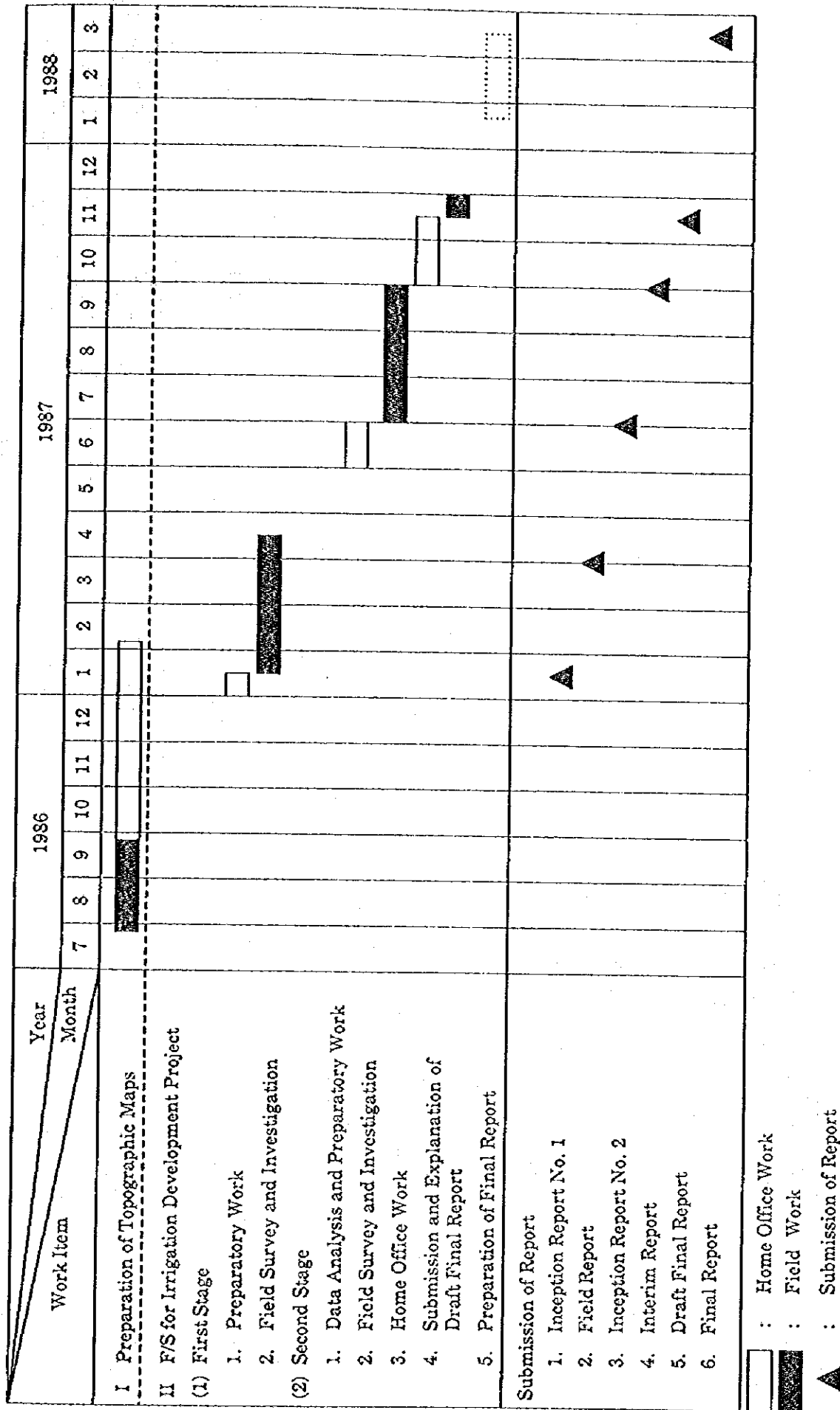


FIGURES



□ : Home Office Work
 ■ : Field Work
 ▲ : Submission of Report

Fig.1.3.1 GENERAL WORK SCHEDULE FOR FEASIBILITY STUDY

Source) 1 : Population Census 1979, CBS
 2 : Population Projections for Kenya 1980 - 2000, CBS
 3 : Statistical Abstract 1985
 4 : Unpublished Data from NIB

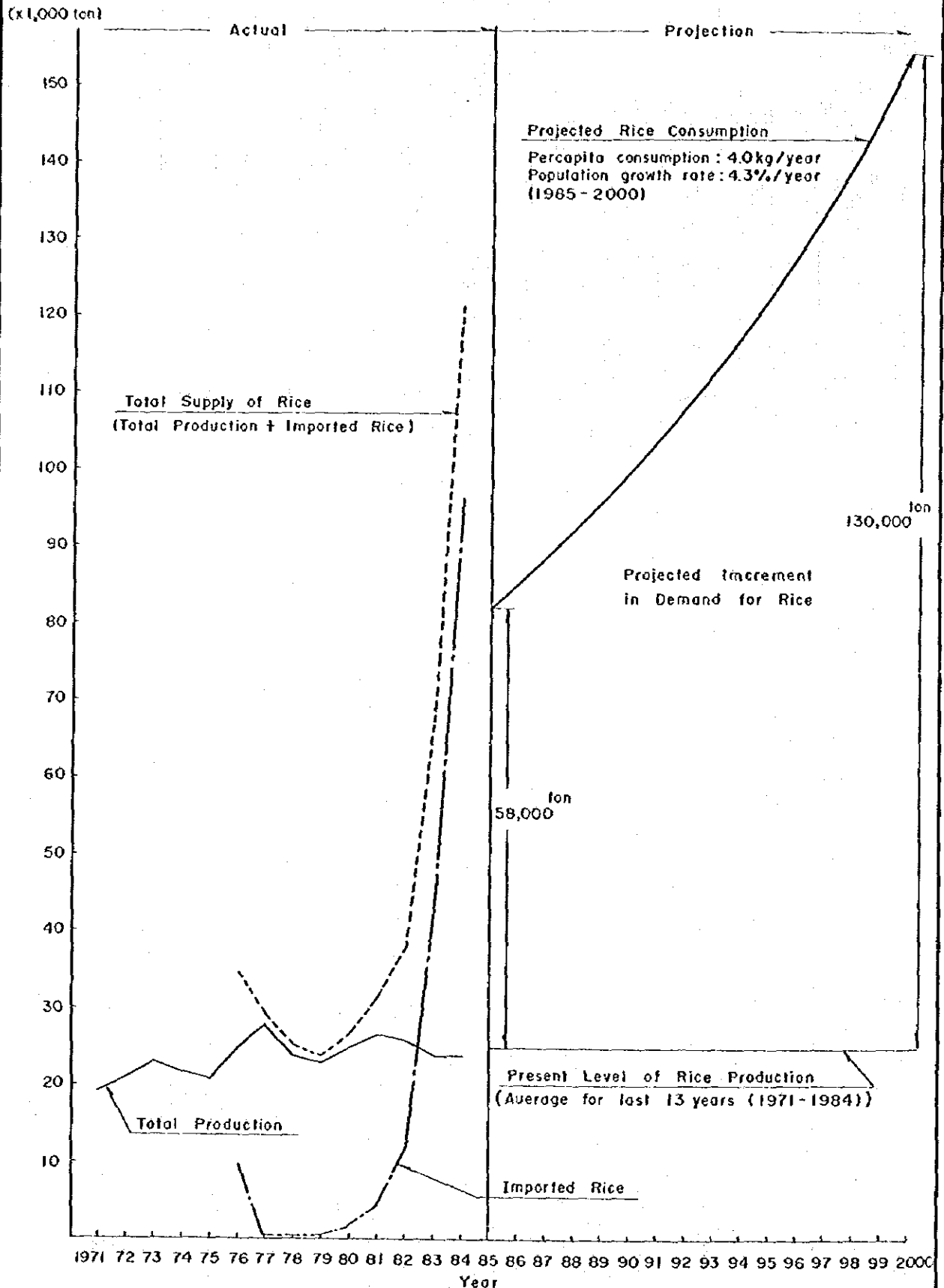
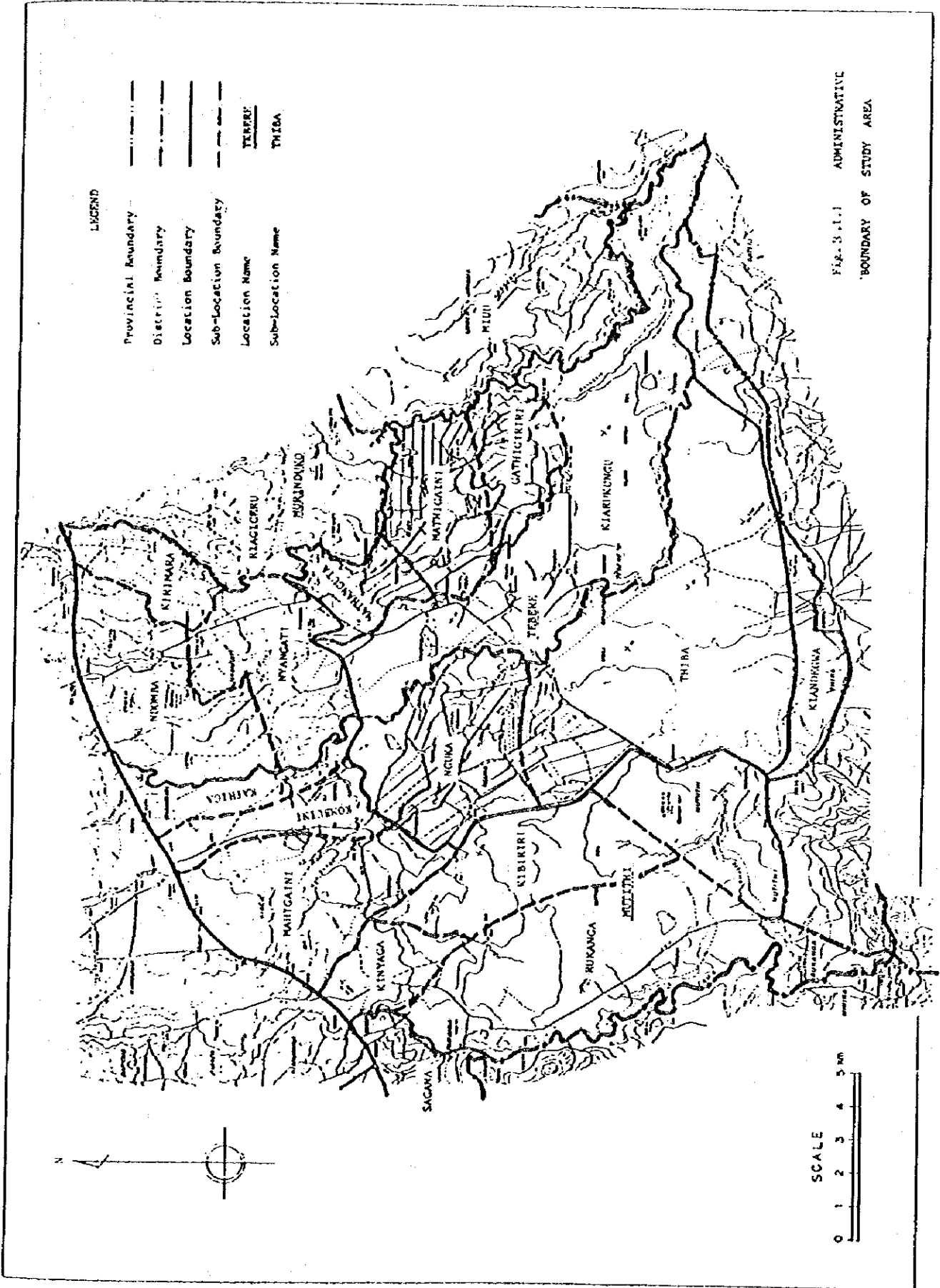


Fig.2.5.1 DEMAND AND SUPPLY OF RICE



LEGEND

- Provincial Boundary
- District Boundary
- Location Boundary
- Sub-Location Boundary
- Location Name
TERRU
- Sub-Location Name
THIBA

Fig. 3.1.1 ADMINISTRATIVE
BOUNDARY OF STUDY AREA

SCALE
0 1 2 3 4 5 km

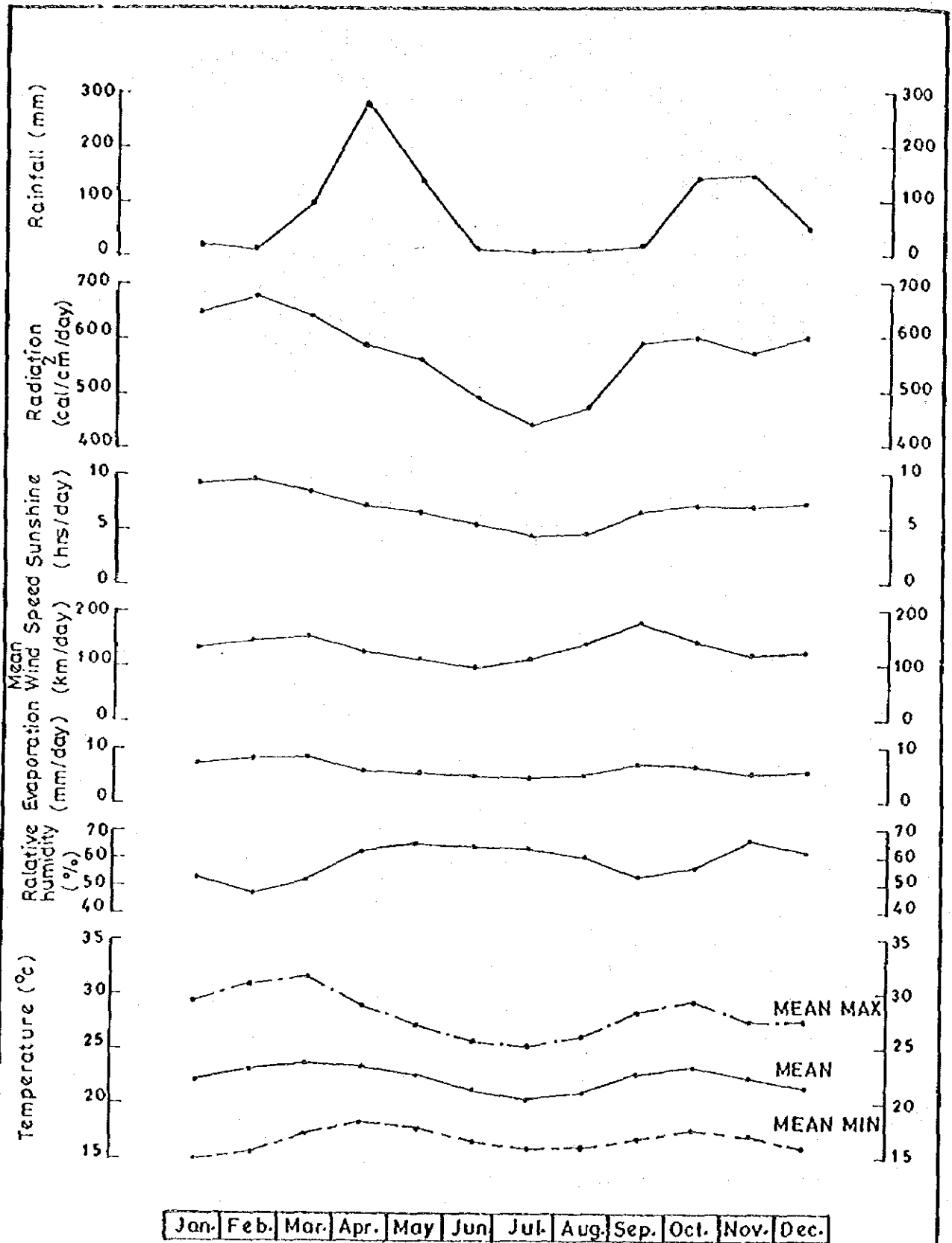
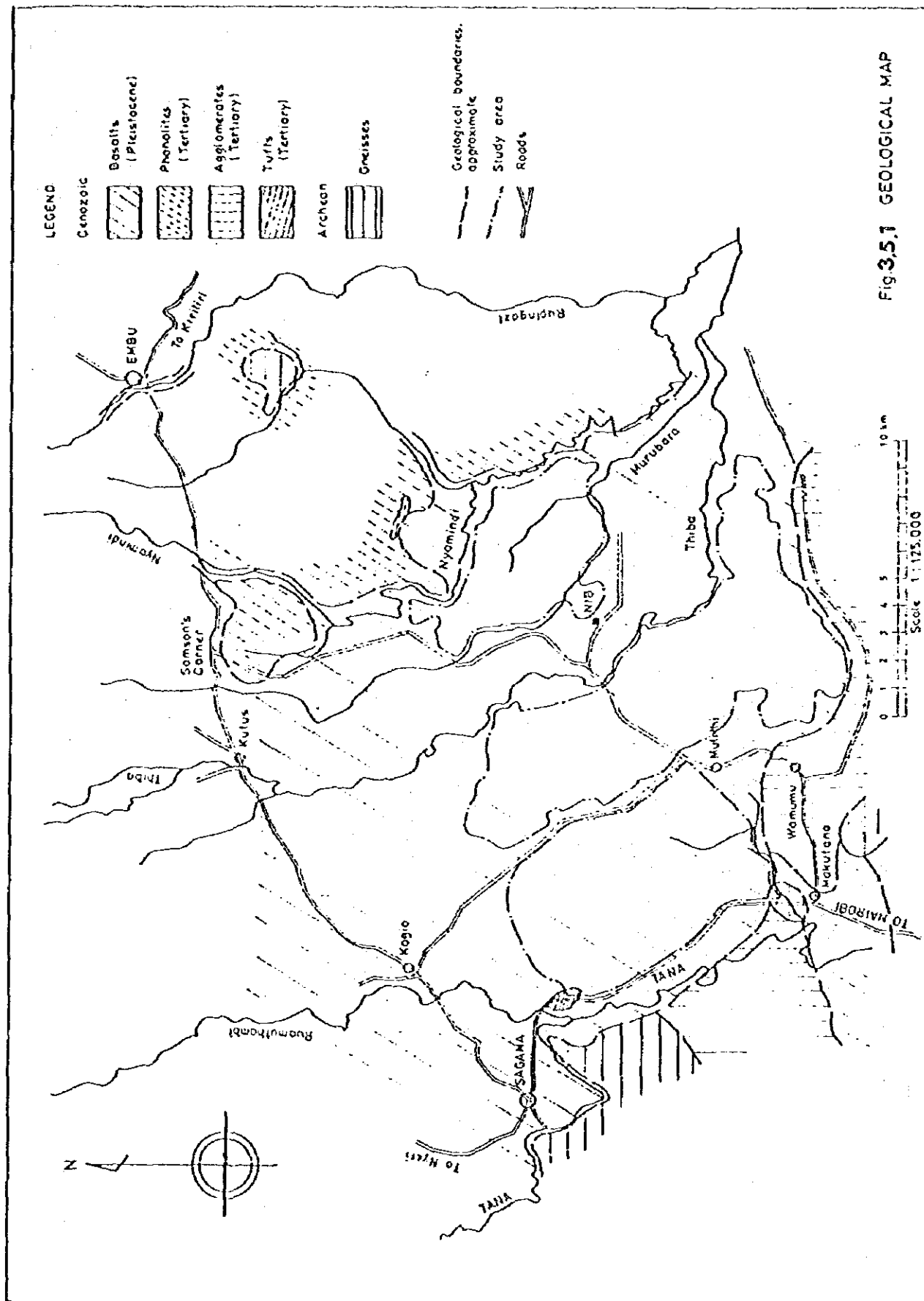


