0.80	+0.90	+0.90	+1.00	+1.10	+1.20	+1.25	+1.30	+1.40	+1.50	+1.50	+1.70	+1.80	+1.90	+2.00	+2.05
CANAL BED ELEVATION	-1.57	-3.14	-3.10	-3.10	-3.10	-3.06	-2.96	-2.86	-2.86	-2.93	-3.03	-3.13	-3.23	-3.23	-3.23	-3.05	-3.05	-2.95	-2.85	-2.75	-2.65	-2.55	-2.45	-2.35	-2.35	-2.25	-2.15	-2.05	-1.95	-1.90
GROUND ELEVATION	0.00	-1.57	-3.10	0.04	0.04	0.04	0.20	0.26	0.43	0.57	0.70	0.79	0.80	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.16	1.42	1.95	3.40	3.90
REDUCED DISTANCE	0	1,000	1,000	2,000	2,950	3,000	4,000	5,000	5,350	6,000	7,000	8,000	9,000	9,500	10,000	11,000	11,800	12,000	13,000	14,000	14,300	15,000	16,000	17,000	17,150	18,000	18,150	19,000	20,000	21,000	22,000	22,300
DISTANCE	0	1,000	1,000	950	950	50	1,000	1,000	350	650	1,000	1,000	1,000	500	500	1,000	800	200	1,000	1,000	300	700	1,000	1,000	150	850	150	850	1,000	1,000	1,000	300
STATION	0	1		2		3	4	5		6	7	8	9		10	11		12	13	14		15	16		17	18		19	20	21	22	



MAIN DRAIN MD-2															
WATER SURFACE ELEVATION	+0.06	+0.09	+0.27	+0.45	+0.65	+0.81	+1.00	+1.18	+1.36	+1.54	+1.72	+1.90	+2.09	+2.27	+2.45
CANAL BED ELEVATION	-2.26	-2.11	-1.93	-1.75	-1.57	-1.39	-1.31	-1.12	-0.94	-0.76	-0.58	-0.40	-0.03	-0.06	-0.33
GROUND ELEVATION	+0.10	+0.35	+0.51	+0.67	+0.88	+1.05	+1.00	+1.04	+1.35	+1.36	+1.85	+1.80	+1.78	+2.16	+3.30
REDUCE DISTANCE	0	950	1,850	2,850	3,850	4,950	5,850	6,950	7,950	8,950	9,950	10,950	11,950	12,950	13,950
DISTANCE	0	950	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
STATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14



MAIN DRAIN MD-3																	
WATER SURFACE ELEVATION	+0.60	+0.76	+0.66	+0.56	+0.46	+0.36	+0.26	+0.16	+0.06	+0.04	+0.14	+0.24	+0.34	+0.44	+0.54	+0.64	+0.74	+0.84	+0.90
CANAL BED ELEVATION	-3.45	-3.35	-3.25	-3.15	-3.05	-2.95	-2.85	-2.75	-2.65	-2.55	-2.45	-2.35	-2.25	-1.34	-1.24	-1.14	-1.04	-0.94	-0.86
GROUND ELEVATION	0.0	0.0	+0.02	+0.12	+0.13	+0.17	+0.15	+0.04	0.15	0.32	0.46	0.65	0.80	0.80	0.80	0.80	0.80	1.00	1.00
REDUCED DISTANCE	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	17,400
DISTANCE	0	1,000	1,000	1,000	700	300	1,000	1,000	1,000	1,000	1,000	1,000	1,000	750	1,000	1,000	1,000	1,000	400
STATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	



DIMENSION OF MAIN DRAIN

TYPE	DESIGN DISCHARGE (m³/s)	DESIGN VELOCITY (m/s)	B (m)	d (m)	W (m)
D-I	11.080	0.338	8.0	1.78	15.12
D-II	14.304	0.397	12.0	2.18	20.72
D-III	15.864	0.439	16.0	2.46	25.84
D4	25.000	0.53	18.0	2.12	—
D-IV	26.808	0.54	18.0	2.26	28.28
D-V	28.120	0.456	18.0	2.57	28.28
D-VI	37.904	0.490	21.4	2.83	32.72
D-VII	42.064	0.505	22.2	2.96	34.04
D-VIII	60.016	0.552	25.4	3.38	38.92
D-IX	63.536	0.560	25.9	3.46	39.74
D-X	65.456	0.564	26.2	3.50	40.20
D-XI	78.944	0.591	28.1	3.75	43.10
D-XII	90.944	0.612	29.7	3.95	45.50
D-XIII	115.824	0.651	32.5	4.33	49.82
D-XIV	149.424	0.693	35.7	4.76	54.74
D-XV	168.304	0.714	37.4	4.98	57.32
D-XVI	173.584	0.720	37.8	5.04	57.96
D-XVII	200.392	0.69	40.0	4.57	58.28

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING

MAIN DRAINAGE CANAL PROFILE & TYPICAL CROSS SECTION

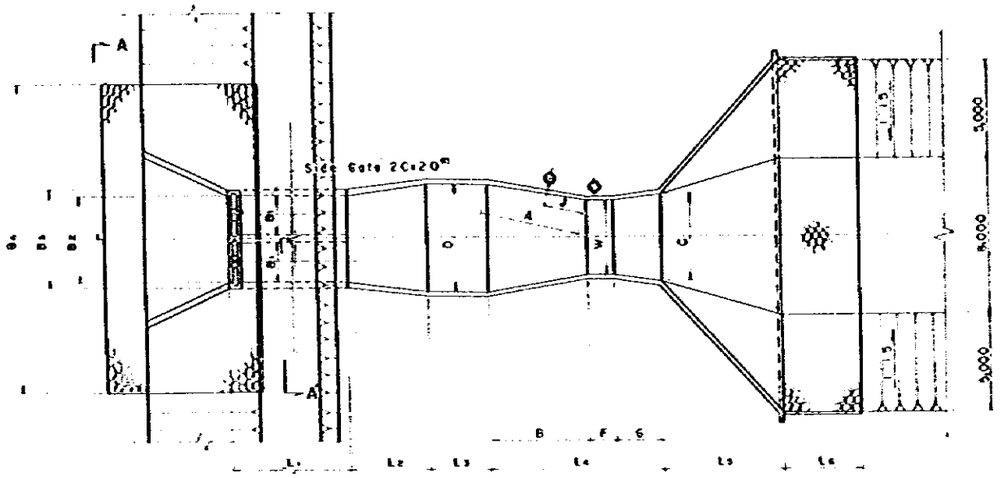
JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO

