FIGURE

Fig. V-1 POTENTIAL AGRICULTURAL DEVELOPMENT AREA

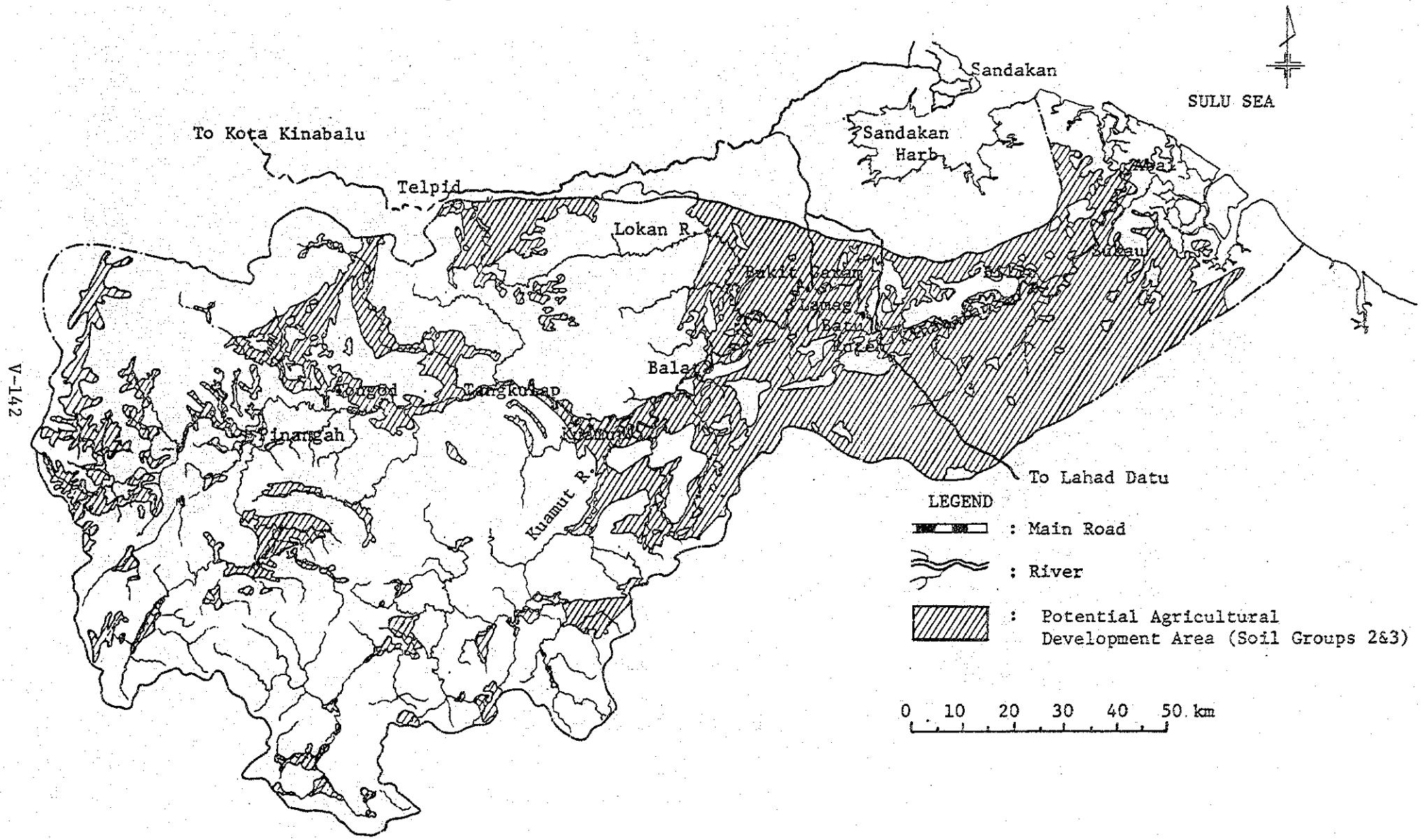


Fig. V-2 LAND CAPABILITY MAP

(Downstream of proposed damsite)

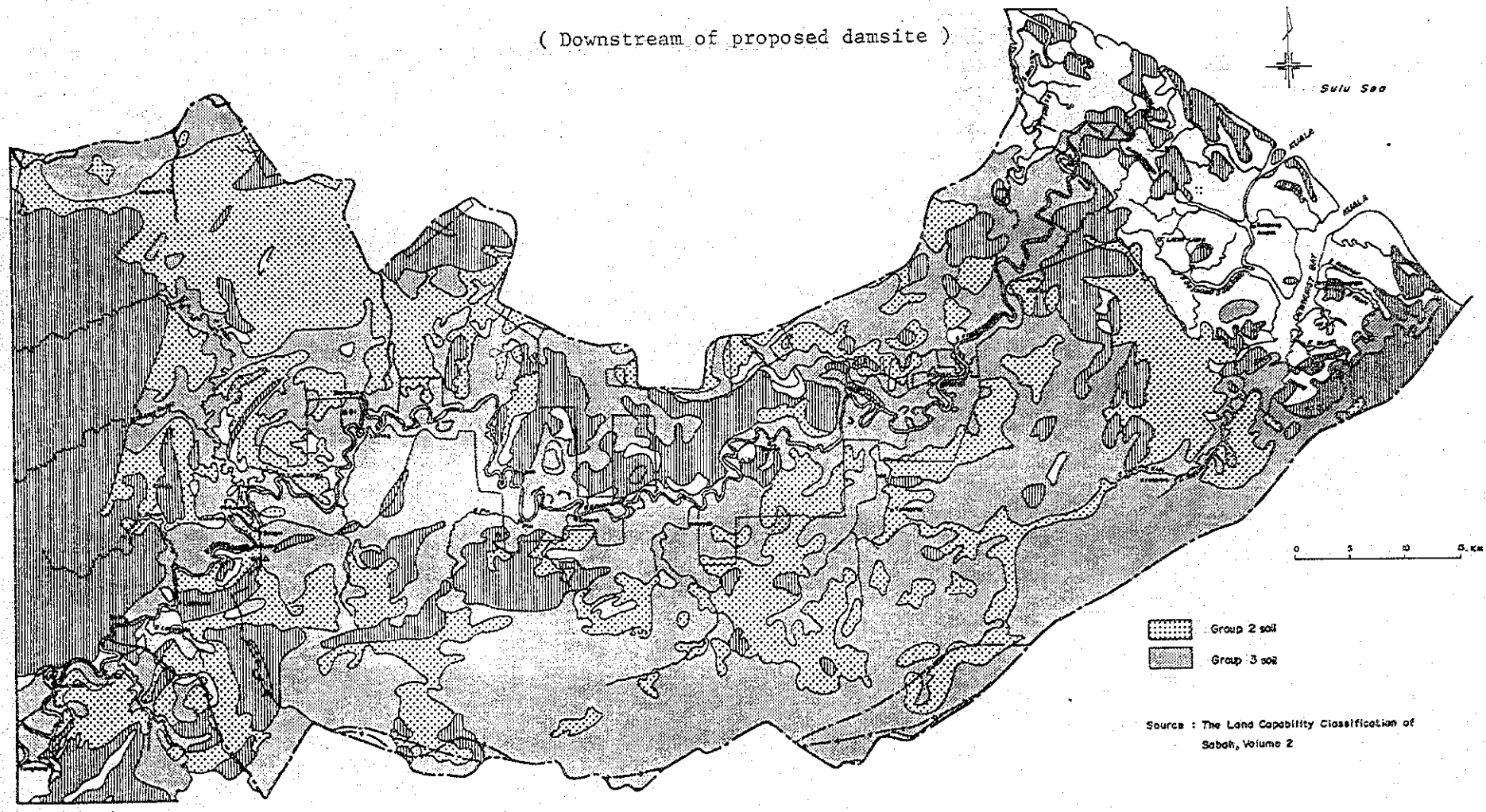


Fig. V-3 PRESENT CROPPING PATTERN

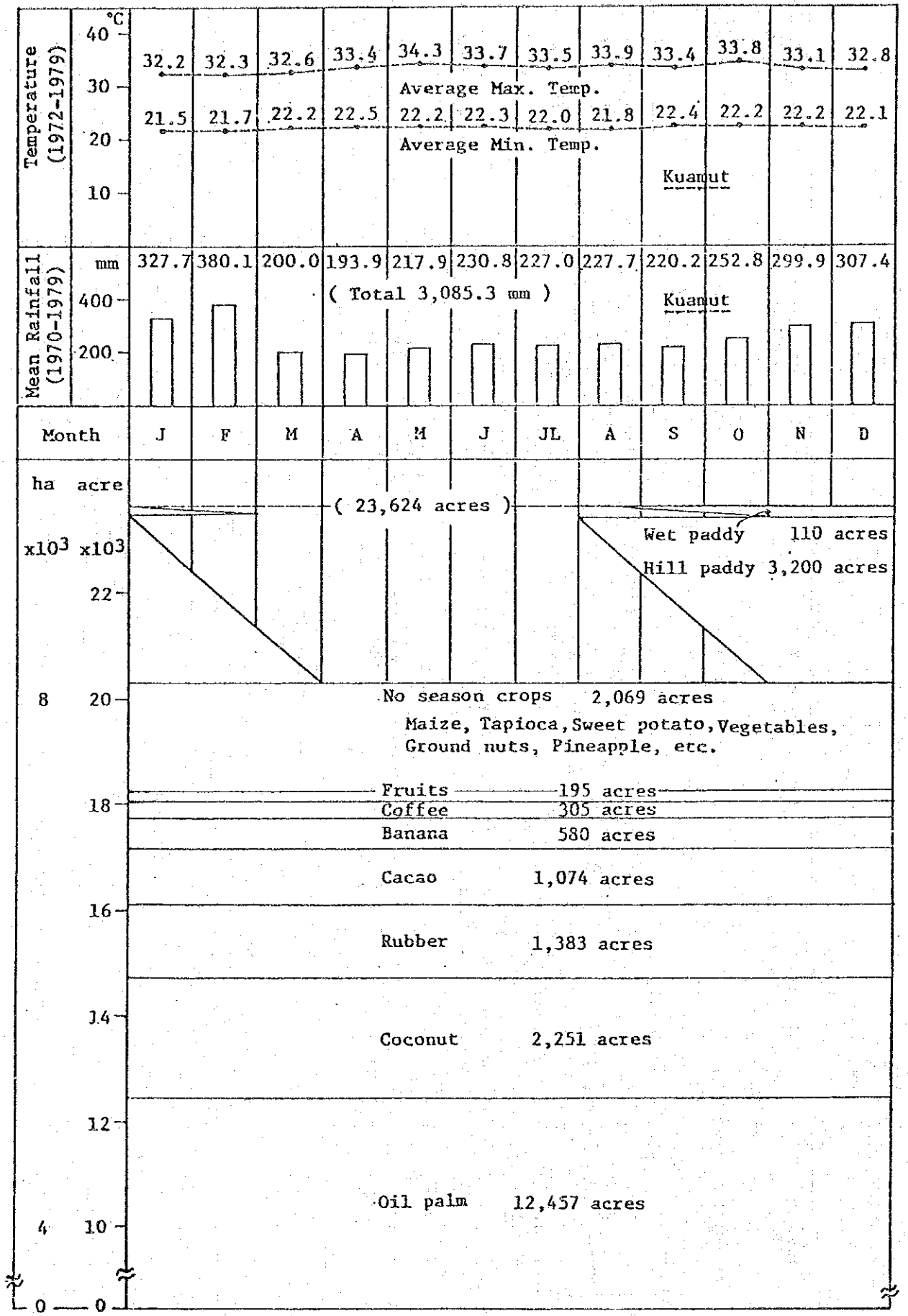


Fig. V-4 ORGANIZATION CHART-DEPARTMENT OF AGRICULTURE

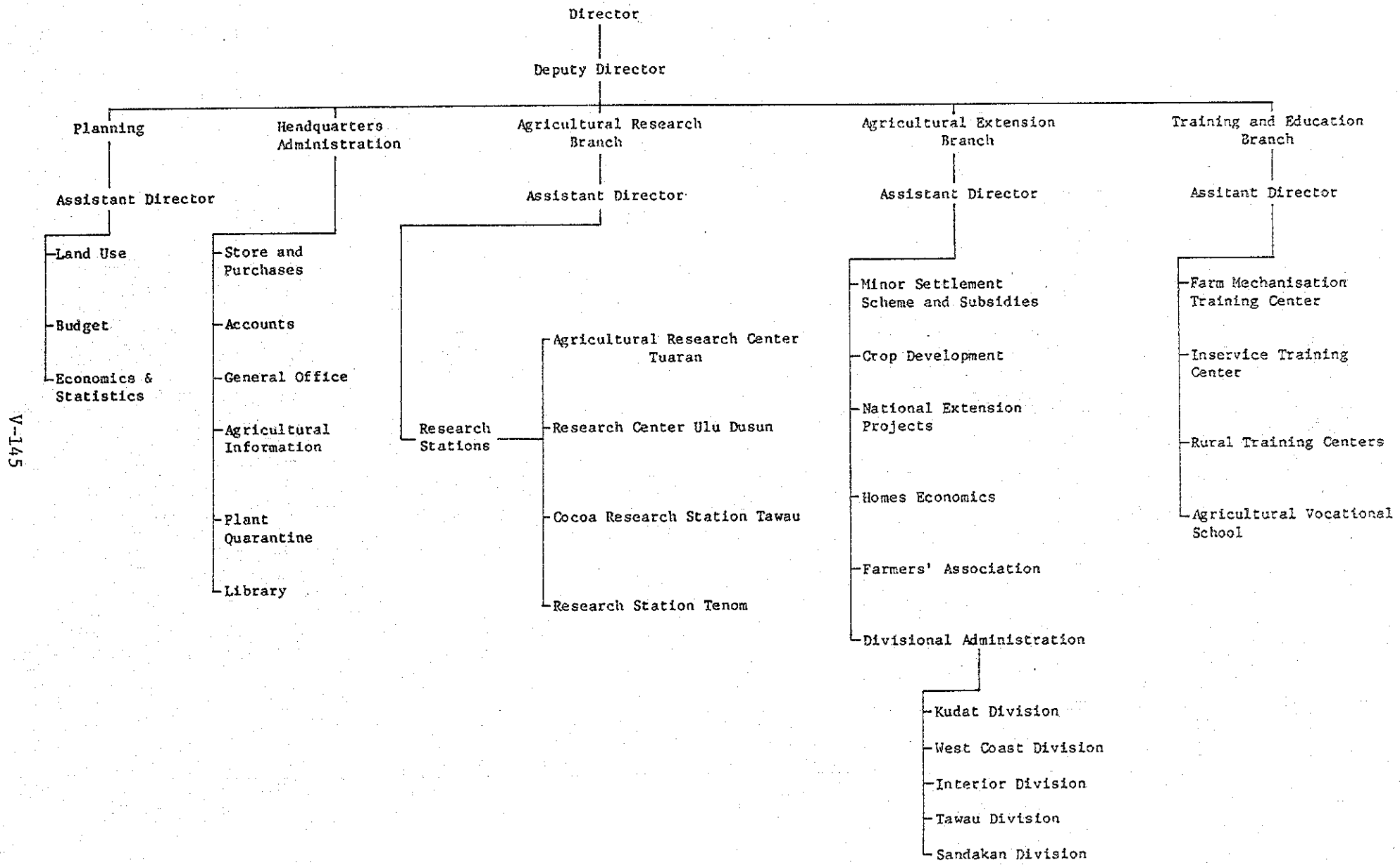
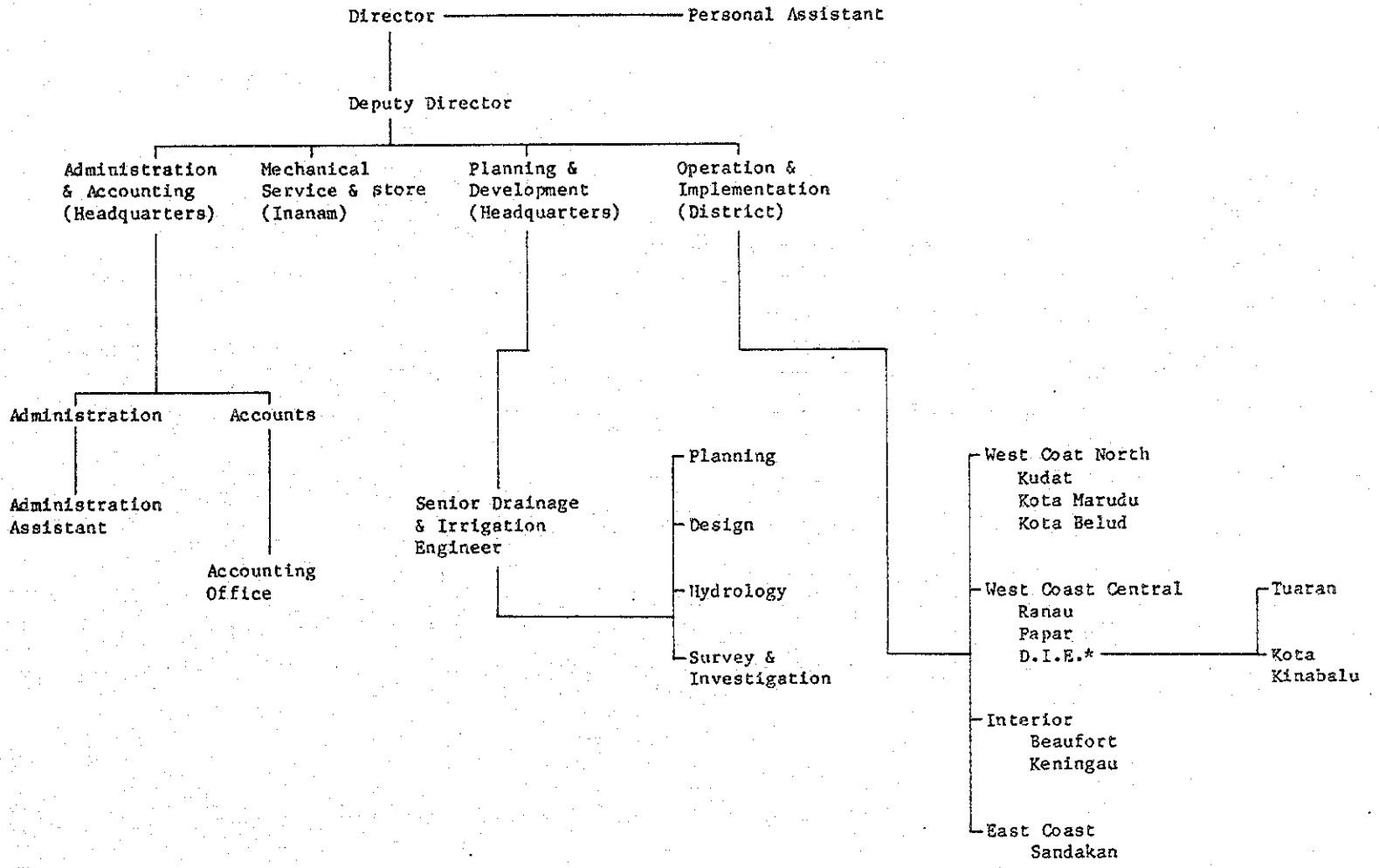