Fig.3.3.1 MONTHLY METEOROLOGICAL FLUCTUATION



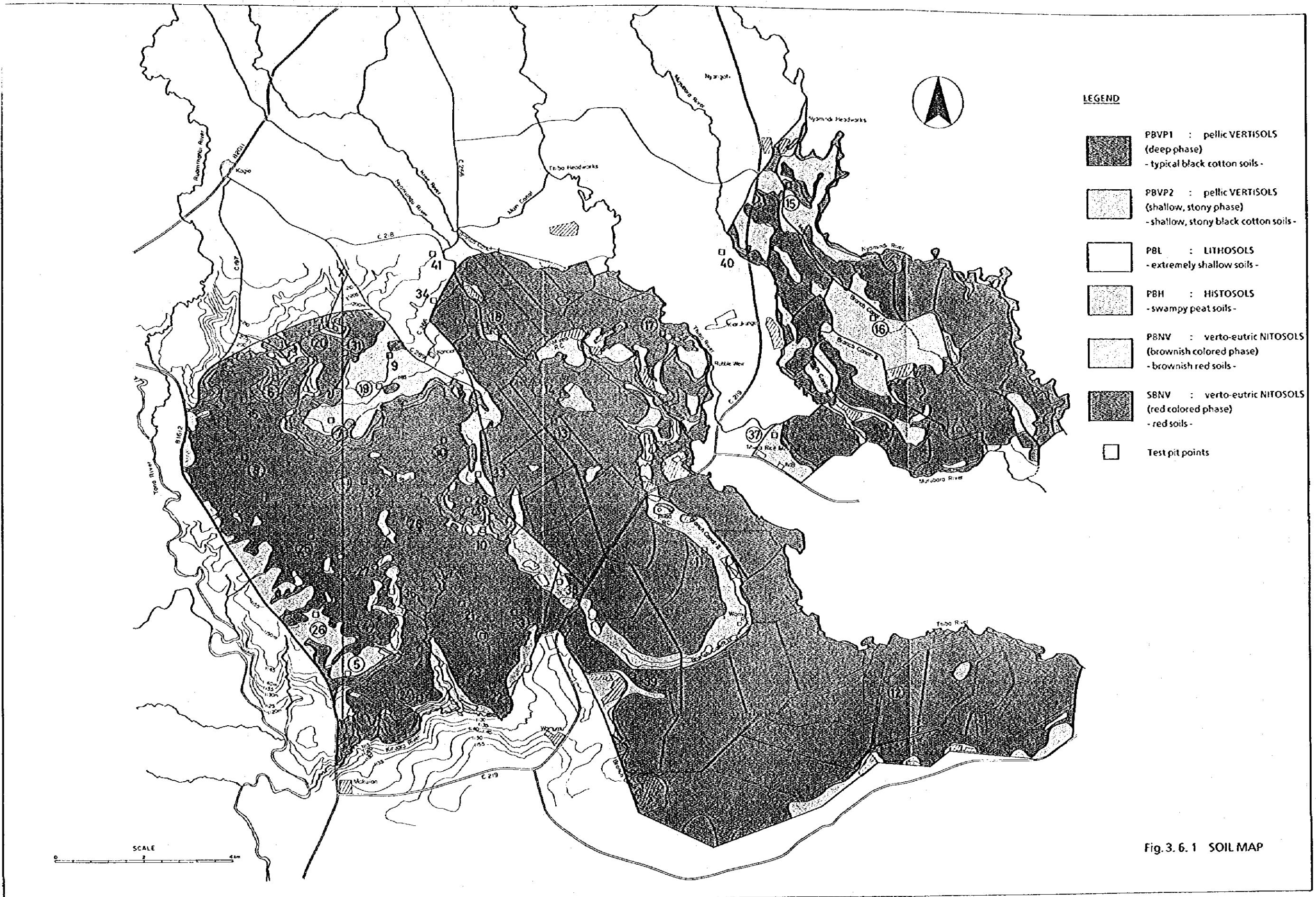


Fig.3.6.1 SOIL MAP

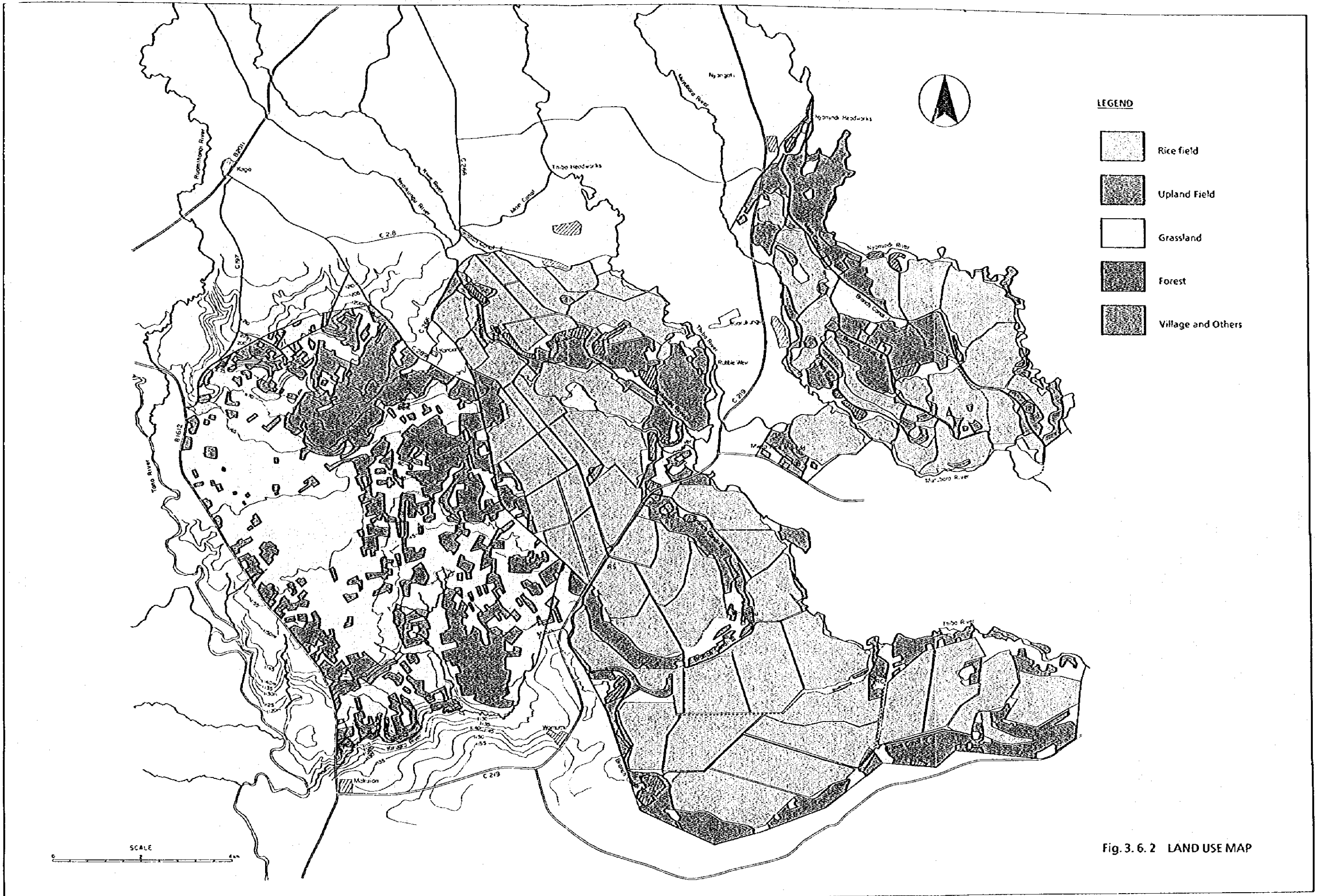


Fig. 3.6.2 LAND USE MAP

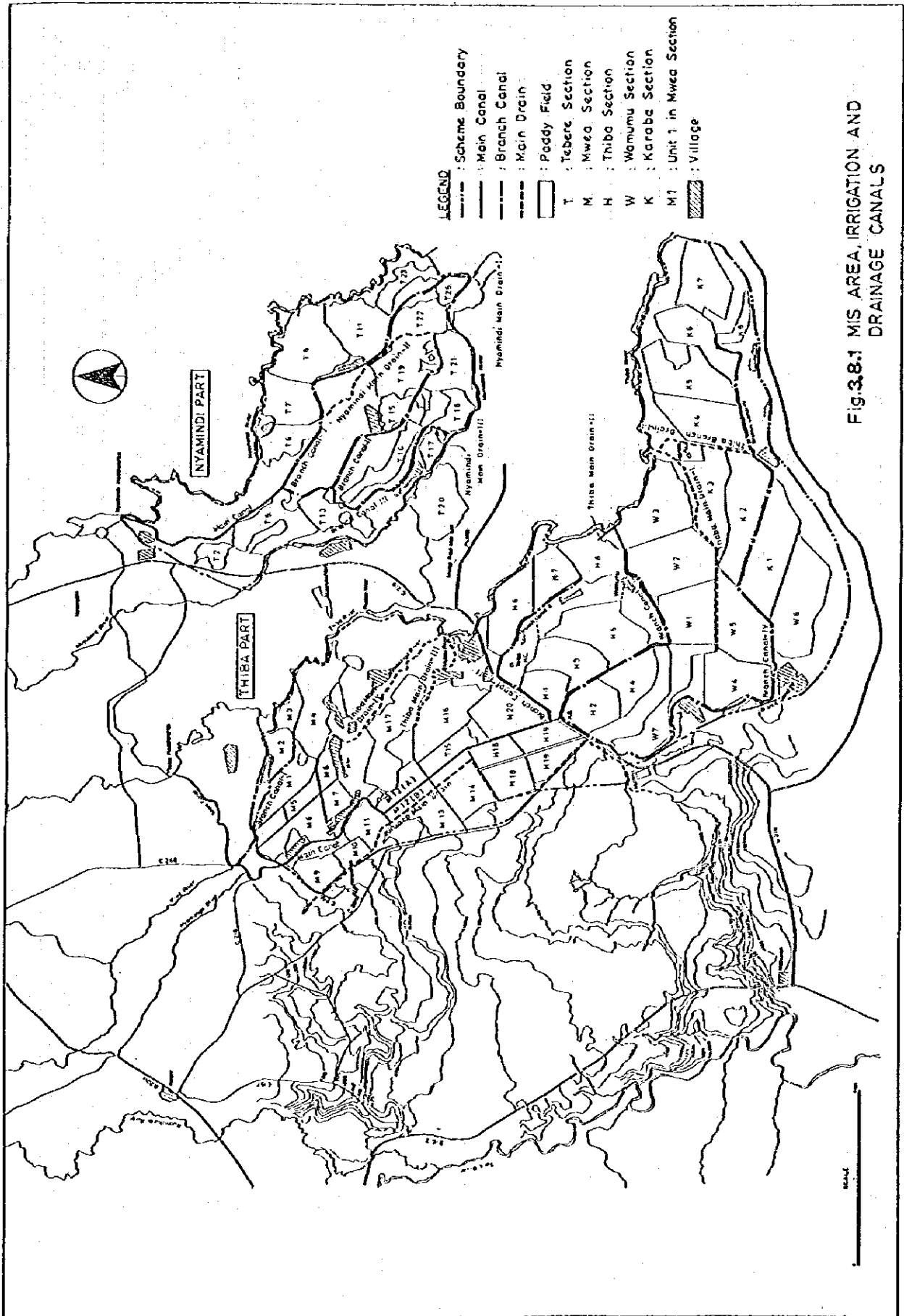


Fig.3.8:1 MIS AREA, IRRIGATION AND DRAINAGE CANALS

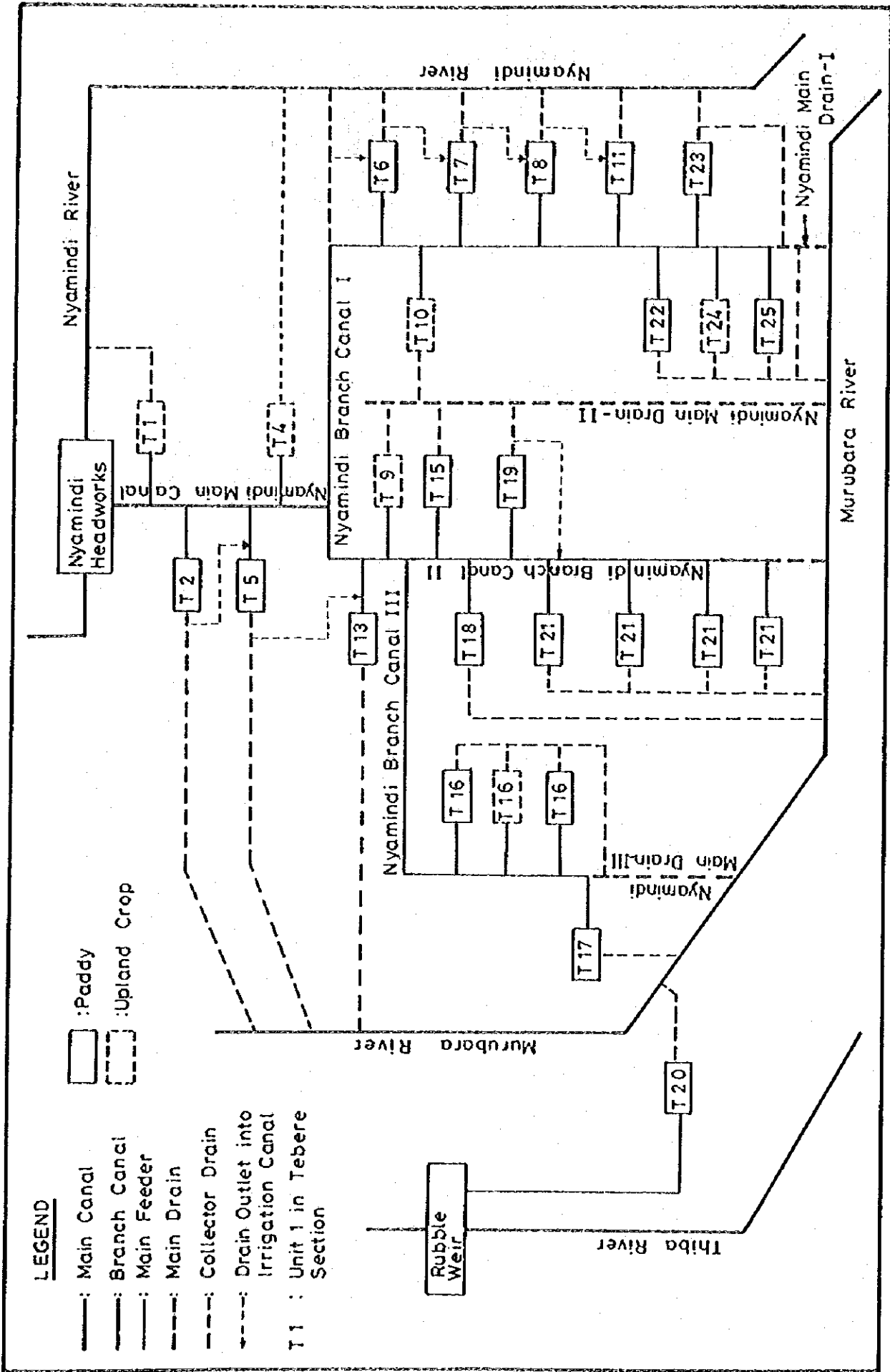


Fig.3.8.2 IRRIGATION AND DRAINAGE DIAGRAM (NYAMINDI PART)

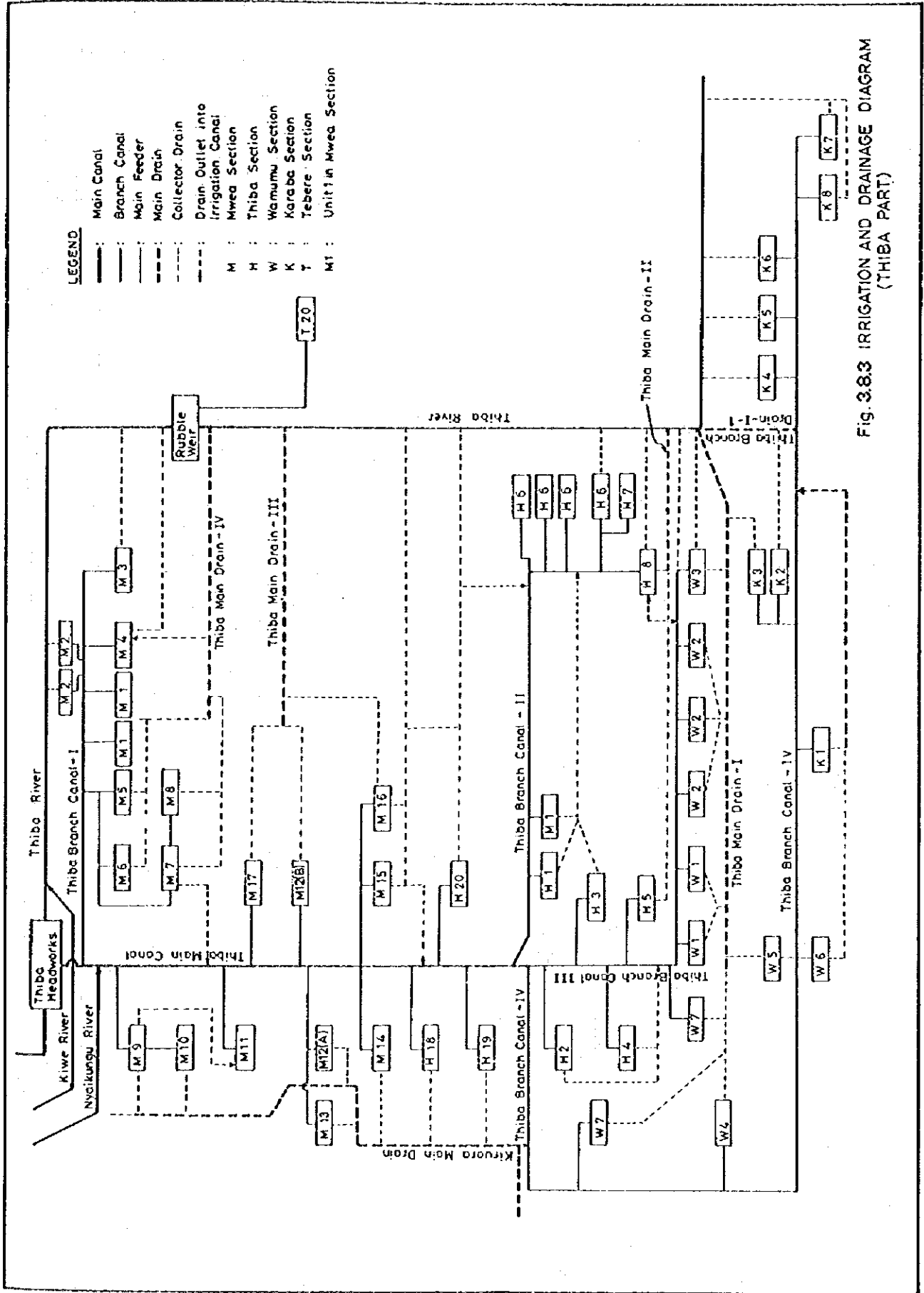


Fig. 3.83 IRRIGATION AND DRAINAGE DIAGRAM (THIBA PART)