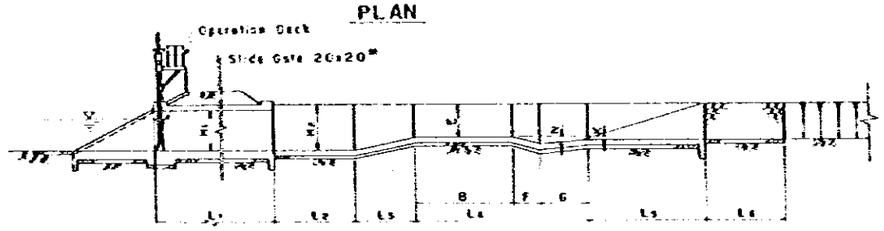
DWG. NO 7

TURNOUT (SCALE - A)

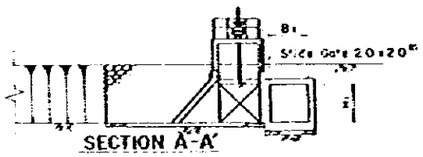
TYPE-A



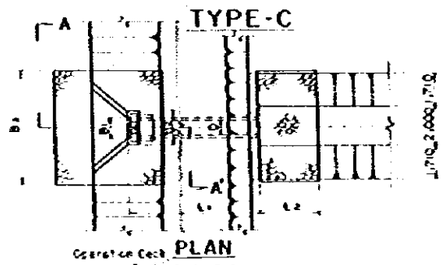
PLAN



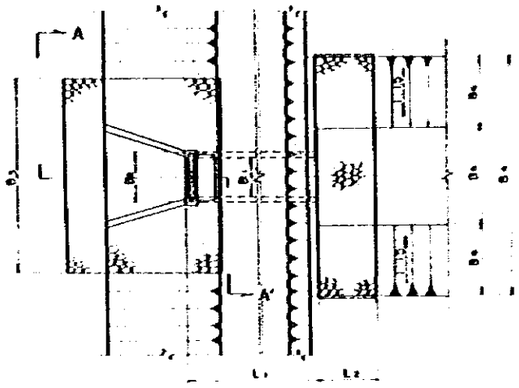
PROFILE



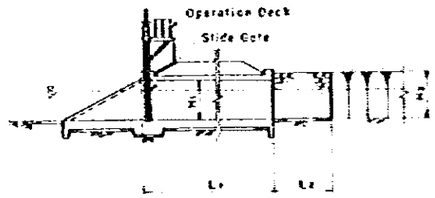
TYPE-C



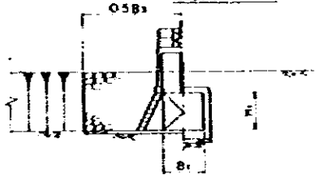
TYPE-B



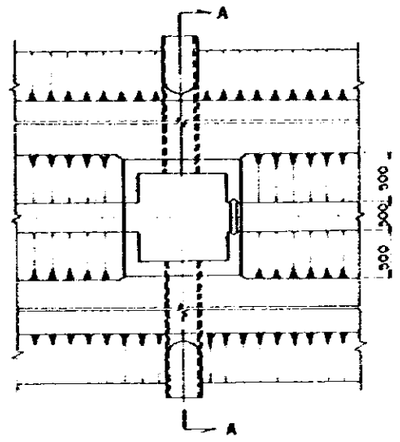
PLAN



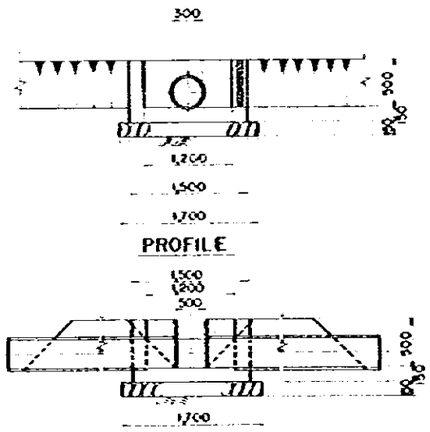
PROFILE



DIVISION BOX (SCALE - B)



PLAN



PROFILE

SECTION A-A

DIMENSIONS OF TURNOUTS

TYPE-A	A-1	A-2
L1	6,000	3,000
L2	4,000	4,000
L3	3,104	3,104
L4	8,229	8,229
L5	4,000	4,000
L6	4,000	4,000
B1	2,000	2,000
B2	4,490	4,000
B3	5,200	5,200
B4	6,000	6,000
H1	2,000	2,000
H2	2,300	2,300
B	4,877	4,877
F	914	914
G	2,438	2,438
A	4,975	4,975
a	343	343
E	152	152
D	5,607	5,607
B	3,658	3,658
C	4,420	4,420
Gate	2.0×2.0	2.0×2.0
J	2,032	2,032
K	1,524	1,524
HC	826	825

TYPE-B	B-1	B-2	B-3	B-4	B-5	B-6
L1	6,000	5,000	2,000	6,000	5,000	2,000
L2	3,000	3,000	3,000	3,000	3,000	3,000
B1	2,000	2,000	2,000	1,000	1,000	1,000
B2	2,800	2,800	2,800	1,800	1,800	1,800
B3	6,000	6,000	6,000	6,000	6,000	6,000
B4	2,170	2,170	2,170	7,650	7,650	7,650
B5	5,000	5,000	5,000	3,000	3,000	3,000
B6	3,585	3,585	3,585	2,325	2,325	2,325
H1	2,000	2,000	2,000	1,000	1,000	1,000
H2	2,390	2,390	2,390	1,550	1,550	1,550
Gate	2.0×2.0	2.0×2.0	2.0×2.0	1.0×1.0	1.0×1.0	1.0×1.0