Fig.V-5 ORGANIZATION CHART-DRAINAGE AND IRRIGATION DEPARTMENT



* D.I.E. : Drainage & Irrigation Engineer

Fig. V-6 ORGANIZATION CHART-SABAH PADDY BOARD

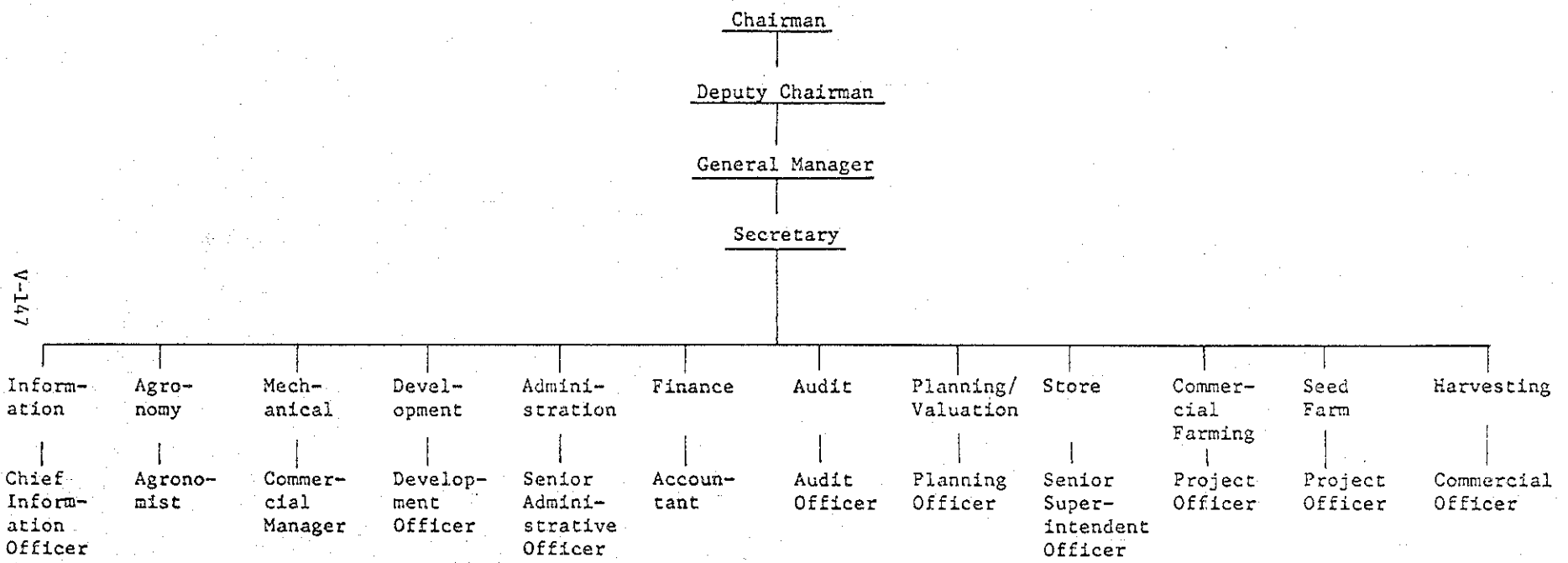


Fig. V-7 PROPOSED AGRICULTURAL DEVELOPMENT AREA

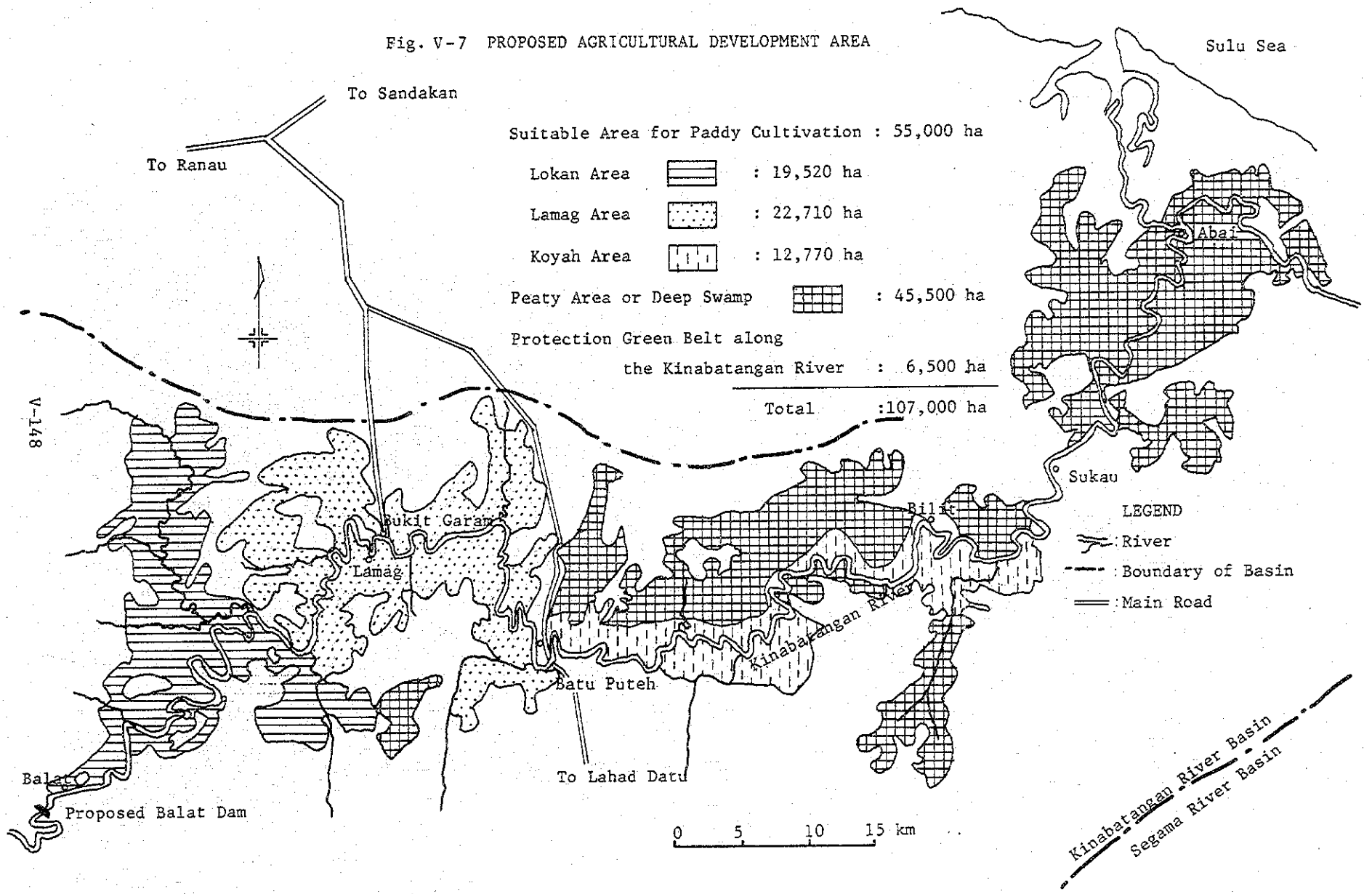
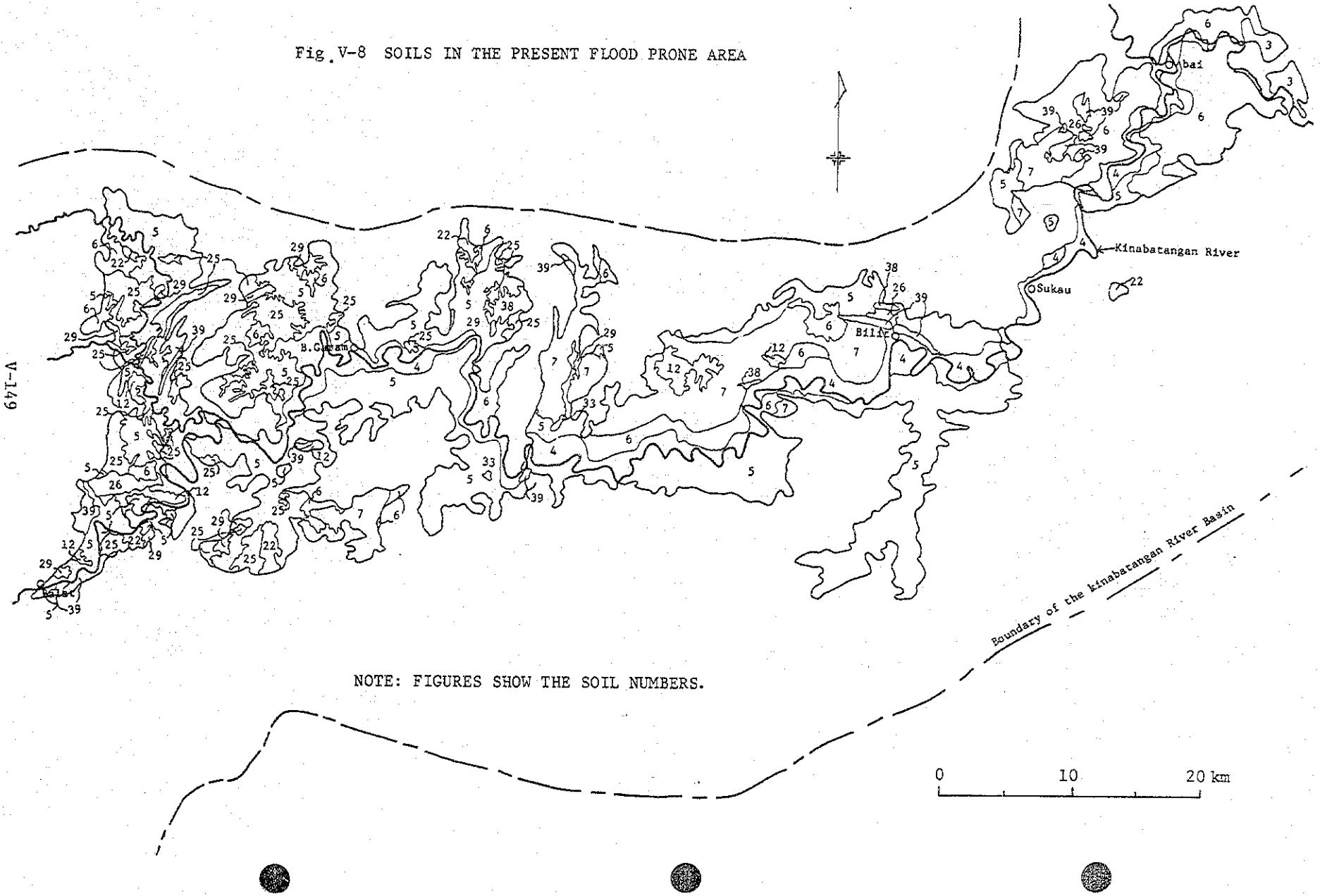


Fig. V-8 SOILS IN THE PRESENT FLOOD PRONE AREA



NOTE: FIGURES SHOW THE SOIL NUMBERS.

Fig. V-9 EXISTING LAND USE PLAN IN THE PRESENT FLOOD PRONE AREA

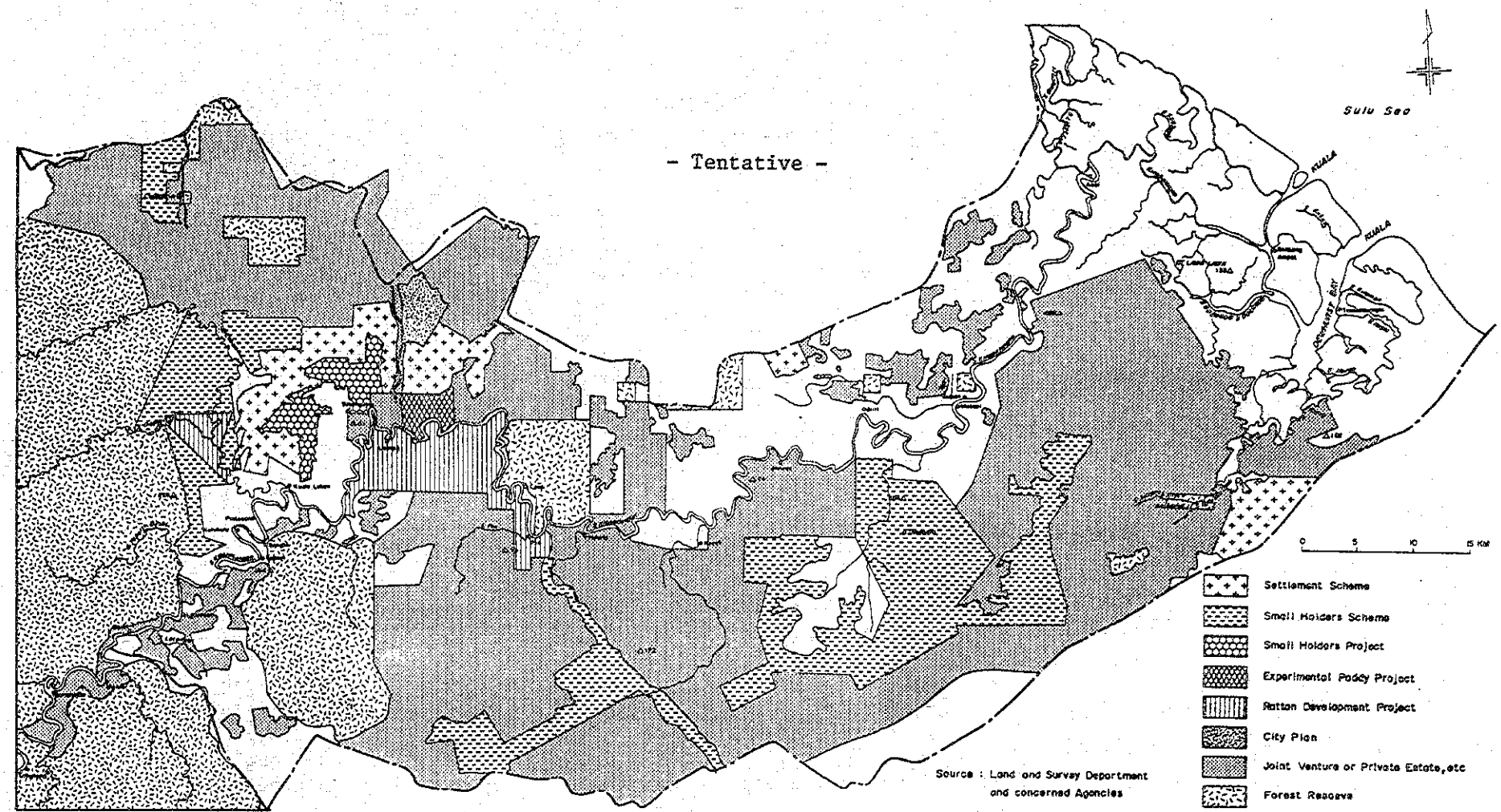


Fig. V-10 PROPOSED AREA FOR PADDY DEVELOPMENT

Lokan Area : ▤ Lamag Area : ▨ Koyah Area : ▦

Block No.	Area (ha)
1	860
2	960
3	2,750
4	3,780
5	1,130
6	2,220
7	1,880
8	1,240
9	810
Total	15,630

Block No.	Area (ha)
10	1,860
11	2,960
12	4,240
13	2,780
14	2,120
15	2,960
16	1,240
Total	18,160

Block No.	Area (ha)
17	2,160
18	1,010
19	1,000
20	1,860
21	1,180
22	1,610
23	1,390
Total	10,210

LEGEND
○ : Block Number (23 blocks)
● : Proposed Rice Mill (11 places)
★ : Proposed Pumping Station (23 stations)

Proposed area for paddy development : 44,000 ha.