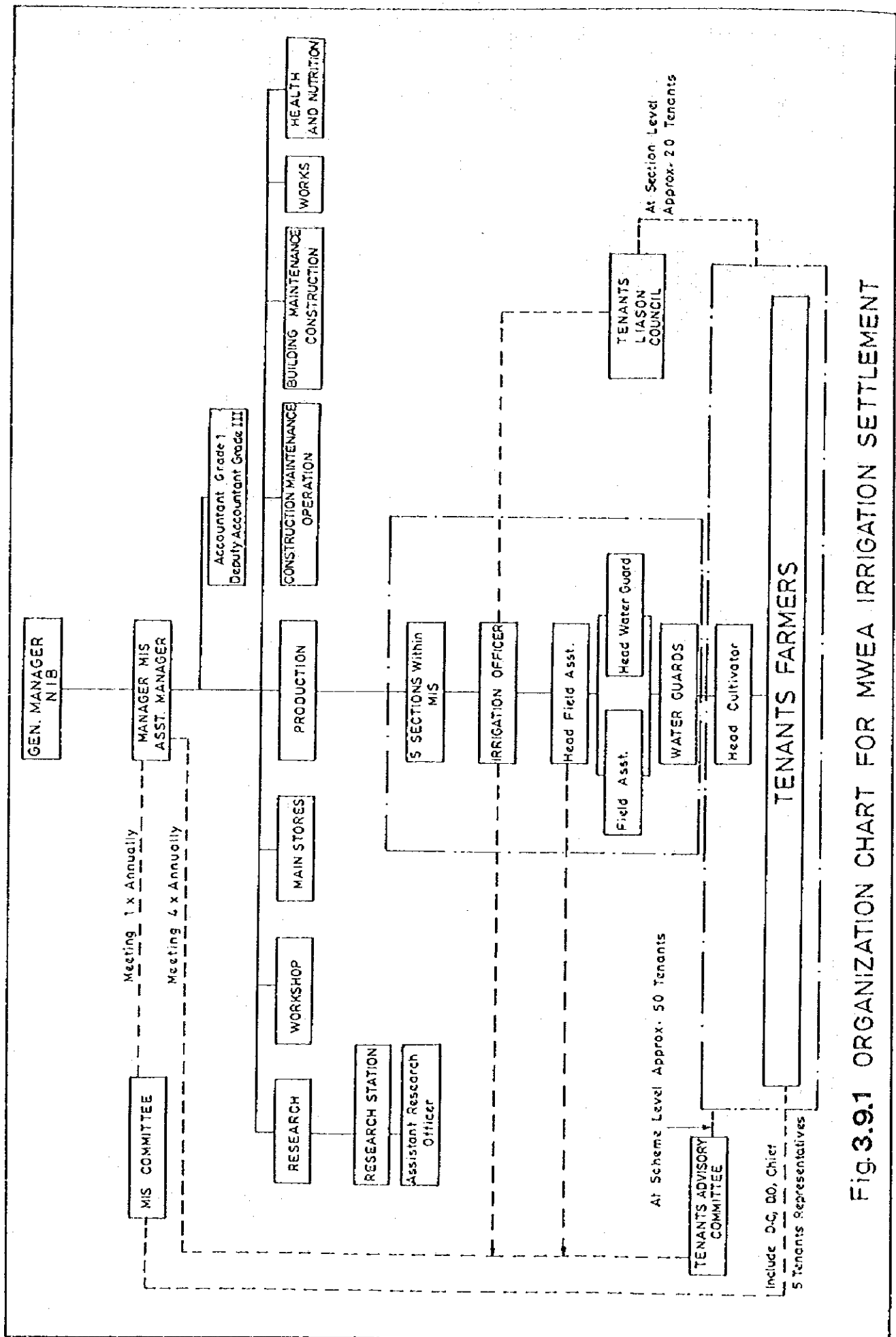


Fig.3.9.1 ORGANIZATION CHART FOR MWEA IRRIGATION SETTLEMENT

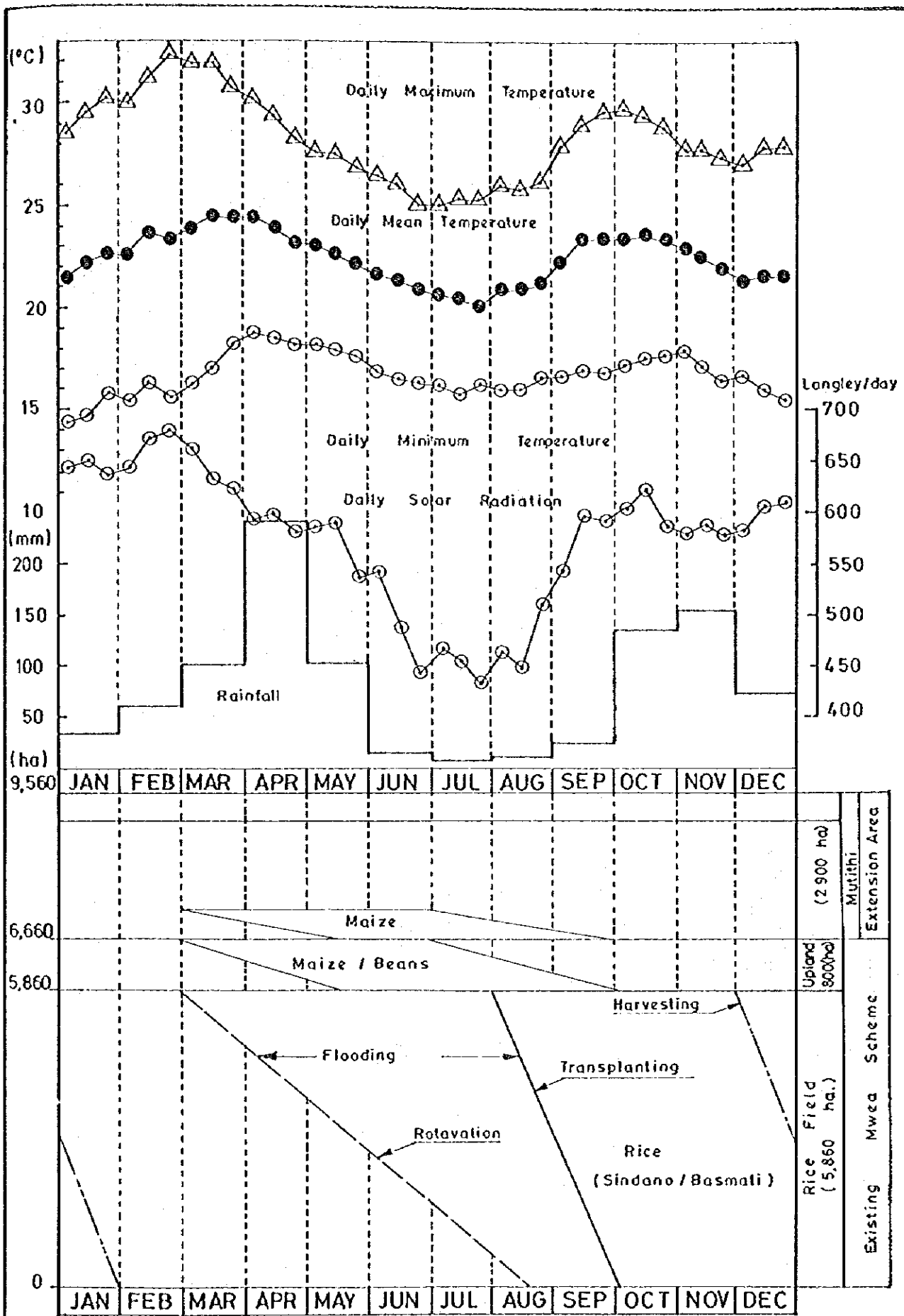


Fig.3.9.2 PRESENT CROPPING PATTERN AND CLIMATIC CONDITION IN WHOLE PROJECT AREA

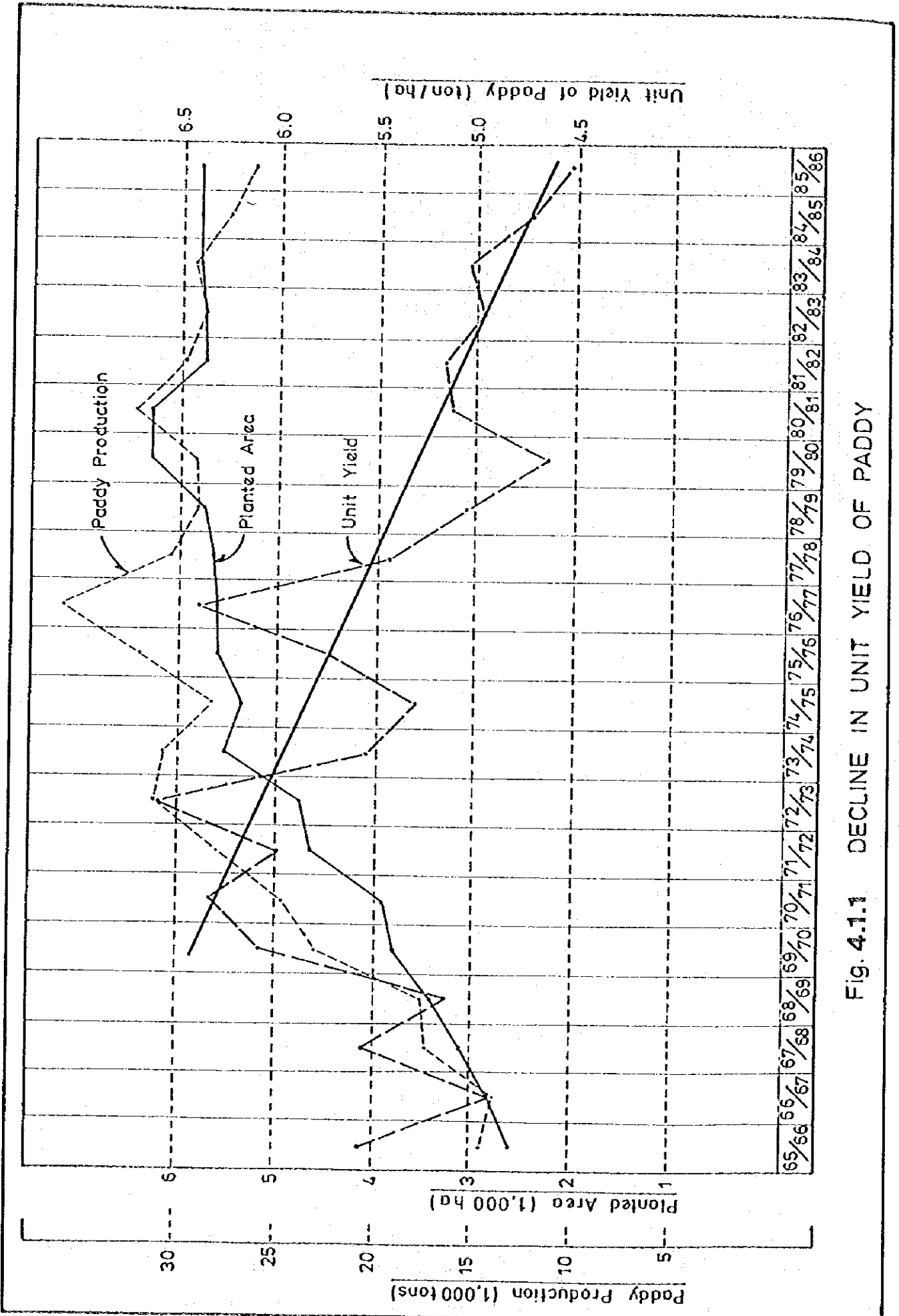


Fig. 4.1.1 DECLINE IN UNIT YIELD OF PADDY

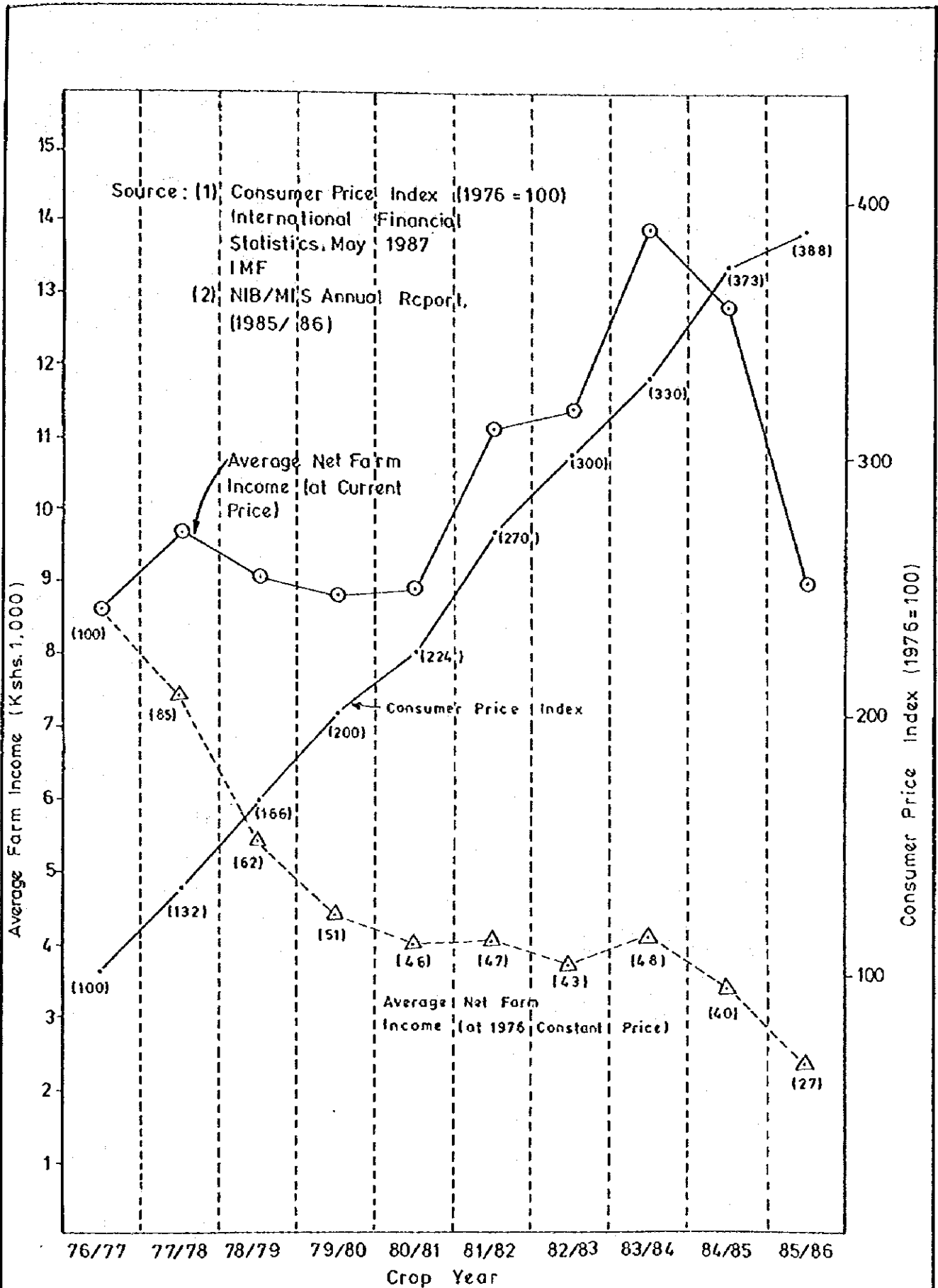


Fig. 4.1.2 DECLINE IN ACTUAL INCOME LEVEL AMONG MIS FARMERS

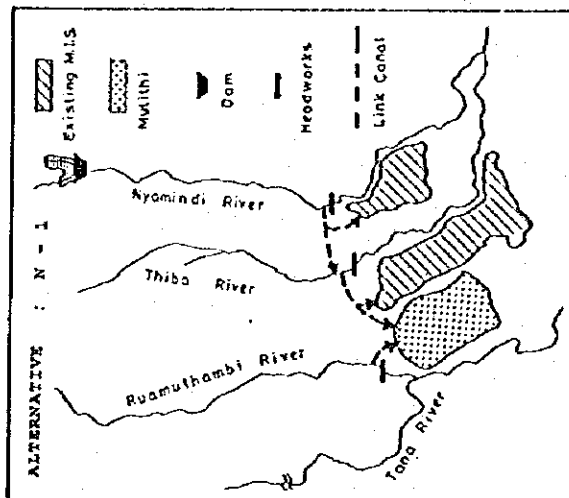
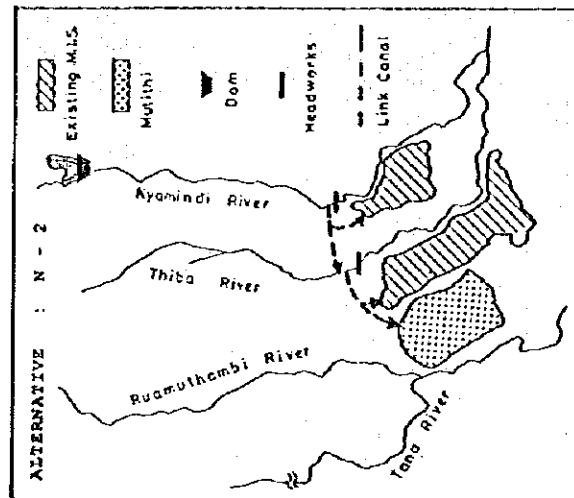
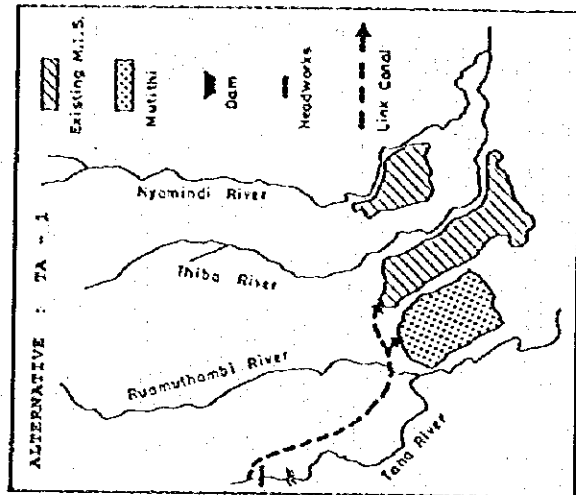
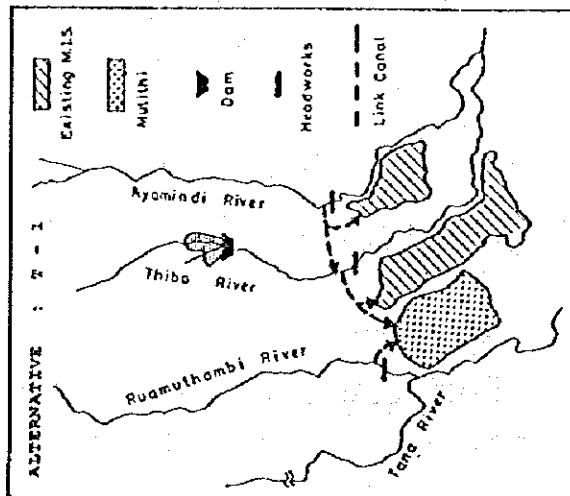
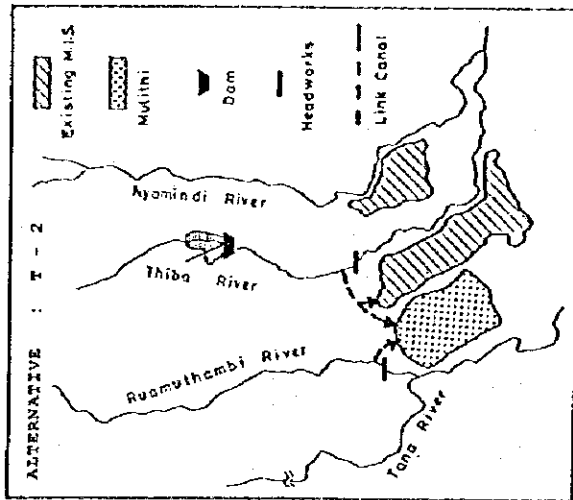
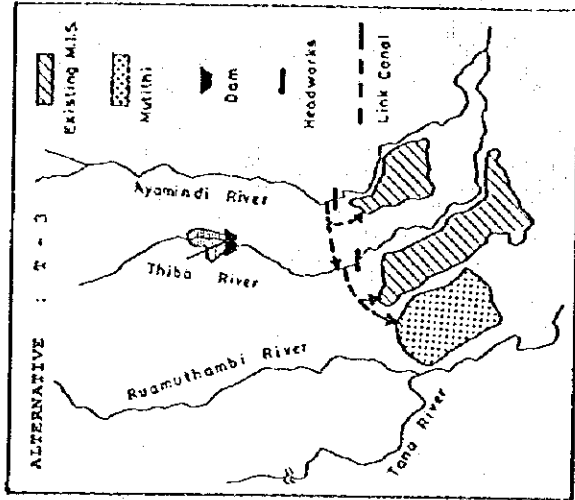
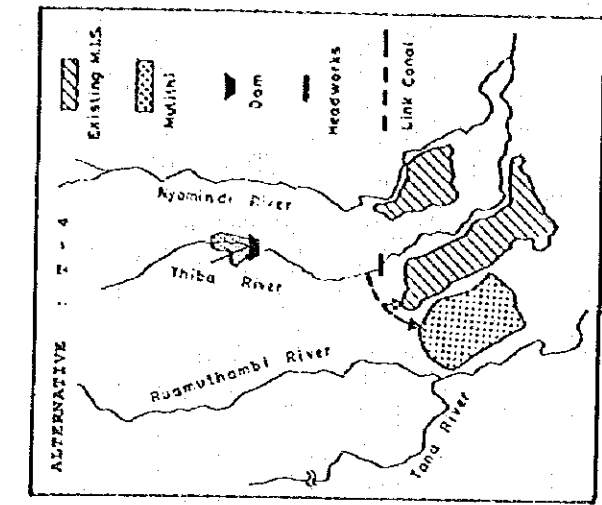


Fig. 4.4.1 POSSIBLE DEVELOPMENT ALTERNATIVES

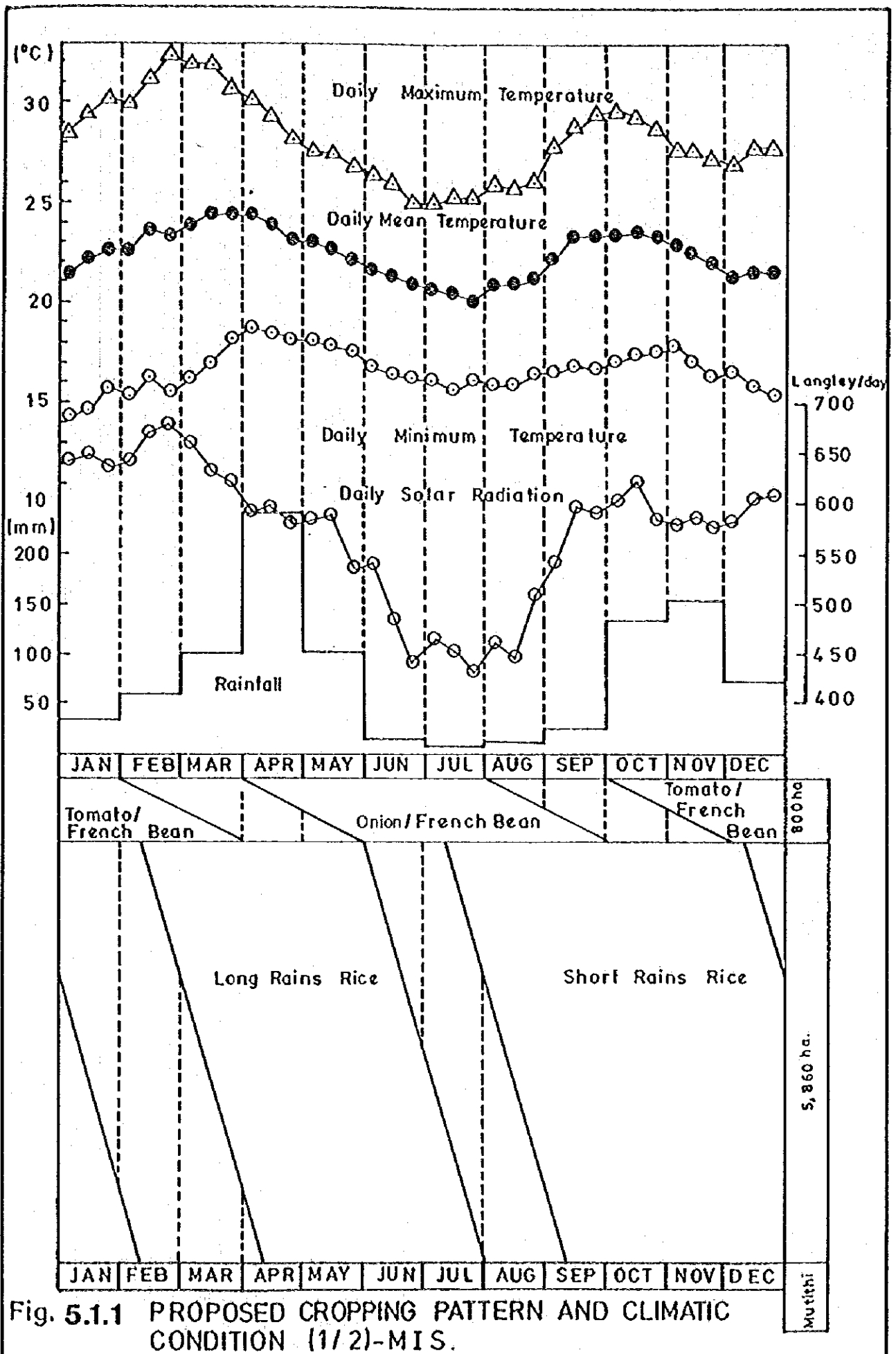


Fig. 5.1.1 PROPOSED CROPPING PATTERN AND CLIMATIC CONDITION (1/2)-MIS.

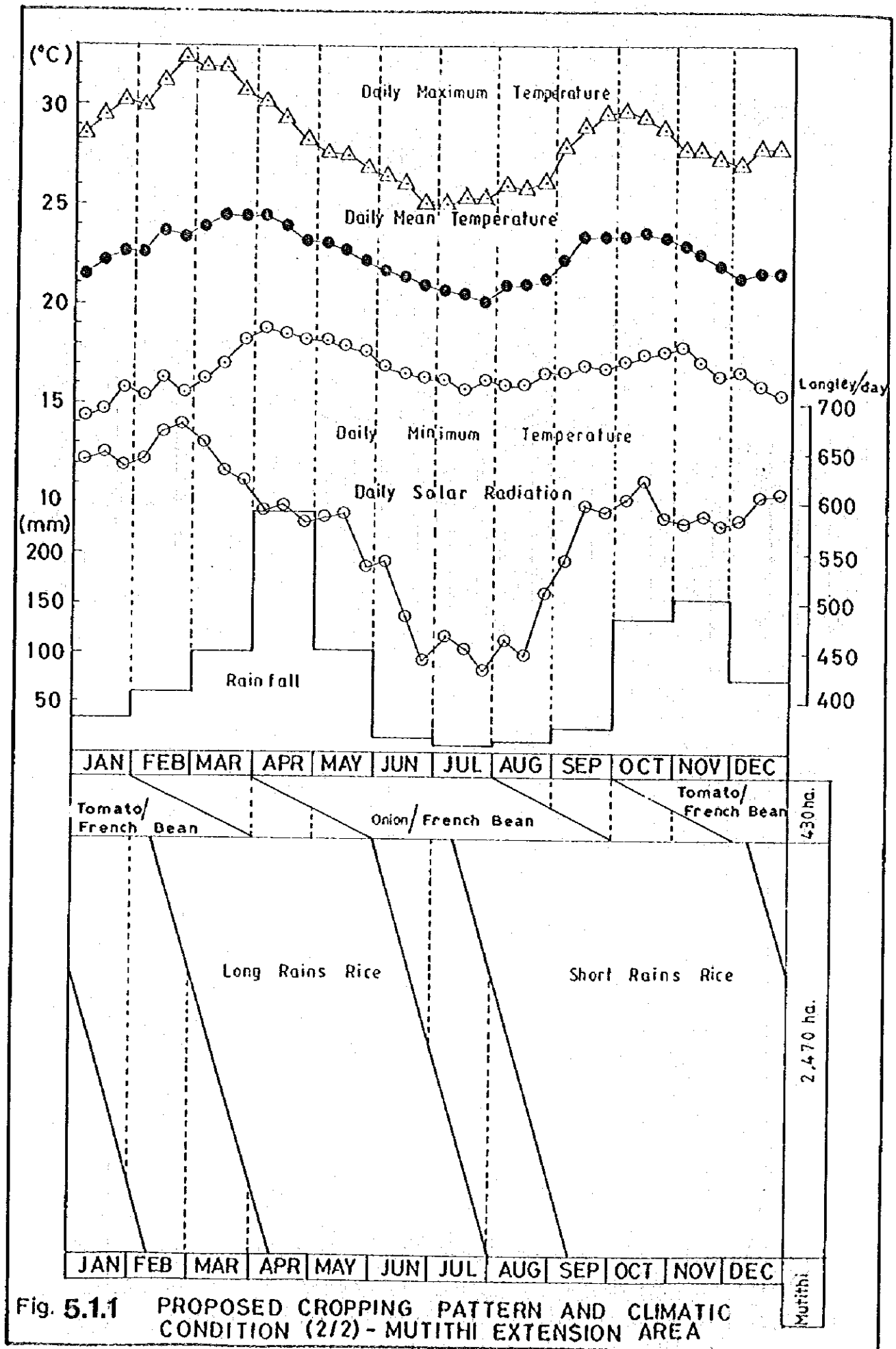


Fig. 5.1.1 PROPOSED CROPPING PATTERN AND CLIMATIC CONDITION (2/2) - MUTITHI EXTENSION AREA

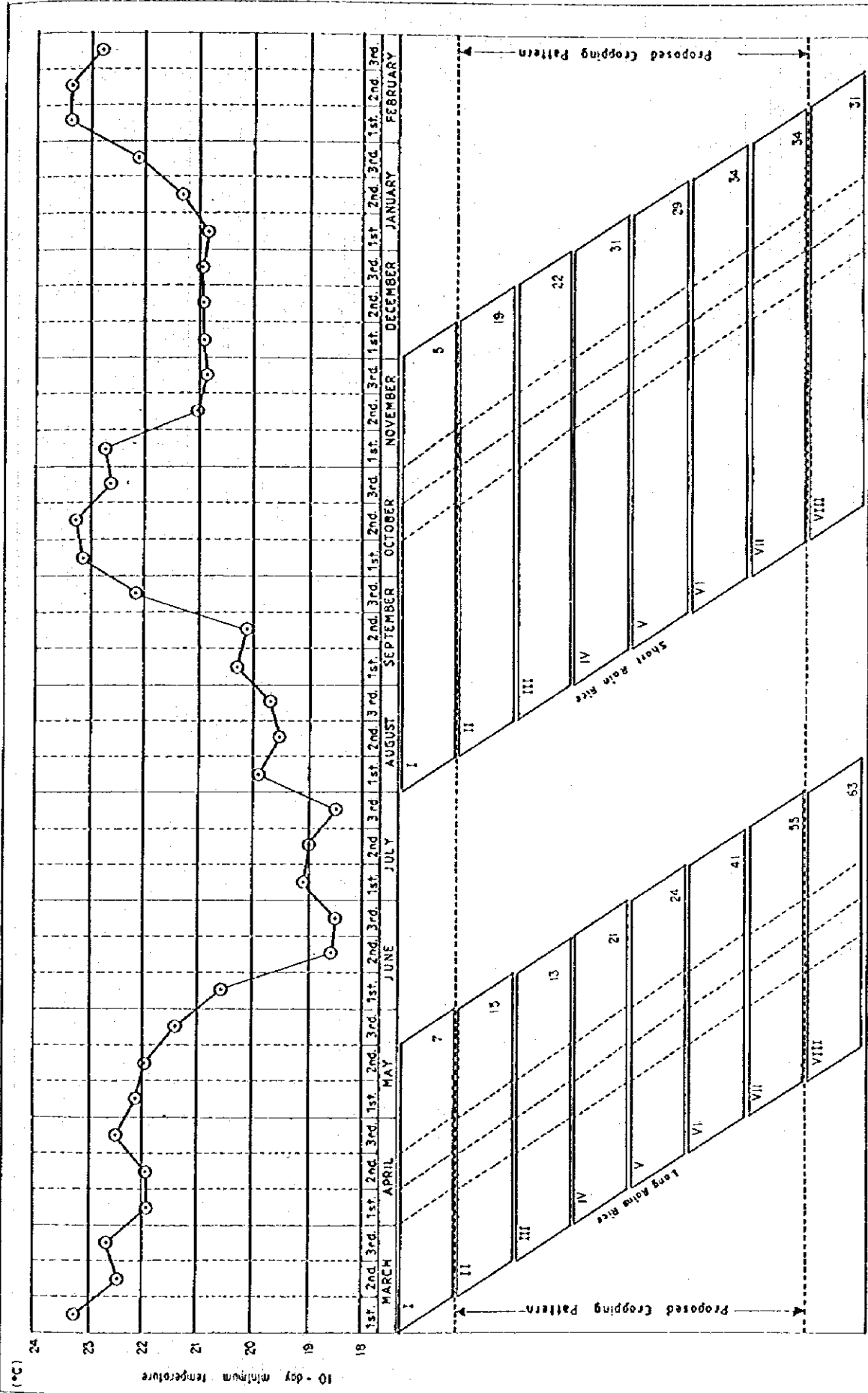


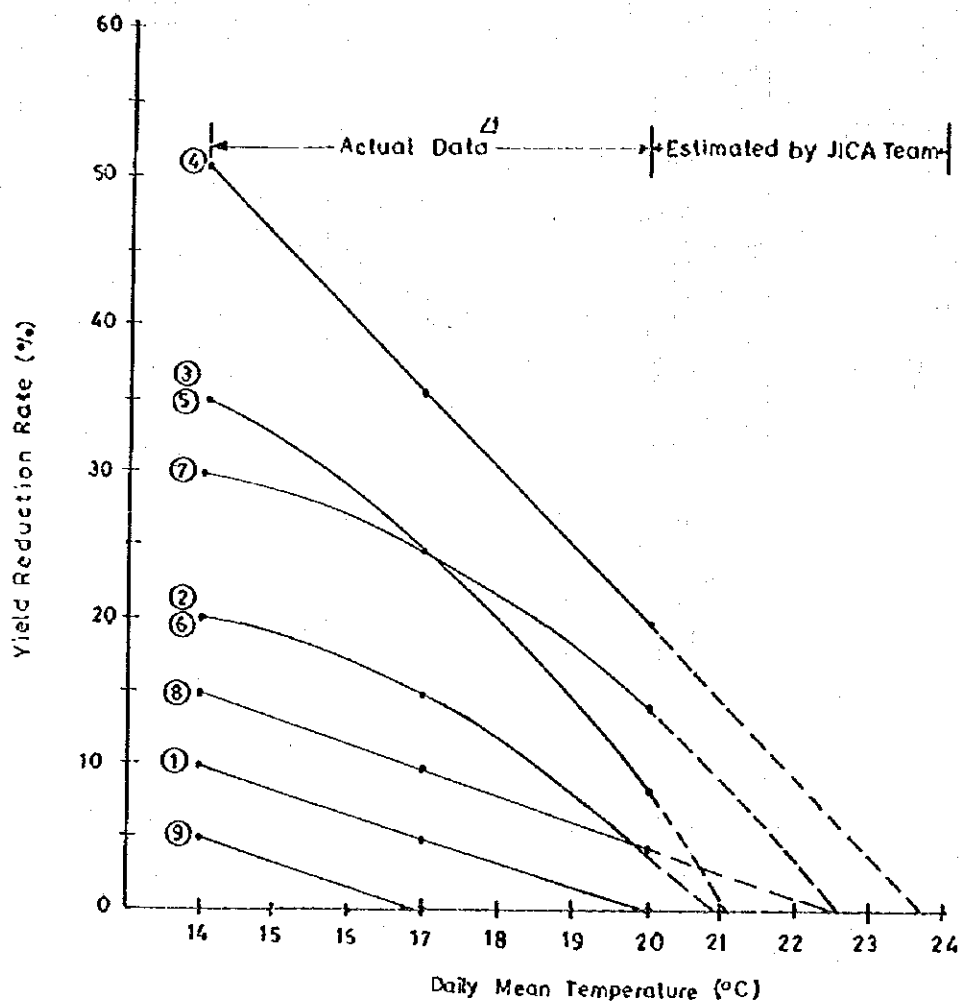
Fig. 5.1.2
 10-DAY MEAN TEMPERATURE
 IN BASIC YEAR AND YIELD
 REDUCTION RATE

Example) Transplanting Harvesting

①: Initial Booting Stage
 ②: Middle Booting Stage
 ③: Heading/Flowering

Note ①②③: Three major critical stage to low temperature

13: Total percentage of yield reduction

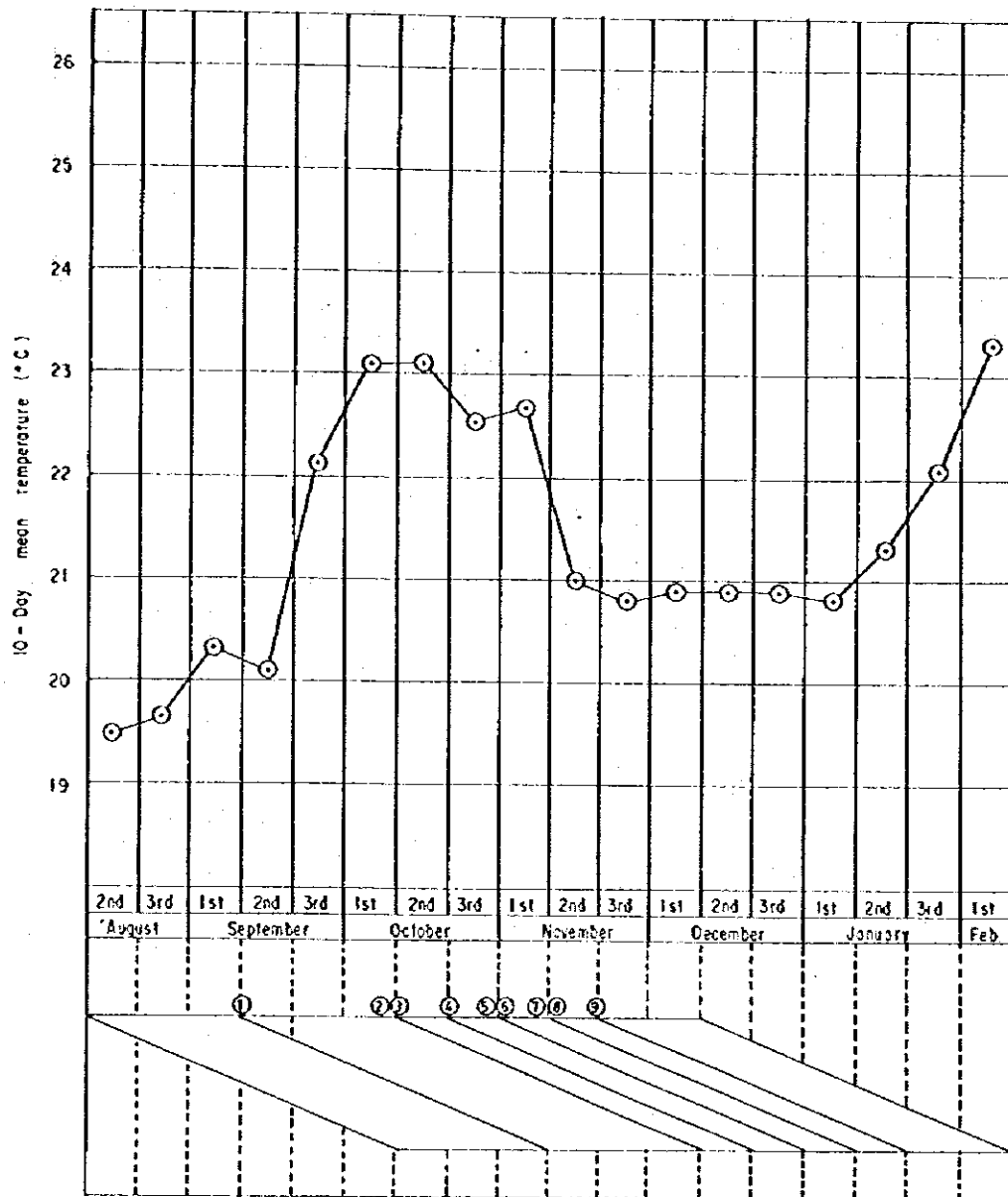


REMARKS:

- ① Tillering Stage
- ② Initial Panicle Formation Stage (30~25 days before heading)
- ③ Middle Panicle Formation Stage (25~15 days before heading)
- ④ Initial Booting Stage (15~10 days before heading)
- ⑤ Middle Booting Stage (10~5 days before heading)
- ⑥ Late Booting Stage (5~0 days before heading)
- ⑦ Heading / Flowering
- ⑧ Initial Ripening Stage (5~10 days after heading)
- ⑨ Middle Ripening Stage (10~25 days after heading)

△: Data from guideline for estimation of yield reduction against low temperature, Japanese Ministry of Agriculture, Forestry and Fishery.