TYPE-C	C-1	C-2	C-3	C-4	C-5	C-6
L1	6,000	5,000	2,000	6,000	5,000	2,000
L2	3,000	3,000	3,000	3,000	3,000	3,000
B1	1,000	1,000	1,000	700	700	700
B2	1,850	1,850	1,850	1,300	1,300	1,300
B3	6,000	6,000	6,000	4,000	4,000	4,000
D	800	850	850	500	500	500
Gate	ø 800	ø 850	ø 850	ø 500	ø 500	ø 500

SCALE - A 0 5 10m

SCALE - B 0 1 2m

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING

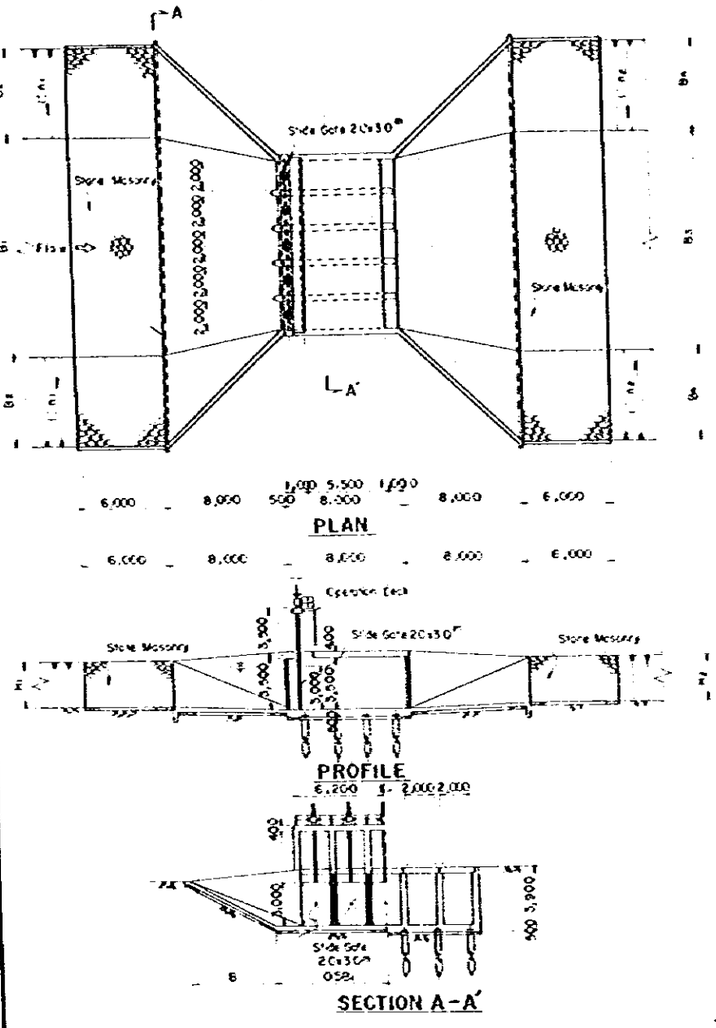
TURNOUT AND DIVISION BOX

JAPAN INTERNATIONAL COOPERATION AGENCY

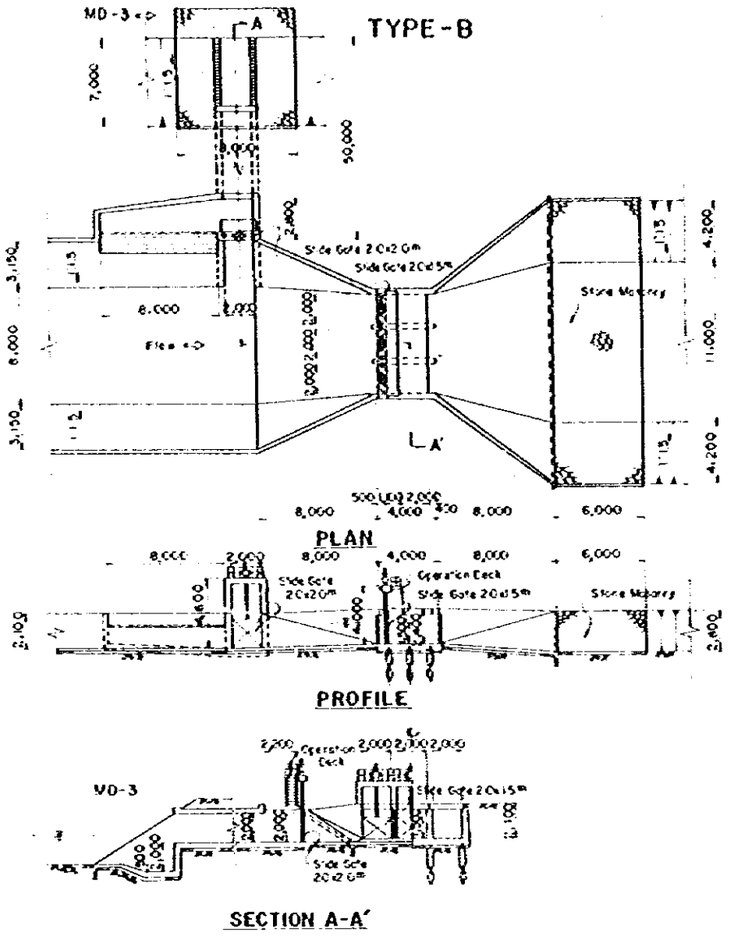
TOKYO

DWG No. 8

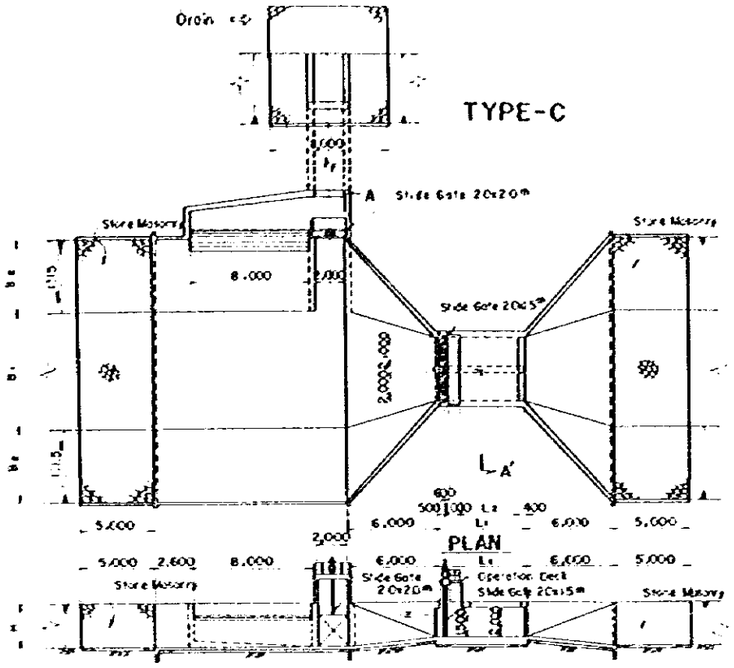
TYPE-A



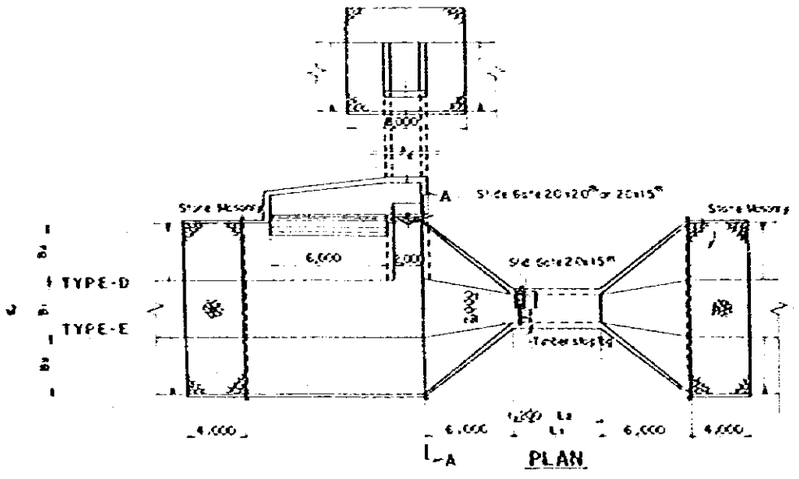
TYPE-B

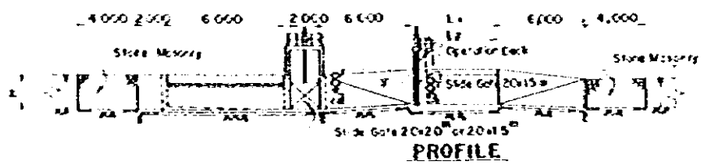