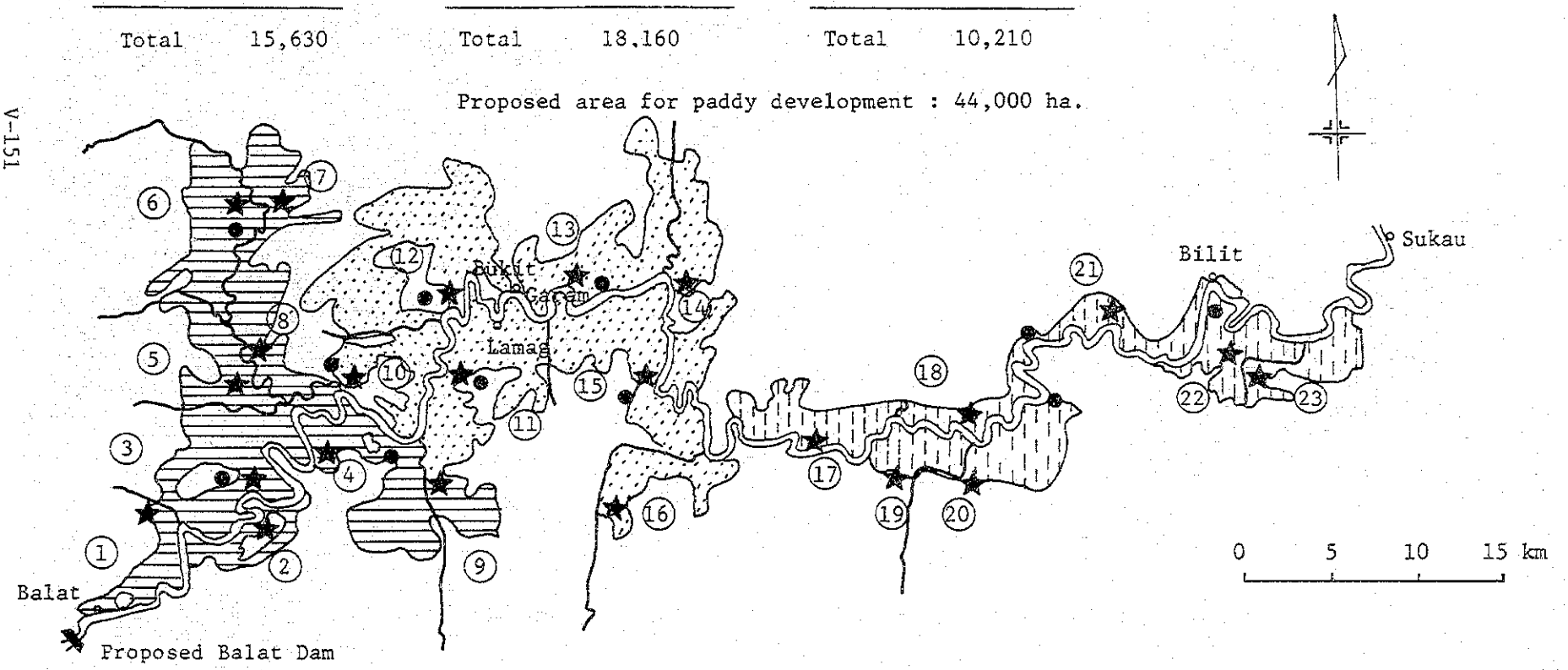


Fig. V-11 TYPICAL LAYOUT OF FIELD STRUCTURE

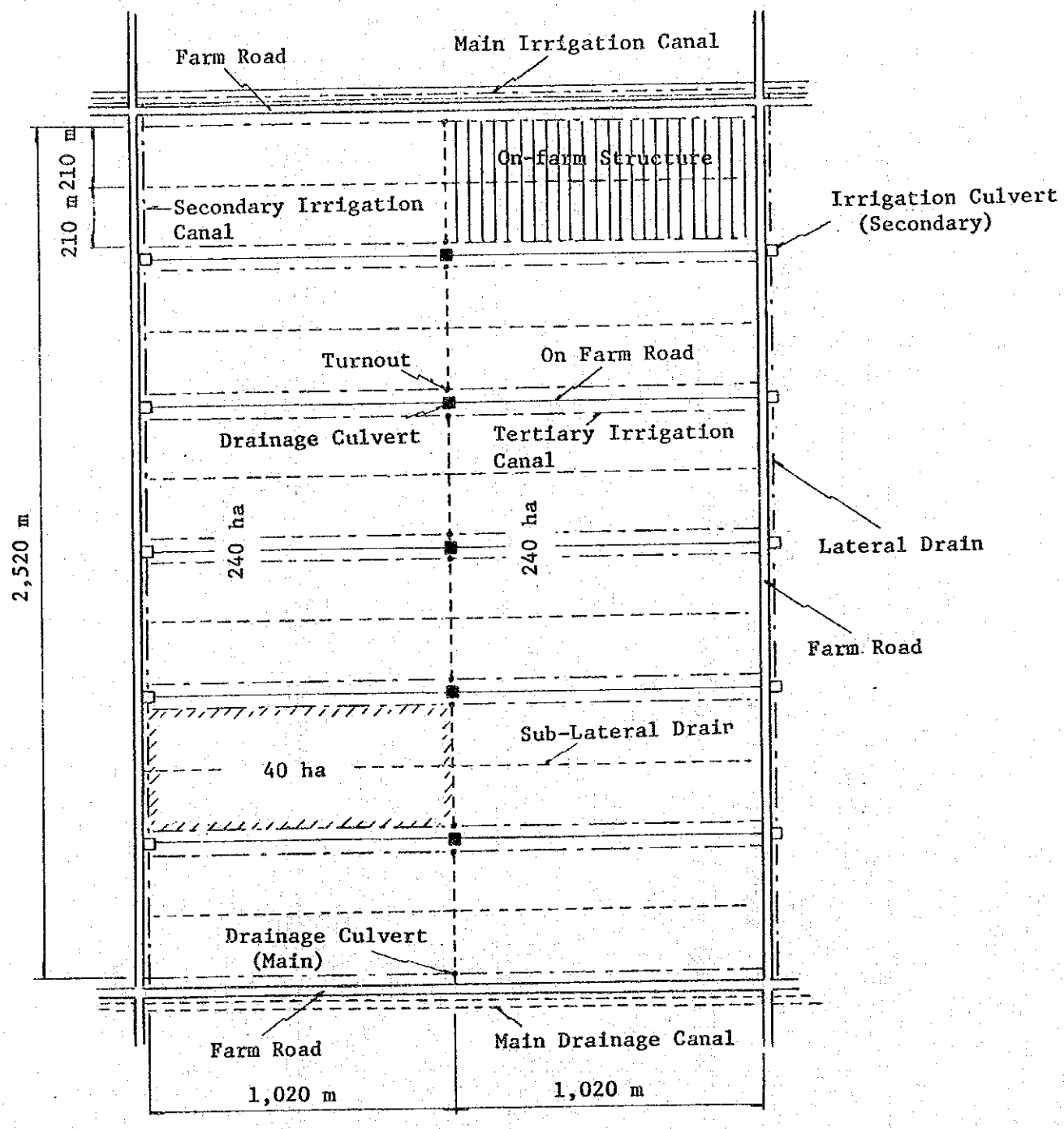


Fig. V-12 TYPICAL LAYOUT OF ON-FARM STRUCTURE

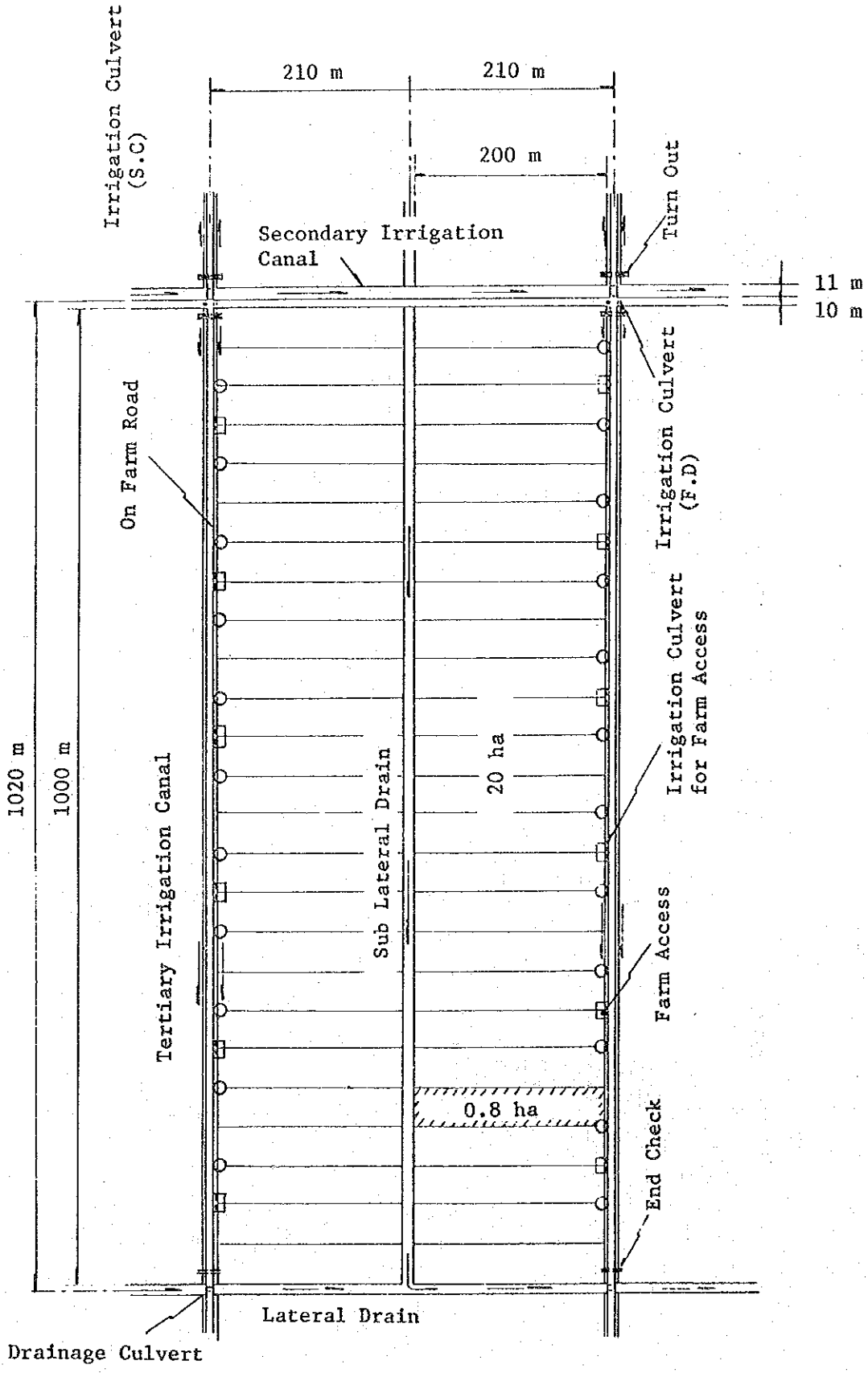


Fig.V-13 (1) GENERAL PLAN OF DEVELOPMENT AREA

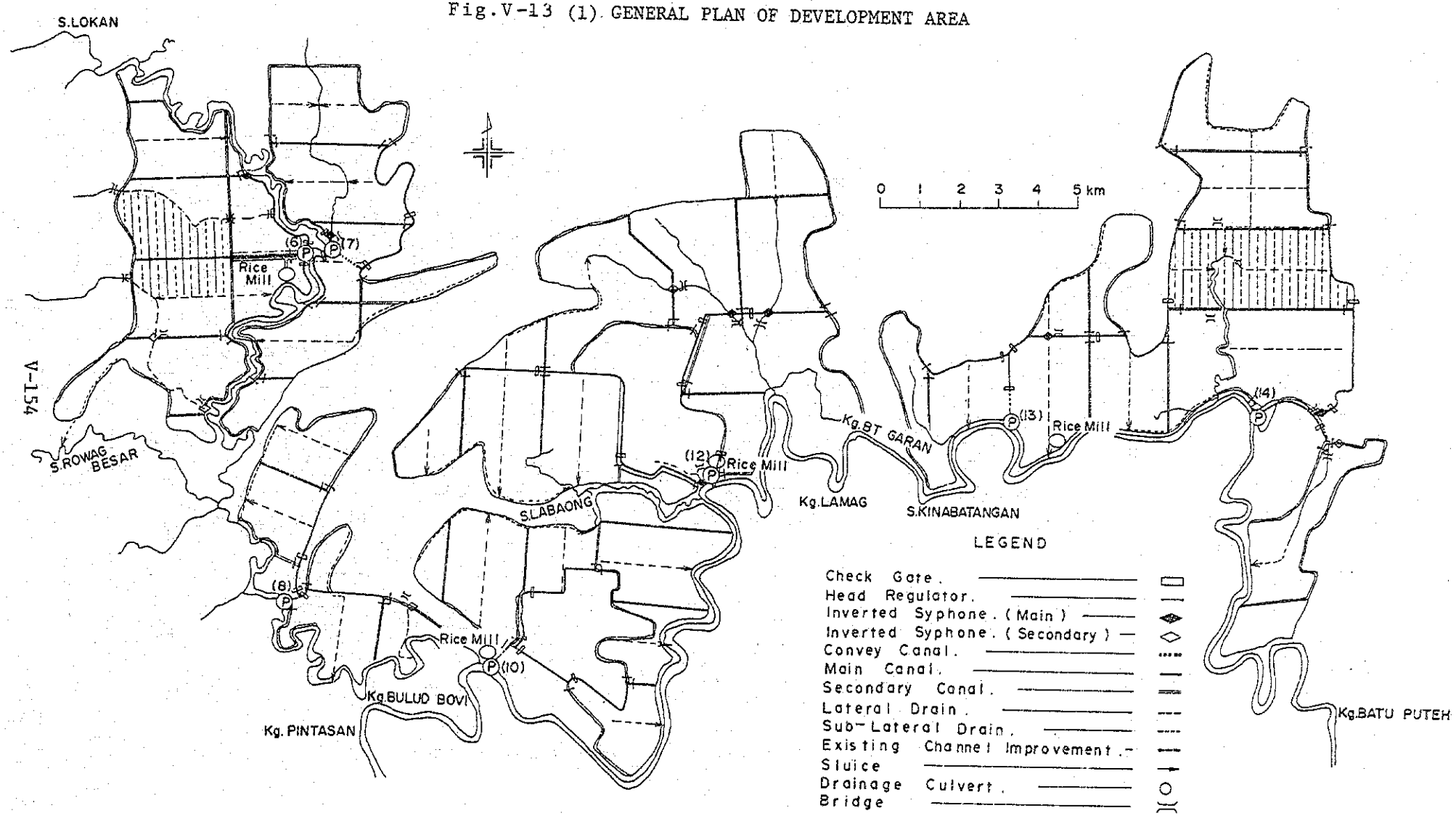


Fig. V-13(2) GENERAL PLAN OF DEVELOPMENT AREA

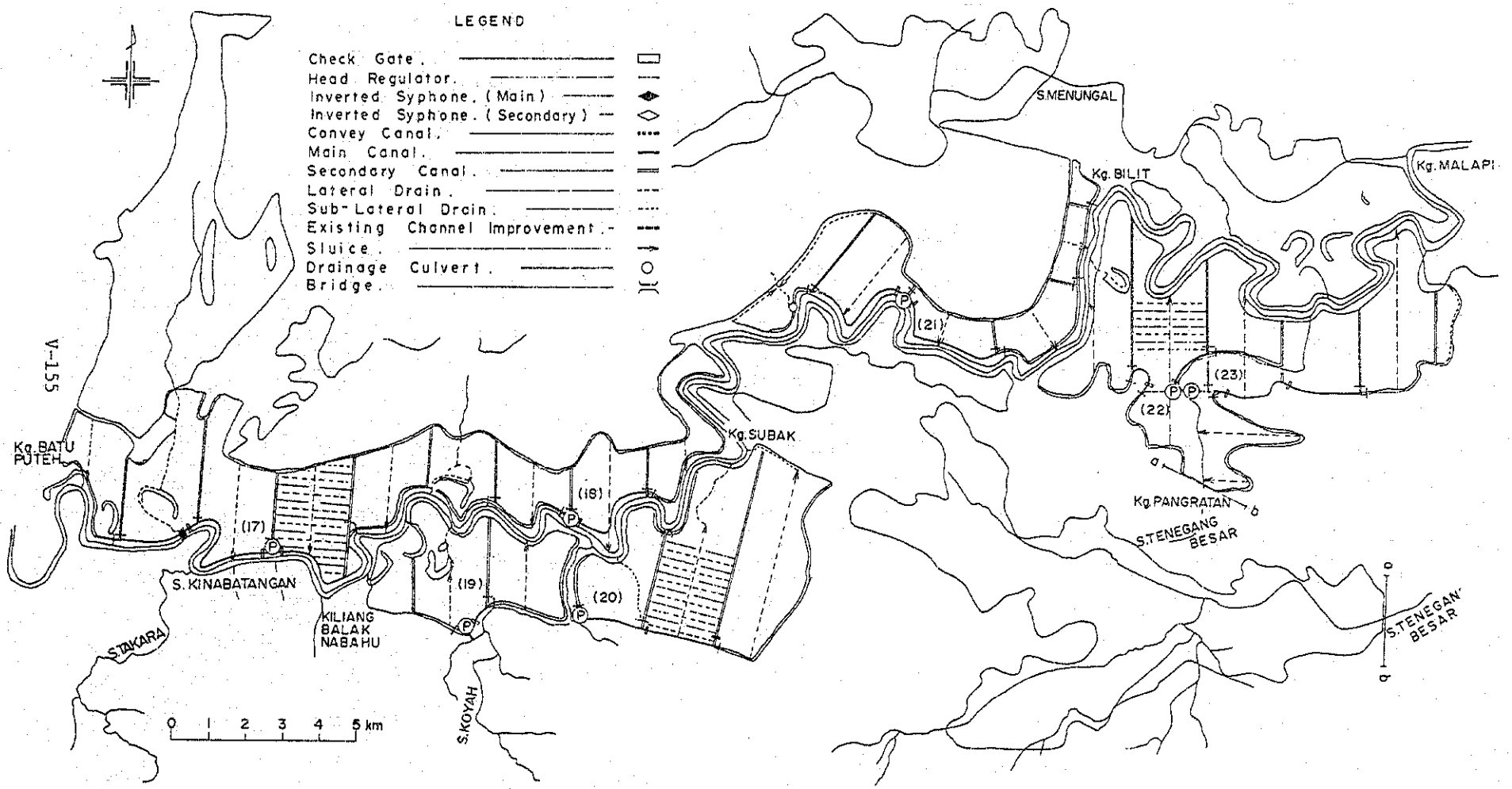


Fig. V-13(3) GENERAL PLAN OF DEVELOPMENT AREA

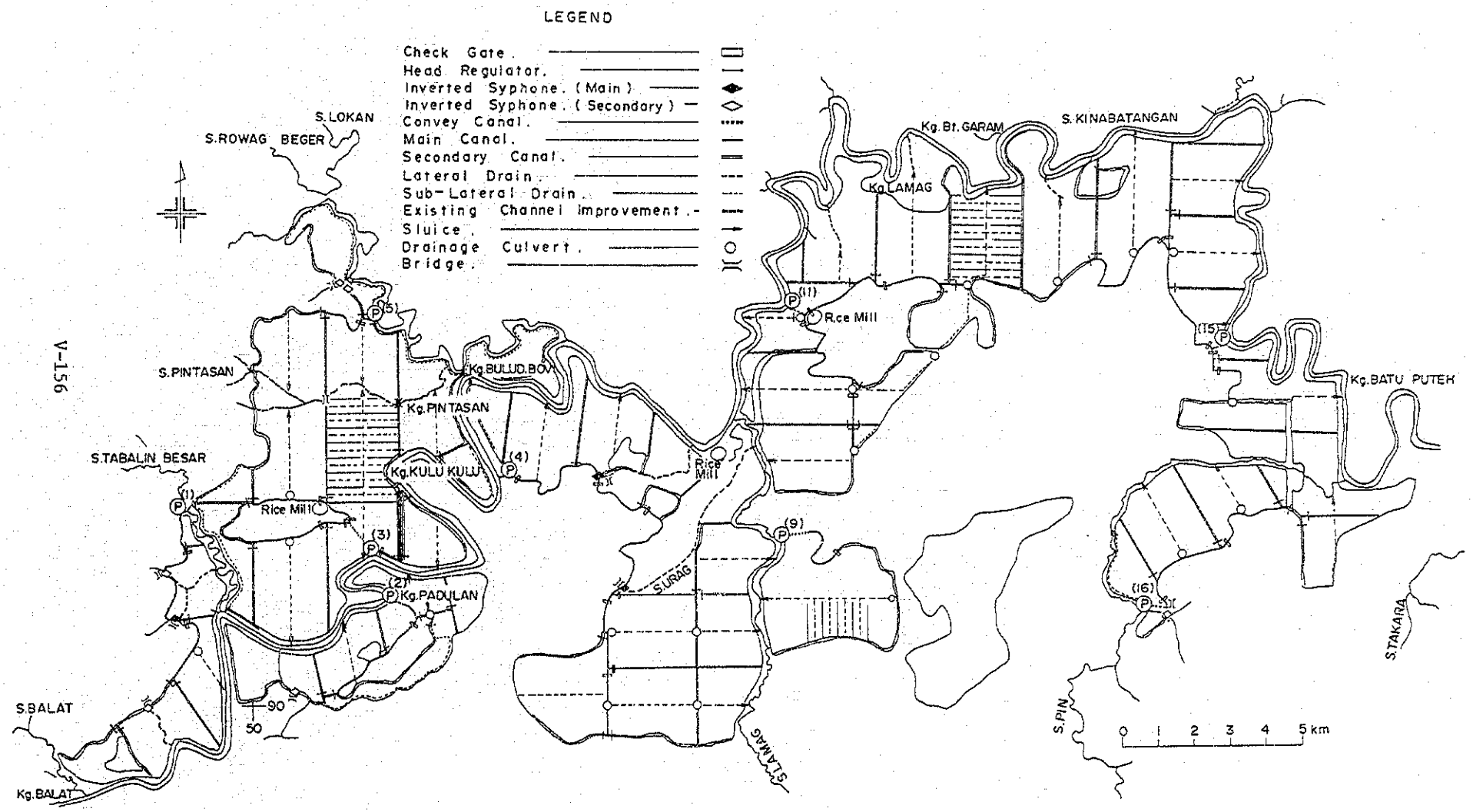


Fig. V-14 FLOW DIAGRAM OF MAXIMUM DIVERSION REQUIREMENT

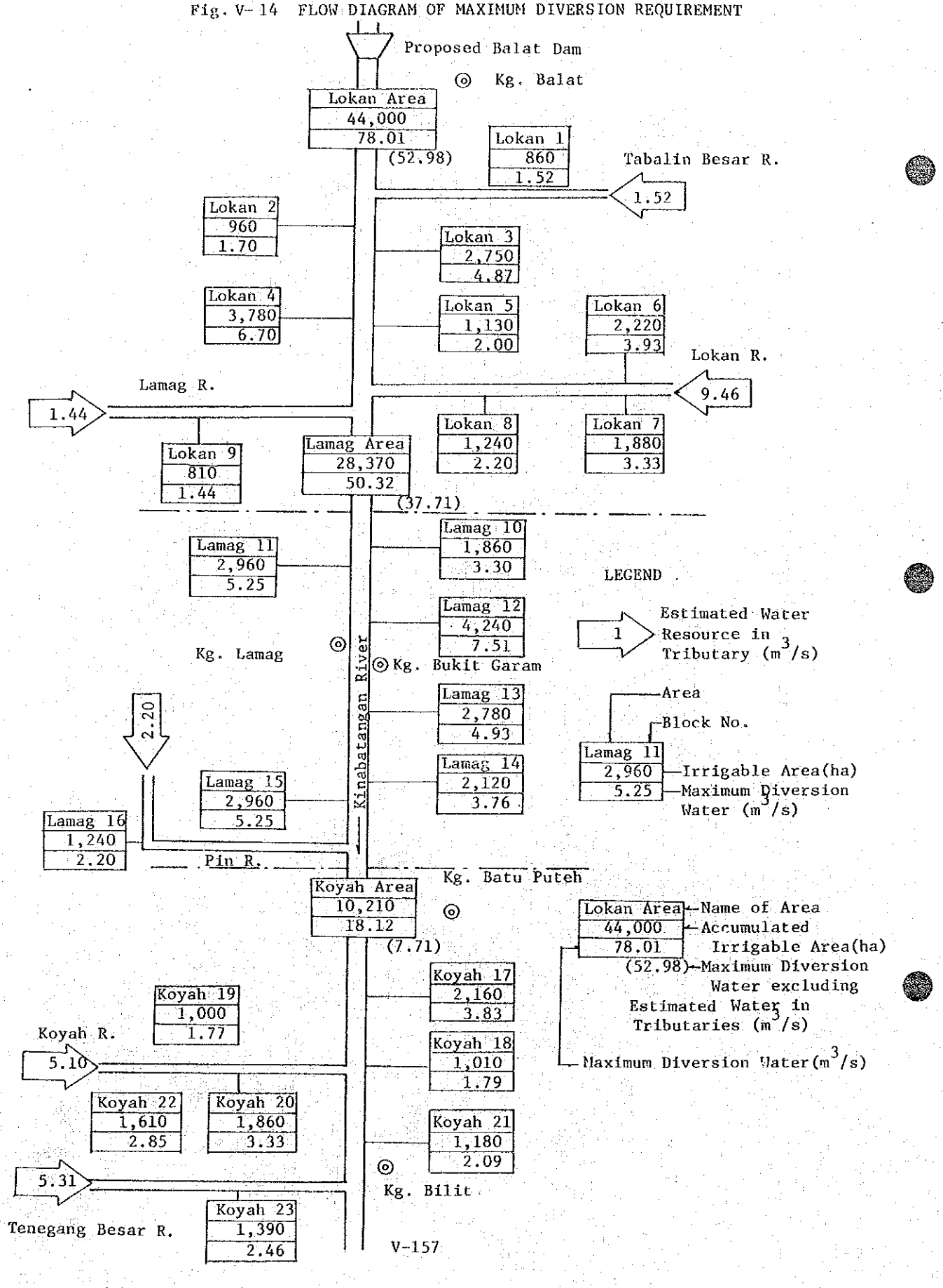


Fig. V-15 LAYOUT OF TYPICAL PUMPING STATION

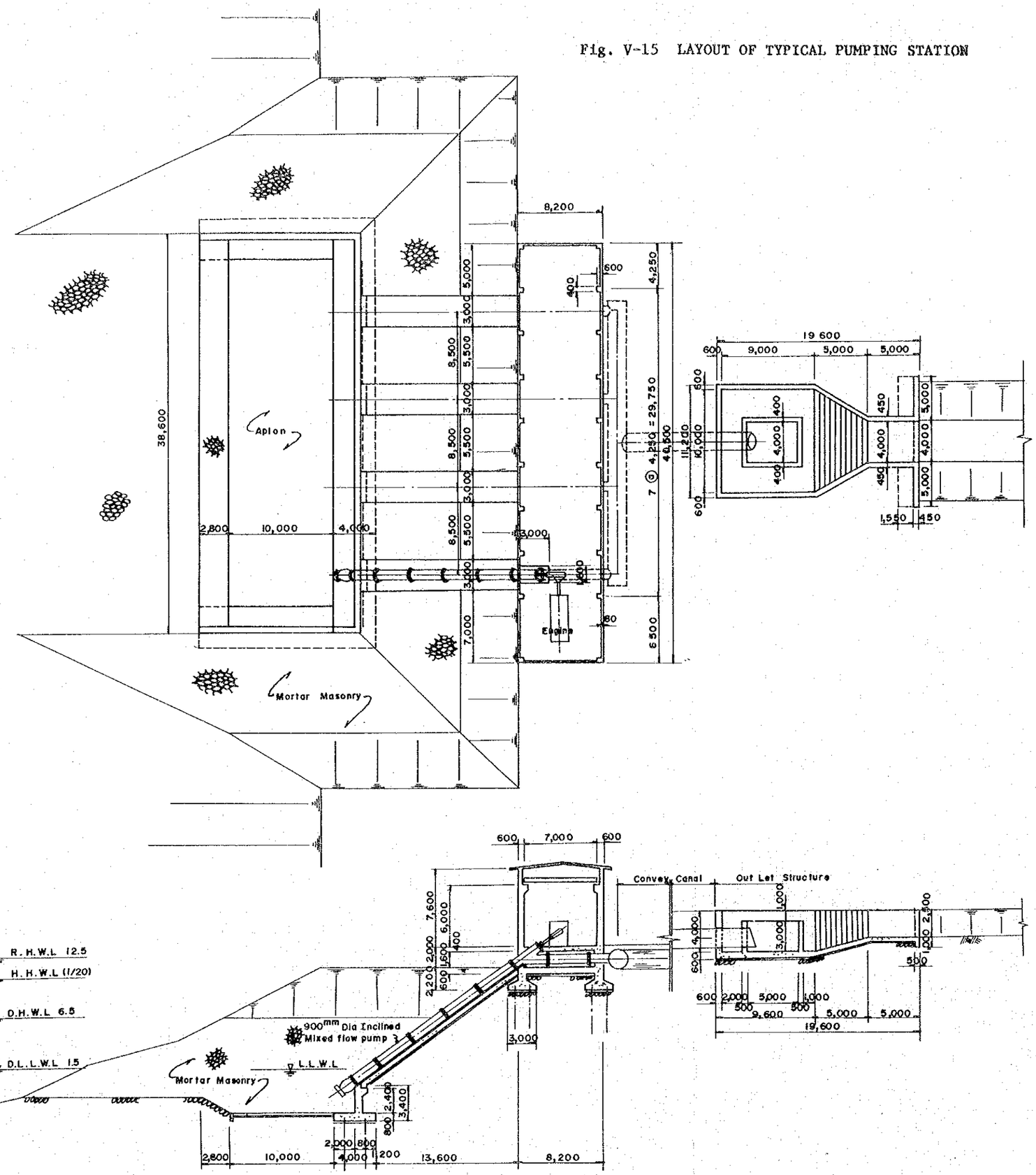
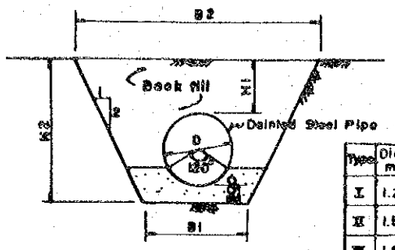