Fig. 5.1.3 YIELD REDUCTION AND LOW TEMPERATURE

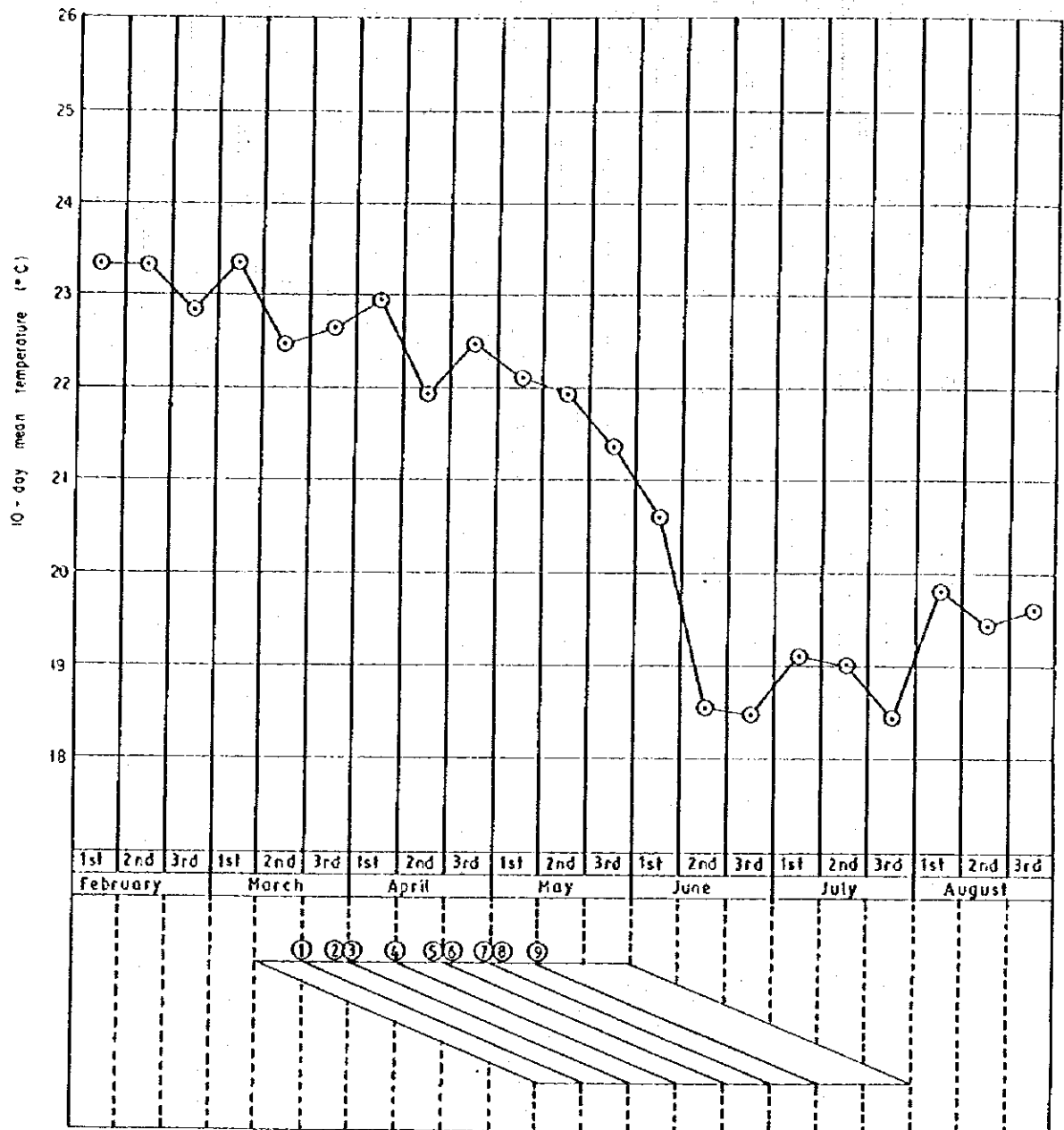


Yield Reduction Rate L1 (%)

① Tilling stage	0	0	0	0	0	0												Average (%)	0
② Initial Panicle Formation stage					0	0	0	0	2	1								1	
③ Middle Panicle Formation stage					0	0	0	3	4	4							2		
④ Initial Booting Stage						7	6	15	15	15	15						12		
⑤ Middle Booting Stage							0	3	4	4	4	4					3		
⑥ Late Booting							0	0	2	1	1	1					1		
⑦ Heading / Flowering								10	11	11	11	11	11				11		
⑧ Initial Ripening Stage								3	4	3	3	3	4				3		
⑨ Middle Ripening Stage								0	0	0	0	0	0	0			0		
Yield Reduction Rate per ha through cropping pattern																	29		

(Note) L1 : Yield reduction rate in each 10 days of cropping period
 L2 : Average yield reduction rate in each growing stage for 60 days of cropping period

Fig. 5.1.4 10 - DAY MEAN TEMPERATURE IN BASIC YEAR AND YIELD REDUCTION RATE ON SHORT RAINS RICE UNDER PROPOSED CROPPING PATTERN



Yield Reduction Rate (%)

	1	2	3	4	5	6	7	8	9	Average (%)
① Tilling Stage	0	0	0	0	0	0	0	0	0	0
② Initial Panicle Formation Stage	0	0	0	0	0	0	0	0	0	0
③ Middle Panicle Formation Stage	0	0	0	0	0	0	1			0
④ Initial Booting Stage										11
⑤ Middle Booting Stage				10	7	9	10	13	17	4
⑥ Late Booting Stage				0	0	0	0	6	17	2
⑦ Heading / Flowering				0	0	0	0	2	10	12
⑧ Initial Ripening Stage					4	5	10	12	20	21
⑨ Middle Ripening Stage					2	2	3	4	8	7
Yield Reduction Rate per ha through cropping pattern					0	0	0	0	0	0
										29










(Note) L1 : Yield reduction rate in each 10 days of cropping period

L2 : Average yield reduction rate in each growing stage for 60 days of cropping period

Fig. 5.1.5

10 - DAY MEAN TEMPERATURE IN BASIC YEAR AND YIELD REDUCTION RATE ON LONG RAINS RICE UNDER PROPOSED CROPPING PATTERN

LEGEND

- : Main Canal
- - - - - : Branch Canal
- : Main Feeder Canal
- : Main Drain
- - - - - : Collector Drain
- - - - - : Re-Use Point
- M : Mera Section
- H : Thibe Section
- W : Wamumu Section
- K : Karaba Section
- T : Tabata Section
- M1 : Unit I in Mera Section
-  : Name of Unit
-  : Area of Paddy (ha)
-  : Discharge (m³/s)
-  : Name of Unit
-  : Area of Surrounding Land (ha)
-  : Discharge (m³/s)
-  : Accumulated Area of Paddy (ha)
-  : Accumulated Area of H.C. (ha)
-  : Discharge (m³/s)
- () : Figure in Parenthesis means Irrigable Area By Re-Use of Drainage Water

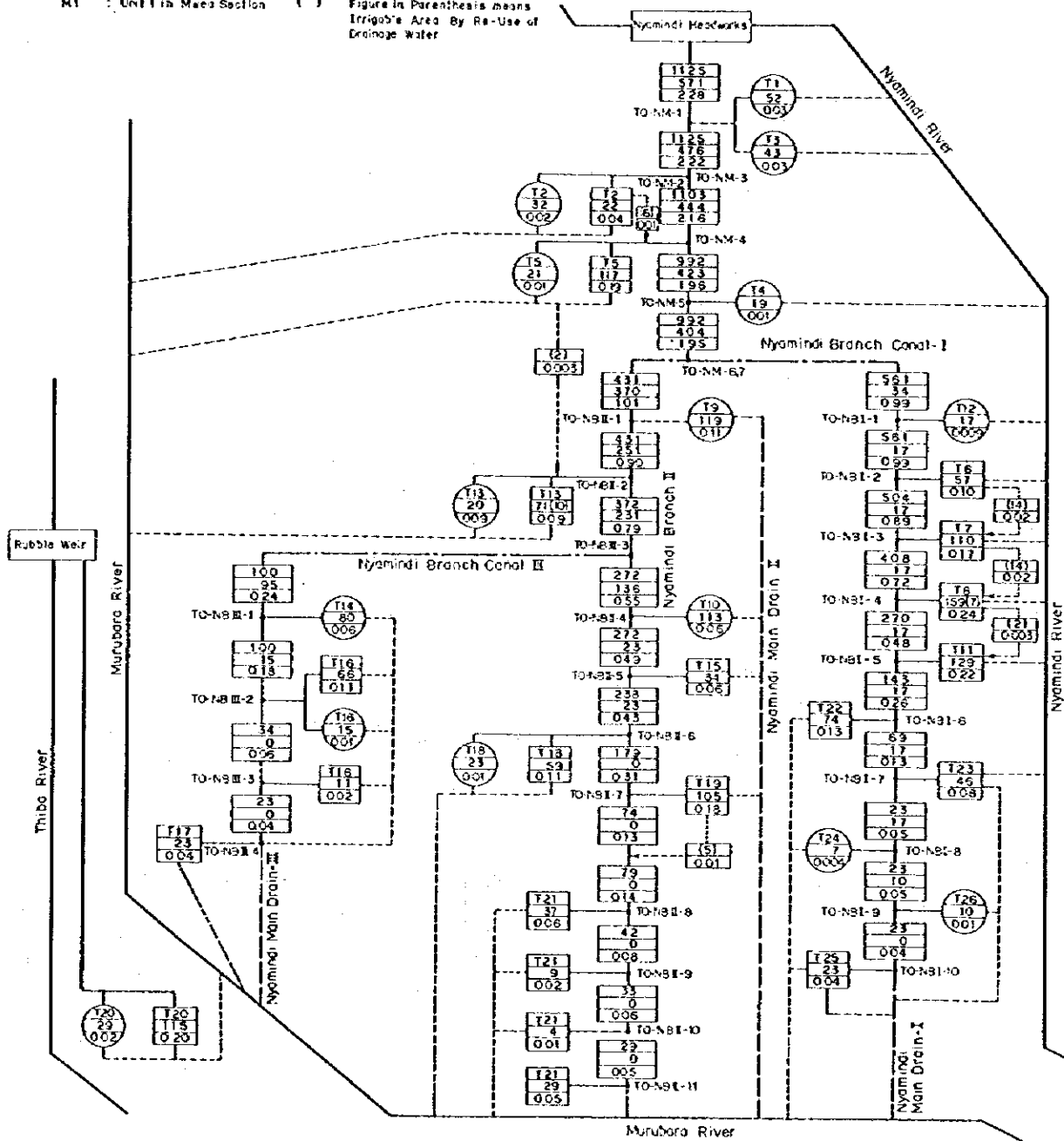


Fig.5.2.1 IRRIGATION DIAGRAM (Nyomindi Part, 1/3)

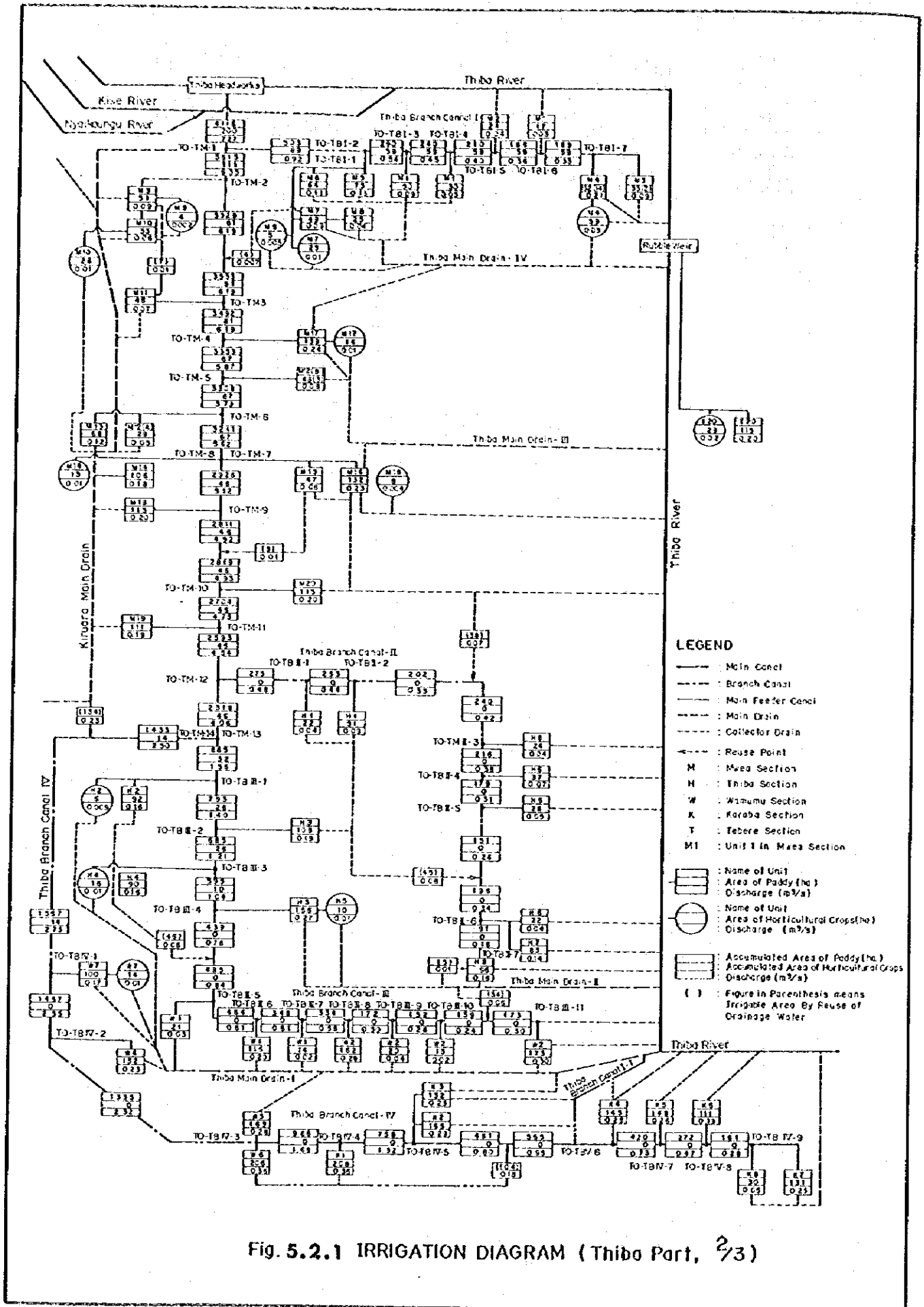


Fig. 5.2.1 IRRIGATION DIAGRAM (Thibo Part, 2/3)

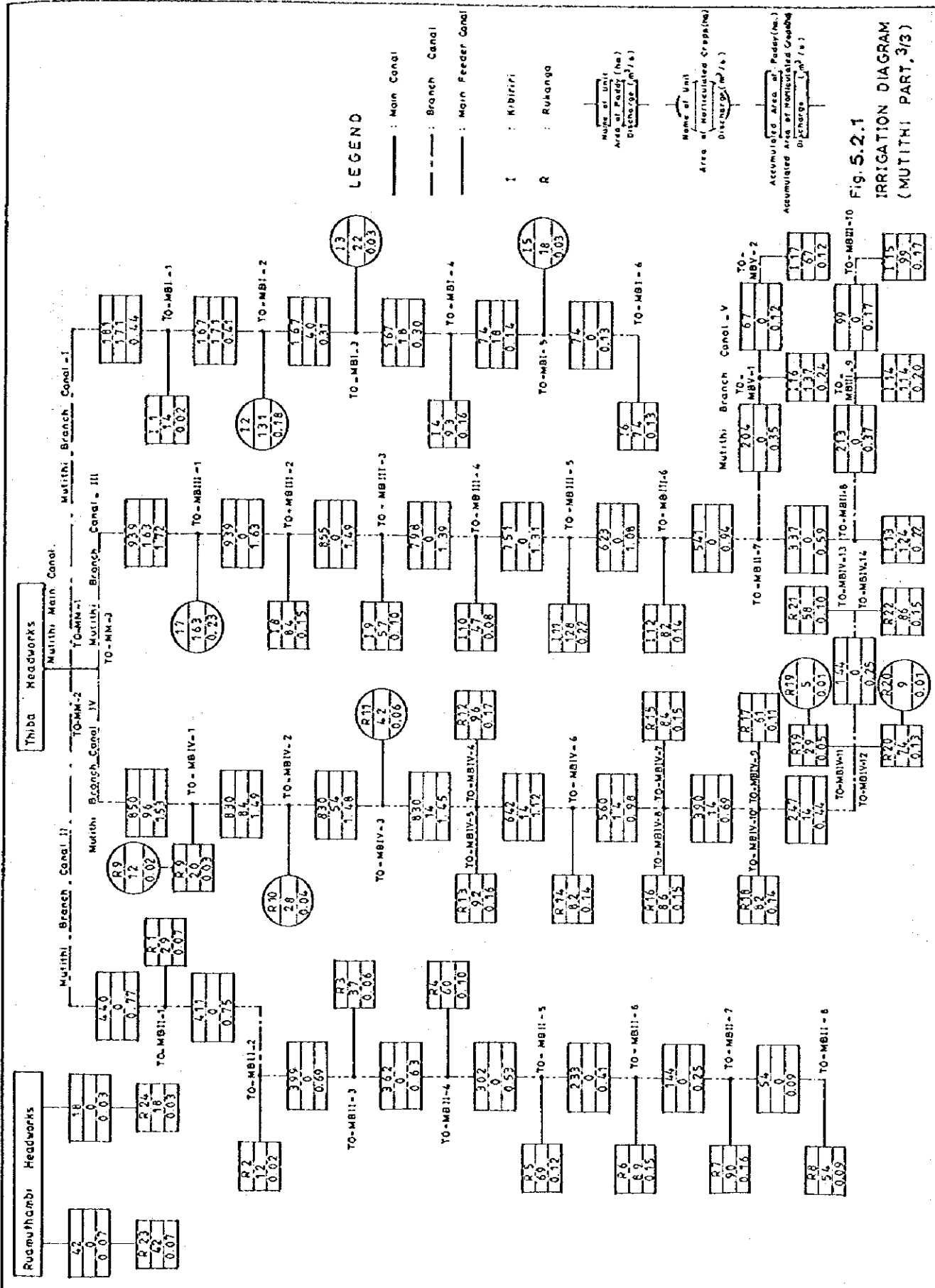
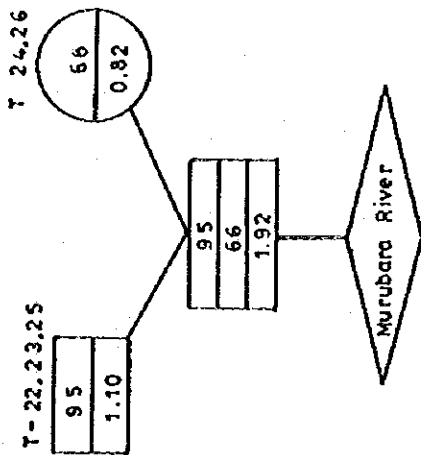
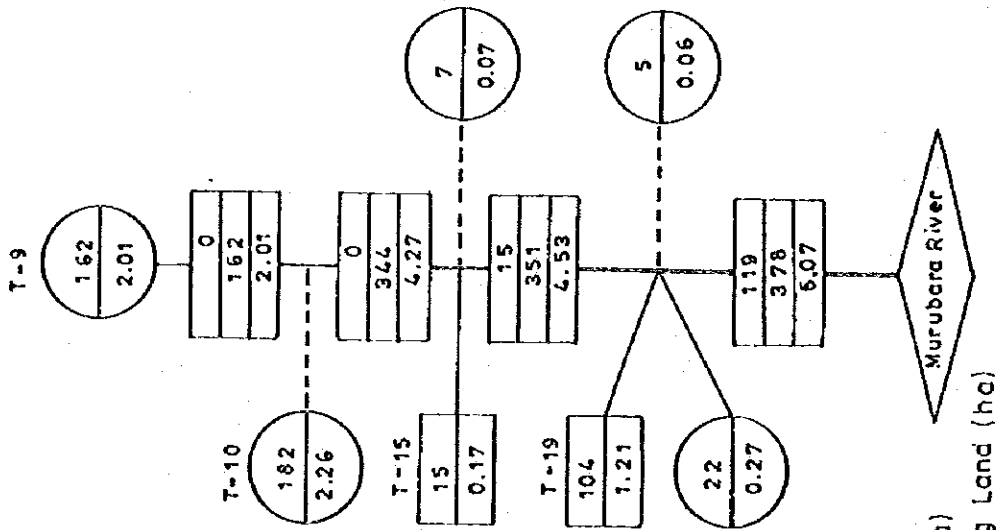


Fig. 5.2.1
IRRIGATION DIAGRAM
(MUTITHI PART, 3/3)

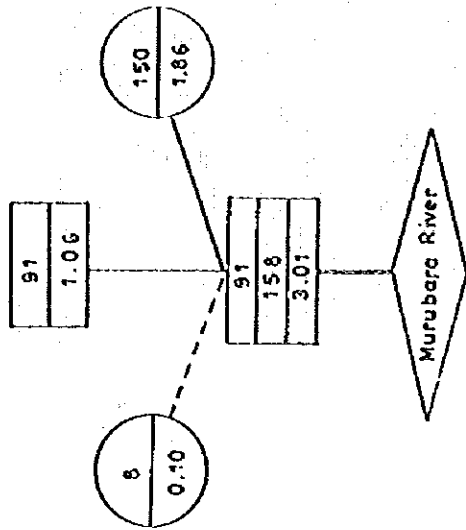
Nyamindi Main Drain - I



Nyamindi Main Drain - II



Nyamindi Main Drain - III



LEGEND

- : Main Drain
- : Collector Drain
- ▭ : Area of Paddy (ha)
- ▭ : Discharge (m^3/s)
- : Area of Surrounding Land (ha)
- : Discharge Area (m^3/s)
- ▭ : Accumulated Area of Paddy (ha)
- ▭ : Accumulated Area of Surrounding Land (ha)
- ▭ : Discharge (m^3/s)

Fig.5.2.2 DRAINAGE DIAGRAM (1/5) (NYAMINDI PART)

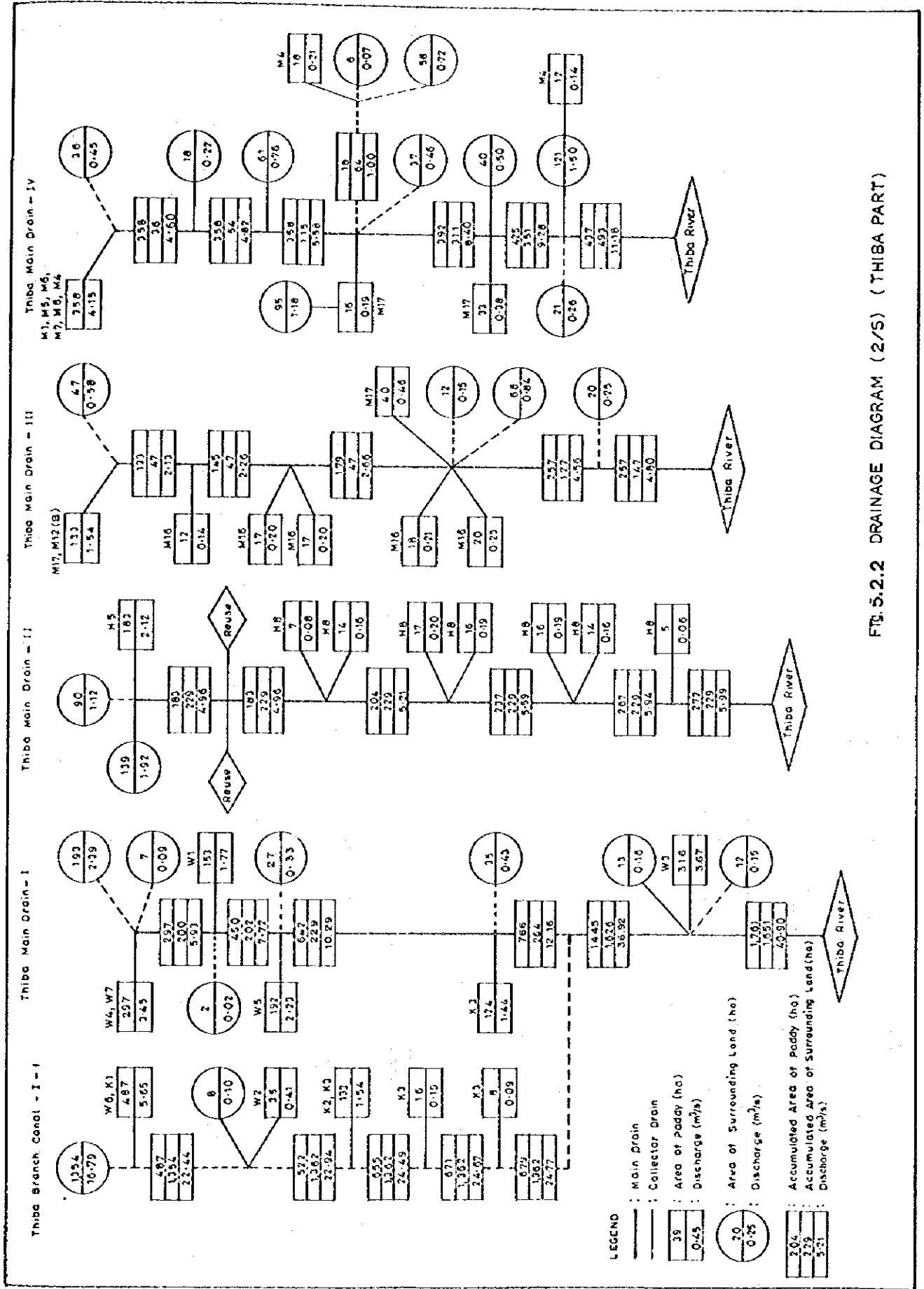


FIG. 5.2.2 DRAINAGE DIAGRAM (2/S) (THIBA PART)

Kiruru Main Drain.