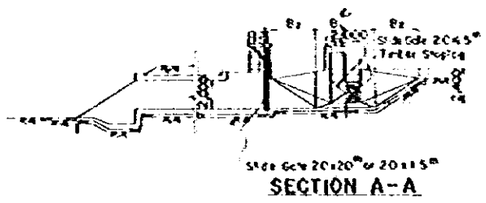
TYPE-C



TYPE-D AND TYPE-E







DIMENSIONS OF CHECK GATES

	TYPE-A		TYPE-C		TYPE-B		TYPE-E	
	A-1	A-2	C-1	C-2	B-1	B-2	E-1	E-2
B1	17,000	15,000	8,000	8,000	5,000	5,000	3,200	3,200
B2	6,800	6,400	3,795	3,795	3,585	3,585	2,305	2,305
B3	17,000	8,200	—	—	—	—	—	—
B4	6,800	3,800	—	—	—	—	—	—
H	—	—	7,350	7,350	7,350	7,350	3,550	3,550
H1	3,400	3,230	—	—	—	—	—	—
H2	3,400	3,400	—	—	—	—	—	—
L1	—	—	5,500	5,500	5,500	5,500	5,200	5,200
L2	—	—	5,000	5,500	4,000	4,500	5,000	5,500

SCALE

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING

CHECK GATE STRUCTURE

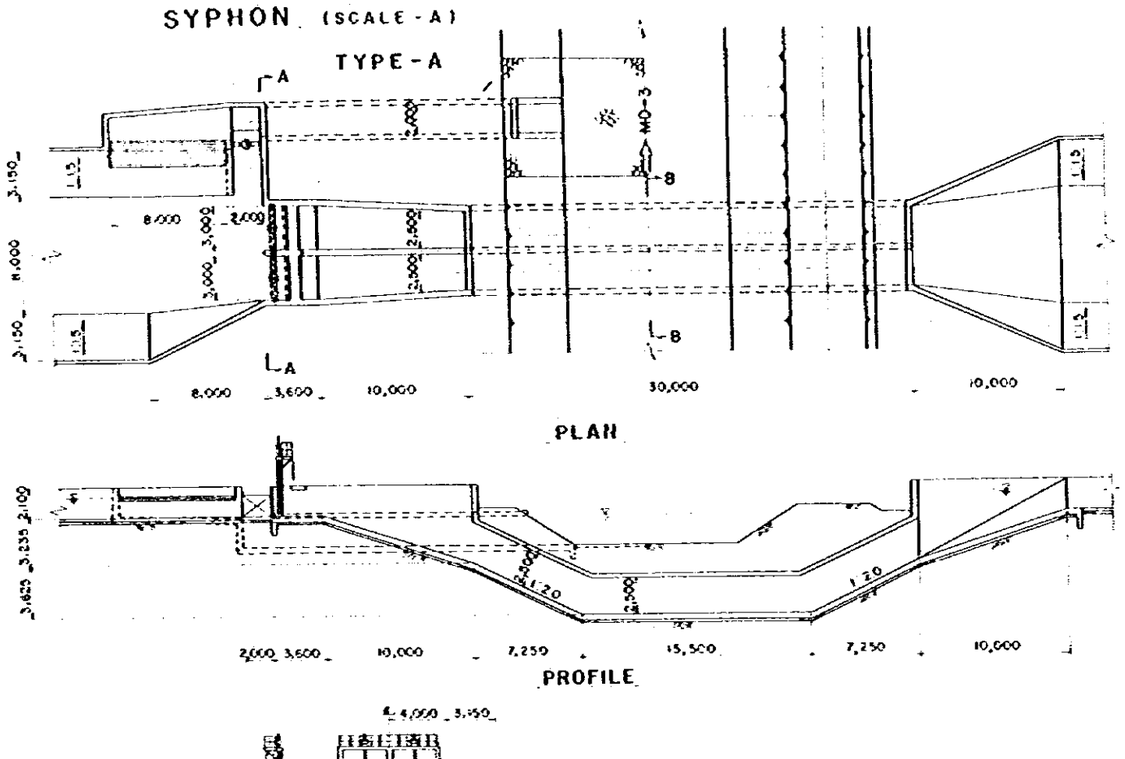
JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO