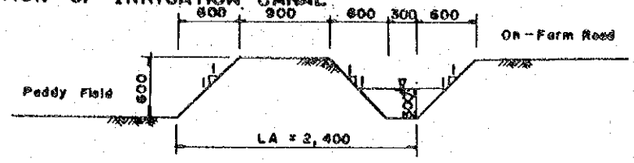
Fig. V-16 LAYOUT OF IRRIGATION FACILITIES



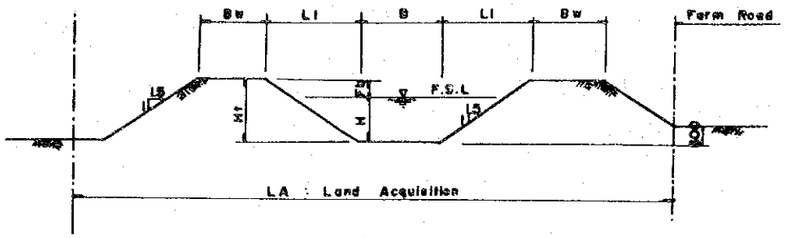
CONVEY CANAL

Type	Dia m	B1 m	B2 m	H1 m	H2 m
I	1.2	1.8	4.2	0.9	2.4
II	1.8	2.1	5.1	1.2	3.0
III	1.8	2.4	5.7	1.5	3.3

TYPICAL X-SECTION OF IRRIGATION CANAL



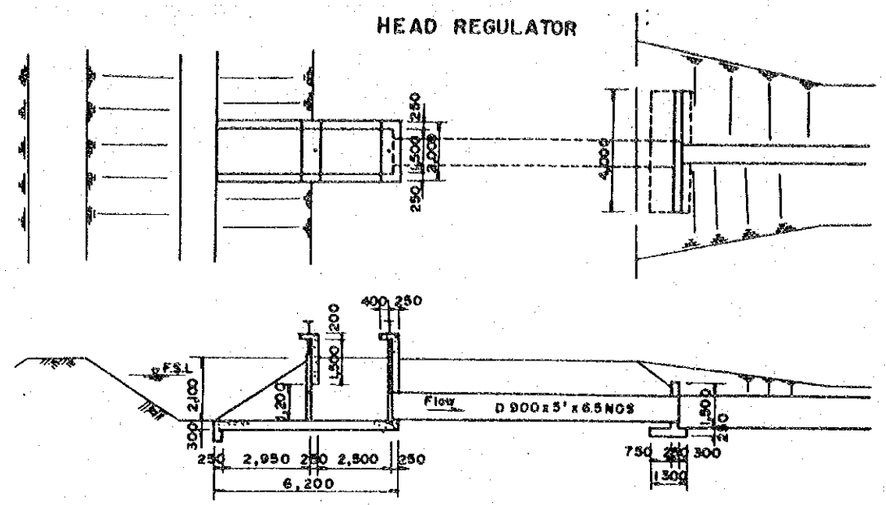
TERTIARY CANAL



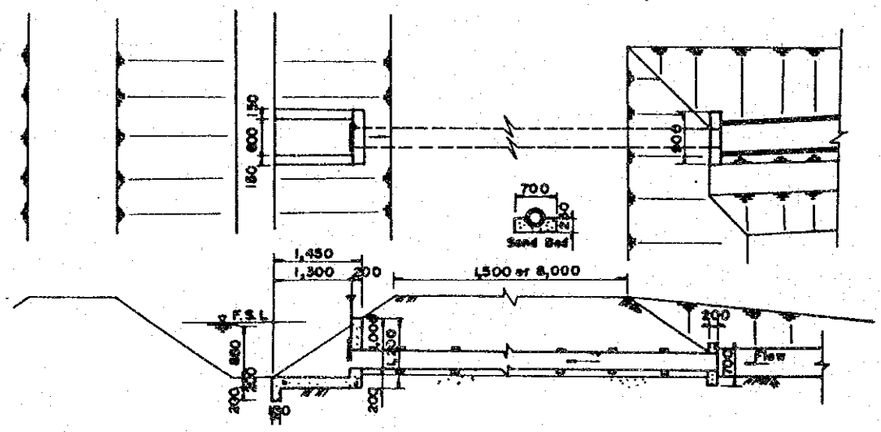
Canal Type		B (m)	H (m)	Fb (m)	H1 (m)	Bw (m)	LI (m)	LA (m)
Main	I	1.5	1.2	0.50	1.70	2.1	2.55	15.0
	II	1.8	1.35	0.80	1.85	2.4	3.26	17.0
	III	2.7	1.8	0.60	2.10	2.4	3.15	20.5
	IV	2.7	1.8	0.60	2.40	2.7	3.60	23.0
Secondary		1.2	0.9	0.45	1.35	1.8	2.02	13.0

MAIN AND SECONDARY CANAL

HEAD REGULATOR

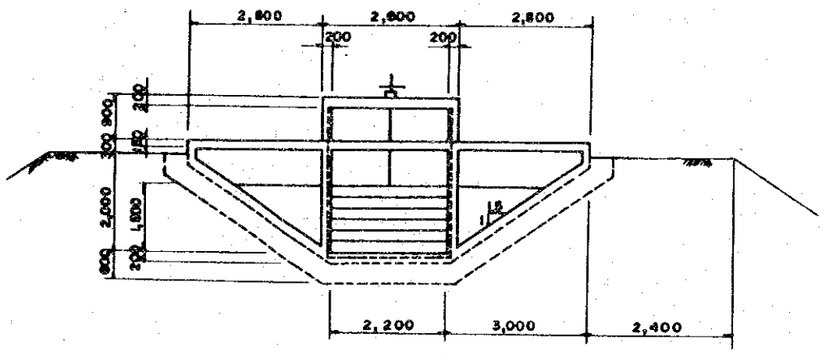


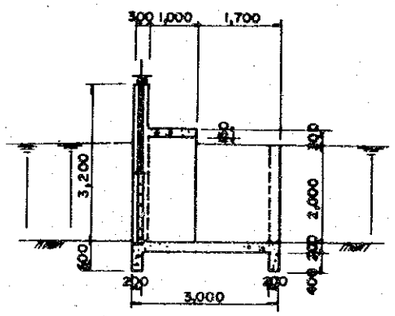
TURN OUT (TYPE I B2)



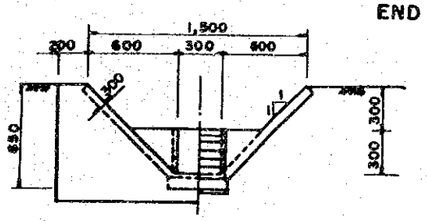
CHECK GATE

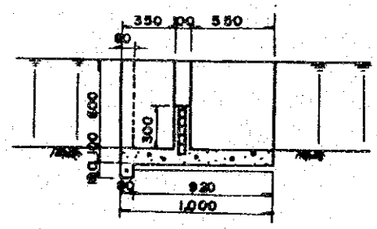
All Dimensions shown Average



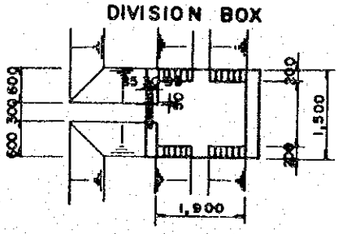


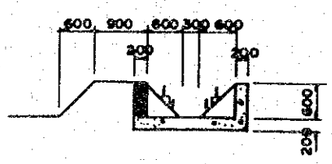
END CHECK





DIVISION BOX





INVERT SYPHON

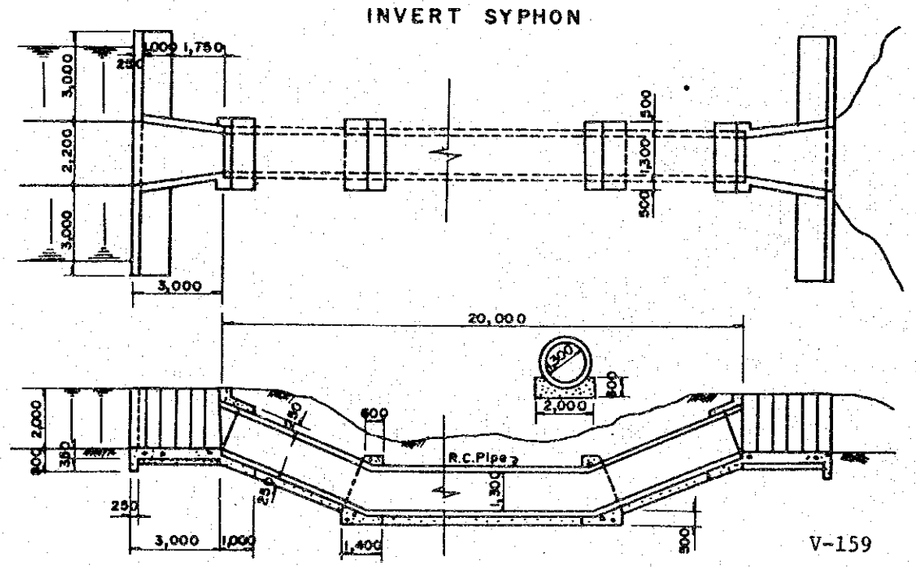
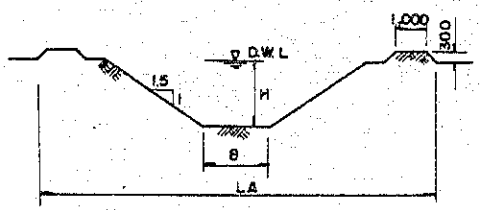
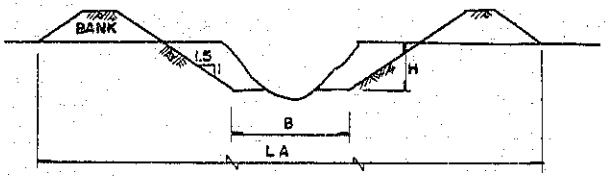


Fig. V-17 LAYOUT OF DRAINAGE FACILITIES AND FARM ROAD

TYPICAL X-SEXTION OF DRAINAGE CANAL

NO scale

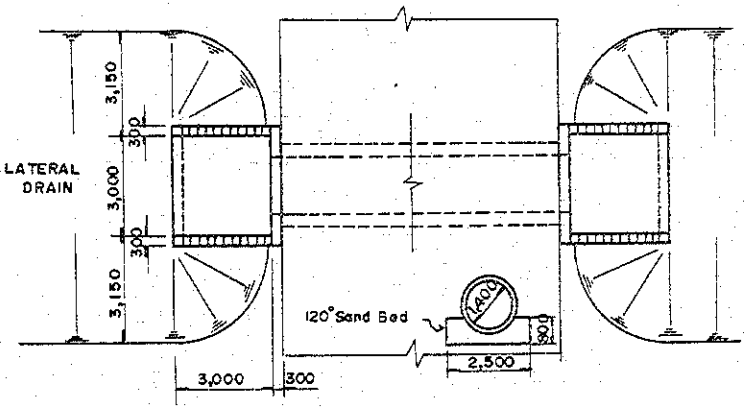


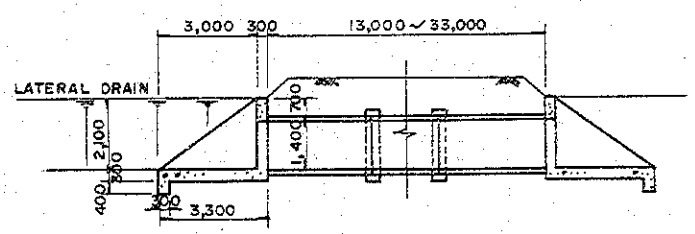


Canal Type	B (m)	H (m)	LA (m)	V of E.W (Cu.m/m)
Lateral	0.6	1.0	8.2	2.1
Sub-Lateral	3.0	2.1	13.5	12.9

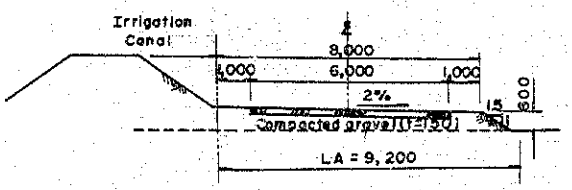
Canal Type	B (m)	H (m)	LA (m)	V of E.W (Cu.m/m)
I	5.0	2.5	22.5	10.9
II	8.0	3.0	29.0	18.8
III	10.0	3.5	34.5	26.7

DRAINAGE CULVERT

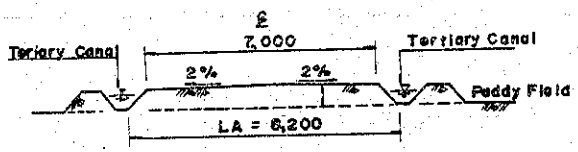




TYPICAL X-SEXTION OF FARM ROAD



FARM ROAD



ON-FARM ROAD

SLUICE

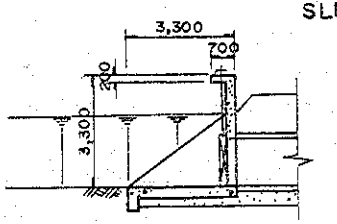


Fig. V-18 PROPOSED CROPPING PATERN AND METEOROLOGICAL CONDITION

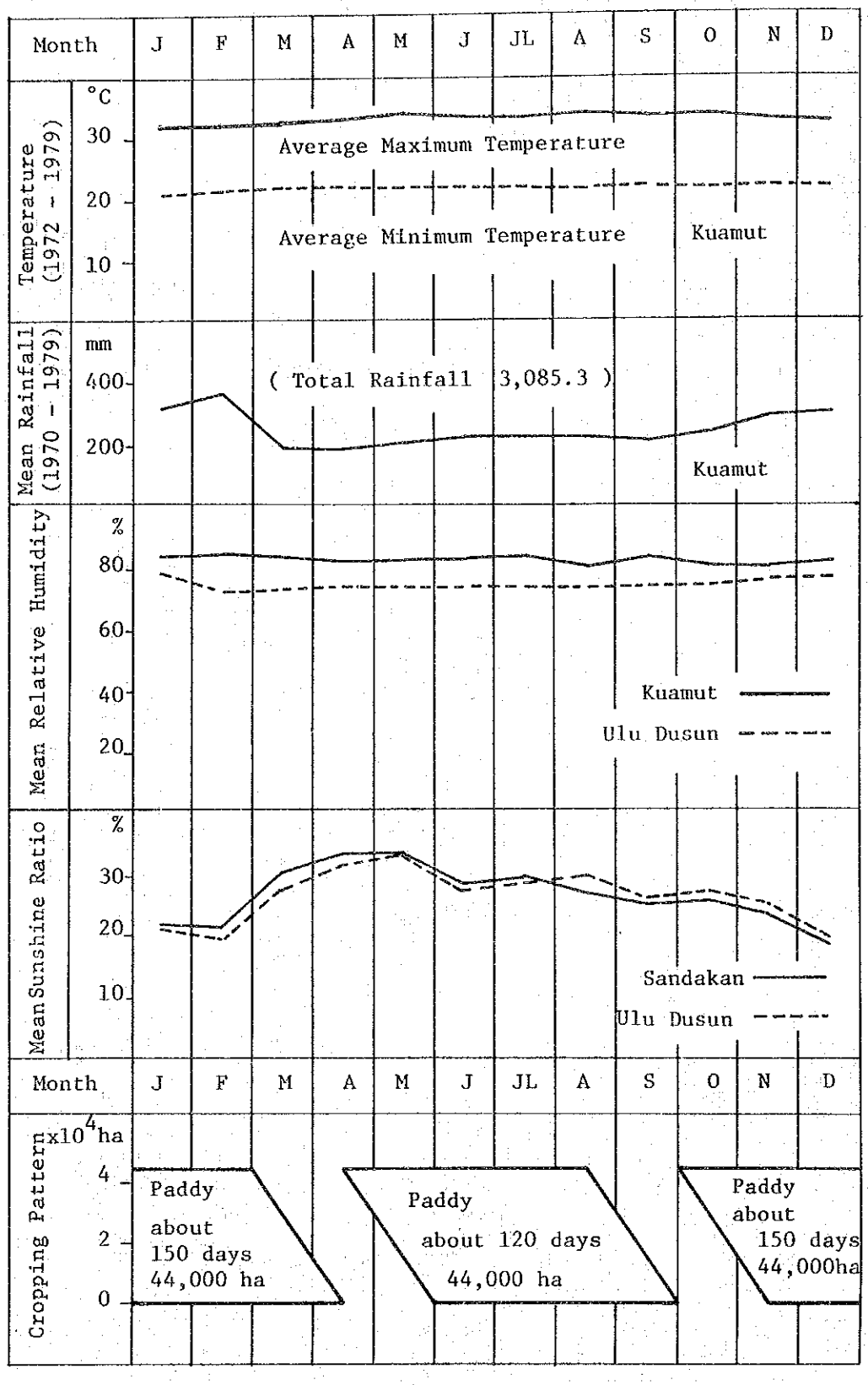


Fig. V-19 CROPPING PATTERN OF MAJOR FARM MACHINERY OPERATION

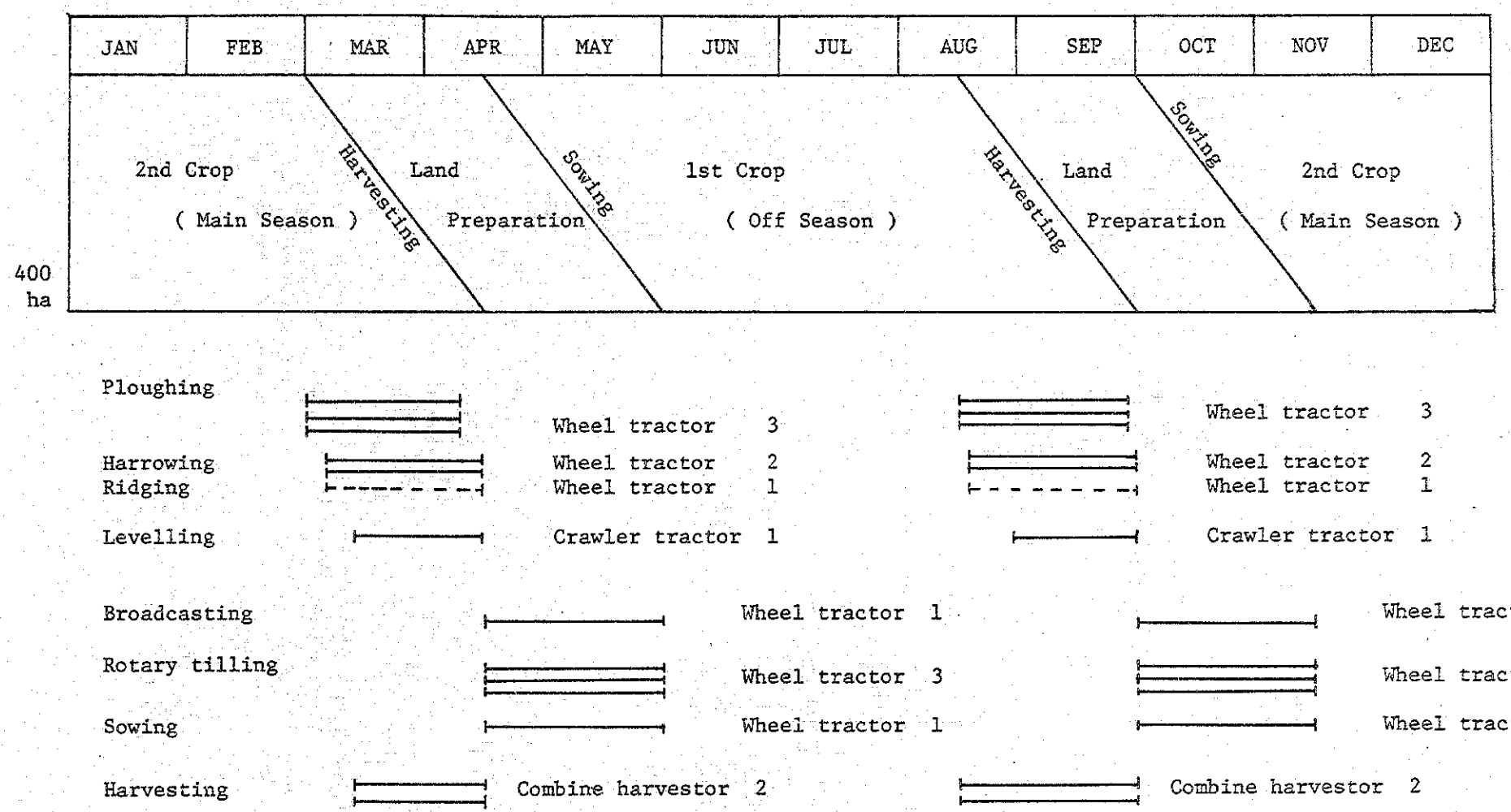
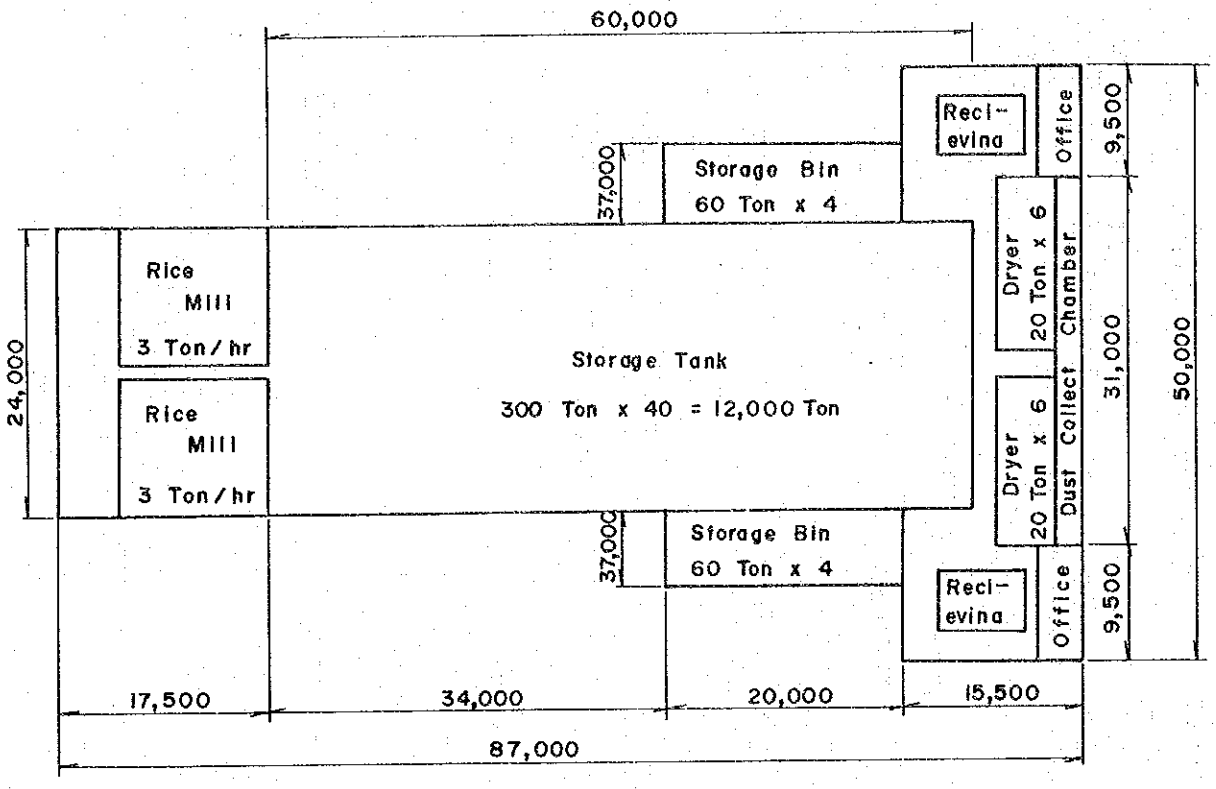