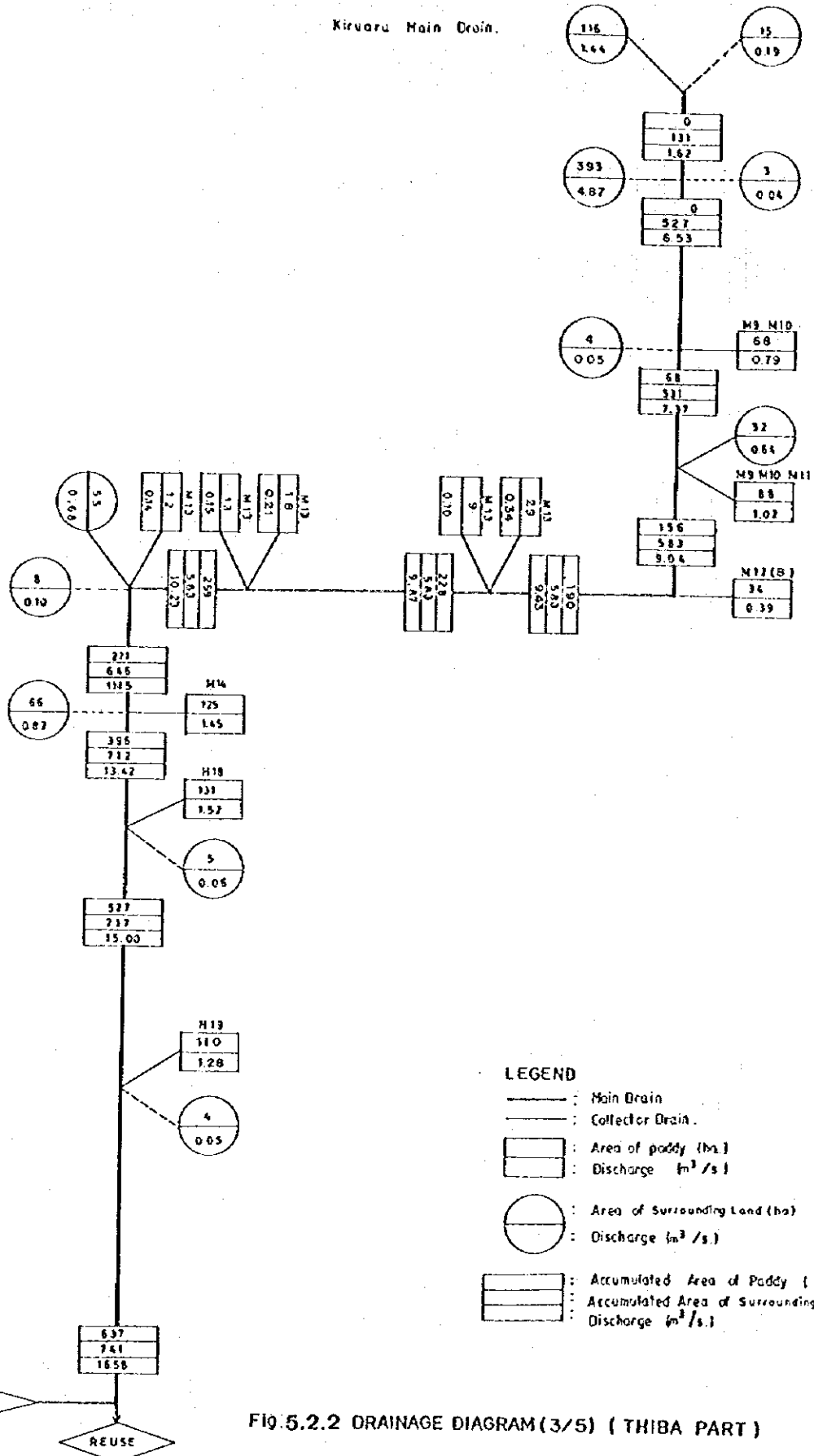


FIG. 5.2.2 DRAINAGE DIAGRAM (3/5) (THIBA PART)

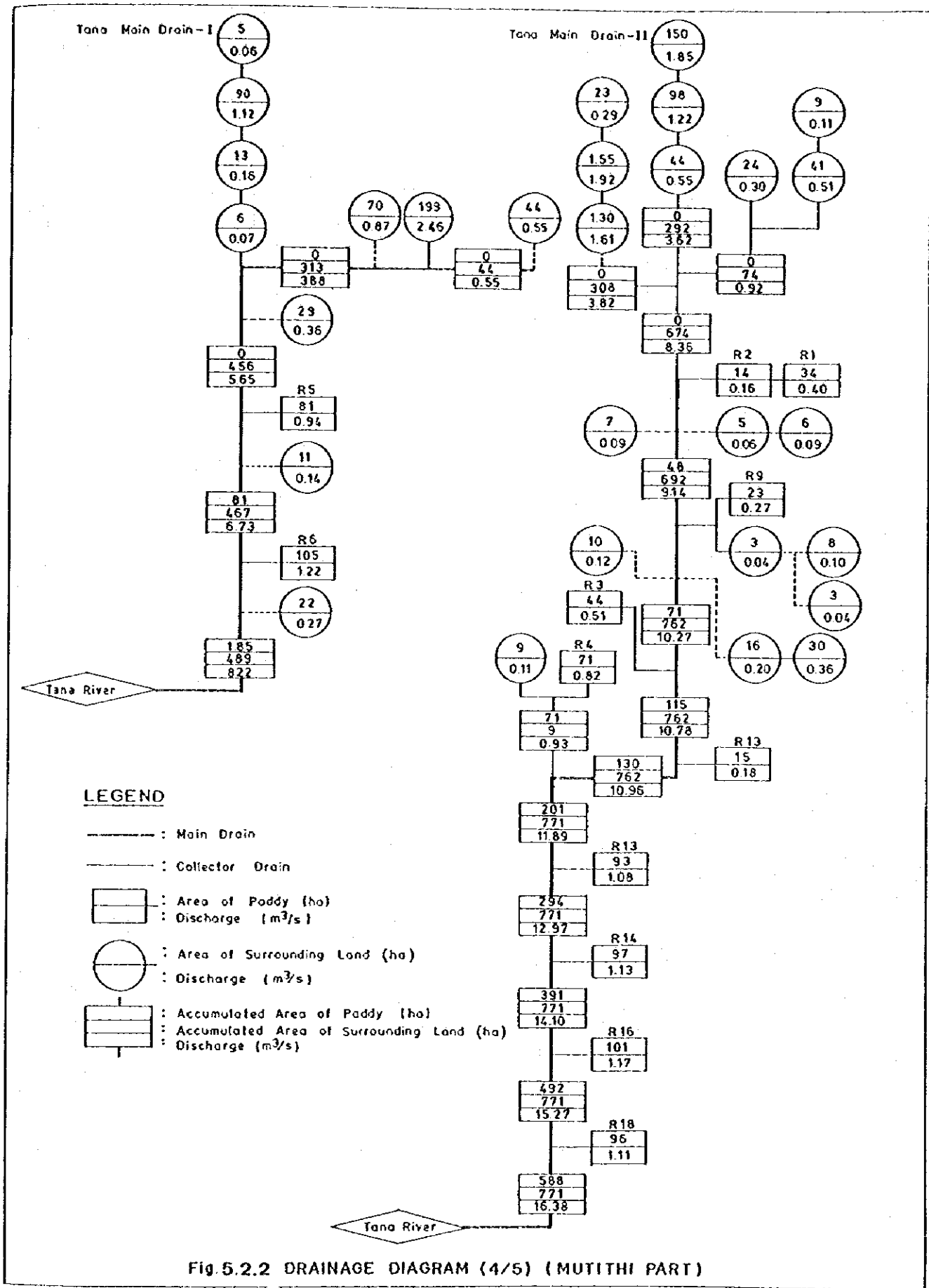


Fig.5.2.2 DRAINAGE DIAGRAM (4/5) (MUTITHI PART)

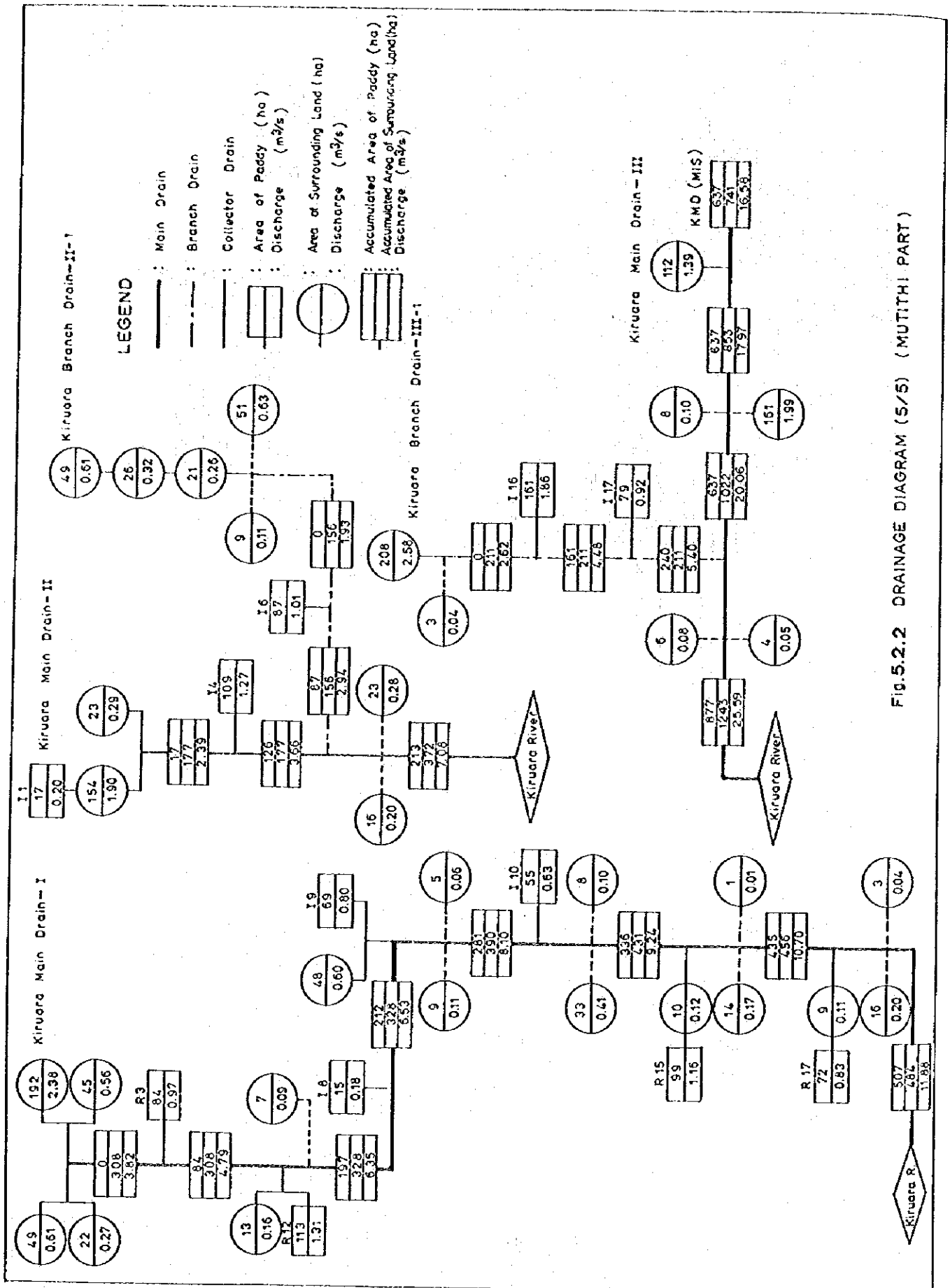


Fig.5.2.2 DRAINAGE DIAGRAM (S/5) (MUTITHI PART)