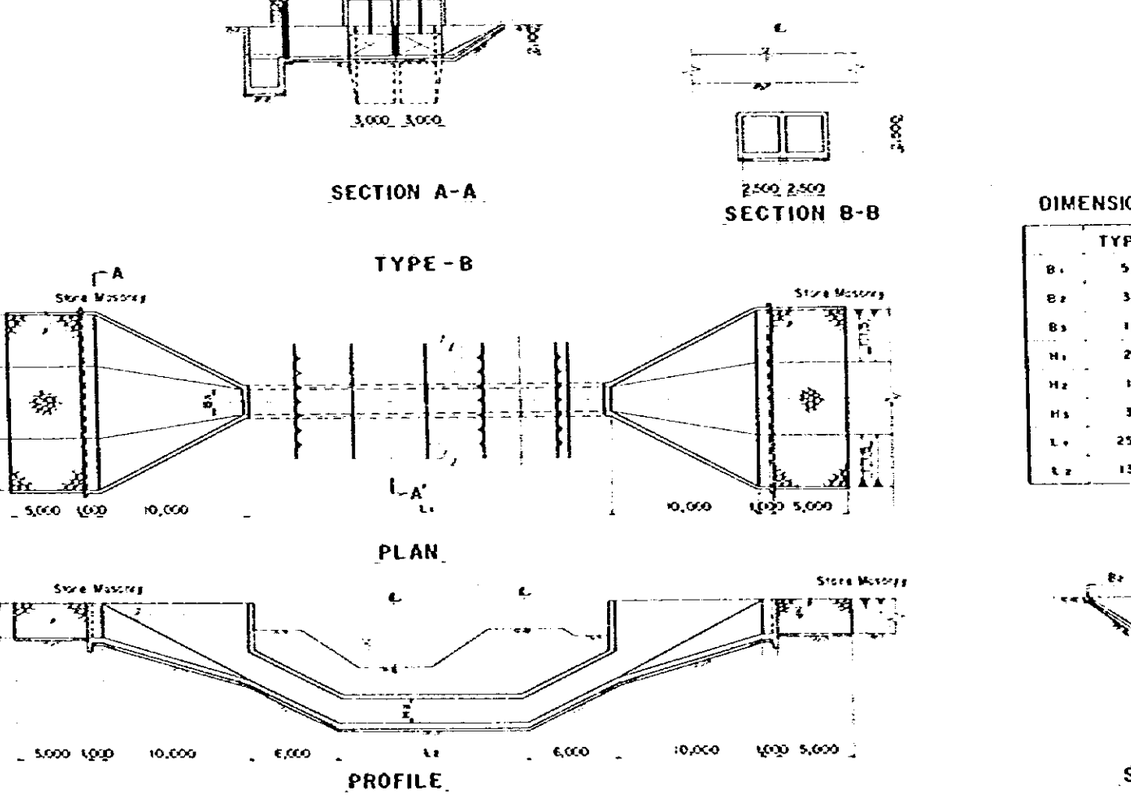
DWG No. 9

SYPHON (SCALE - A)

TYPE - A



PLAN



PROFILE

SECTION A-A

SECTION B-B

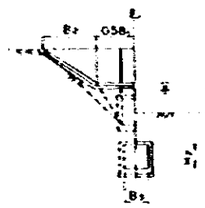
TYPE - B

PLAN

PROFILE

DIMENSIONS OF SYPHONS

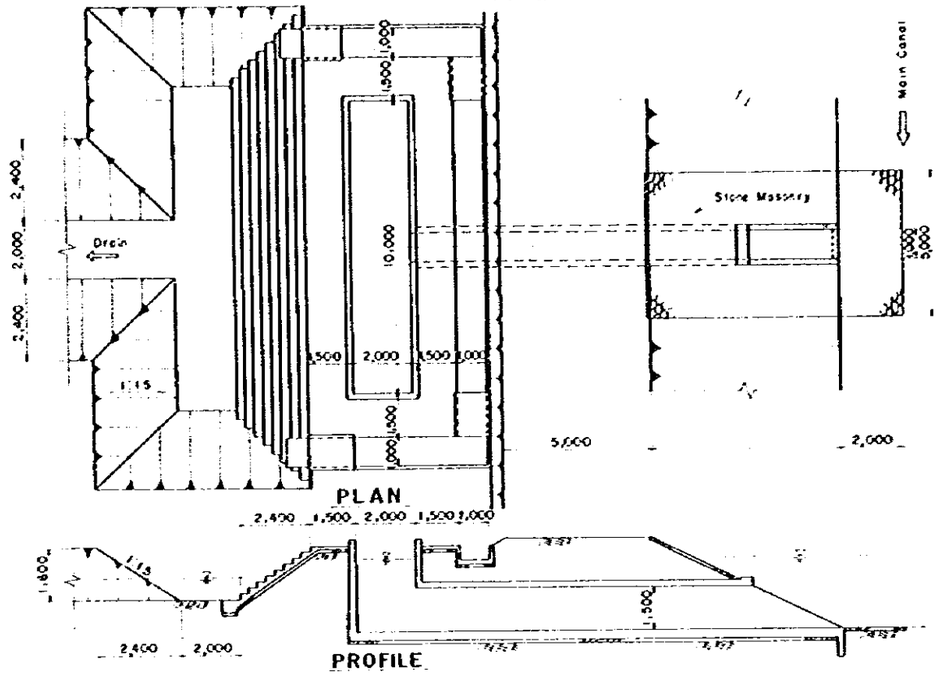
	TYPE-B-1	TYPE-B-2
B_1	5,000	4,000
B_2	3,585	2,980
B_3	1,700	1,200
H_1	2,390	1,960
H_2	1,700	1,200
H_3	3,800	6,487
L_1	25,000	45,000
L_2	13,000	33,000