Fig.V-20 PLANT LAYOUT



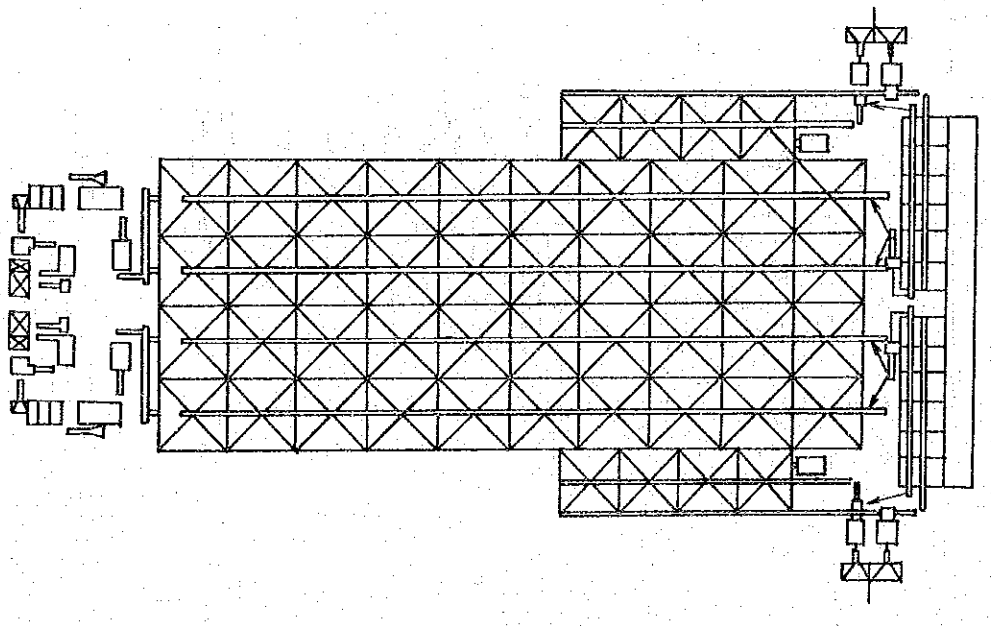


Fig. V-21 FLOW DIAGRAM OF RICE PROCESSING & STRAGE PLANT

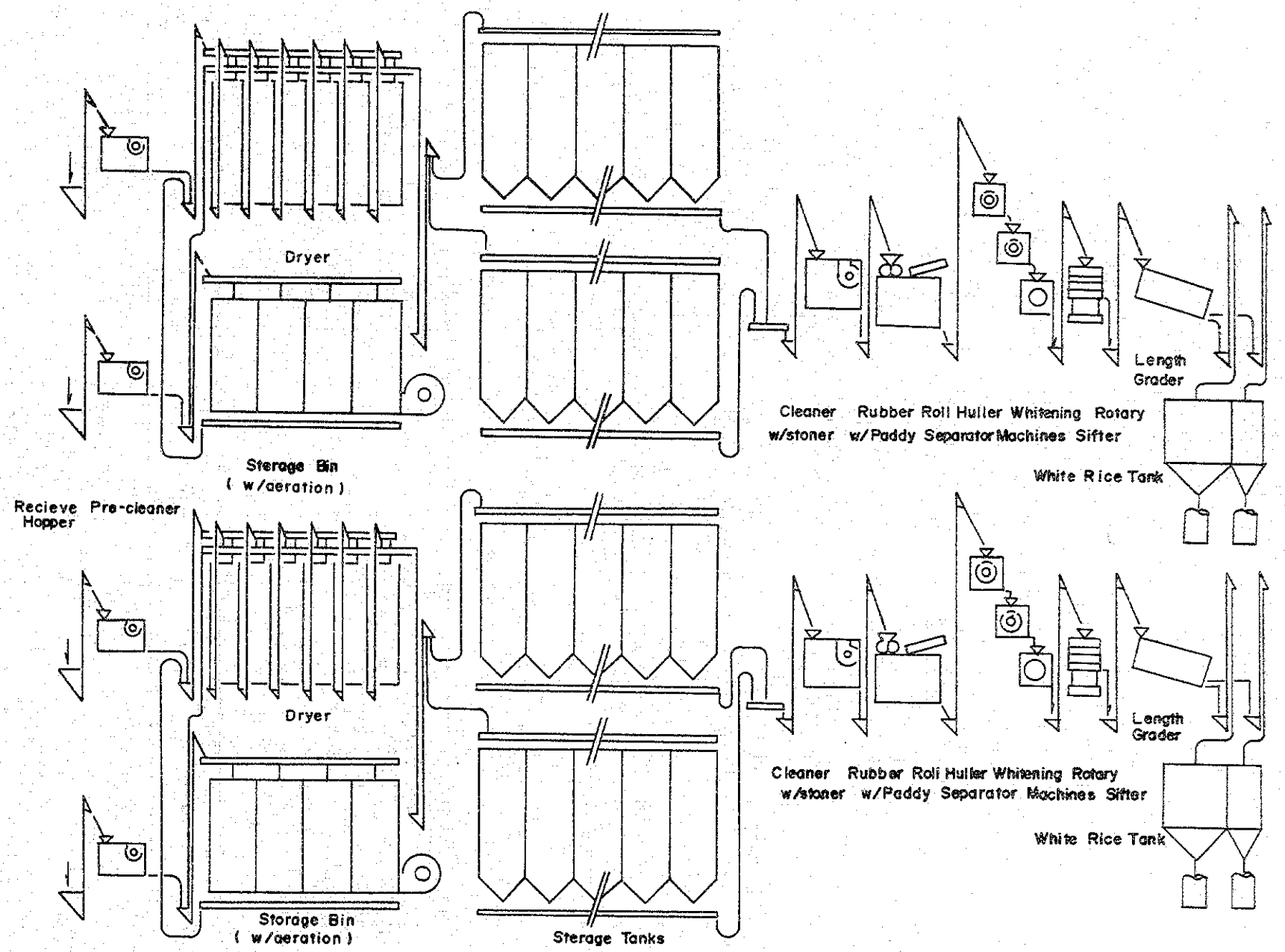
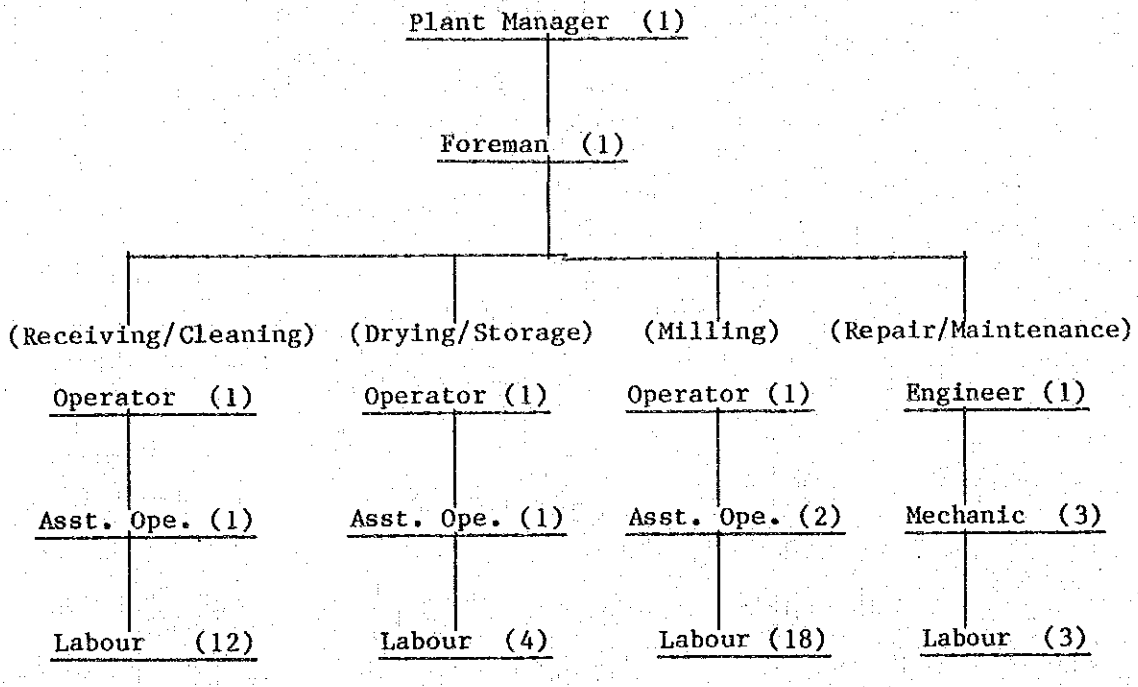
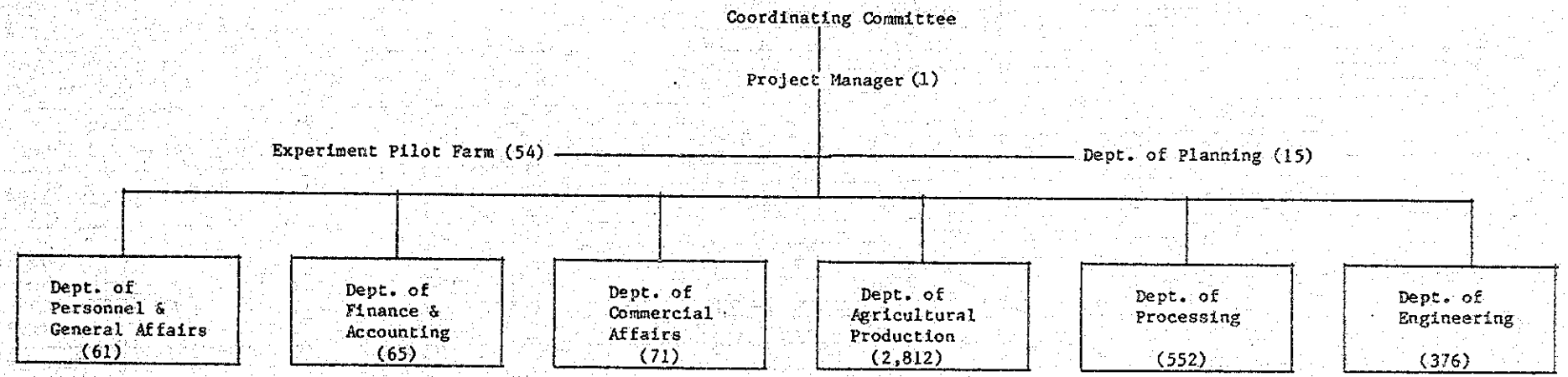


Fig.V-22 OPERATION ORGANIZATION IN ONE UNIT PLANT AND STAFFING



	Rec./Clean	Dry/Stor	Milling	Rep/Main	Total
Plant Manager/ Foreman	-	-	-	-	2
Shift (1)	7	3	7	3	20
Shift (2)	7	3	7	2	19
Shift (3)	0	0	7	2	9
Total	14	6	21	7	50

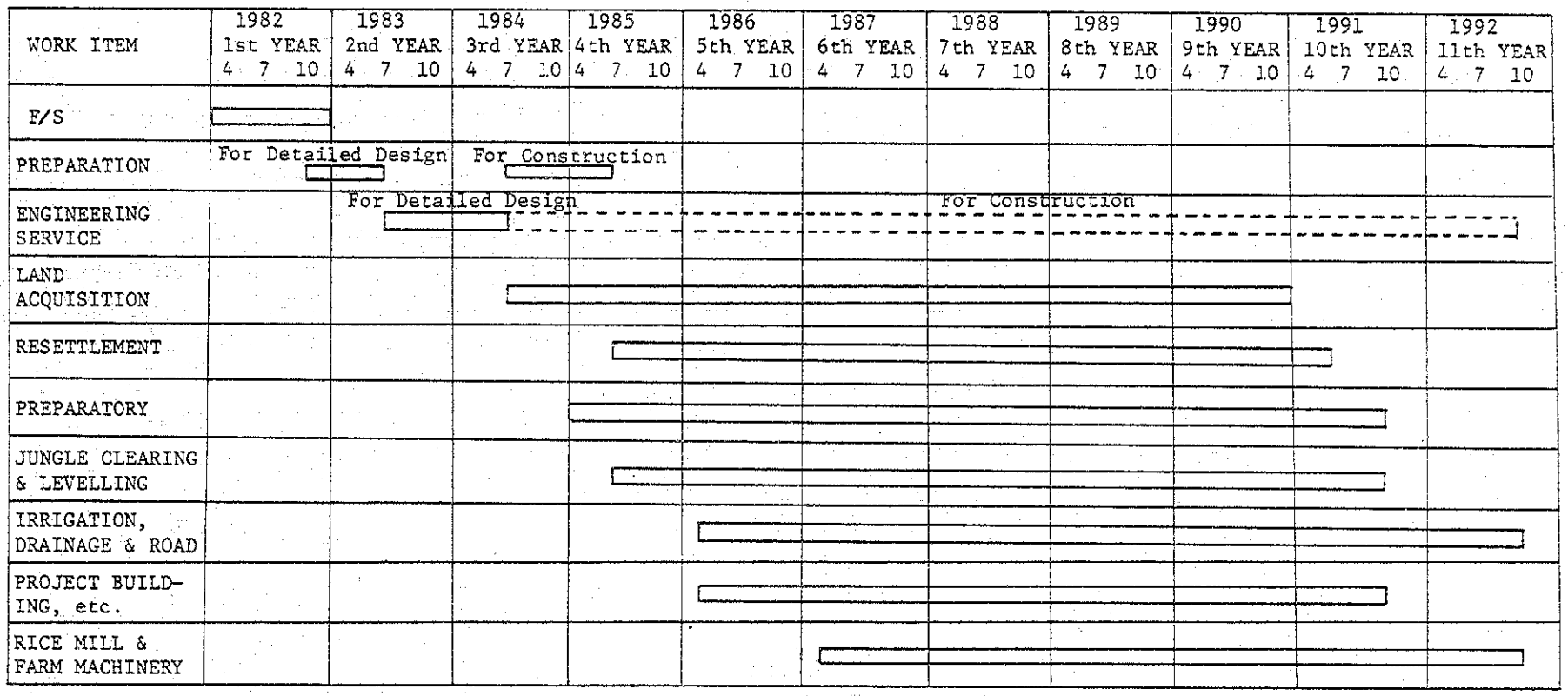
Fig.V-23 FARMING ORGANIZATION



Note : Total required manpower would be 4007.

( ) ; Number of required stuff.

Fig. V-24 IMPLEMENTATION SCHEDULE FOR AGRICULTUAL DEVELOPMENT



VI. HYDRO POWER

VI. CONTENTS OF HYDRO POWER

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1. GENERAL

For the development of Kinabatangan River Basin, the construction of Balat dam has been proposed. Balat hydro power station proposes to generate electricity by use of the discharge of irrigation and surplus water from the reservoir and by utilizing the head made available by Balat dam.

In this sector, taking the incremental future power demand in the State of Sabah into account, supply area for the Balat power station was selected and then the optimum generating type of the power station was determined based on the comparative study on several alternative cases. Furthermore, the preliminary design, construction schedule and cost estimate have been made.

2. PRESENT CONDITION

In the State of Sabah, generation, distribution and control of electric power come under the jurisdiction of the Sabah Electricity Board (SEB), established in 1957. The State consists of the East and West divisions. Only about 30% of the total population of the State of Sabah is benefitted from the power supply in 1978 by SEB.

As of 1978, there are 12 power stations in the East Division consisting of 5 major and 7 minor stations in urban areas, and 29 minor ones in rural areas. All are diesel power plants.

The location of the above-mentioned power stations and routes of the major transmission lines are shown in Fig. VI-1.

The total annual power supply of the entire State of Sabah now amounts to some 250 x 10^3 MWH, of which about 27% goes to industry, about 33% to domestic consumption, about 20% to commercial, and the balance to public facilities and others. The growth of maximum demand, consumers, installed capacity, units sold and units generated in the period between 1971 and 1978 is shown in Fig. VI-2.

Since inter-station transmission grids are not yet established, all power stations are serving the respective neighbouring areas only. However, among cities in the West Division with more population, shorter transmission lines such as 22 kV line between Kota Kinabalu and Tuaran and 11 kV and 6.6 kV lines between Kota Kinabalu and Papar are already in service. Also, the 132 kV and 66 kV transmission lines from the Tenom Pangi power station to Kota Kinabalu is scheduled for service from 1982. The existing power distribution is either AC 240V, single phase or 415V, 3-phase both 50 Hz.

3. FUTURE DEMAND AND SUPPLY AREA

3.1 FUTURE DEMAND

Future power demand in the whole State of Sabah, and in such major cities in the east division as Sandakan, Tawau, Lahad Datu are shown in Table VI-1. The Table shows that the power demand in Sandakan, the nearest city to the proposed Balat hydro power station, is anticipated to reach 68.3 x 10^3kW in 1990.

To cope with the growing power demand, SEB has been trying to expand the capacities of the existing diesel power stations and also planning construction of hydro power and natural gas power station in view of ever-increasing fuel oil cost.

3.2 SUPPLY AREA

The Balat power station is situated in the eastern part of the State of Sabah where such major cities as Sandakan, Tawau are located. Out of the cities mentioned above, Sandakan was selected as the most appropriate for the supply area of the Balat power station based on the reasons mentioned below.

1) The nearest city to the proposed Balat power station.

2) Generated energy of 31.5 x 10^3 kW at the power station for the future demand at Sandakan of 68.3 x 10^3 kW in 1990.

Daily load curve of Sandakan selected as the supply area is shown in Fig. VI-3.

4. DEVELOPMENT SCALE OF BALAT POWER STATION

4.1 SELECTION OF OPTIMUM GENERATING TYPE

4.1.1 Flow Regime

The required flow regime is based on the discharge observation data at Balat for 10 years between 1970 and 1979. Plentiful, ordinary, low and droughty flow data during the above-mentioned 10 years are shown in Table VI-2.

Flow regime data of 1975 which corresponds to the average in the 10 years is adopted for the formation of the proposed power generation scheme. The discharge-duration curve and capacity factor of the above-mentioned 1975 are shown in Fig. VI-4 and VI-5.

4.1.2 Comparative Study on Generating Type

The comparison of three generating types such as run-of-river, regulating pondage and reservoir has been studied for the optimum generating type.

Run-of-river Type

In this type, irrigation and surplus water released from the dam are used for power generation. No resevoir storage is specially allocated for power generation.

In designing the run-of-river type power station, the maximum discharge in 4 cases, i.e. 400, 450, 500 and 550 m^3/s are examined.

The intake water level is fixed at EL. 17.5 m which is the equivalent of the Normal Water Level of the Balat dam, while the tailrace water level is fixed at EL. 8.0 m which is normal water level of the down-stream river.

Based on the above-mentioned conditions, maximum output, annual generated energy and construction cost per kWH are computed. The result is shown in Table VI-3.

Regulating Pondage Type

This type is intended for a peak supply to meet a daily load demand.

The peak hour is fixed at 6 hours from 08:00 to 14:00 to serve daily load in Sandakan.

The required discharge for power generation is fixed at 100 m^3/s in off-peak hours which is the near equivalent to the drought flow obserbed in 1975. As for the selection of optimum discharge for peak hours, 3 cases, i.e. 350, 400 and 450 m^3/s are examined.

Intake water level at EL. 17.5 m and tailrace water level at EL. 8.0 m are exactly the same as the run-of-river type in the foregoing.