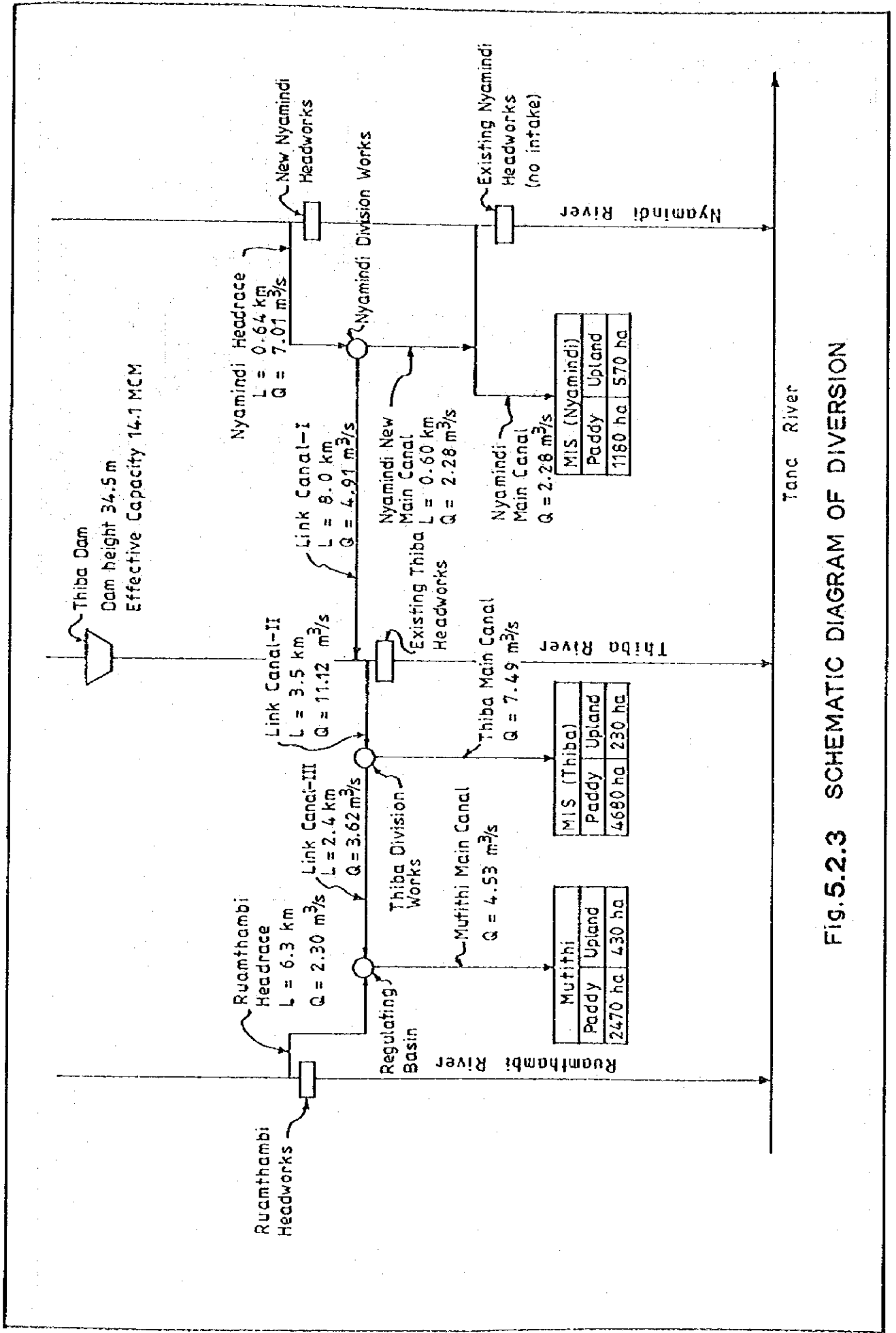


Fig. 5.2.3 SCHEMATIC DIAGRAM OF DIVERSION

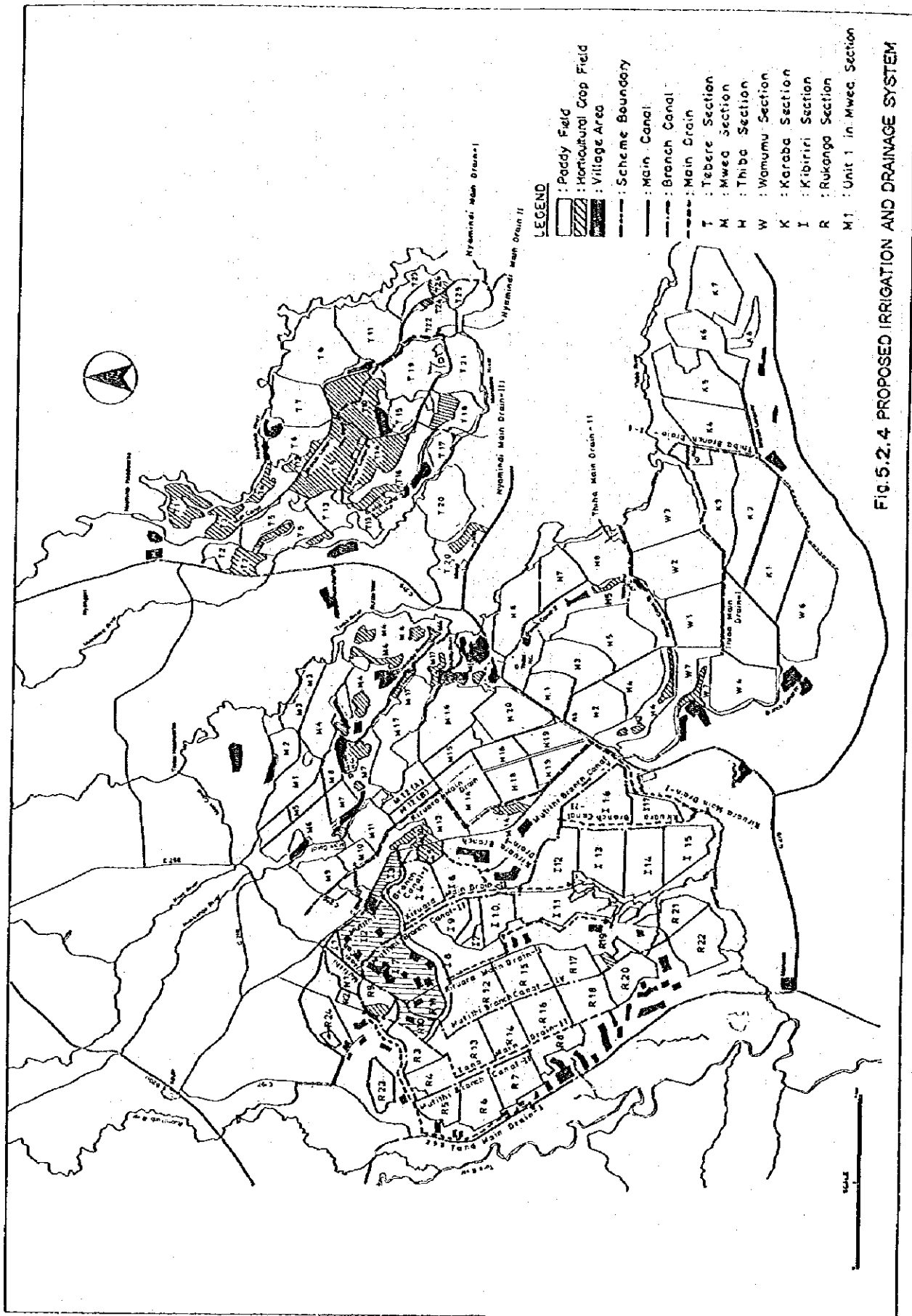


FIG. 5.2.4 PROPOSED IRRIGATION AND DRAINAGE SYSTEM

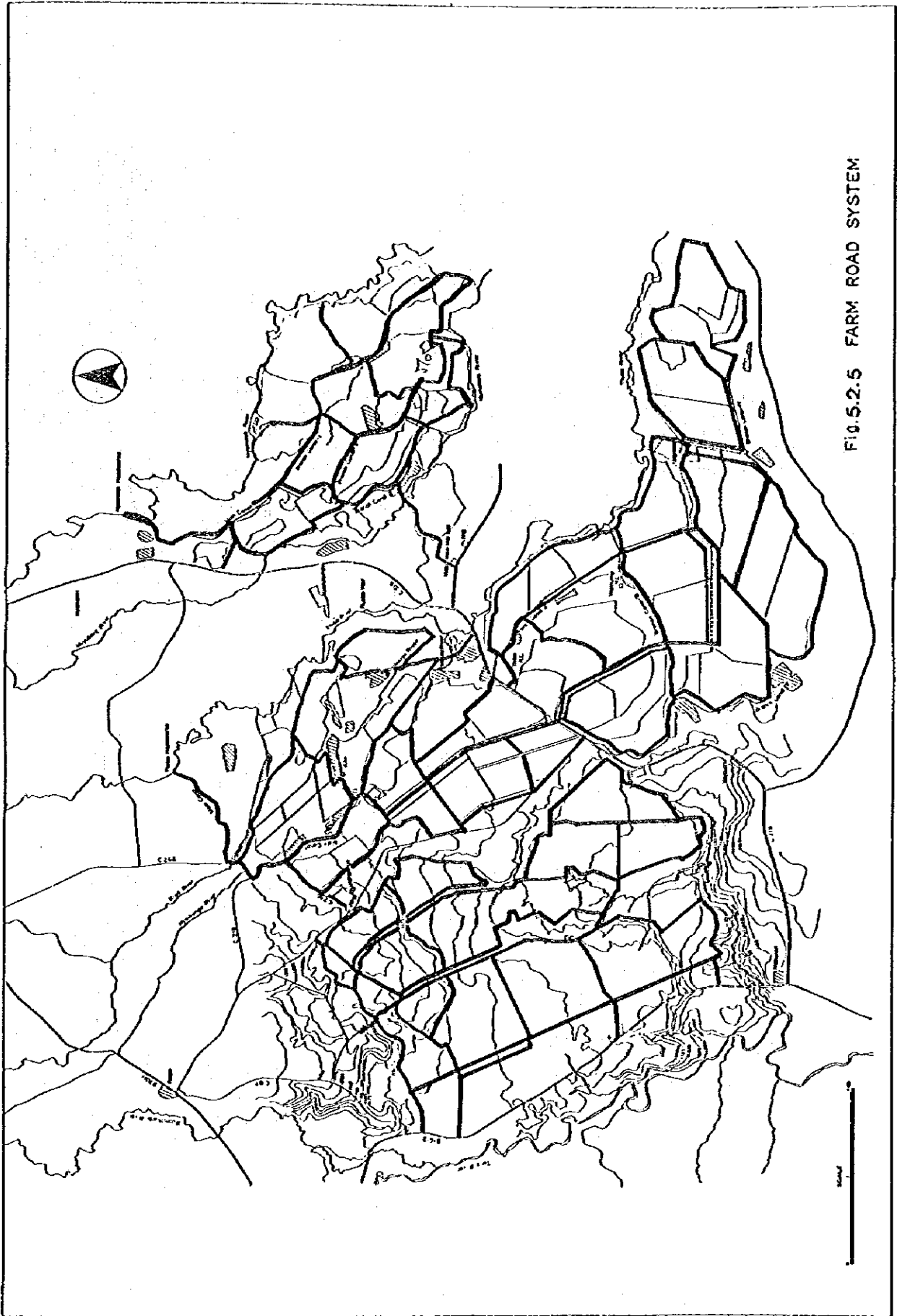


FIG. 5.2.5 FARM ROAD SYSTEM

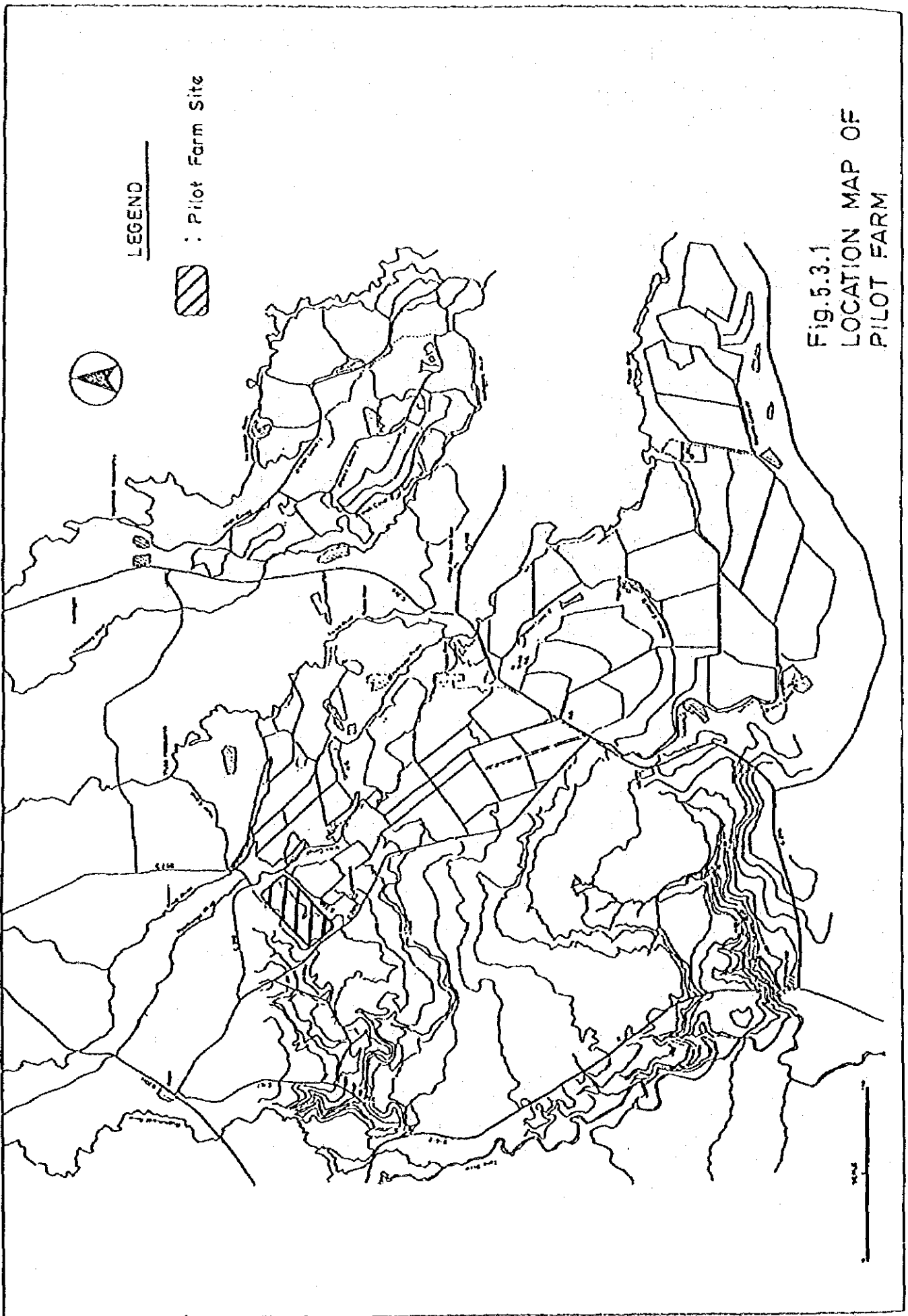


Fig.5.3.1
LOCATION MAP OF
PILOT FARM

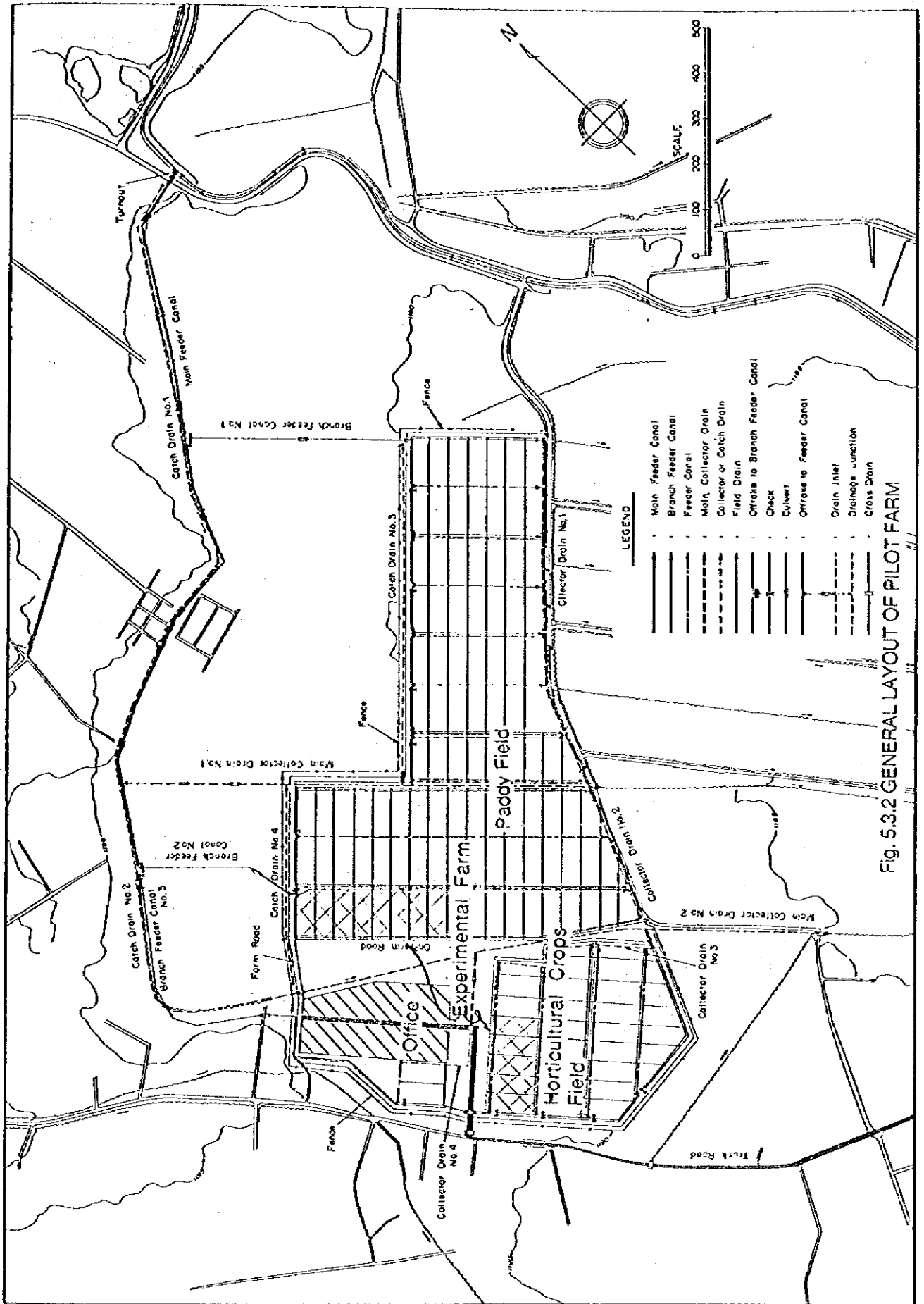
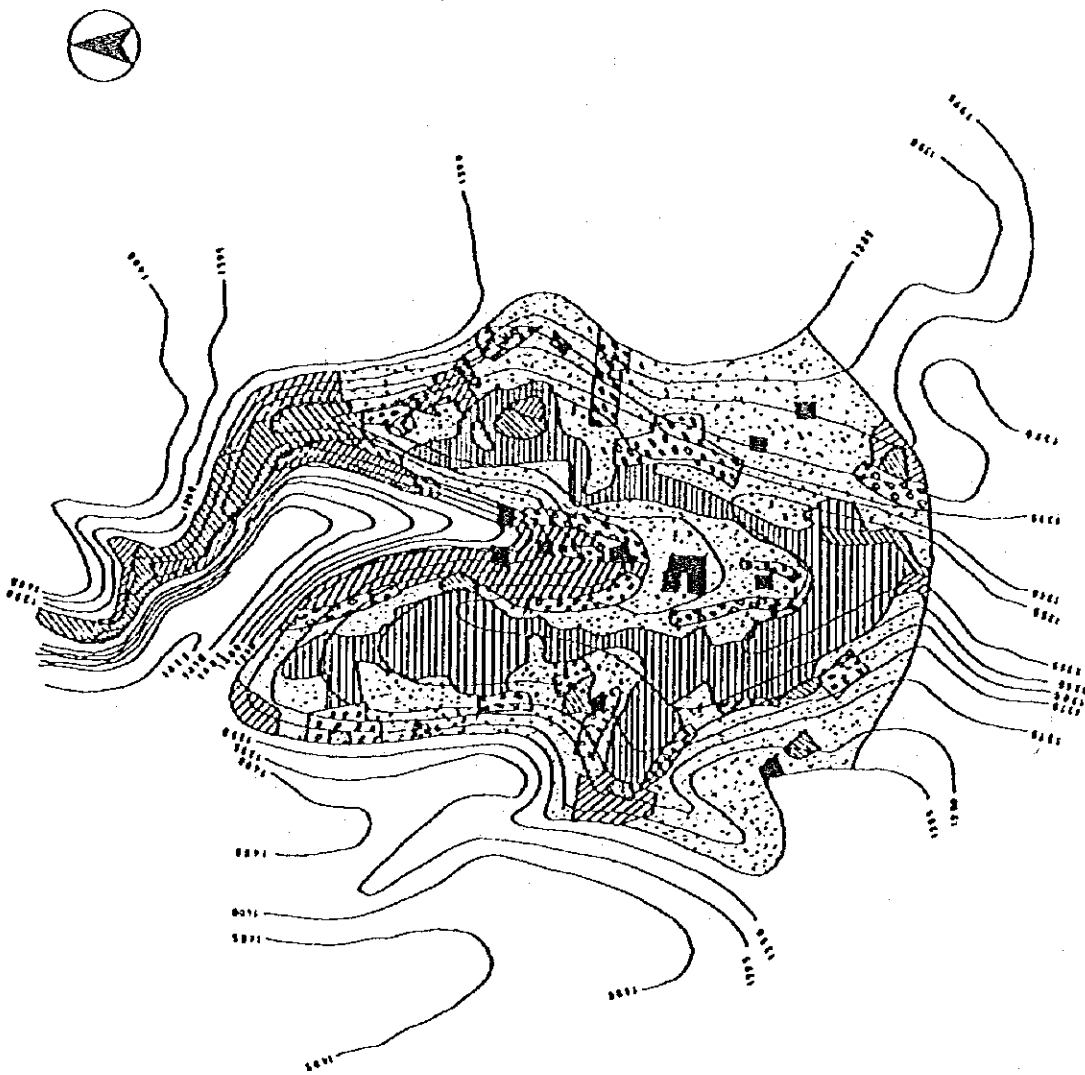


Fig. 5.3.2 GENERAL LAYOUT OF PILOT FARM



LEGEND

	Area	No	(%)
Coffee		14.0	(9.9)
Maize etc.		66.7	(47.0)
Forest		9.9	(7.0)
Bush		10.6	(7.5)
Swampy Grassland		31.1	(21.9)
Residential		1.6	(1.1)
Total		141.9	(100.0)

REMARKS: 1 Number of farm households is assumed to be 28.

2 Elevation below 1200 m will be sunk under the water.



Fig. 5.3.3 PRESENT LAND USE CONDITION IN THE RESERVOIR AREA

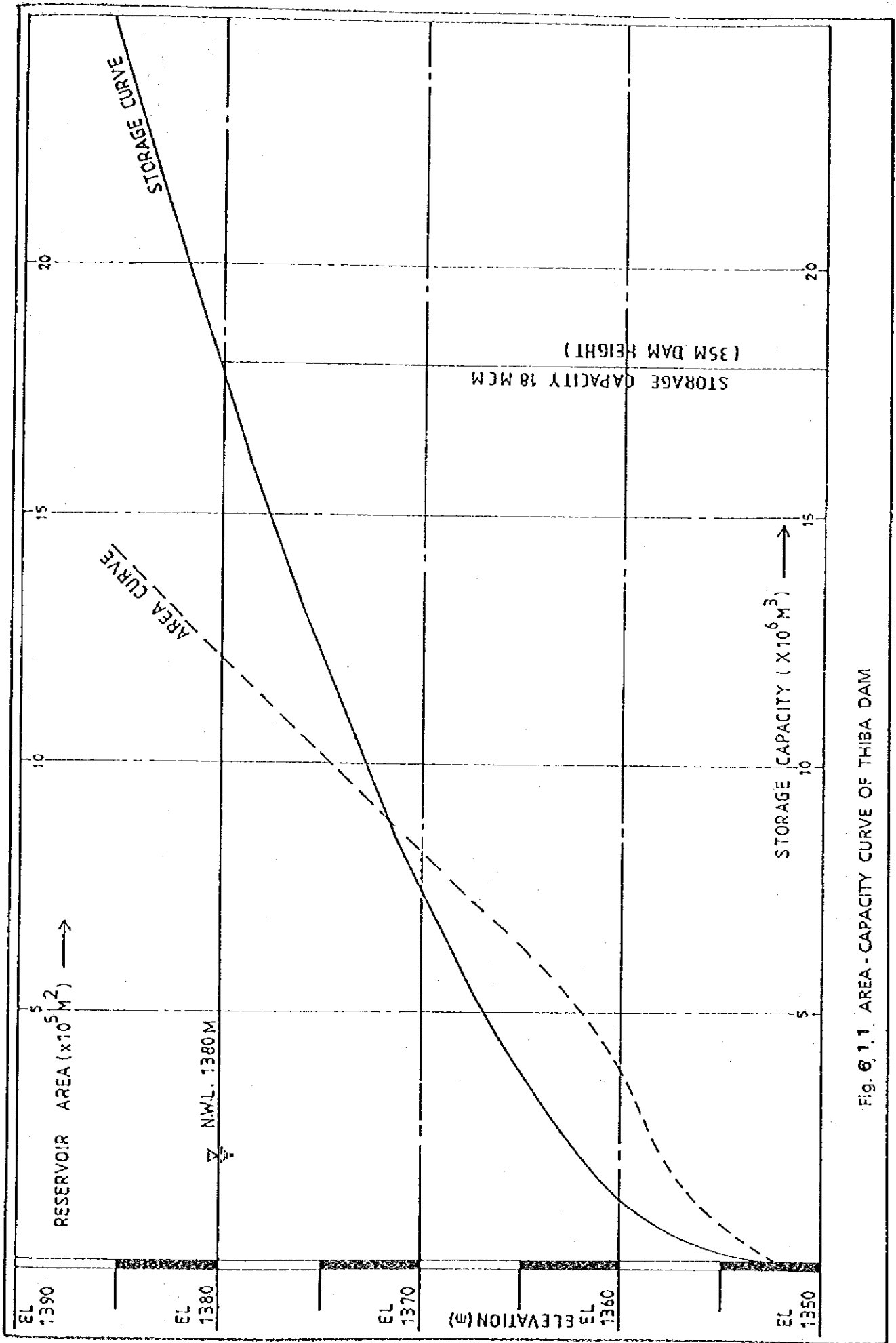


Fig. 6.1.1. AREA - CAPACITY CURVE OF THIBA DAM

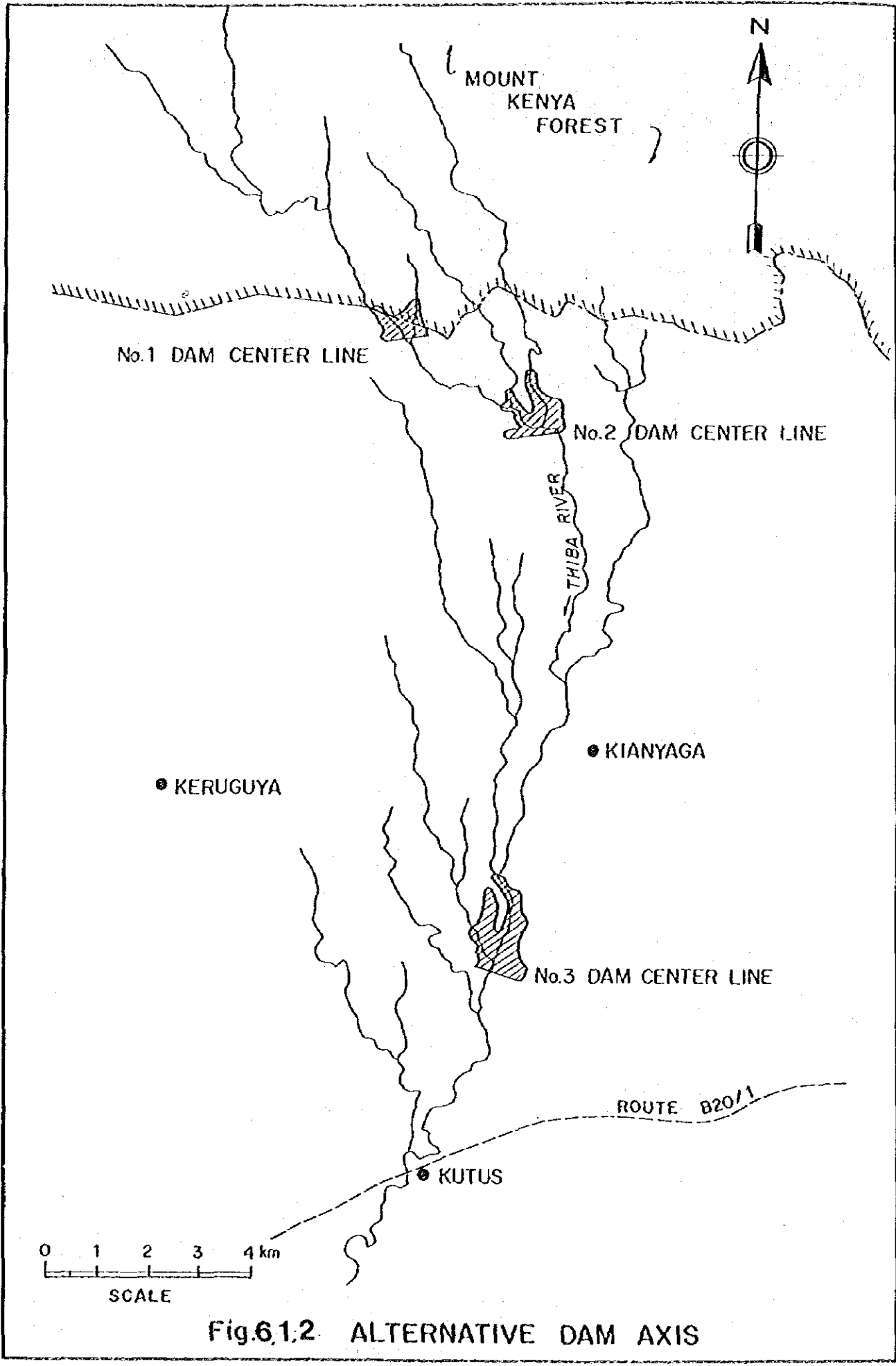


Fig.6.1.2 ALTERNATIVE DAM AXIS

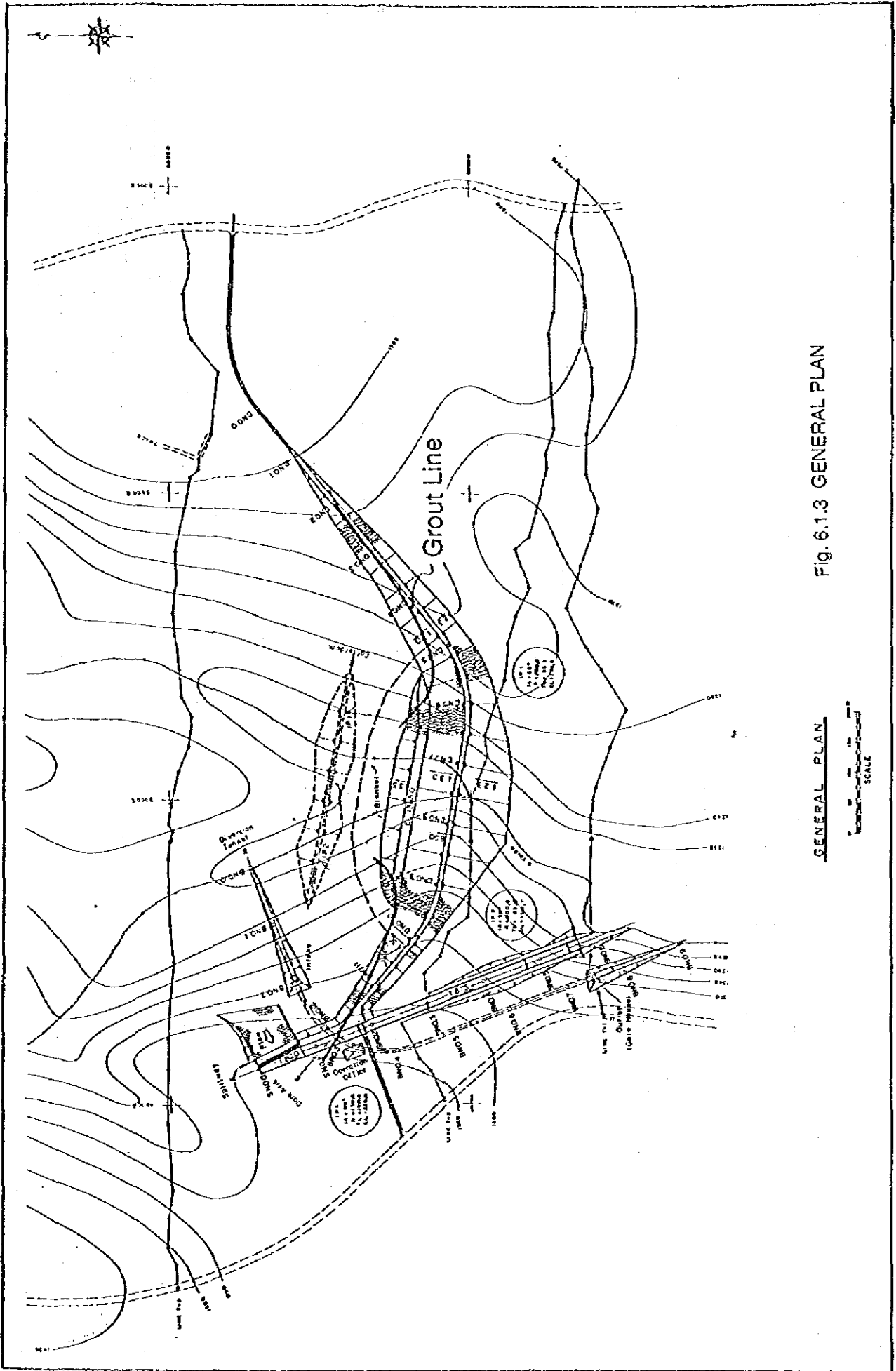
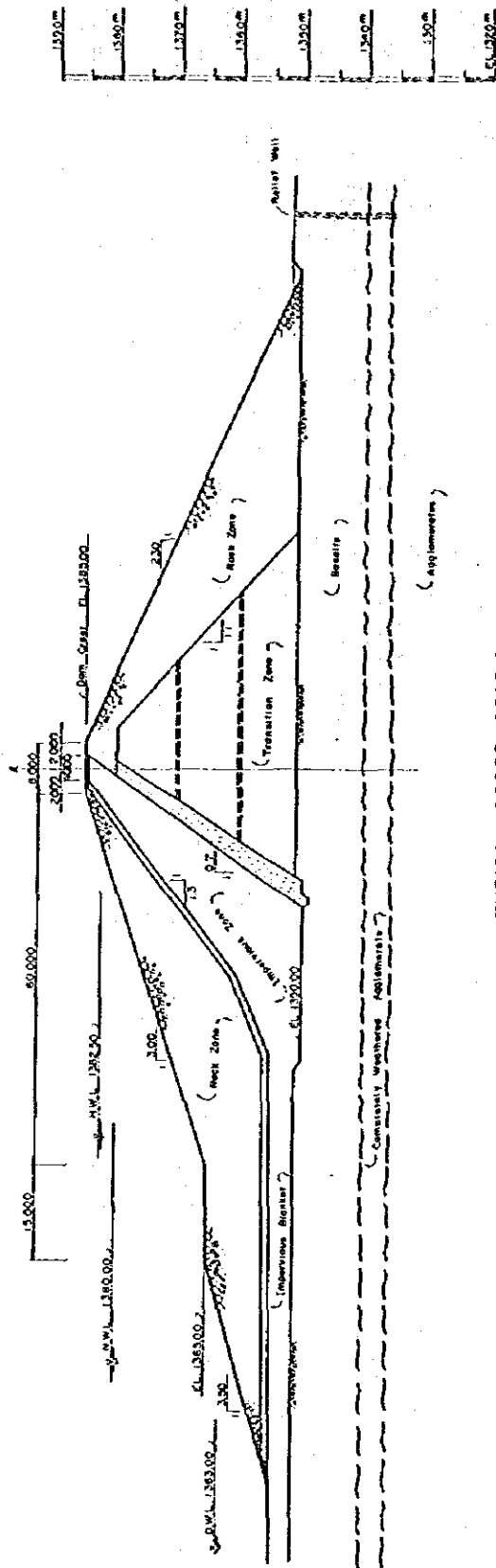