SECTION A-A'

WASHING BASIN (SCALE-B)

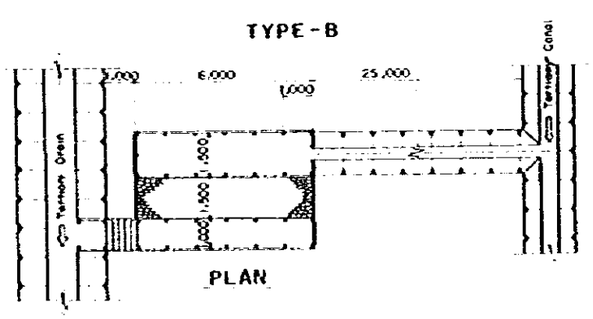
TYPE - A



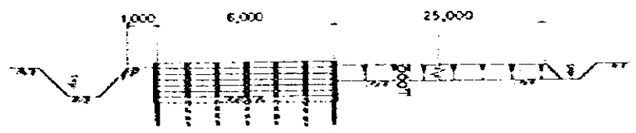
PLAN

PROFILE

TYPE - B



PLAN



PROFILE

SCALE - A 0 5 10 15 20m

SCALE - B 0 5 10m

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING

SYPHON AND WASHING BASIN

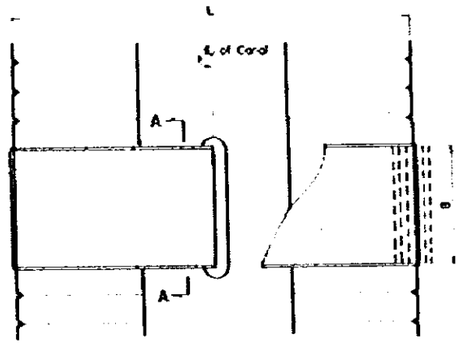
JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO

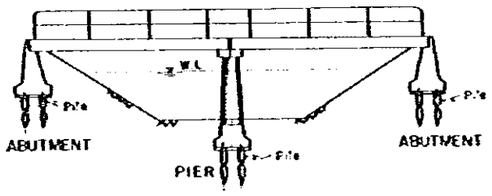
DWG NO. 10

BRIDGE

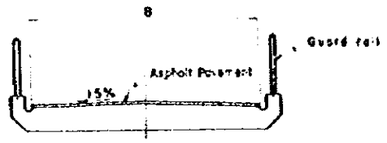
TYPE-SS
(Simple Slab Bridge)