The capacity required of the reservoir and afterbay.

$$V = 3,600 \times T \times (Qp - Qp')$$

where

V : capacity of regulating resevoir (m^3)
Qp : required discharge in peak hours (m^3/s)
Qp' : required discharge in off-peak hours (m^3/s)
T : duration of peak hours (hour)

Reuiqred capacity in peak hours at 350 m^3/s :

$$V = (350 - 100) \times 6 \times 3600$$
$$= 5400 \times 10^3 \ m^3$$

Required capacity in peak hours at 400 m^3/sec. :

$$V = (400 - 100) \times 6 \times 3600$$
$$= 6500 \times 10^3 \ m^3$$

Required capacity in peak hours at 450 m^3/s :

$$V = (450 - 100) \times 6 \times 3600$$
$$= 7600 \times 10^3 \ m^3$$

Based on the above-mentioned conditions, maximum output, annual generated energy and construction cost per kWH are computed. The result is shown in Table VI-4.

Reservoir Type

This type has an allocated storage capacity for power generation in the reservoir, so a steady power supply is guaranteed.

Based on the mass curves in 1975, respective reservoir capacities to allow maximum discharge required for power generation in 3 cases, i.e. 200, 250 and 300 m^3/s are computed as shown below.

Max. Power Discharge m^3/s	Req'd Reservoir Capacity $10^6 m^3$	Intake water level m	Tailrace water level m
300	1,451	27.2	8.0
250	821	24.1	8.0
200	454	21.8	8.0

The mass curves in 1975 mentioned above are shown in Fig. VI-6.

Based on the above-mentioned conditions, maximum output, annual generated energy and construction cost per kWH are computed. The result is shown in Table VI-5.

4.1.3 Optimum Generating Type

Fig. VI-7 shows construction costs per kWH of the respective type of power generations, i.e. run-of-river, regulating pondage and reservoir types.

From this figure, the run-of-river type is selected as the optimum generating one for Balat power station because its economical advantage over the others.

The principal features of the optimum power generation is as shown below.

Type	:	Run-of-river
Max. discharge	:	450 m^3/s
Intake water level	:	17.5 m (N.W.L.)
Tailwater level	:	8.0 m
Effective head	:	8.4 m
Max. output	:	31,500 kW
Annual generated energy	:	168 x 10^6 kWH

4.2 TRANSMISSION LINES

A transmission line from Balat power station to Sandakan will be constructed for a distance of about 100 km along the proposed access road of Balat dam and the existing main road as shown in Fig. VI-8. Generated power will be conveyed by a 132 kV 3-phase, 3-wire transmission system.

4.3 BENEFIT

The value of Balat hydro power station is evaluated based on the cost of the lowest-priced alternative thermal plant.

In this study, a gas fired steam station with the capacity of 350,000 kW will be adopted for the alternative based on the report of "MASTER PLAN FOR POWER SYSTEM DEVELOPMENT - INTERIM REPORT, June 1980, SAMA Consortium".

The capacity value and the energy value given in the JICA report "National Water Resources Study, Malaysia Phase II, Dec. 1981" are used for the estimation on the basis of the alternative cost mentioned above.

Capacity value ..... US$68/kW

Energy value ..... US$0.019/kWH

Annual benefit of Balat hydro power station is estimated at US$3.7 million as shown below:

Capacity benefit (dependable peak power: 9,700 kW)

9,700 kW x US$68/kW = US$700,000

Energy benefit

168×10^6 kWH x 0.96* x US$0.019/kWH = US$3,000,000

Total annual benefit : US$3,700,000

---

* Excluding 4% transmission loss.

5. PRELIMINARY DESIGN

5.1 POWER STATION

Balat power station will be located on the left bank of the dam where the bed-rock is sound. The overall layout of the power station is shown in Fig. VI-9.

The power generation facilities are consisting of intake facility, generating equipment and tailrace, and their brief descriptions are as below.

5.1.1 Intake Facility

The intake facility is design to take 450 m^3/s at N.W.L. of EL. 17.5 m and comprises three intake pipes (7 m in diameter and 35 m in length, each). Screen and intake gates are installed at the inlets of the intake pipes.

5.1.2 Power House

The power house is a reinforced concrete building of 20 m in length, 48 m in width, and 20 m above and 15 m below the ground level.

5.1.3 Tailrace

The tailrace is 7 m in diameter and 25 m in length. There are 3 of them with draft gates.

5.2 GENERATING EQUIPMENT

The generating equipment which consists of hydraulic turbine and generator has been designed based on the following items:

Discharge per one unit	150 m^3/s
Normal water level	EL. 17.5 m
Low water level	EL. 16.5 m
Normal water level	EL. 8.0 m
Effective head	8.4 m

The followings are the principal features of the hydraulic turbine and generator to be installed in Balat power station.

Turbine

Tyep:	Bulb type tubular turbine
Max output:	10,500 kW each
Number of unit:	3

Generator

Type :	3-phase alternating synchronous generator.
Max. output:	11,000 KVA each
Number of unit:	3

5.3 TRANSMISSION LINE

The steel tower for the 132 kV transmission line will be installed at every 250 m, for a distance of about 100 km between Balat power station and Sandakan. The conductor selected is 160 mm^2 Aluminum Cable Steel Reinforced (ACSR).

6. CONSTRUCTION SCHEDULE AND COST

6.1 CONSTRUCTION SCHEDULE

The commencement of commercial operation of power generation is scheduled, simultaneously with the completion of the dam and power station construction.

The construction work schedule of power station is formed taking time required for the following matters into consideration.

- Manufacture of power generating equipment
- Transportation of the equipment to the project site.
- Installation of the equipment
- Construction of outlet facility of main dam

The total time required for the above is estimated at 3 years. The commencement for the construction of transmission lines will be in time with the completion of installation of the power generating equipment at the proposed site.

The construction work schedule is shown in Fig. VI-10.

6.2 COST ESTIMATE

6.2.1 Construction Cost

The construction cost for the hydro power station comprises power station, civil work, generating equipment, transmission line, engineering cost and plus 10% physical contingencies.

The total cost of US$40.3 million consists of US$34.1 milllion in foreign and US$6.2 million in local currency.

The breakdown of the construction cost is shown in Table VI-6.

6.2.2 Operation, Maintenance and Replacement Cost

The operation and maintenance cost will comprise the personnel cost, operation machinery and equipment, automobiles, administrative cost and miscellaneous. The annual operation and maintenance cost is estimated at US$0.80 million for the whole period from the initial power operation to the end of the project life.

Replacement cost of the generating equipment after 35 years from the initial operation is US$19.6 million.

T A B L E

Fig. VI-1 FUTURE POWER DEMAND

Unit: MW

Year	Sabah	Sandakan	Tawau	Lahad Datu	Semporna
1981	93.7	20.3	11.4	3.0	0.7
1982	112.0	23.5	13.7	3.5	0.9
1983	113.0	27.3	16.4	4.1	1.1
1984	157.0	31.4	19.5	4.7	1.3
1985	185.0	36.1	23.2	5.4	1.6
1986	210.9	41.2	27.4	6.1	1.9
1987	238.3	46.9	32.4	6.9	2.3
1988	266.9	53.5	38.2	7.9	2.7
1989	296.3	60.5	44.7	8.9	3.2
1990	328.9	68.3	52.3	10.2	3.7
1991	361.7				
1992	397.9				
1993	437.7	No figures available			
1994	477.2				
1995	520.1				
1996	566.9				
1997	617.9				
1998	667.3				
1999	720.7				
2000	778.4				

Source : Sabah Electricity Board (SEB)

Table VI-2 FLOW REGIME OF KINABATANGAN RIVER AT BALAT

Unit : m^3/s

Year	Discharge				Annual Average
	Plentiful/1	Ordinary/2	Low/3	Droughty/4	
1970	401	267	168	63	318
1971	526	313	175	76	485
1972	502	245	136	71	409
1973	310	160	89	38	254
1974	380	248	156	73	331
1975	437	246	132	86	341
1976	377	221	140	76	301
1977	582	346	217	75	492
1978	400	318	177	99	310
1979	426	221	105	68	282
Average	434	259	150	73	253

Note : /1 The 95th largest discharge in a year

/2 The 185th largest discharge in a year

/3 The 275th largest discharge in a year

/4 The 355th largest discharge in a year

Table VI-3 UNIT CONSTRUCTION COST PER KWH OF A RUN-OF-RIVER TYPE

Maximum Discharge (m^3/s)	400	450	500	550
Effective Head (m)	8.40	8.40	8.40	8.40
Maximum Output (kw)	28,000	31,500	35,000	38,500
Annual Energy Output (10^6kwh)	159	168	175	182
Construction Cost (10^3US$)	22,600	23,700	27,000	32,600
Unit Construction Cost per kwh (US$)	0.142	0.141	0.154	0.179

Table VI-4 UNIT CONSTRUCTION COST PER KWH OF A REGULATING PONDAGE TYPE

Maximum Discharge (m^3/s)	350	400	450
Effective Head (m)	8.40	8.40	8.40
Maximum Output (kw)	24,500	28,000	31.500
Annual Energy Output (10^6kwh)	150	159	168
Construction Cost (10^3US$)	120,000	123,000	124,000
Unit Construction Cost per kwh (US$)	0.800	0.770	0.740

Table VI-5 UNIT CONSTRUCTION COST PER KWH OF A RESERVOIR TYPE

Maximum Discharge (m^3/s)	200	250	300
Effective Head (m)	12.6	14.9	18.0
Maximum Output (kw)	21,000	31,000	45,000
Annual Energy Output (10^6kwh)	167	217	262
Construction Cost (10^3US$)	41,600	58,400	76,700
Unit Construction Cost per kwh (US$)	0.249	0.269	0.293

Table VI-6 CONSTRUCTION COST

Unit : 10^3US$

Work Item	Foreign Currency	Local Currency	Total
1. Main Works			
Civil Works	800	700	1,500
Power House	1,900	900	2,800
Generating Equipment	18,200	1,400	19,600
Transmission Line	4,900	1,500	6,400
Preparatory Work	2,600	400	3,000
Sub Total	28,400	4,900	33,300
2. Engineering Service	2,600	700	3,300
3. Physical Contingency	3,100	600	3,700
Total	34,100	6,200	40,300