Fig. 6.1.3 GENERAL PLAN



TYPICAL CROSS SECTION
SCALE - A

Fig. 6.1.4 CROSS SECTION OF DAM

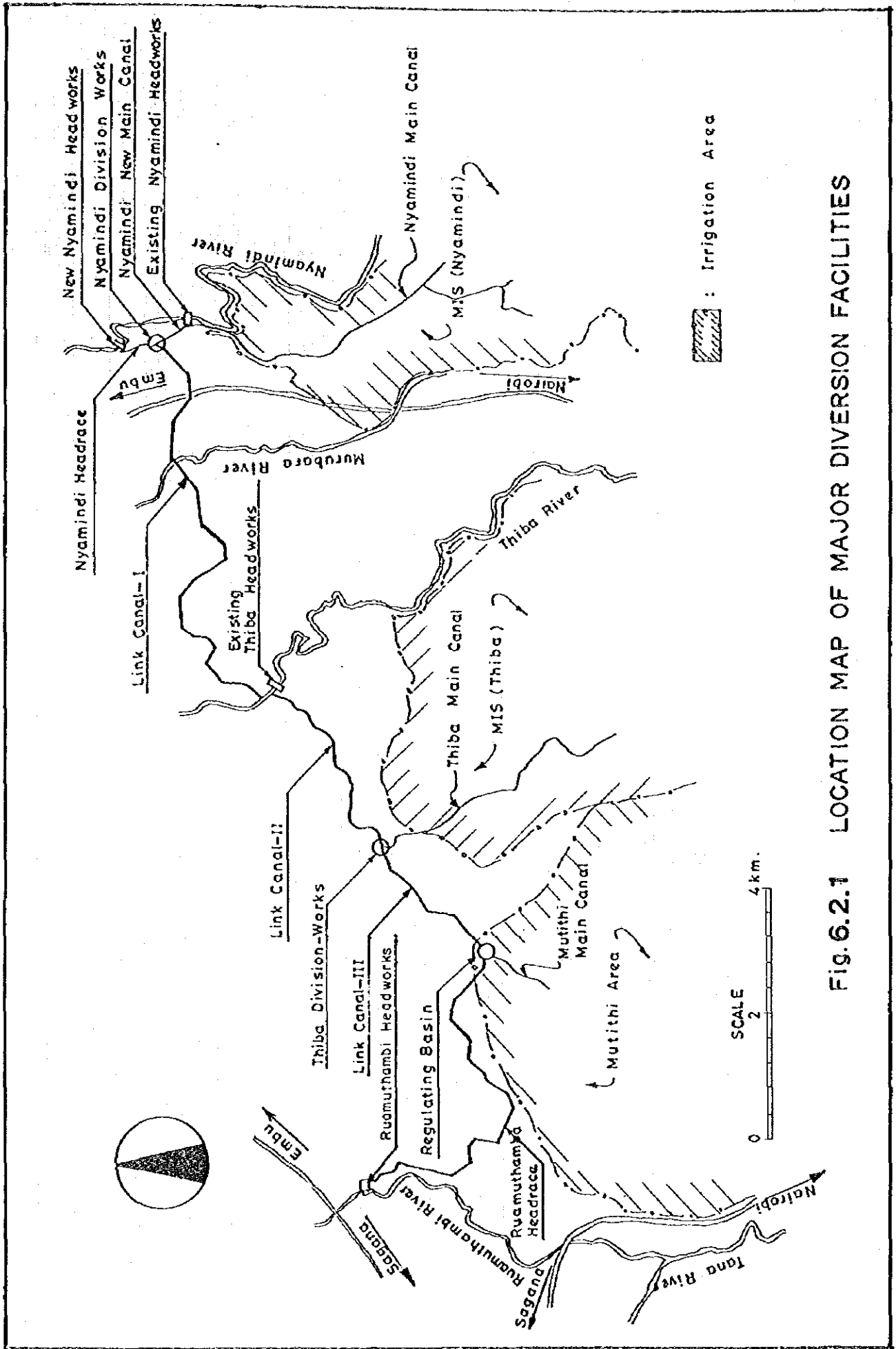


FIG. 6.2.1 LOCATION MAP OF MAJOR DIVERSION FACILITIES

Phase	Work Item	Fiscal Year	1988	1989	1990	1991	1992	1993	1994	
I	Detailed Design									
	Construction	Pilot Farm								
		Nyamindi New Headworks								
		Thiba Headworks								
		Nyamindi Headrace								
		Nyamindi New Main Canal								
		Link Canal I								
		Link Canal II								
		MIS Rehabilitation								
		Farm Investment	Agricultural Machinery							
O/M Equipment:										
Farm Buildings										
Detailed Design										
	Preparatory Works									
		Construction	Thiba Dam							
			Ruamuthambi Headworks							
			Ruamuthambi Headrace							
Link Canal III										
Mutithi Extension										
Farm Investment	Agricultural Machinery									
	O/M Equipment:									
	Farm Buildings									

Fig. 6.5.1 IMPLEMENTATION SCHEDULE OF THE PROJECT

ORGANIZATION OF THE GOVERNMENT OF KENYA

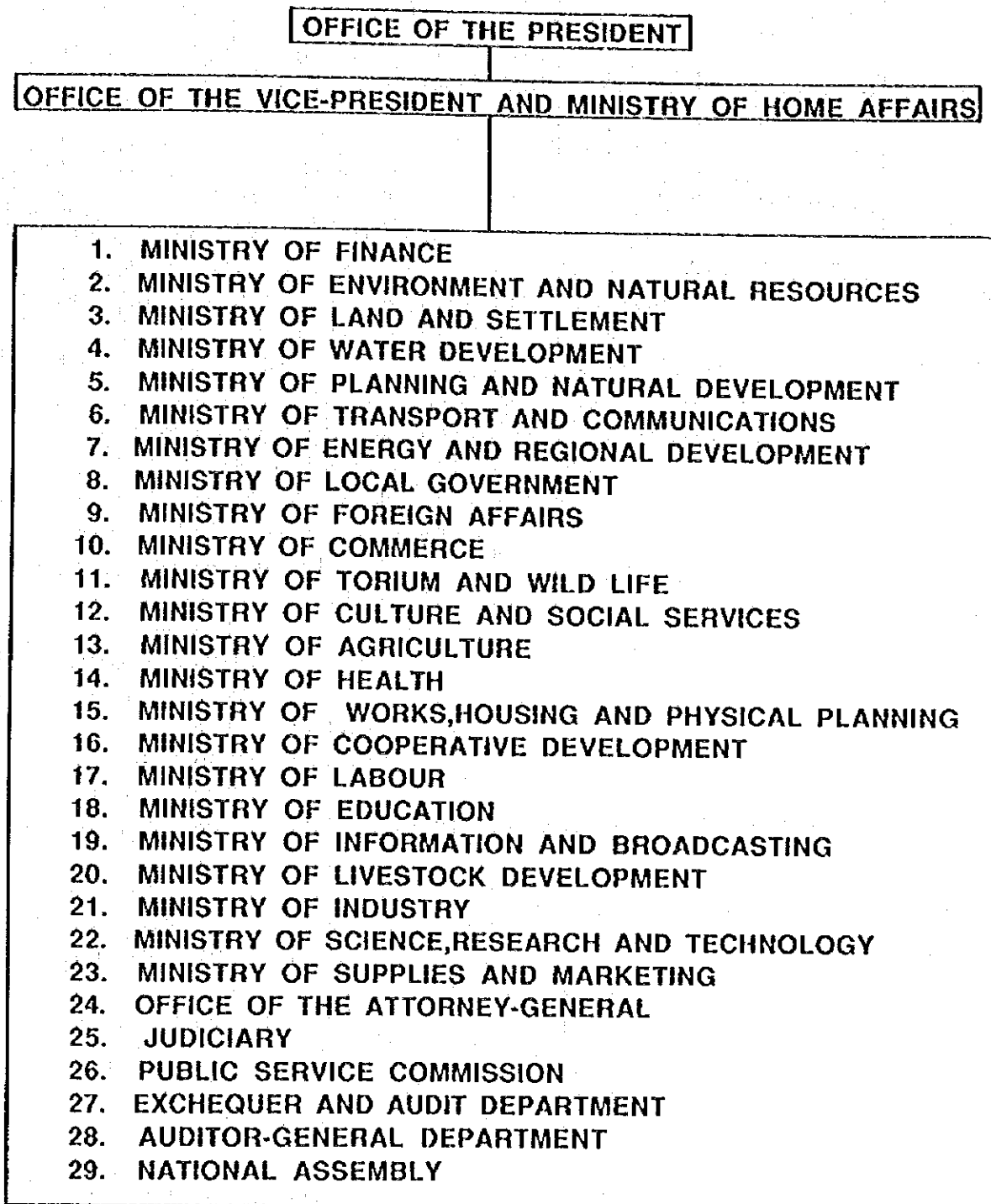


Fig. 7.1.1 ORGANIZATION OF THE GOVERNMENT OF KENYA

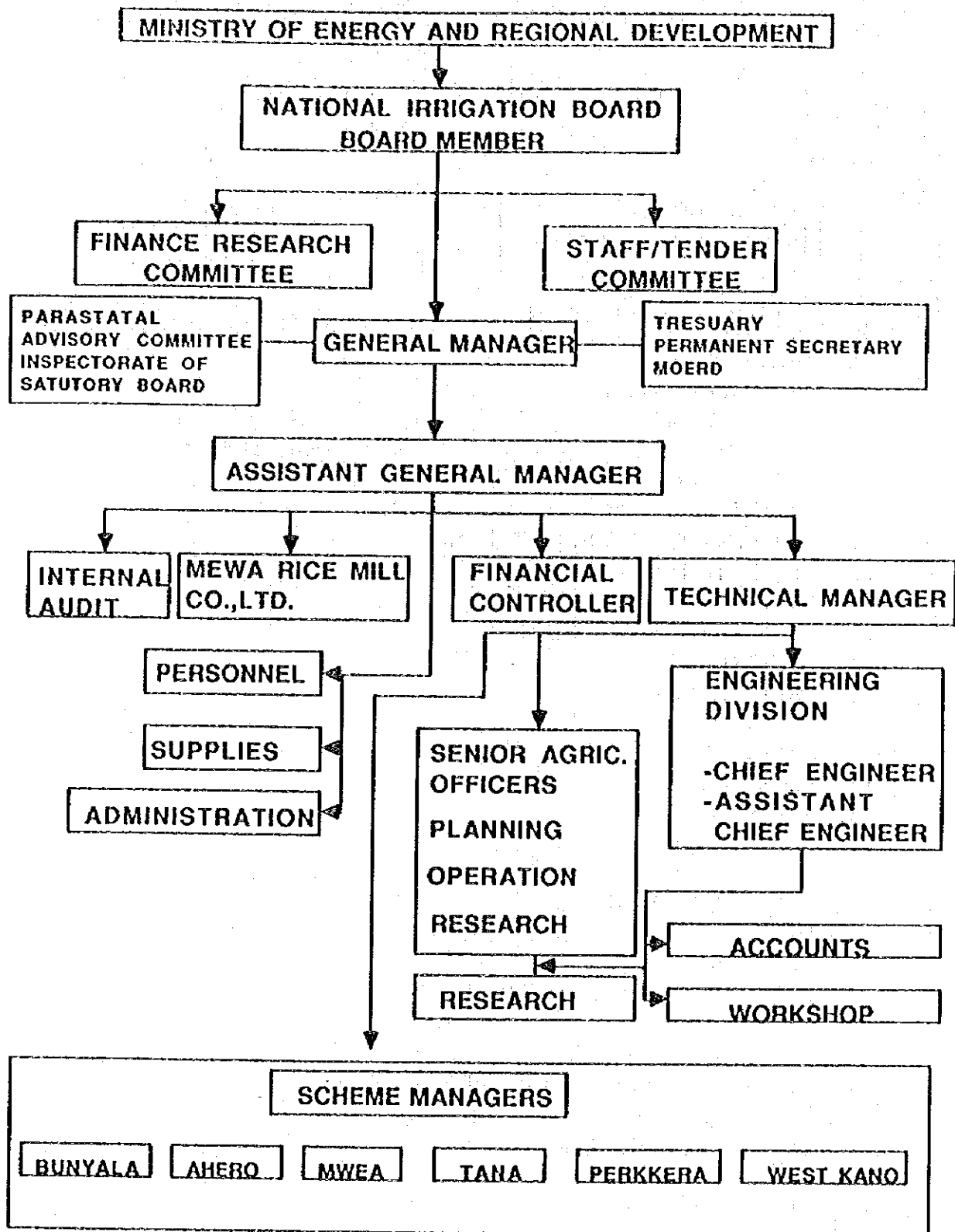


Fig. 7.1.2 ORGANIZATION CHART OF NATIONAL IRRIGATION BOARD(NIB)

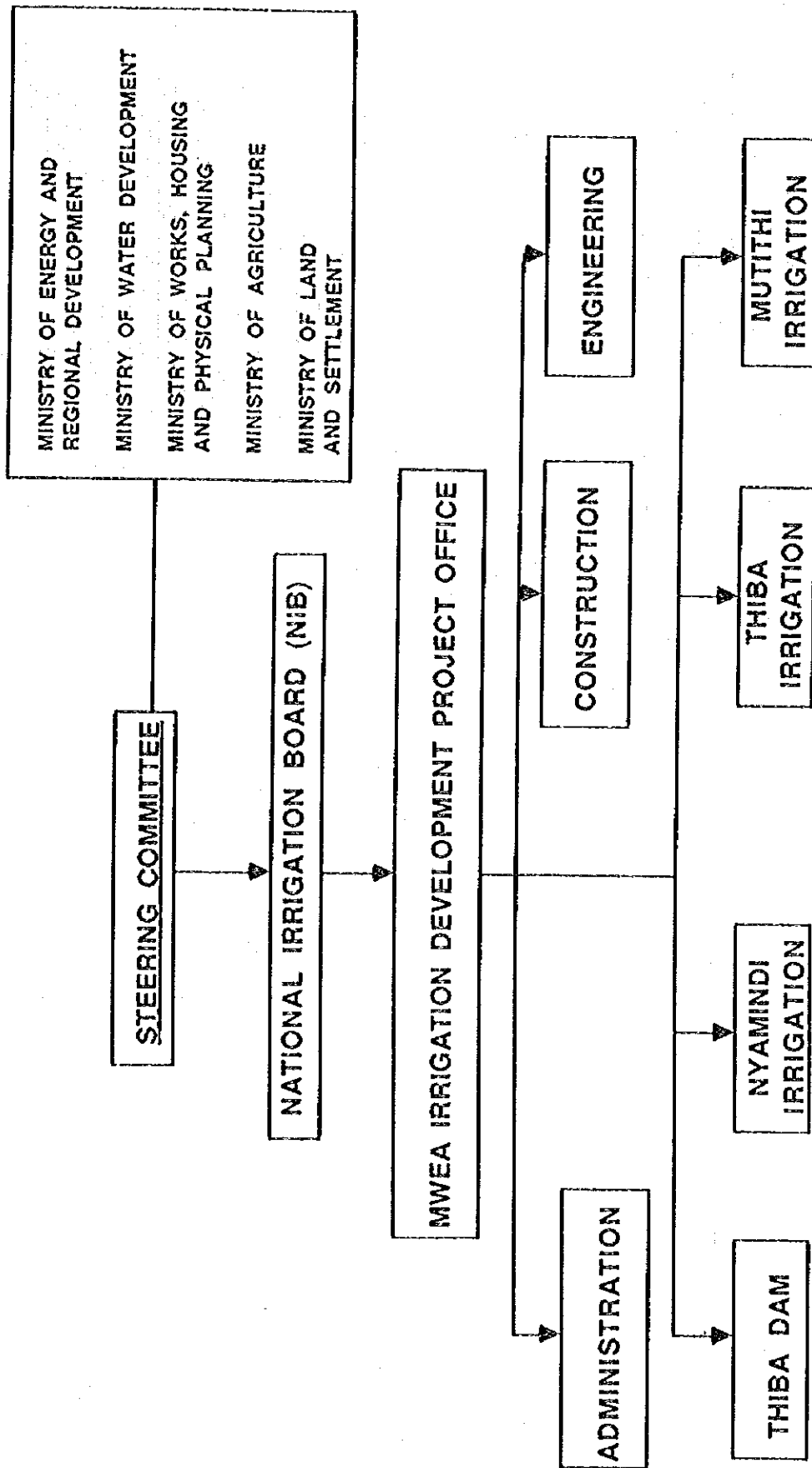


Fig. 7.1.3 PROPOSED ORGANIZATION OF PROJECT OFFICE

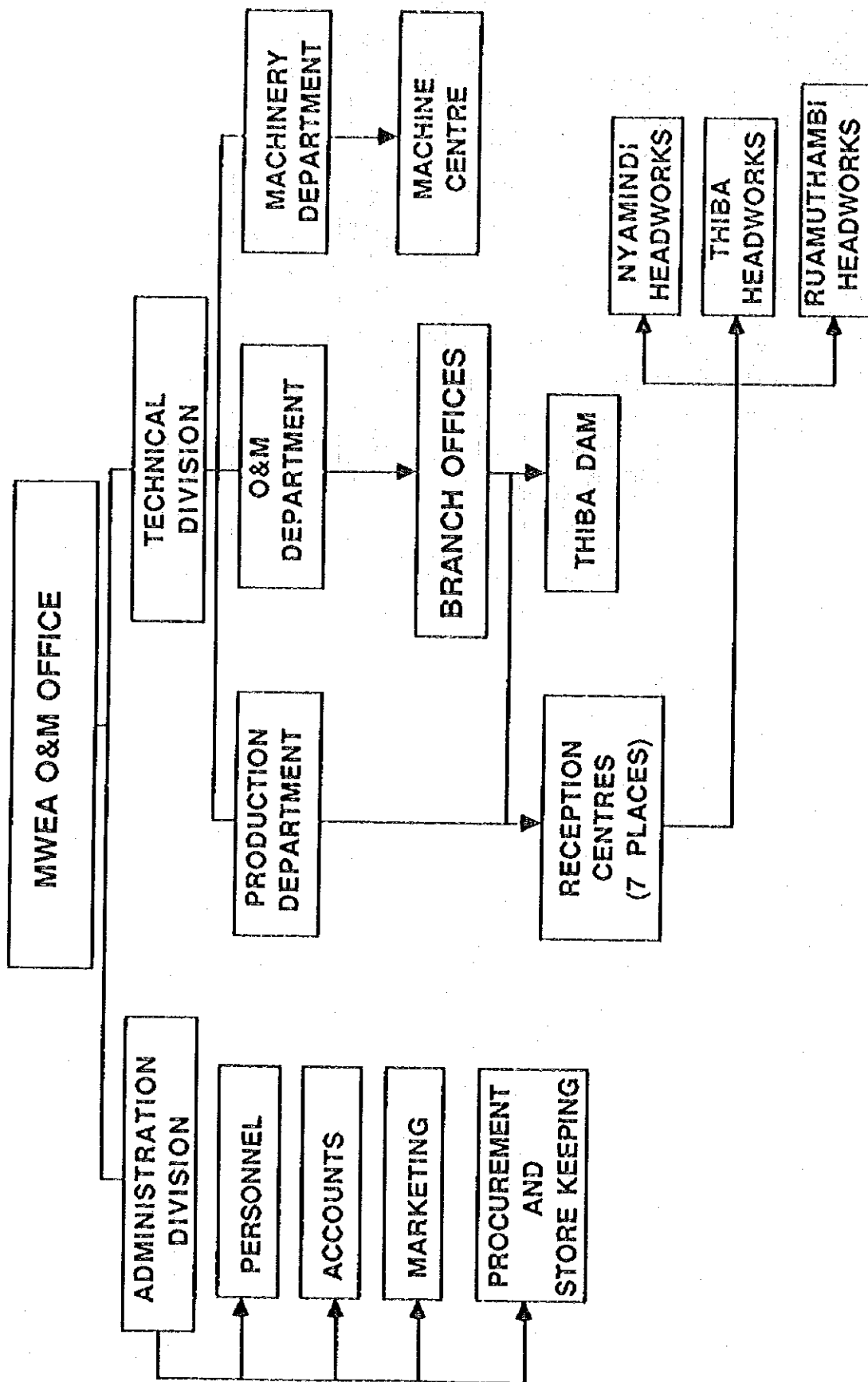


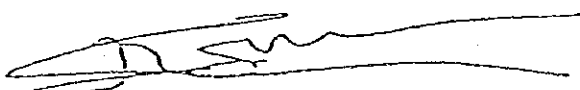
Fig. 7.2.1 PROPOSED ORGANIZATION OF PROJECT O&M OFFICE

ATTACHMENTS

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
MWEA IRRIGATION DEVELOPMENT PROJECT
IN
THE REPUBLIC OF KENYA

AGREED UPON BETWEEN THE GOVERNMENT OF KENYA
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

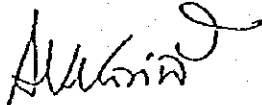
NAIROBI, 13TH NOVEMBER 1985



Mr. H. M. Lempaka
General Manager
National Irrigation Board

Mr. Takeshi Nasu
Leader of the Japanese
Preliminary Survey Team
Japan International
Cooperation Agency

Permanent Secretary
Ministry of Agriculture and
Livestock Development



I. INTRODUCTION:

In response to the request of the Government of the Republic of Kenya, the Government of Japan decided to conduct the Feasibility Study on the Mwea Irrigation Development Project in the Republic of Kenya (hereinafter referred to as "the study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will, undertake the study in close cooperation with the National Irrigation Board (hereinafter called "the Board") under the Ministry of Agriculture and Livestock Development representing the Government of Kenya (hereinafter called "the Government").

The present document sets forth the scope of work with regard to the study.

II. OBJECTIVES OF THE STUDY:

The objectives of the study are to formulate the plan of rehabilitation, extension and development of the red soils of the Mwea Irrigation Settlement (hereinafter called "the Project") and to assess the technical soundness and economic viability of the project.

III. STUDY AREA:

The study area is located 90 km. northwest of Nairobi in the Kirinyaga District and comprises 12,000 ha. of the existing Mwea Irrigation Settlement plus 4,000 ha. of the proposed Mutithi Extension.

The 12,000 ha. of the existing scheme comprise 6,000 ha. under irrigated paddy which requires rehabilitation and 6,000 ha. which includes buildings, roads, canals and unirrigated areas. The unirrigated areas include some red soils.

IV. SCOPE OF THE STUDY:

The activities to be undertaken by the Japanese Study Team (hereinafter called "the Study Team") will be broadly divided into the following three categories:-

Work - I: Preparation of the topographic map on a scale of 1:5,000 covering the whole study area.

Work - II: Data collection, survey and investigation, and formulation of basic concept of the project.

Work - III: Formulation of a development plan including a pilot farm for the red soils and double-cropping programme, and preparation of a feasibility study report including a preliminary design of the pilot farm.

Major work items of each work category are:-

1. Work - I

- (1) Install ground control beacons for aerial photography.
- (2) Conduct ground control surveys such as traverses and levelling necessary for mapping.
- (3) Conduct aerial photography over the land within and around the study area.
- (4) Prepare aerial photographs on a scale of 1:20,000.
- (5) Prepare topographic maps on a scale of 1:5,000 with contour interval of 1.0 m. covering about 35,000 ha. of land within and around the study area.

2. Work - II

- (1) Collect and review the existing data and information relevant to the project.

A) Physical Conditions:

- a) Topography
- b) Meteorology and hydrology
- c) Geology and soil mechanics
- d) Soils
- e) Irrigation and drainage
- f) Vegetation
- g) Others.

B) Socio-economic Status:

- a) Demographic conditions

- b) Agriculture, including Livestock
- c) Land use and tenure
- d) Agro-economy and institution
- e) Regional and national economy
- f) Infrastructure
- g) Marketing arrangements
- h) Existing institutional arrangements for the Board
- i) Others.

C) Programmes:

- a) Regional and national development plans relevant to the project
- b) Settlement programme

(2) Conduct surveys and investigations necessary for formulating development plan of the project.

- a) Soils and land use
- b) Agricultural survey
- c) Irrigation and drainage survey including inventory survey of the major existing facilities
- d) Soil mechanics and geology
- e) Agro-economic survey
- f) Socio-institutional survey
- g) Construction material and cost survey
- h) Others.

(3) Formulate basic concept of the project

- a) Delineation of the project area
- b) Outline of agricultural development plan
- c) Outline of rehabilitation plan of the existing irrigation and drainage facilities

- d) Basic development plan of the pilot farm
- e) Basic layout of major facilities
- f) Strategy for implementation
- g) Others.

3. Work - 111

- (1) Formulate the development plan of the project on the basis of the results of the study on data and information collected through field survey and investigation in work - 11.
 - a) Final delineation of the project area
 - b) Formulation of agricultural development plan
 - c) Layout of the project works including preliminary design of major facilities.
 - d) Preliminary design of the pilot farm
 - e) Establishment of implementation plan schedule
 - f) Benefit and cost estimates
 - g) Economic and financial evaluation
 - h) Recommendation on marketing possibilities
 - i) Recommendation on institutional plan for the project operation and management.
- (2) Prepare the study report including preliminary design of the pilot farm as shown under item VI below.

V. WORK SCHEDULE:

The tentative work schedule is shown in the APPENDIX. It is scheduled that all the works including finalisation of the feasibility study report shall be completed within 17 months.

VI. REPORTS:

JICA will prepare the following reports in English and submit them for distribution, comments and approval.

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(1) Inception Report:

Thirty (30) copies within one month after the commencement of the work.

(2) Interim Report:

Thirty (30) copies at the end of the work - II.

(3) Draft Final Report:

Forty (40) copies at the end of the work - III.

(4) Final Report:

Fifty (50) copies within two (2) months after receiving the comments from Kenyan side on the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF THE REPUBLIC OF KENYA:

1. To facilitate the smooth implementation of the study, the Government of the Republic of Kenya shall take necessary measures:--
 - (i) To ensure the safety of the Study Team where and as it is required.
 - (ii) To permit the members of the Study Team to enter, leave and sojourn in Kenya for the duration of their assignment therein, and exempt them from alien registration requirements during the period of the study.
 - (iii) To exempt the Study Team from taxes, duties and any other charges on equipment, machinery and other materials to be brought into Kenya for the implementation of the study.
 - (iv) To guide the Study Team to suitable medical facilities as needed to be paid for by the Study Team.
 - (v) To exempt the members of the Study Team from Income Tax and other charges imposed on or in connection with any emoluments or allowance paid to the members of the Study Team for their services in connection with the implementation of the study.
 - (vi) To provide necessary facilities to the Study Team for remittance as well as utilization of the funds introduced

into Kenya from Japan in connection with the implementation of the study.