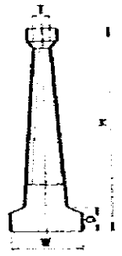
PLAN Scale : A



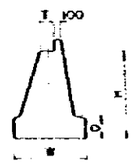
PROFILE Scale : A



SECTION A-A Scale : D

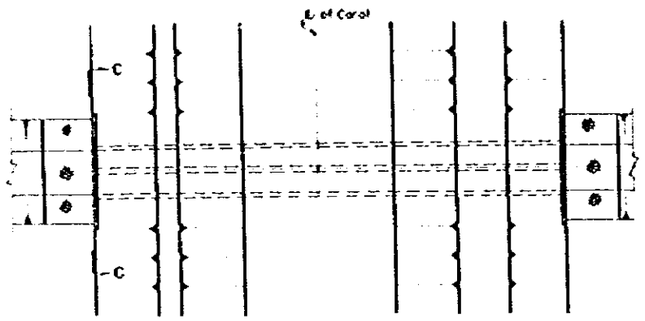


PIER Scale : D

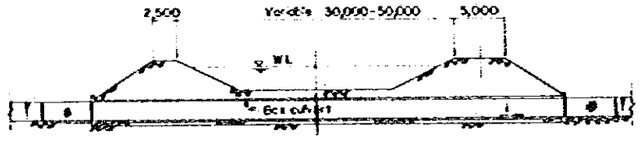


ABUTMENT Scale D

CULVERT

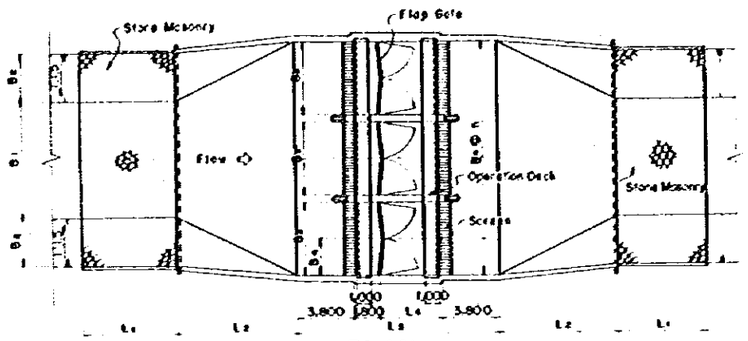


PLAN Scale : C

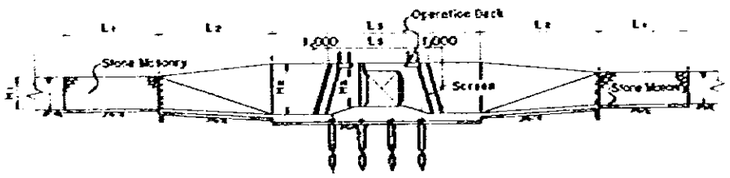


PROFILE Scale : C

DRAINAGE SLUICE

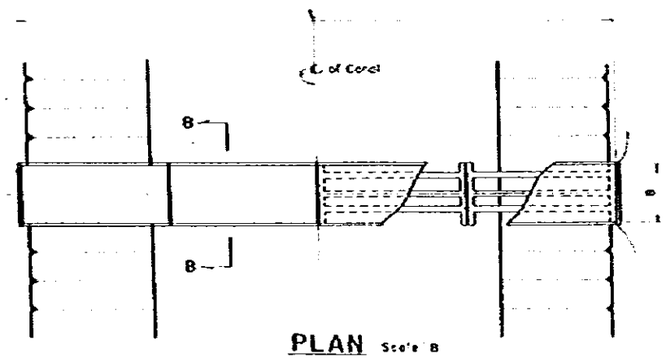


PLAN Scale : B

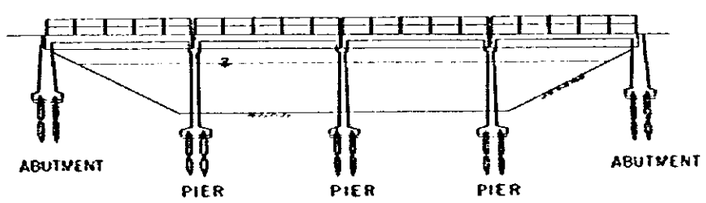


PROFILE Scale : B

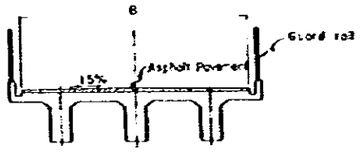
TYPE-SG
(Simple Girder Bridge)



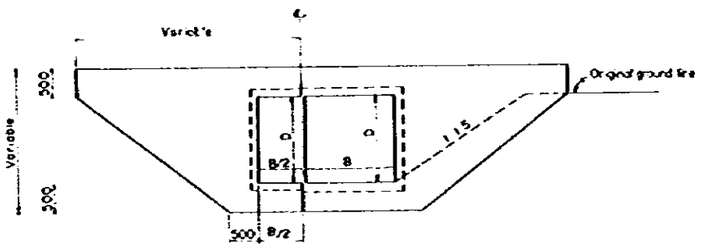
PLAN Scale : B



PROFILE Scale : B

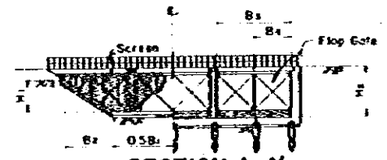


SECTION B-B Scale : D



TYPE-A TYPE-B

SECTION C-C Scale : D



SECTION A-A' Scale : B

DIMENSIONS OF PIERS

TYPE	H	D	W	T
PSS - I	25m	03m	09m	03m
- II	35	035	12	"
- III	40	04	13	035
PSS - I	65	05	25	06
- II	55	"	"	"
- III	50	"	20	05
- IV	35	"	"	04

DIMENSIONS OF ABUTMENTS

TYPE	H	D	W	T
ASS - I	15m	04m	12m	03m
ASS - II	30	05	20	05

DIMENSIONS OF BRIDGES

BRIDGE TYPE	L	B	PIER TYPE	Nos of PIER	ABUT TYPE	CROSSING CANAL TYPE
SS - 1	6m	485m	PSS-I	0		I
- 2	8	"	PSS-II	0		II
- 3	10	"	"	1		IV
- 4	14	"	"	1	ASS-I	V
- 5	17	"	"	2		VI
- 6	19	"	"	2		VII
- 7	24	"	PSS-III	2		VIII
- 8	26	"	"	3		IX
SG - 1	60	5	PSS-I	5		
- 2	50	4	PSG-II	4		MAIN DRAIN
- 3	40	5	PSS-III	3	ASG-II	
- 4	35	4	PSG-IV	3		
- 5	20	8	"	1		MAIN CANAL

DIMENSIONS OF CULVERTS

Discharge (m³/s)	TYPE	B = D
- 1	A	0.8m
1 - 3		1.5
3 - 6		2.0
6 - 8	B	1.7
8 - 10		1.9

SCALE

A : 0 1 2 3m
B : 0 1 2 3 4 5m
C : 0 1 2 3 4 5 6 7 8 9 10 11 12m
D : 0 1 2 3 4 5m

DIMENSIONS OF DRAINAGE SLUICES

	TYPE I	II	III	IV	V	VI	VII	VIII	IX
B1	3,000	3,000	4,000	5,000	8,000	11,000	12,000	16,000	16,000
B2	2,858	2,100	2,333	3,143	3,429	3,800	3,429	4,286	4,571
B3	4,000	4,000	4,000	5,000	5,000	5,000	5,000	6,000	6,000
B4	3,000	3,000	3,000	3,000	3,800	3,800	3,800	3,800	3,800
H1	2,878	1,600	1,730	2,878	2,185	2,600	2,385	2,850	2,878
H2	3,000	3,000	3,000	3,000	3,500	3,800	3,800	5,000	5,000
H3	3,000	3,000	3,000	3,000	3,800	3,800	3,800	3,800	3,800
L1	6,000	6,000	6,000	6,000	6,000	6,000	6,000	8,000	8,000
L2	6,000	6,000	6,000	6,000	8,000	8,000	8,000	10,000	10,000
L3	13,000	13,000	13,000	13,000	13,800	13,800	13,800	16,000	16,000
L4	3,800	3,800	3,800	3,800	4,200	4,200	4,200	5,800	5,800
L5	6,000	6,000	6,000	6,000	6,200	6,200	6,200	7,000	7,000
Gate	2.0x2.5	2.0x2.8	2.0x3.0	2.0x3.8	2.5x2.5	2.5x3.5	2.5x3.5	3.0x3.5	3.0x3.5
No	2	2	2	2	2	2	2	2	2