F I G U R E

Fig. VI-1 SABAH GENERATING STATIONS, 1978

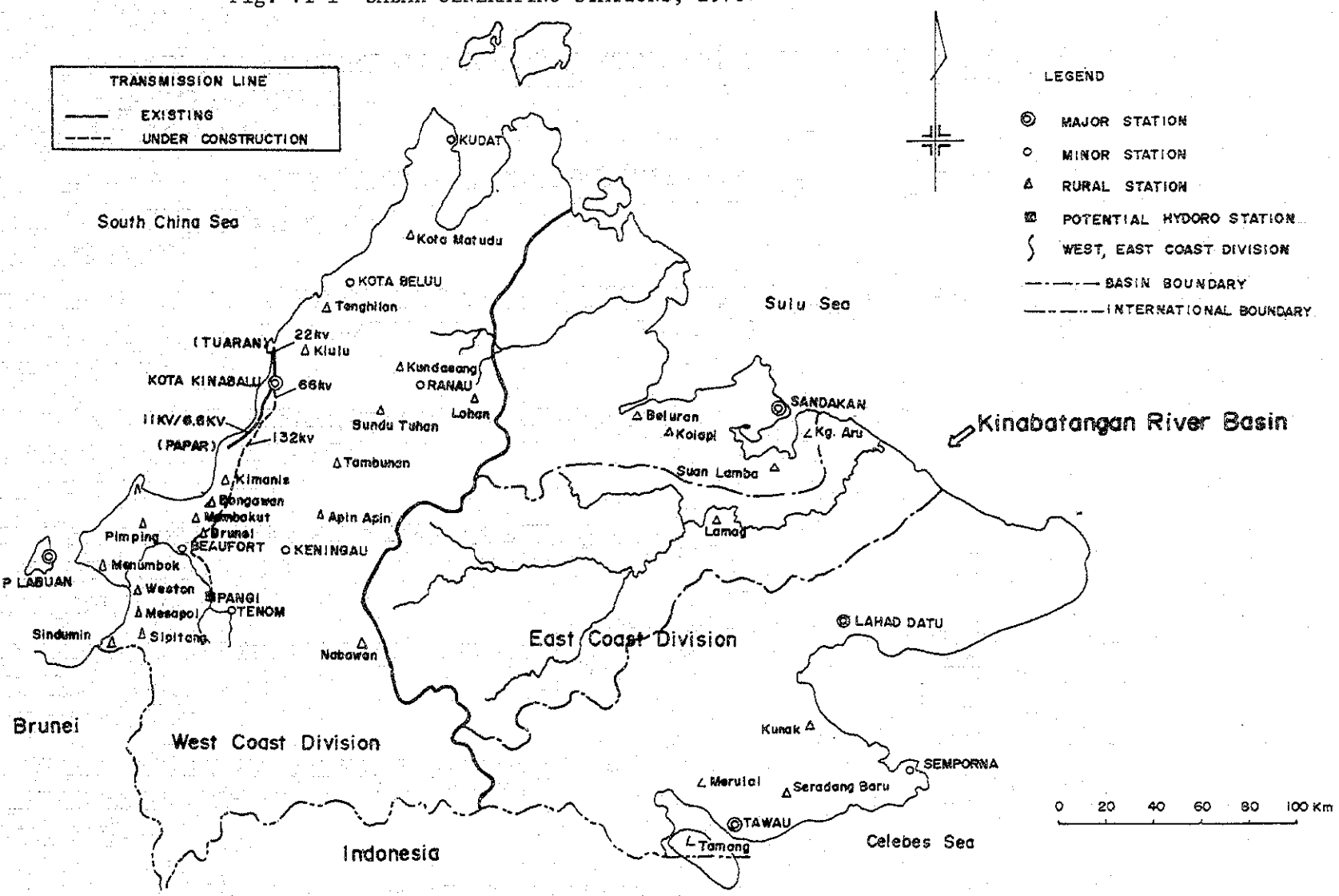


Fig.VI-2 GROWTH OF MAXIMUM DEMAND, CONSUMERS, INSTALLED CAPACITY, UNITS SOLD AND UNITS GENERATED

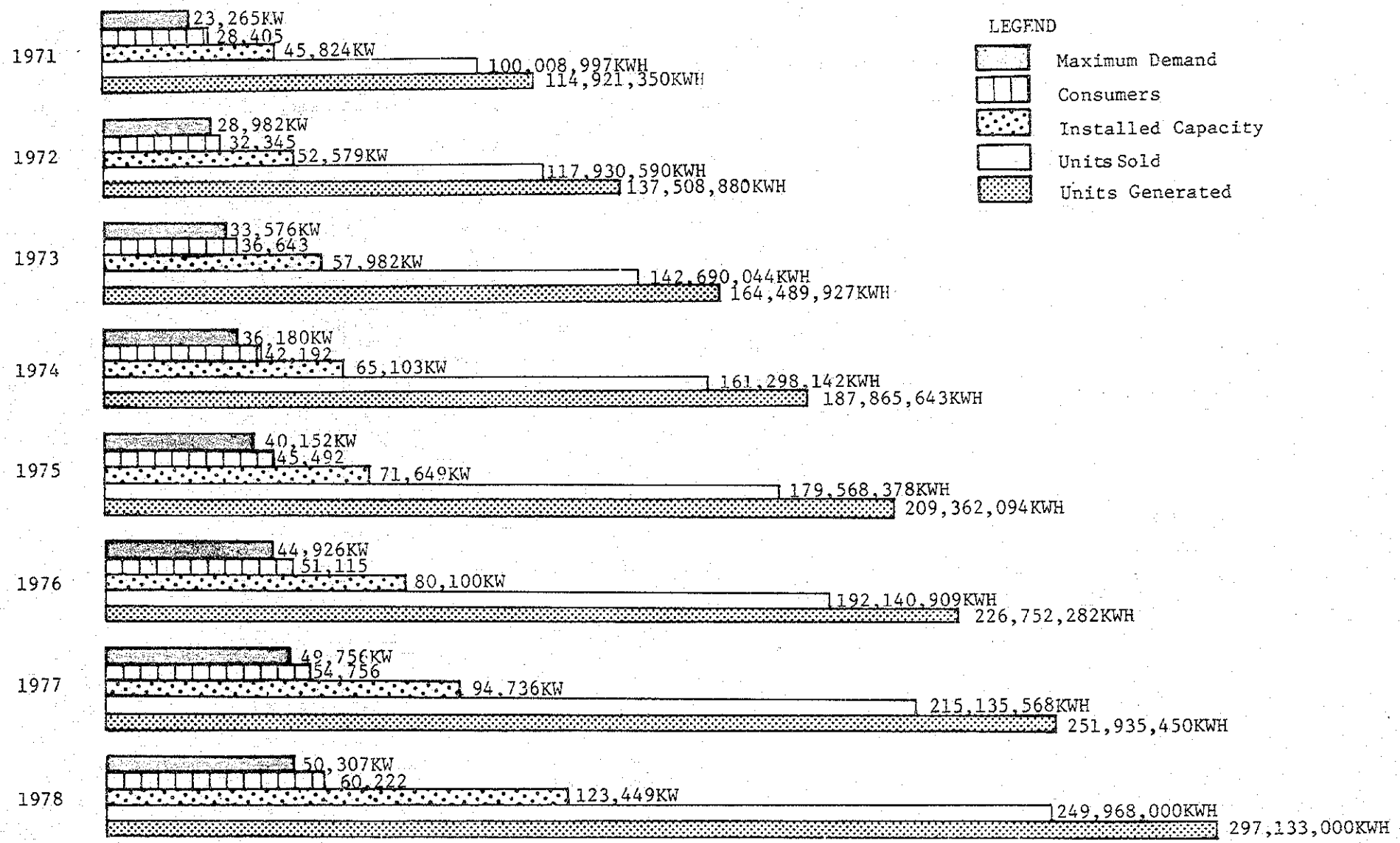


Fig.VI-3 DAILY LOAD CURVE OF SANDAKAN

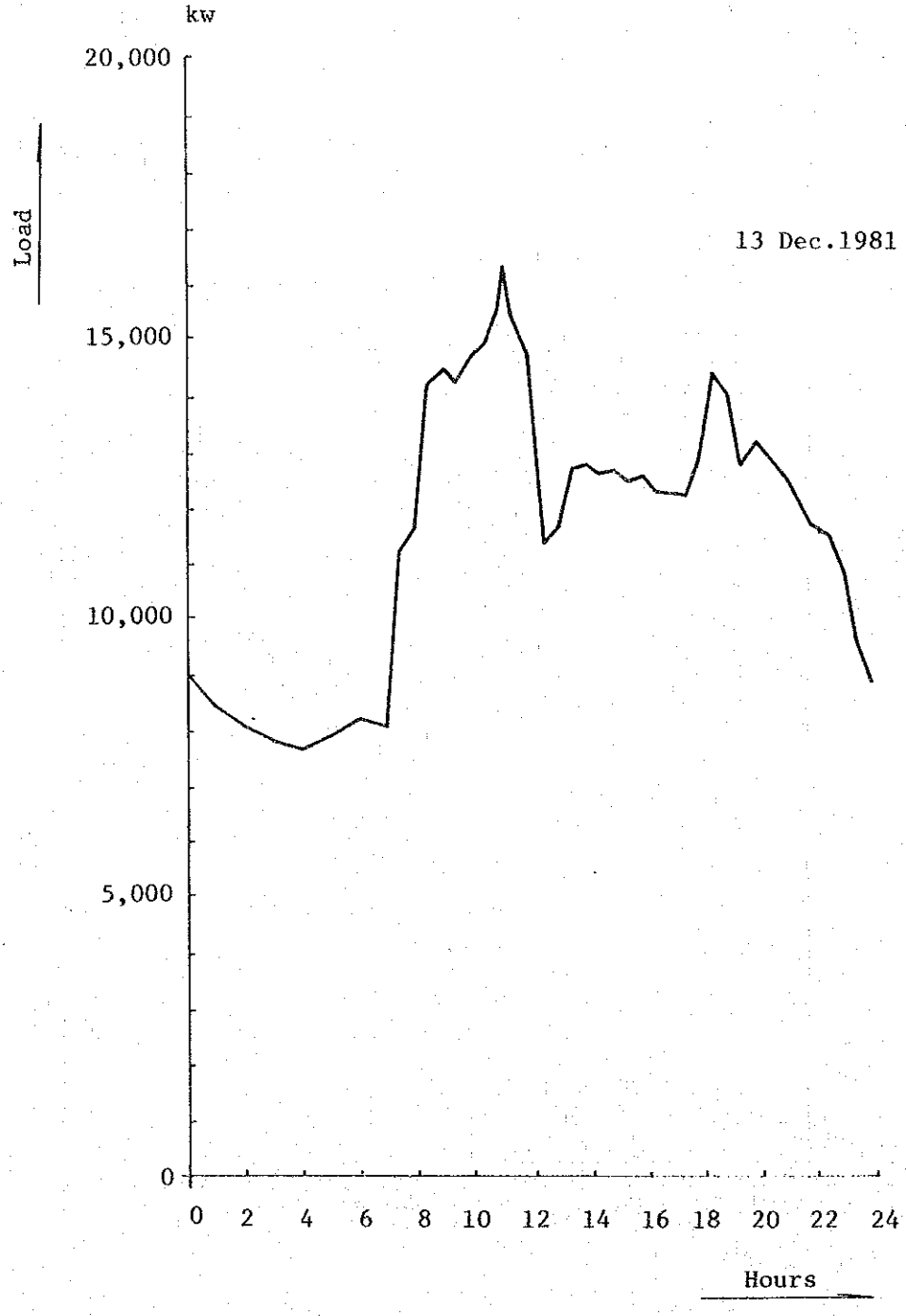


Fig. VI-4 DURATION CURVE-1975

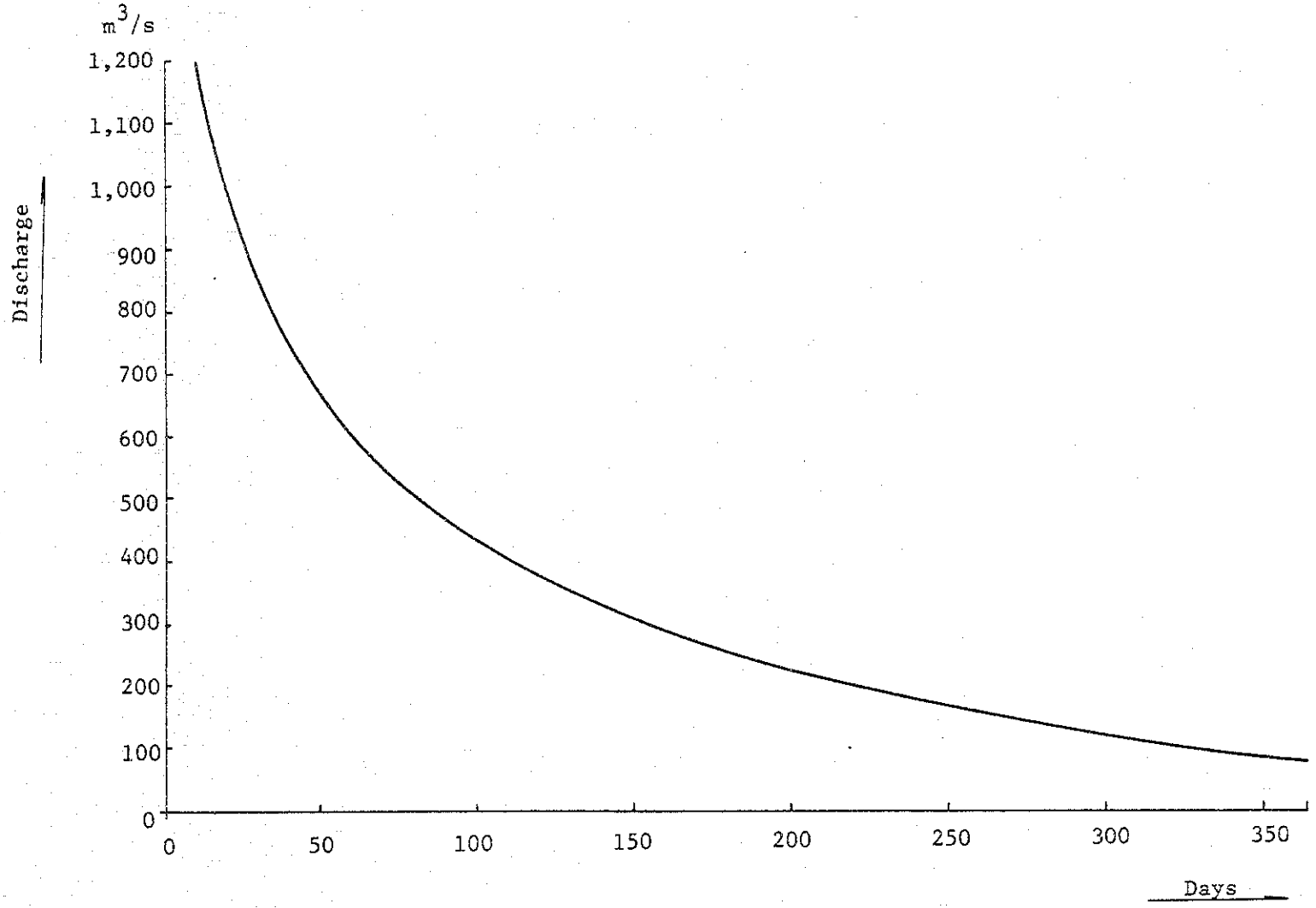


Fig. VI-5 CAPACITY FACTOR CURVE-1975

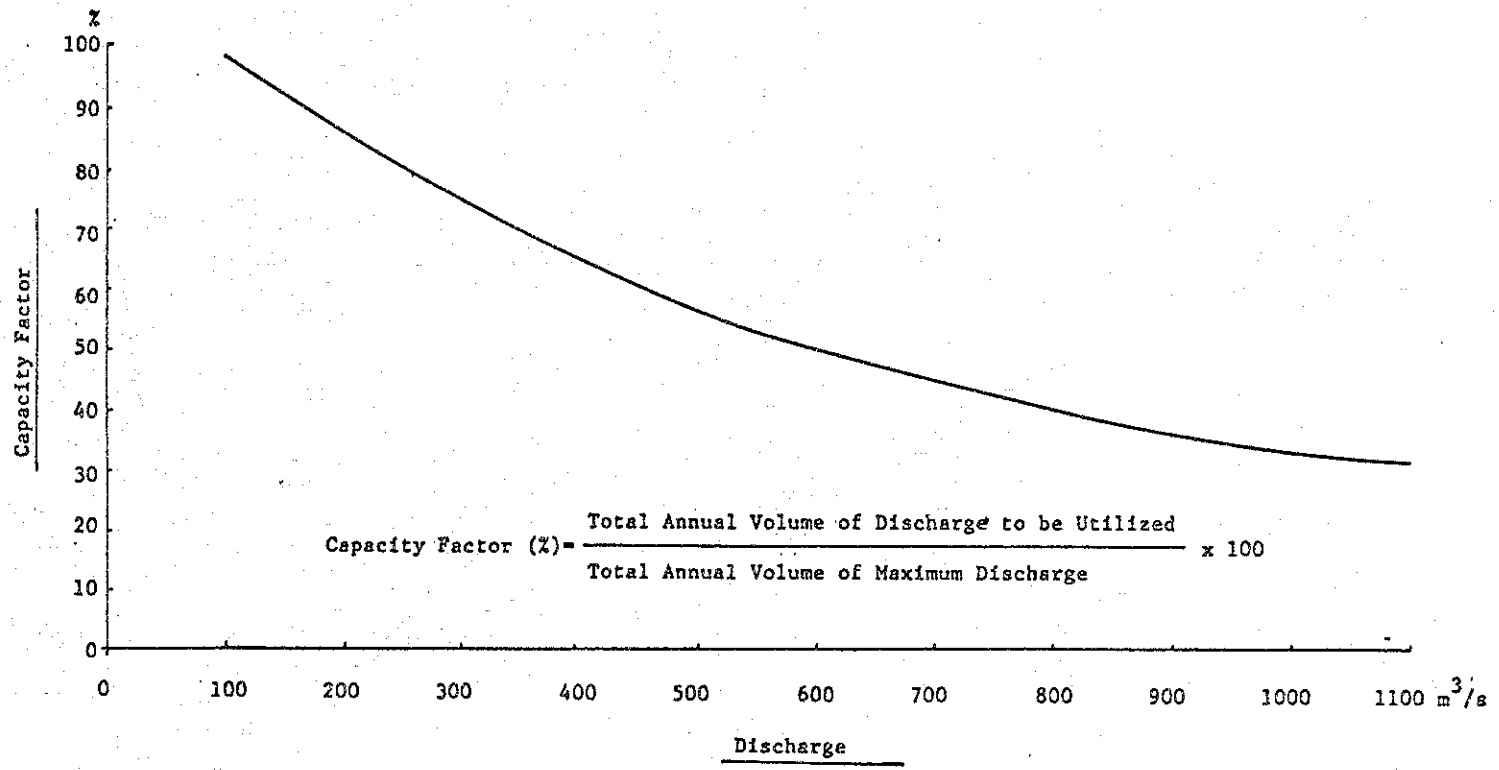
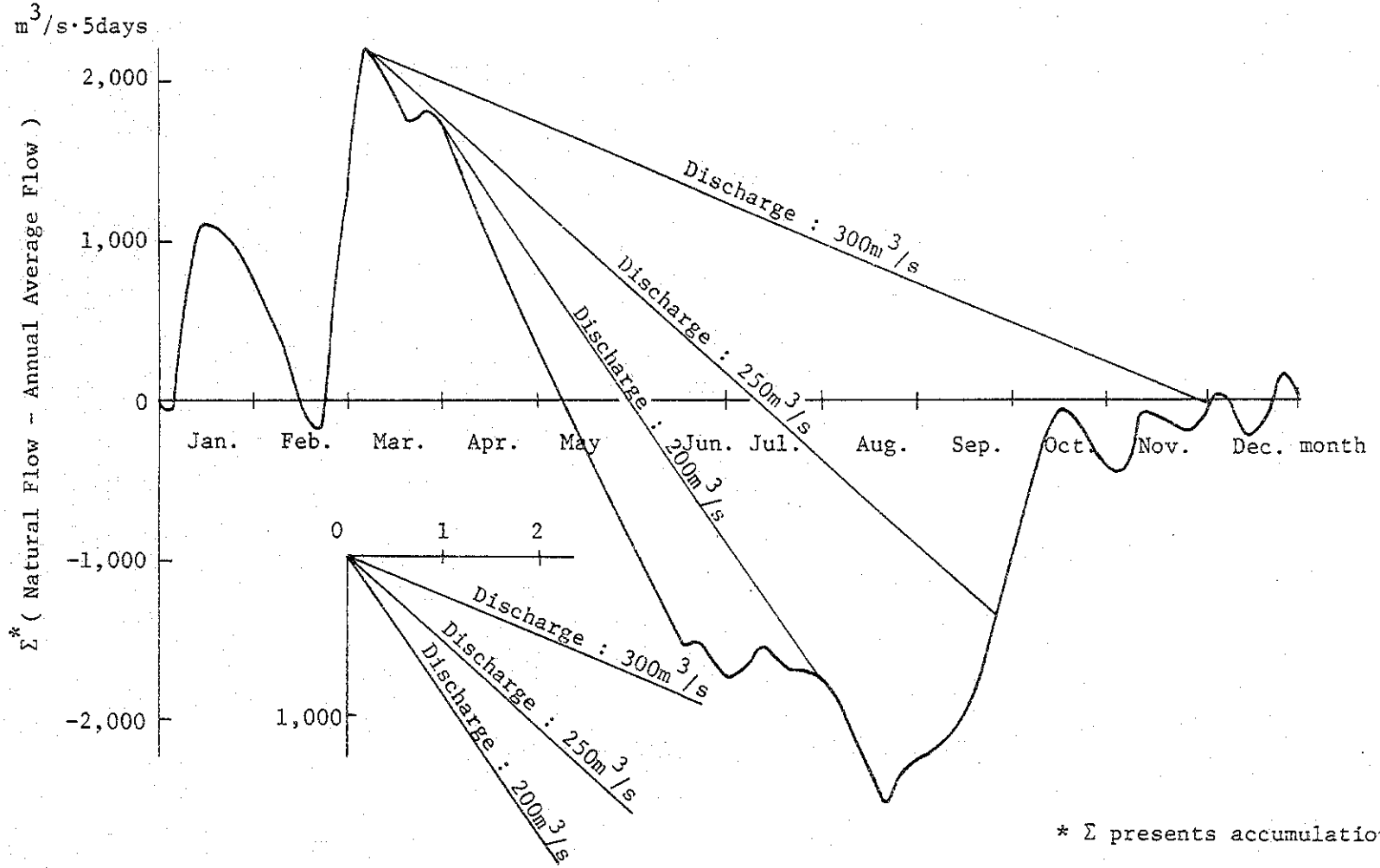


Fig. VI-6 MASS CURVE, 1975



* Σ presents accumulation.

Fig. VI-7 COMPARISON OF GENERATING TYPE

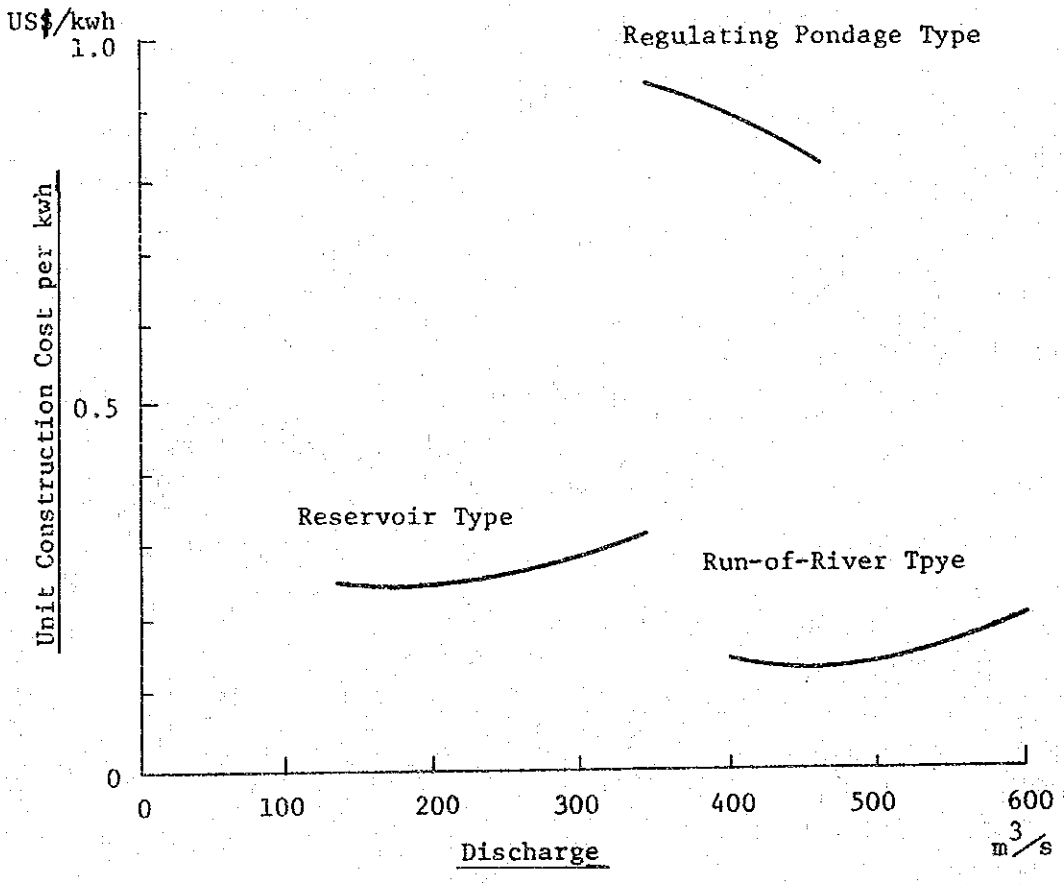


Fig. VI-8 ROUTE MAP OF TRANSMISSION LINE

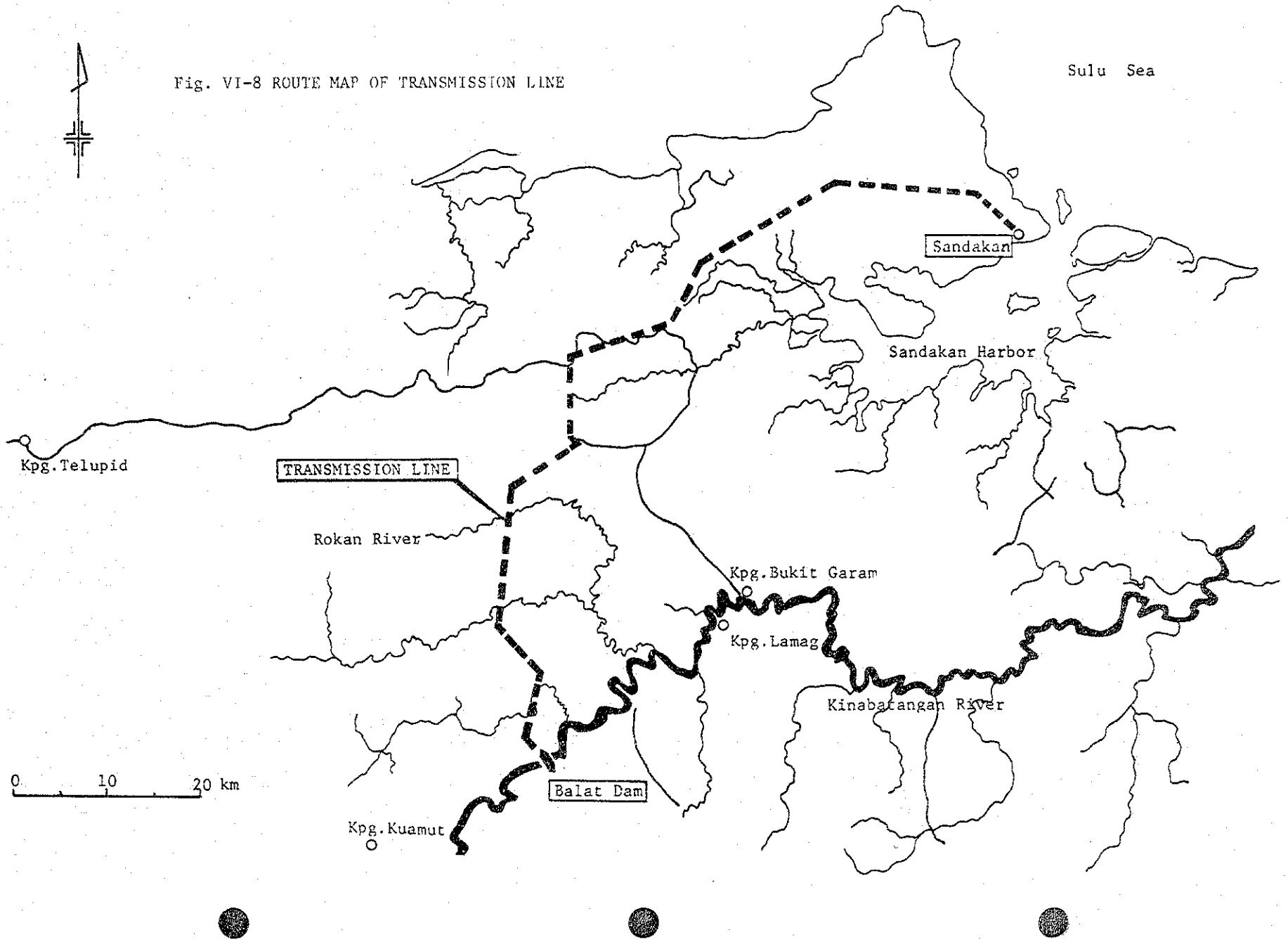


Fig. VI-9 PLAN AND CROSS-SECTION OF HYDRO POWER STATION

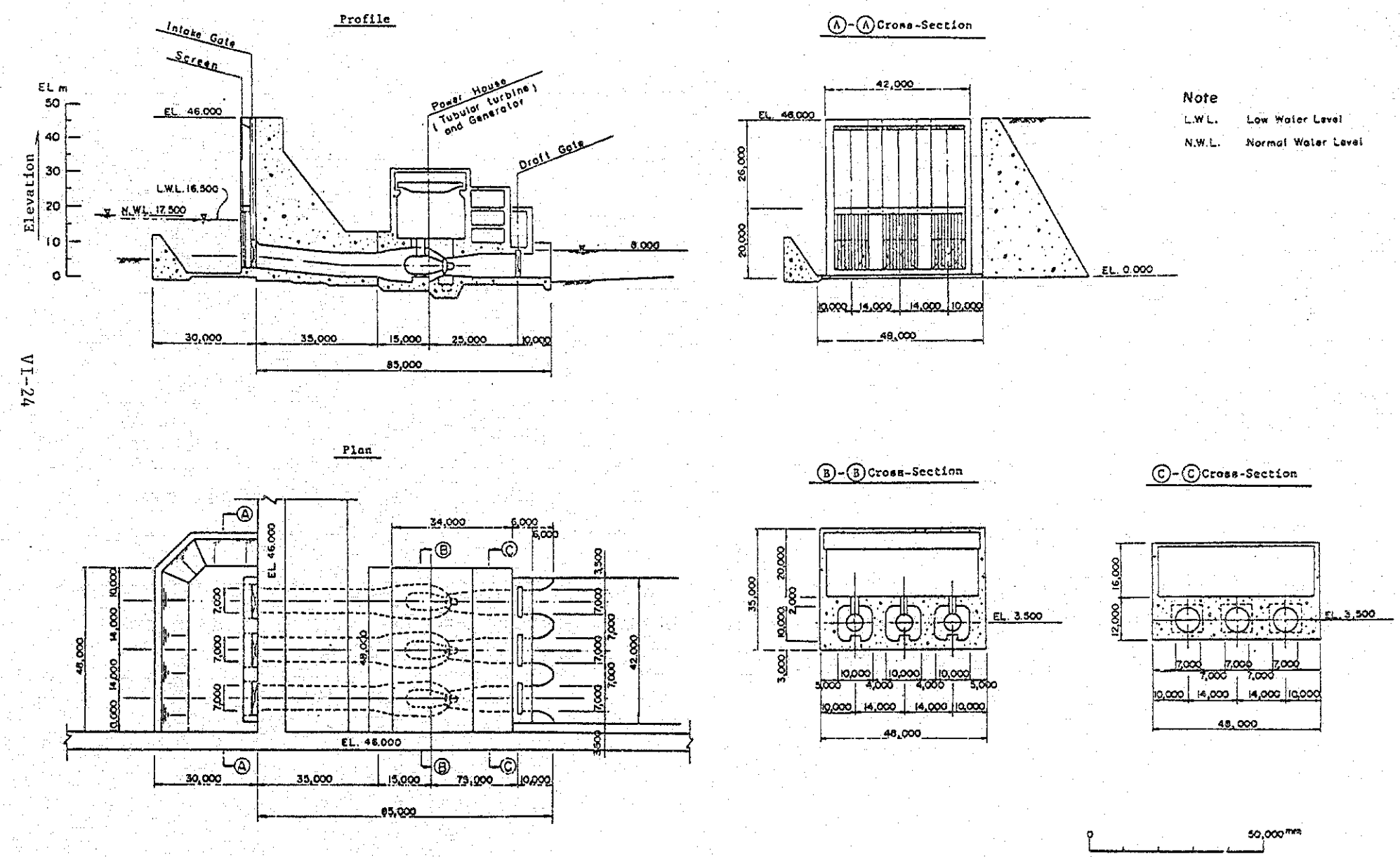
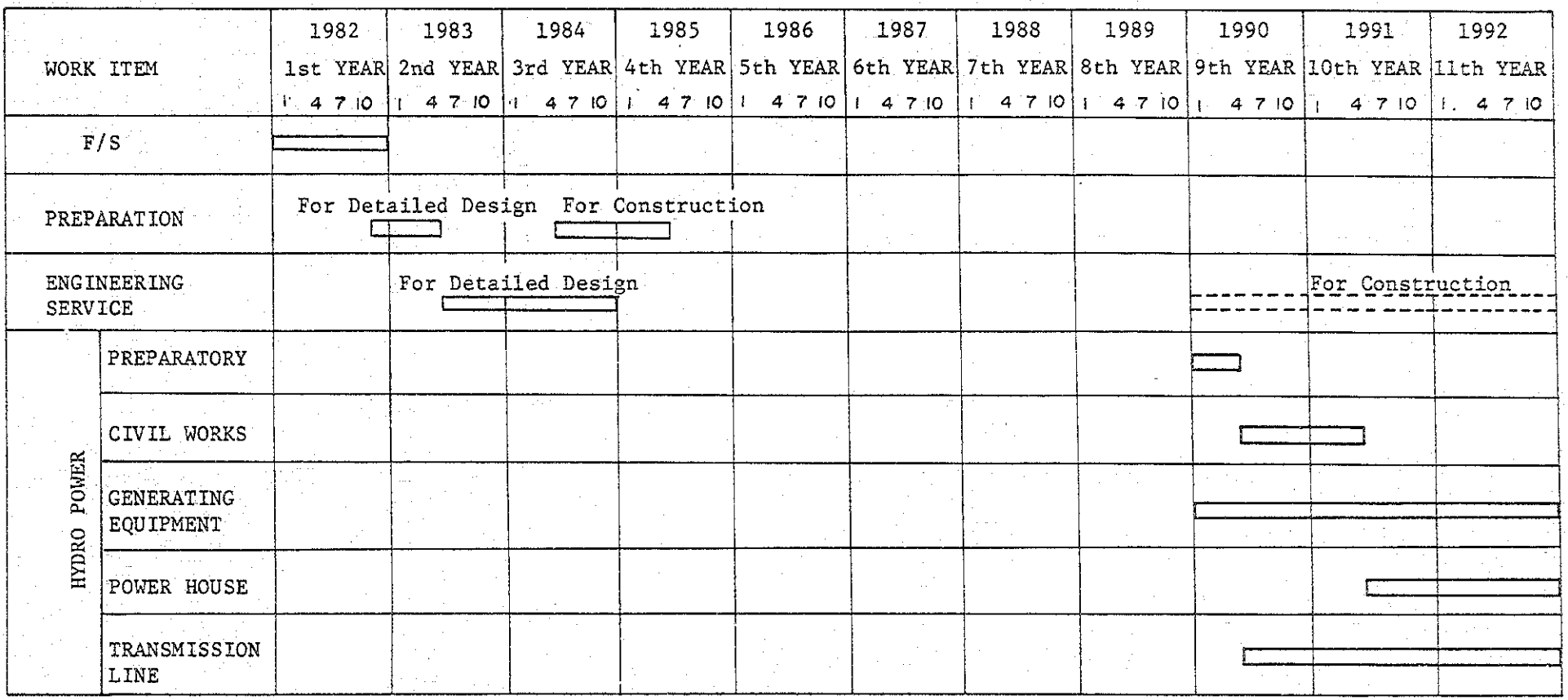


Fig. VI-10 CONSTRUCTION SCHEDULE



VII. SOCIO-ECONOMIC BACKGROUND

VII. CONTENTS OF SOCIO-ECONOMIC BACKGROUND

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1. GENERAL

As mentioned in the main report, the Kinabatangan River Basin Development Project consists of flood control, agricultural development and hydro power generation. The implementation of the project will have effect on the socio-economic environment of the State of Sabah especially east coast area. The implementation, however, is subject to the proceeding socio-economic condition of the state.

This sector, therefore, deals with socio-economic environments of the state and socio-economic profile of the Kinabatangan River Basin.

2. SOCIO-ECONOMIC ENVIRONMENTS

2.1 THE MAIN FEATURES

The State's area of 73,711 km^2 is the second largest of the 13 Malaysia States and occupies 23% of the national land area with population in 1980 of 1,097,800 which is about 7.5% of the national total. Indigennous group combined with Malay has a dominant share of about 60% which is followed by Chinese, Filipino, Indonesian and others in order of their respective share.

The State has various distinctive features which are summarized as follows:

1) The Sabah economy has achieved rapid real growth in GDP averaging 9.4% per annum as against the national average of 8.1% between 1971 and 1980. (Refer to Table VII-1.)

2) Per capita incomes of Sabahan in 1980 appear to be almost equal to the national average but as it is said that prices in general in Sabah are roughly 30% higher than in Peninsular Malaysia, real average incomes in Sabah become below the national average. (Refer to Table VII-1.)

3) The Sabah economic structure heavily depends on two primary sectors of agriculture including forestry and fisheries and mining and quarring having shares of 44.3% and 13.6% respectively which are outstandingly higher than those of the national of 22.9% and 4.8%. On the other hand, Sabah manufacturing sector has a mere share of less than 1% of the national. (Refer to Table VII-1.)

4) The above sources of income primarily come from the resources subject to depletion such as timber, copper and petroleum which widely depends on the behavior of the international markets. Therefore, it is urgently required to transform the present structures among sector and sub sectors.

5) The State has larger land availability for development which is found in the east coast region. However, availability of manpower both of skilled and unskilled is quite limited which is considered a main development constraint unless it is filled by the domestic and international migrants.

6) The State revenue has grown remarkably at an average annual rate of about 20% from 1974 to 1978, major contributor of which is forests that occupies 66% of the revenue in 1978. Under the circumstances that the State's forest resources are apt to dwindle and volatile international economic climate, it is unlikely to sustain the past growth rate. (Refer to Table VII-2)

2.2 PAST PERFORMANCE OF SABAH ECONOMY

Sabah economy is dependent on the exploitation of a small number of commodities. They are timber, petroleum, oil palm, cacao, copper, rubber and rice. These commodities provide most of Sabah's export income, government revenue and employment opportunity. Primarily due to the healthy climate of the international markets during the past decade, the rapid growth in real GDP at an average annual rate of 9.4% is impressive. However, the State's population has increased at an average annual rate of 5.3%, which is almost two times higher than that of the national average of 2.8%. Therefore, the per capita GDP of the State during the period remained at the national average.

Six commodities mentioned above except for rice provide over 90% to export revenue. Since 1972 two commodities alone, timber and petroleum have each year provided over 70% of export income. (Refer to Tables VII-2 and VII-3)

The rapid growth in the economy over the period has accompanied by substantial structural change. Major sectoral and sub sectoral performances are as follows:

Agriculture, Forestry and Fisheries

This sector has achieved annual average growth rate of 7.2% in GDP while the national average was 4.3%. Land developed during the period total of 59,243 acres (24,290 ha) of which 98% was done by the State's agencies.

1) Paddy

Judging from the available data from 1970 to 1975, production has increased at an average annual rate of 3.8% with 121,468 tons in 1974 and then registered a dramatic decrease of about 30% from the previous year in 1975 due to floods. Domestic production has just covered about 50% of consumption and the rest has to depend on importation. Rice import has increased at an average annual rate of 7.4% amounting to 68,801 tons in 1979.

Sabah Paddy Board (SPB), a statutory authority, was created in 1968 to encourage paddy production by giving imput subsidies. In spite of their efforts the gap could not be narrowed effectively. Since rice is a strategic crop under the foods self-sufficiency program and also has vital role in diversification of the crops, it is considered necessary that special measures to be taken for this sub sector. (Refer to Tables VII-4 and VII-5)

2) Forestry

As mentioned earlier, forestry is foremost important sub sector to the State's economy. As of 1978, it was estimated that the remaining forest area was 13.2 million acres (5.4 million ha) representing 72% of the total land area of Sabah. The forest areas being logged during the SMP and TMP were mainly the virgin forest reserves. It has been estimated that approximately 2.5 to 3.0 million acres (1.0 to 1.2 million ha) of the productive forest reserves were logged during the same period. However, with the introduction of the quota system on round log exports in 1977 the annual forest exploitation area had been reduced.

Sabah Forest Development Authority (SAFODA), another statutory authority was set up early 1977 with wide range of functions and objectives. However in the light of the urgent needs to regenerate the deforested land, the Authority has given emphasis to the reafforestation program.

Table VII-6 shows timber production from 1973 to 1978. The average annual growth rate of production was 3.4% during the period. Significant progress of local processing took place in the later years when the quota system of log exports was introduced.

3) Palm Oil, Cacao, Coconut and Rubber

An average annual growth rate of palm oil in area and production from 1971 to 1978 were 11.7% and 15.8% respectively. Cacao made significant progress at the rate of 17.6% and 23.5% in area and production during the same period. On the other hand, coconut production and area have been reduced slightly and rubber has stayed almost unchanged.

4) Fisheries

The sub sector shows an average annual growth rate of 5.5% from 1970 to 1979. Prawn catch by trawlers has grown at 7.2% and has contributed for export earnings. A cold storage for the purpose was built in Sandakan during the period. There has no remarkable growth in the inland fishing.

Mining

The mining and quarrying sector had emerged as a major contributor to the Sabah economy due to the exploitation of petroleum and copper. An average annual growth rate during 1971 to 1980 was 57% while its national average was 3.8%. The production of crude petroleum from offshore fields commenced in 1974. Mamut copper mining started in 1975. These two commodities accounted for 37% of Sabah's exports in 1978.

Manufacturing

An average annual growth rate of the sector from 1971 to 1980 was 8.8% as against 12.5% of the national average. The secator's GDP share in 1971 and 1980 was 2.5% and 2.3% respectively which are almost one eighth of the sector's share in Malaysis's total GDP. In another words, the State is one of the least industrialized state in Malaysia.

Government Services

The Sabah State Government is the wealthiest of Malaysia State Governments and that this has made it possible for the State Government to the major source of investment capital in Sabah, and to expand its expenditures rapidly during TMP. In 1978 revenue share of the State Government was 39% of the Malaysia State Governments which largely owes to forest revenue. The State development expenditure in the same year was about 22% of the Malaysia State Governments of which roughly two third came from the State's own fund.

2.3 POPULATION AND LABOUR FORCE

The population of Sabah is estimated to be 1,097,800./1 This total represents an average annual growth rate of 5.3% since 1970 when the last census was carried out. This rapid growth rate is almost double rate of the national average of 2.8% in the same period.

In addition to the 3.1% of natural increase, there have been substantial immigration that can be attributed first to the attraction of Malaysia from Peninsular Malaysia and of Indonesians by the high labour demand resulting from the rapid expansion of Sabah's economy and second to the influx of Filipino refugees from the political and religious disorders of the mid 1970's in the Southern Philippines.

/1 : Forth Malaysia Plan

2.3.1 Population Distribution and Density

Table VII-7 shows distribution and density of populations in 1980 by division and district which based on the preliminary field count conducted in 1980. There are three among twenty three districts that have more than 100,000 populations, i.e., the State capital Kota Kinabalu, Sandakan and Tawau.

The major variations in growth rate between districts were caused not only by rural-urban migration (Kota Kinabalu) but also by the substantial immigration of Peninsular Malays, Indonesian and the Southern Filipino which has occured since 1970 and this applies especially to the east coast regions.

There are five major towns, Kota Kinabalu, Sandakan, Tawau, Labuan and Lahad Datu which had experienced rapid growth and their total population in 1980 is estimated around 28% of the State's population. Kota Kinabalu has grown as an administrative and light industrial center. On the other hand, Sandakan, Tawau and, to a lesser extent, Lahad Datu, are centers for the forestry and agricultural estates.

2.3.2 Racial, Age and Sex Composition

Racial composition of the State's population in 1970 and 1980 is shown in Table VII-8. The main changes which have occured during the period are the substantial increases in the proportion of Malays, Indonesians, and Filipinos. The Table VII-9 gives age distribution among the major ethnic groups which indicates variation in age composition but 15-24 age group has outstandingly increased in the all racial groups. Also it is said that there is a substantial excess of males over females in the working age population due to immigration of single males in search of employment.

2.3.3 The Labour Force

There are 584,100 people of working age (between 15 and 65) in 1980 as against 331,800 in 1970. Changes in the age structure of all ethnic groups have led to an increase in the percentage of the total population of working age as in the percentage of the total population of working age as shown in Table VII-10. According to Sabah Regional Planning Study (SRPS) the estimated labour force in Sabah is 366,900 or 62.8% of the total working age population and has increased at an average annual rate of 6.2%. Structure of the labour force in 1970 and 1978 is shown in Table VII-11. As notice there has been a dramatic decrease in share of labour absorption of paddy and yet it has the largest share of 23.3%.

2.4 FMP AND MAJOR DEVELOPMENT ISSUES

2.4.1 The Fourth Malaysia Plan (FMP 1981 - 85)

The FMP inaugurates the second decade of the OPP which is based on a broad review of the progress that has already been achieved under SMP and TMP. During the eighties, the Malaysian economy may face greater challeeges than the last decade, as it has to accomplish not only the long term targets of the NEP but also to compensate for past shortfalls in terms of performance. The perspective growth target was set at 7.9% per annum but the rate achieved during the next decade, the economy will have to grow at least by 8% per annum to enable the achievement of the various socio-economic objective.

Strategic elements are further aurgumentation of the productivity of agriculture, the expansion and diversification of the industrial base, modernization of the financial and services sectors and diversification of the sources of growth. Investment and exports will have to continue to grow at rapid rates and new sources of export growth and import substitution have to be identified and developed. Another essential element of the development strategy is a balanced socio-economic development among the regions in the country.

2.4.2 Major Development Issues and Sabah Development Plan

In order to challenge to uphold the current development momentum to obtain consecutive economic growth, the major development issues for the next five year period for the State can be recapitulated as follows:

1) Reduction of the heavy dependence on the exploitation of forest resources

2) Diversification of agricultural crops

3) Shift of labour force to higher productivity sectors

4) Manpower development

In line with the context of the NEP, the State formulated the following development policy objectives under the FMP.

1) Rapid economic growth and higher standards of living

2) Reduction of socio-economic imbalance

3) Higher labour productivity and increasing mobility of labour

4) Efficient infrastucture system

5) Foods self-sufficiency

6) Industrial development

Strategies employed to achieve the above mentioned objectives are as follows:

1) Agricultural and Rural Development

- Small scale intergrated Kampung and area Development schemes
- Extensive land development-diversified mix of agriculture and rural based activities and encouragement of land settlement
- Primary processing
- To increase output and productivity of small holders by extension advice, financial assistance and other incentives
- Improvement to marketing facilities

2) Foods Production

- Mechanized large scale rice production

3) Industrial Development

- Utilization of local resources
- Promotion of export of processed products
- To broaden the industrial base
- To promote tourist development

4) Manpower Supply and Labour Productivity

- Training and Educaiton
- Improvement of the market information networks
- Introduction of appropriate and efficient labour saving technologies

3. SOCIO-ECONOMIC PROFILE OF THE AREA

3.1 ON-GOING DEVELOPMENT PLANS

In line with the policies foregoing, some development plans are being initiated.

Public agricultural development schemes through direct efforts of the executing agencies may be summarized as follows:

Settlement Schemes	-	Sabah Land Development Board Federal Land Development Authority Rural Development Corporation
Small Holders Schemes	-	Agriculture Department Lands and Survey Department Rubber Fund Board
Experimental Paddy Development Schemes	-	Sabah Paddy Board
Joint Venture of Private Estate	-	Department of Co-operative

As far as this District is concerned, 888 acres (360 ha) of the Minor Settlement Scheme and 200 acres (80 ha) of Paddy Pilot Scheme are all what has been implemented in the public sector.

On the other hand, land development by the estates and smallholders through the encouragement and assistance of the State Government has been noteworthy. Out of 41,000 acres (16,000 ha) which was alienated for the private sector in the Kinabatangan District during 1977 (refer to Table VII-12), about 20,000 acres (8,100 ha) has been planted by crops except hill paddy of the shifting cultivaiton.

In the recent years, there have been several projects which were either implemented or proposed in the Kinabatangan River Basin. Mostly aimed at the agricultural development, they sum up to the total area of approximately 708,000 acres (286,000 ha) and yet the net progress has been made in merely 5% of the cumulative total area. (Refer to Table VII-13)

Apart from the agricultural sector, the Sabah Forestry Development Authority (SAFODA) has rattan project areas in the flood plain along the Kinabatangan River.

As for the road projects, the trunk road between the Lahad Datu and Batu Puteh is now being improved by the Public Works Department. Within this plan, a new bridge over the Kinabatangan River will be constructed. In adition to this, the improvement of feeder roads connecting the agricultural

development area and the trunk roads are carried out by private estates and such government bodies as the Federal Land Development Authority (FELDA) and the Lands and Surveys Department.

A township development is being planned in the area 10 km north of Bukit Garam. The proposed town with the tentative name of Kota Kinabatangan will serve as a new center of the Kinabatangan District.

3.2 FUTURE POPULATION AND LABOUR FORCE

Labour force is one of the essentials for the smooth implemetation of on-going project aforementioned. Future labour force in the Kinabatangan River Basin will be studied through presuming the future increase of population.

3.2.1 Future Population

The population in 1970, 1980 and 1990 is presented only on the state level by FMP, and 2000's population is projected by Human Resources Section (HRS) of EPU in 1980. The population on the district level can be known from the census results of 1970 and 1980, which are compiled in Preliminary Field Count Summary (PFCS). The population of Sabah State reported in PFCS is lower than that of FMP.

In this study, the provided value of FMP and HRS will be adopted as the future project population of the Sabah State, and the population by PFCS will be supplementary used for the study of future population.

The procedure of estimation for the future population is as follows:

1) Growth rate of population from 1970 to 1980 is based on the PFCS as shown in Table VII-14.

2) Assuming that this growth rate last for the following decade, 1990's population is caluculatd by using this growth rate on a base of 1980's population of each district described in PFCS.

3) The calculated 1990's population on the district level is modified so that the total population of each district comes to the 1990's population of Sabah presented in FMP.

4) The growth rate of the population from 1980 to 1990 is also revised by using the modified population of 1990.

5) 2000's population can also be estimated on the basis of 1990's population and the growth rate mentioned in 4).

Table VII-15 shows the future population on the district level.

3.2.2 Labour Force

Since the age distribution of population which is commonly used for a study of labour force, is hardly identified due to little data, the labour force ratio to the total population of the state are applied for the estimation of the future labour force.

The labour force ratio which is calculated on the basis of the population and labour force of Sabah State described in FMP is approximately 0.34 as shown below:

Year	1970	1980	1985
Population (1)	645,000	1,098,000	1,285,000
Labour force (2)	222,000	367,000	433,000
Ratio (2)/(1)	0.34	0.33	0.34

The future labour force on the district level can be estimated by using aforementioned population of each district and labour force ratio. (Refer to Table VII-16.) According to this Table, future labour force in the Kinabatangan district in 1990 and 2000 are 16,000 and 25,000 respectively.

4. IMPACTS THROUGH PROJECT IMPLEMENTATION

4.1 LAND ACQUISITION AND HOUSE EVACUATION

4.1.1 Land Acquisition

Land acquisition is caused by the following two reasons, namely; 1) dam construction and 2) agricultural development.

1) Dam construction

The land to be submerged after completions of the proposed dam will be acquired before the commencement of the dam construction. The area of land acquisition will be about 520 km^2. The total land aquisition cost are amounts to US$29.7 million.

2) Agricultural Development

8% of the total agricultural development are will be utilized for road and irrigation facilities. This land also will be acquired, and the land aquisition cost is US$2.5 million.

4.1.2 House Evacuation

The houses which exist in the submerged area shall be evacuated. The number of the houses counted on the basis of 1/50,000 topographic map and 1980 census amounts to 850. The house evacuation cost is US$1.1 million.

4.1.3 Implementing Schedule

Land acquisition and house evacuation in the submerged area shall be finished by commencement of the impounding of reservoir. And land acquisition in the agriculture development area shall be carried out correspondingly with proceeding of the development.

4.2 RESETTLEMENT SCHEME

4.2.1 Number of the Settlers

The resettlement scheme will be required for the following backgrounds:

1) The area where 850 houses are located will be submerged by dam construction. Consequently the inhabitants in the area must be resettled.

2) 4,000 labour forces which consists of 770 skilled and 3,230 semi-skilled labourers will be needed for the implementation of agriculture development plan proposed in this project. And all of them will be settled in and around the Kinabatangan River Basin.

Under this situation, this project proposed to resettle the people in the submerged area to the agricultural development area.

And they are expected to fulfil some portions of the required semi-skilled laboures mentioned above.

Semi-skilled labourers who are still not enough for this project, will be filled up from the other area in the Kinabatangan River Basin.

Regarding with skilled labourers, it is assumed that all of them will be settled from Kota Kinabalu.

Since the labour are requested to be specialized for his assignment through the trainning, it is assumed that one family supplies one labourer. As a result, the number of the families of settlers coincides with the number of the labour force.

The settlers mentioned above are devided into 11 groups in accordance with such the proposal of agriculture sector that the development area is separated into 11 tracts.

4.2.2 Required Facility and Cost

The required facilities for the establishment of resettlement are studied on the basis of on-going resettlement scheme carried out by Sabah Land Development Board (SLDB). And the items of the required facilities in each tract are proposed below. Eventually, the total numbers of the required facilities and cost are shown in Table 5-16.

1) Settler's housing including quarters for management and administration staff

2) School, hospital, mosque and general store

3) Transpotation facility

4) Electric supply facilities

4.2.3 Implementing Schedule

Resettlement scheme carried out correspondingly with expansion of the agriculture development area, will be performed during a period of 7 years.

In this duration, the resettlement cost and number of settlers are assumed to increase in proportion to the expansion of the area.