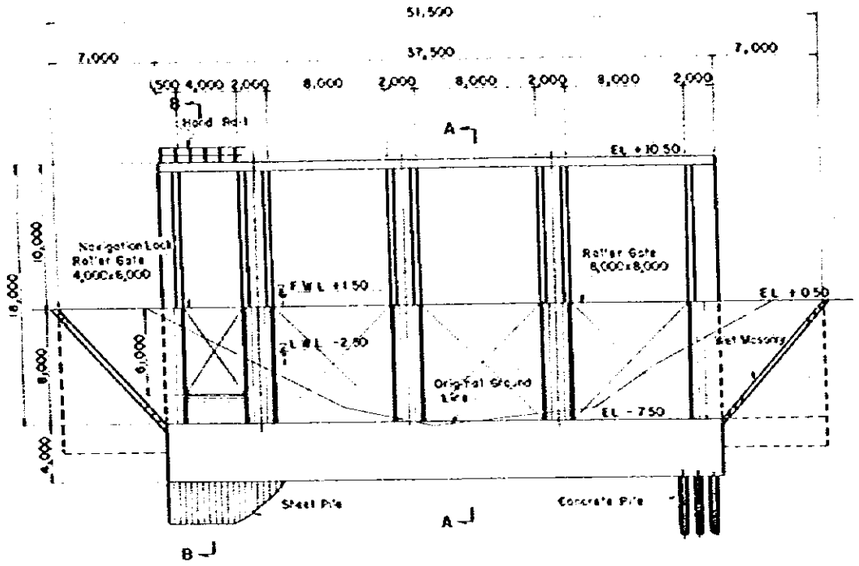
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING
BRIDGE, CULVERT & DRAINAGE SLUICE

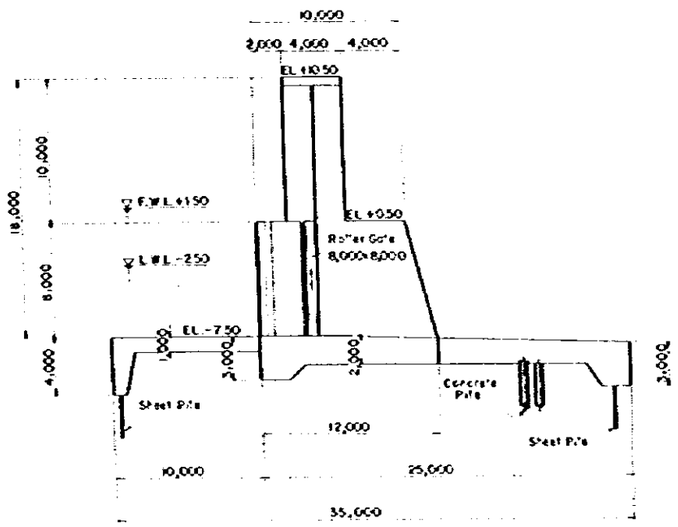
JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO

DWG. No. 11

TIDE GATE

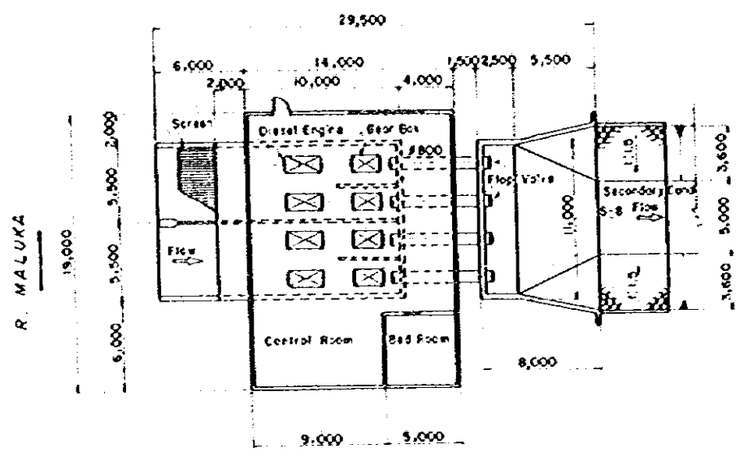


UPSTREAM VIEW SCALE : A

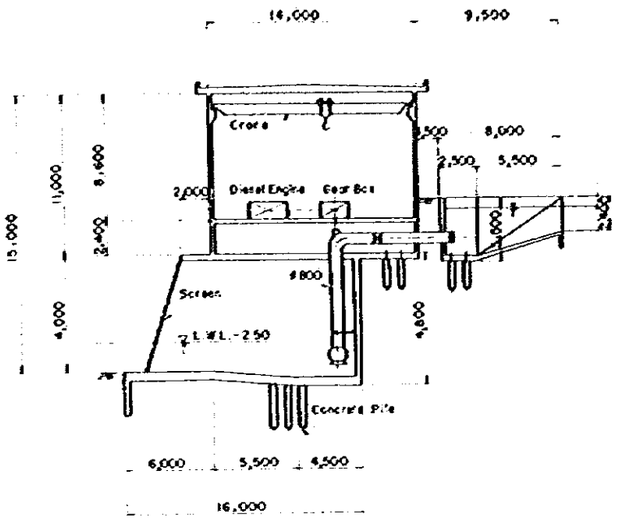


SECTION A-A SCALE : A

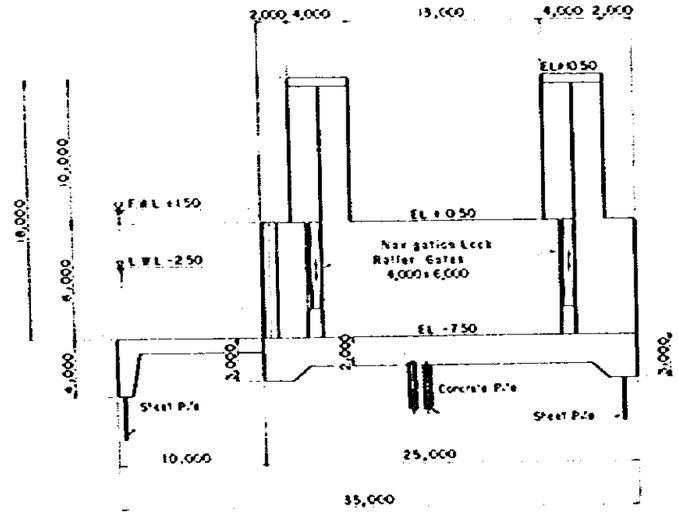
PUMP STATION



PLAN SCALE : A



PROFILE SCALE : A



SECTION B-B SCALE : A

SCALE : A

0 2 4 6 8 10 20m

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

RIAM KANAN IRRIGATION PROJECT

TITLE OF DRAWING

TIDE GATE AND PUMP STATION

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO

DWG. No 12