- (vii) To secure permission for the Study Team to take all data and documents related to the study including aerial photographs out of Kenya to Japan for the purposes of study.
 - (viii) To secure permission for entry into private land for the conduct of the study.
 - (ix) To assist in securement of licences for use of walkie-talkie for execution of the field study.
 - (x) Sub-paragraphs (ii), (iii), (v), (vi), (vii), (viii) and (ix) are subject to approval by appropriate agencies of the Government of Kenya.
2. The Government of the Republic of Kenya shall bear claims, if any arises against the members of the Study Team resulting from, occurring in the course of or otherwise connected with the discharge of their duties in the implementation of the study, except when such claims arise from gross negligence or wilful misconduct on the part of the Study Team.
3. The Board shall be the co-operating agency with JICA and shall provide counterparts to the Study Team. It will also act as a co-ordinating body with other relevant Ministries and Organizations for the smooth implementation of the study.
4. The Board shall, at its own expense, provide the Study Team with the following, in co-operation with other relevant Ministries and Organizations:-
- (1) Available data and information to the Study Team
 - (2) Credentials or identification cards to the members of the Study Team
 - (3) Suitable office space in Nairobi and Mwea with necessary equipment
 - (4) Necessary number of counterpart personnel including a Project Co-ordinator throughout the study period
 - (5) Appropriate number of drivers to be paid for from the Grant, and
 - (6) Secretarial Services, re-imbursable at cost.

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VIII. UNDERTAKING OF JICA:

For the implementation of the study, JICA shall take the following measures:-

- (1) To bring to Kenya, maintain the Study Team in Kenya during study, and to return the Study Team to Japan at the end of the study on its own expense.
- (2) To provide appropriate training to Kenyan counterpart personnel in the course of the study.
- (3) To provide the necessary equipment for the implementation of the study.
- (4) To provide sufficient vehicles for the Study Team.
- (5) To return to the Government of Kenya all data and documents collected in Kenya by the Study Team for the purposes of the study unless otherwise agreed between JICA and the Board.

IX. OTHERS:

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

MINUTES OF MEETING
ON
INCEPTION REPORT FOR FEASIBILITY
STUDY ON THE MWEA IRRIGATION
DEVELOPMENT PROJECT

1. DATE : January 20, 1987 9:00 a.m. - 11:45 a.m.
2. PLACE : Board Room of NIB
3. ATTENDANTS : see attached list

4. SUMMARY OF DISCUSSION :

The Team Leader, Mr. T. SAKAMOTO explained to the attendants the Inception Report which the JICA Study Team submitted to NIB on January 19, 1987. The chairman, Mr. J.K. Mbandi, expressed his general acceptance of the Report and asked the attendants from NIB to make comments on the Report. Various discussions were then made on almost every aspects of the Project between NIB attendants and JICA Study Team, and both sides confirmed the following through discussions:

- (1) The general concept and plan of operation for the feasibility study described in the Inception Report was accepted by NIB.
- (2) NIB would assign the counterpart personnel for execution of the feasibility study as given in the attached list.
- (3) The feasibility study would deal with only surface water. The field investigation and study for exploitation of groundwater would not be included in the feasibility study.
- (4) NIB requested the JICA Study Team that :
 - a. less priority should be given to the pumping scheme alternatives.

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- b. double cropping of paddy should be carefully studied.
- c. limitation of land should be noted in preparation of pilot farm development plan.
- d. various horticultural crops should be considered for development of red soil area.
- e. careful attention should be paid to marketing problems involved in large scale production of horticultural crops.

January 20, 1987


Tadashi SAKAMOTO

Team Leader
JICA Study Team for
MWEA Irrigation Develop-
ment Project



J.K. Mbandi

General Manager
National Irrigation Board


Akira TAKAHASHI

Resident Representative
JICA Kenya Office

LIST OF COUNTERPART PERSONNEL ASSIGNED
TO
JICA FEASIBILITY STUDY
ON
MWEA IRRIGATION DEVELOPMENT PROJECT

<u>Name</u>	<u>Present position</u>	<u>Assigned Designation in Counterpart Staffing</u>
Mr. C.T. Kimani	Senior Agricultural Officer (Operations)	Team Leader
Mr. F.K. Njoroge	Assistant Engineer	Irrigation/Drainage Engineer Hydrologist
Mr. S.N. Alukonya	Senior Agricultural Officer (Planning)	Agronomist Agricultural Economist
Mr. A. Buigut	Assistant Engineer	Pedologist Soil Mechanical Engineer
Mr. A.A. Ali	Senior Engineer	Construction Engineer Design Engineer
Mr. J. Marete	Assistant Engineer	Survey Expert
Mr. N. Gichohi	Works Officer	Water Management Expert
Mr. J.P. Olum	Assistant Chief Engineer	Co-ordinator

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LIST OF ATTENDANTS

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|-----|---------------|---|
| (1) | J.P.K. MBANDI | General Manager |
| (2) | C.T. KIMANI | Senior Agricultural Officer
(Operations) |
| (3) | I.J.O. OGOMBE | Senior Agricultural Officer
(Research) |
| (4) | S.N. ALUKONYA | Senior Agricultural Officer
(Planning) |
| (5) | A.A. MOHDHAR | Senior Manager, Mwea
Irrigation Settlement |
| (6) | J.P. OLUM | Assistant Chief Engineer |
| (7) | A.A. ALI | Senior Engineer |

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|-----|--------------|--|
| (1) | A. TAKAHASHI | Resident Representative,
Kenya Office |
| (2) | S. KAIHO | Assistant Resident
Representative, Kenya Office |
| (3) | T. SASAKI | JICA, TOKYO |

JICA STUDY TEAM

- | | | |
|-----|-------------|------------------------------|
| (1) | T. SAKAMOTO | Team Leader |
| (2) | A. HONDA | Irrigation/Drainage Engineer |
| (3) | N. ARIGA | Agronomist |
| (4) | K. NODA | Hydrologist |
| (5) | Y. ISHIZAKI | Agricultural Economist |

MINUTES OF MEETINGONFIELD REPORT FOR FEASIBILITYSTUDY ON THE MWEA IRRIGATIONDEVELOPMENT PROJECT

1. DATE : March 24, 1987
(10.00 - 12.30 p.m.)
2. PLACE : Board Room of NIB Office
3. ATTENDANTS : See Attached List
4. SUMMARY OF DISCUSSION

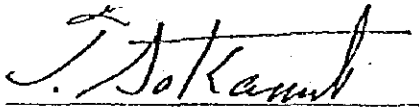
At the request of the Chairman, Mr. J.K. Mbandi (General Manager of NIB), the Team Leader, Mr. T. SAKAMOTO, explained the Field Report to the attendants, laying stress on (1) the problems involved in double cropping of paddy and possible countermeasures, (2) the possible alternatives on water resources development which would be studied in the second stage and (3) the land tenure study required for irrigation development of the Mutithi area. Various discussions were then made between NIB and JICA Study Team mainly on the major issues that the Team Leader pointed out, and both sides confirmed the following through the discussions:

- (1) The Field Report that JICA Study Team submitted to NIB on March 23, 1987 was accepted by NIB.
- (2) The basic concept of the Project should be geared to maximum utilization of land and water resources for increase of rice production. NIB requested the Team to study the possibility of storage dam construction in view of rather limited availability of water in the Study area. NIB pointed out that in case of dam construction, environmental impacts to the surrounding areas and compensation to the reservoir areas to be submerged should be examined, with a view to minimizing the disturbance to the inhabitants in the areas.
- (3) The alternative of the gravity irrigation system from the Tana river should be given the least priority because the prospective canal of about 15 km would run within the densely populated area and also the Tana Power Station of East African Power and Lighting Co., Ltd. has been granted by the Ministry of Water Development the water right to use the full of the normal flow and 17 m³/sec (610 cusec) of the flood flow.
- (4) The Nyamindi No.1 dam would be most attractive in terms of its storage capacity and suitable location in the forest area which would give the least impacts to the local inhabitants. NIB requested the Team to give the highest priority to the Nyamindi dam and in the case that its storage volume would not be adequate


for covering the potential maximum area of 11,200 ha, to study the possibility of the combination with the Thiba dam.

- (5) The possibility of double cropping of paddy should be thoroughly studied, with a view to maximizing the endowed potential for increase in paddy production as well as farmer's income. NIB pointed out that the needs for further research work to find the suitable rice varieties which should have early maturing characteristics with good milling quality and be tolerant to cold climate and also to pests and diseases, and remarked also on the importance of improvement and/or even expansion of staffing, machinery fleet and handling facilities. NIB requested the Team to study all these for successful introduction of double cropping of paddy.
- (6) The land tenure study would be required for formulation of irrigation development plan in the Mutithi area. The terms of reference for the required survey and study would be as per attached. NIB strongly requested the JICA Study Team to carry out these studies jointly with NIB.
- (7) Any pumping alternatives would be excluded from scope of the study.

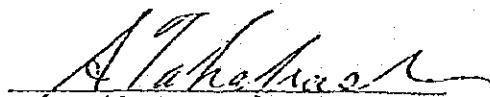
March 26 1987



Tadashi SAKAMOTO
Team Leader
JICA Study Team for
Mwea Irrigation
Development Project



J.K. Mbandi
General Manager
National Irrigation Board



Akira TAKAHASHI
Resident Representative
JICA Kenya Office

LIST OF ATTENDANTS

NIB

1. Mr. J.K. Mbandi : General Manager
2. Mr. B.T.C. Bargoria : Deputy General Manager
3. Mr. S.M. Gitonga : Technical Manager
4. Mr. E. Cheserem : Chief Engineer
5. Mr. J.P. Olum : Assistant Chief Engineer
6. Mr. S.N. Alukonya : Senior Agricultural Officer
7. Mr. J.M. Mulli : Acting Scheme Manager, MIS
8. Mr. J. Marete : Assistant Engineer
9. Mr. A. Buigut : Assistant Engineer

JICA KENYA OFFICE

1. Mr. S. Kaiho : Assistant Resident Representative

JICA STUDY TEAM

1. Mr. T. Sakamoto : Team Leader
2. Mr. N. Ariga : Agronomist
3. Mr. A. Honda : Irrigation/Drainage Engineer
4. Mr. K. Noda : Hydrologist
5. Mr. S. Miyake : Pedologist
6. Mr. S. Susa : Survey Expert

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DRAFT TERMS OF REFERENCE FOR LAND TENURE
STUDY IN MUTITHI EXTENSION AREA

1. Background

The land in the Mutithi area is privately owned. The present JICA Study has identified more than 1,000 land holders who own various sizes and shapes of the lands in the area.

Most of the lands have not been utilized for agricultural purpose, remoting from public services and infrastructure such as electricity and domestic water supplies, roads and agricultural institutions and facilities. There is no irrigation facilities. No single village is observed. Most of the land holders are staying outside of the area. It implies that irrigation development of the area will require not only irrigation/drainage facilities but also other all ancillary facilities which will help the farmers (the land holders) to settle in the area.

Such present situation of the area is quite different from that of the existing Mwea Irrigation Settlement Scheme (MIS), and the Government regulation (The Irrigation Regulations, 1977 - Legal Notices No. 68) which has been applied to the MIS, may not be applicable to the Mutithi area.

There will be a number of possible development strategies for irrigation development in the Mutithi area. The development strategy to be applied should be best suited to the area and acceptable to both NIB and the land holders. Such strategy will be possibly determined only through the studies on the present land tenure conditions and the land holder's intentions to the irrigation development.

NIB and JICA Study Team have agreed, considering the above, that an additional land tenure study will be made jointly by NIB and the Team during the second stage study period.

The Draft Terms of Reference for the study are given hereunder.

2. Objectives

- a. To identify the land holders and their holding size in the Mutithi area,
- b. To study the minimum land holding size which will enable the farmers keep standard level of living welfare through irrigated rice farming,
- c. To study the guideline for land consolidation for tertiary block development including irrigation/drainage canal alignment, and
- d. To study the guideline for compensation to the lands which will be disposed for construction of project facilities and land re-settlement program including operational regulation of the project.

3. Study Area

The Study area shall cover the maximum potential irrigable area of about 3,000 ha in the Mutithi extension area.

4. Investigation and Study

- a. To make a list of land holders in the Study area,
- b. To prepare the cadastral maps of the Study area by superimposing the existing cadastral maps on the topo-maps of 1:5,000 scale.
- c. To confirm the above list and maps in the field, and update the above if discrepancies are found,
- d. To classify the land holders by size of land holding,
- e. To collect data and information on present systems of land transactions and land prices by grade.
- f. To study prospective farm budgets for different sizes of land holding and determine the minimum size of land holding which can afford the farmer's living,
- g. To prepare the possible options of land consolidation and re-settlement programs,
- h. To make interviews to the land holders in order to collect basic information required for selection of the most applicable option which is acceptable to both the farmers and NIB, and

- i. To prepare a report which will contain the results of the above and guideline for compensation of and land consolidation and resettlement program.

5. Schedule of the Study

The Study shall be commenced immediately and be completed by the end of August, 1987. The study items, a through d in the above, shall be made solely by NIB and be completed by the time when the second stage of JICA Study will commence (tentatively the beginning of July, 1987). The other study items, i.e., e downwards, will be made jointly by NIB and JICA Study Team during the period of two months from the beginning of July to the end of August, 1987. In due consideration of staff strength in NIB and the tight schedule for the study, some of the study items may be carried out by the third party. The items to be carried out by the third party shall be subject to further discussions between NIB and JICA Study Team.

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MINUTES OF MEETINGONINCEPTION REPORT NO.2 FORFEASIBILITY STUDY ON THEMWEA IRRIGATION DEVELOPMENT PROJECT

1. DATE : July 10, 1987
(9:00 - 11:10 a.m.)
2. PLACE : Board Room of NIB Office,
Nairobi
3. ATTENDANTS : See Attached List
4. SUMMARY OF DISCUSSION:

At the request of the Chairman, Mr. J.K. Mbandi (General Manager of NIB), The Team Leader, Mr. T. SAKAMOTO explained to the attendants the Inception Report No.2 which was distributed to NIB attendants on July 8, 1987. Various discussions were then made between NIB and JICA Study Team and both sides confirmed the following through the discussions:

- (1) The Inception Report No.2 that the JICA Study Team submitted to NIB on July 8, 1987 was accepted by NIB representatives.
- (2) The JICA Study Team received "The Report of Land Tenure Survey in the Mutithi Extension Area" from NIB on July 8, 1987. The report was prepared by NIB in accordance with the Terms of References agreed upon between NIB and the Study Team on March 24, 1987. The JICA Study Team said that the Report was sufficiently detailed enough for requirement of the feasibility study, covering the items (a) through (d) mentioned in the Terms of Reference. Both sides agreed to discuss, on the earliest possible date, how to execute the rest of work items from (e) to (i).
- (3) NIB accepted the basic framework of the proposed cropping pattern; however, NIB requested the Study Team to examine some new rice varieties for short rains crop because new high-yielding varieties would be likely to replace the existing ones, Sindano/Basmati. NIB also pointed out that the cropping pattern should be practicable with available labour force in the study area.
- (4) NIB pointed out that the proposed overall irrigation efficiency of 60% might be too optimistic, making reference to the prevailing efficiency attained in

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other irrigation projects in Africa, and asked the Team to reduce it upto 60-65%. The Team said the proposed efficiency of 60% would be attainable target through improvement of the existing irrigation facilities as well as water management system. Both sides agreed that this issue would be carefully re-examined during the course of the second stage study.

- (5) NIB requested, in connection with the dam plan, the Study Team to consider some future allowance of water supplies other than irrigation purpose in the study area. The JICA Study Team explained the difficulties involved in estimation of such water requirement.
- (6) NIB would assign the counterpart personnel for execution of the feasibility study in the second stage as given in the attached list. NIB would, in addition to the above, provide the Team with the same office space where the Team worked during the first stage of the study.

July 13 1987



Tadashi SAKAMOTO
Team Leader
JICA Study Team for
Mwea Irrigation
Development Project

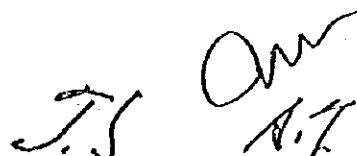


J.K. Mbandi
General Manager
National Irrigation Board



AKIRA TAKAHASHI
Resident Representative
JICA Kenya Office

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LIST OF COUNTERPART PERSONNEL
ASSIGNED TO JICA STUDY TEAM

<u>Designation</u>	<u>Name</u>
1. Team Leader	To be named
2. Project Co-ordinator	Mr. J.P. Olum, Assistant Chief Engineer
3. Agronomist cum Agro-Economist	Mr. S.N. Alukonya, Senior Agricultural Officer
4. Irrigation/Drainage Engineer cum Hydrologist	Mr. F.K. Njoroge, Assistant Engineer
5. Soil Mechanical Engineer	Mr. A. Buigut, Assistant Engineer
6. Pedologist	To be named
7. Construction Planner cum Design Engineer	Mr. J. Marete, Assistant Engineer
8. Water Management Expert	To be named
9. Dam Planner	To be named

LIST OF ATTENDANTS

NIB

1. J.P.K. Mbandi : General Manager
2. S.M. Gitonga : Technical Manager
3. Z.K. Shimba : Financial Controller
4. E.K. Cheserem : Chief Engineer
5. J.P. Olum : Assistant Chief Engineer
6. J. Marete : Assistant Engineer

JICA

1. S. Kaiho : Assistant Resident Representative,
Kenya Office
2. I. Kakuta : JICA, Tokyo

JICA STUDY TEAM

1. T. Sakamoto : Team Leader
2. N. Ariga : Agronomist
3. A. Honda : Irrigation/Drainage Engineer
4. K. Noda : Hydrologist
5. K. Yamada : Water Management Expert
6. S. Miyake : Pedologist
7. Y. Ishizaki : Agricultural Economist
8. H. Mizuno : Soil Mechanical Engineer
9. M. Ichikawa : Construction Planner
10. T. Kajimoto : Design Engineer

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FEASIBILITY STUDY ON
THE NYEA IRRIGATION DEVELOPMENT PROJECT

MINUTES OF MEETING
ON
INTERIM REPORT

1. DATE : September 28, 1987
(2:00 - 4:00 p.m.)
2. PLACE : Board Room of NIB Office, Nairobi
3. ATTENDANTS : See Attached List
4. SUMMARY OF DISCUSSION :

At the request of the Chairman, Mr. B.T.C. Bargarua (Assistant General Manager of NIB), the Team Leader, Mr. T. SAKAMOTO, explained the Interim Report to the attendants, laying stress on (1) comparative study on the development alternatives, (2) selection of the best development alternative T-1 and (3) stagewise implementation schedule of the proposed project. Various discussions were then made between NIB and JICA Study Team mainly on the major issues that the Team Leader pointed out, and both sides confirmed the following through the discussions:

- (1) The Interim Report that JICA Study Team submitted to NIB on September 25, 1987 was accepted by NIB.
- (2) JICA Study Team would study the future situations on demand and supply for horticultural crops and present the study results in the Draft Final Report.
- (3) The proposed development alternative T-1 had been accepted by NIB as the best alternative. JICA Study Team would make further studies only for alternative T-1.
- (4) The preliminary designs of the major project facilities would be presented in the Draft Final Report.
- (5) The future system of water management would carefully be

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studied, with a view to introducing an appropriate centralized water management system. JICA Study Team would prepare the recommendations on future organization and staffing for effective water management.

- (6) NIB had the opinion that in order to realize the proposed project smoothly, some additional studies on such aspects as environmental impacts on dam construction and rural community development in the Mutithi area should be required, though these studies were not included in the "Scope of Works for the Feasibility Study".
- (7) General idea on stagewise development was agreed between NIB and JICA Study Team. NIB pointed out, however, that on the basis of prior discussions with the Ministry of Energy and Regional Development, the stagewise development plan alternative-1 would be more preferable than other alternatives; and also that the proposed time schedule for alternative-1 should be shortened because the Government of Kenya had already accorded its highest priority for early implementation to the irrigation development of the Mutithi extension area as well as rehabilitation works of the existing MIS in due consideration of current shortage of rice in the country. After full discussions on this issue, JICA Study Team agreed to re-examine the stagewise implementation schedule already presented in the Interim Report in order to shorten the implementation time schedule.

September 30, 1987




Tadashi SAKAMOTO

Team Leader
JICA Study Team



J. K. Mbandi

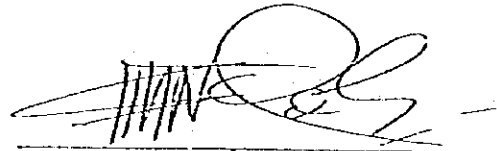


General Manager
National Irrigation Board



Akira TAKAHASHI

Resident Representative
JICA Kenya Office



F. H. Mooli

Senior Assistant Secretary
Ministry of Energy and
Regional Development

LIST OF ATTENDANTS

NIB

1. Mr. B.T.C. Bargarora : Deputy General Manager
2. Mr. S.H. Gitonga : Technical Manager
3. Mr. Z.B.K. Shimba : Financial Controller
4. Mr. E. Cheseren : Chief Engineer
5. Mr. J.P. Olum : Assistant Chief Engineer
6. Mr. I.J.O. Ogombe : Senior Agricultural Officer
7. Mr. S.H. Alukonya : Senior Agricultural Officer
8. Mr. J. Harete : Assistant Engineer
9. Mrs. C.N. Kariithi : Chief Accountant

Ministry of Energy and Regional Development

1. Mr. F.H. Ndooli : Senior Assistant Secretary

Ministry of Water Development

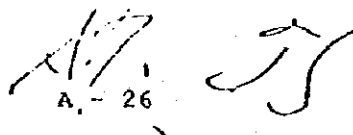
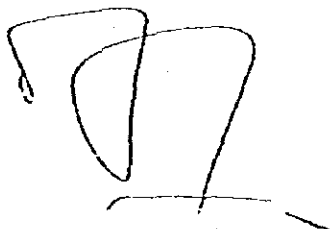
1. Mr. P.K. Hjurumba : Senior Engineer

JICA KENYA OFFICE

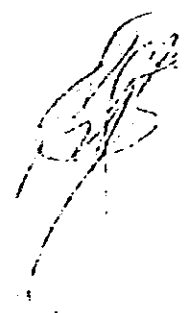
1. Mr. S. Kaiho : Assistant Resident Representative

JICA STUDY TEAM

1. Mr. T. Sakamoto : Team Leader
2. Mr. N. Ariga : Agronomist
3. Mr. A. Honda : Irrigation/Drainage Engineer
4. Mr. K. Noda : Hydrologist
5. Mr. K. Kondo : Dam Engineer
6. Mr. T. Kajimoto : Design Engineer
7. Mr. Y. Ishizaki : Agro-economist



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FEASIBILITY STUDY ON
THE MWEA IRRIGATION DEVELOPMENT PROJECT

MINUTES OF MEETING
ON
DRAFT FINAL REPORT

1. DATE : December 1, 1987
(9:15 a.m. - 4:00 p.m.)
2. PLACE : Board Room of NIB Office
3. ATTENDANTS : See Attached List
4. SUMMARY OF DISCUSSION :

At the request of the Chairman, Mr. B.T.C. Bargarora (Assistant General Manager of NIB), the Team Leader, Mr. T. SAKAMOTO, explained the Draft Final Report to the attendants, laying stress on (1) future water management system and (2) economic evaluation and implementation schedule of the Project. Various discussions were then made between NIB and JICA Study Team mainly on the major issues that the Team Leader pointed out, and both sides confirmed the following through the discussions:

- (1) The Draft Final Report that JICA Study Team submitted to NIB on November 30, 1987 was accepted in principle by NIB.
- (2) The implementation schedule proposed by JICA Study Team should be re-examined, with a view to implementing the Project within the shortest possible period. A total of six (6) years including the periods of design and preparatory works was considered appropriate. The Project would however be implemented in Phase-I and Phase-II as the JICA Study Team recommended.

Phase-I : Establishment of a Pilot Farm (50 ha) and Rehabilitation of existing MIS scheme (6,660 ha), and

Phase-II : Dam construction and development of Mutithi extension area (2,900 ha),


- (3) The Project evaluation would not be made separately for Phase-I and Phase-II, but for the Project as a whole.
- (4) NIB had an opinion that in order to realize the Project benefits smoothly, technical assistance from Japan in the fields of rice breeding, water management and farm machinery would be required and requested the JICA Study Team to indicate the preliminary scope of the prospective technical assistance in the Final Report which would be submitted to NIB by the end of March 1988.
- (5) The unit construction cost per ha would be mentioned in the Final Report for easier cost comparison with other projects.

December 3, 1987



Tadashi SAKAMOTO

Team Leader
JICA Study Team

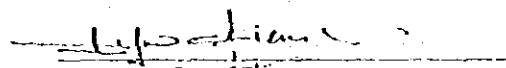


J. K. Mbandi
General Manager
National Irrigation Board



Akira TAKAHASHI

Resident Representative
JICA Kenya Office



A. Vienna

Deputy Secretary
Ministry of Energy and
Regional Development

LIST OF ATTENDANTS

NIB

1. Mr. B.T.C. Bargoria : Deputy General Manager
2. Mr. S.M. Gitonga : Technical Manager
3. Mr. Z.B.K. Shimba : Financial Controller
4. Mr. E. Cheserem : Chief Engineer
5. Mr. J.P. Olum : Assistant Chief Engineer
6. Mr. I.J.O. Ogombe : Senior Agricultural Officer
7. Mr. S.N. Alukonya : Senior Agricultural Officer
8. Mrs. C.N. Kariithi : Chief Accountant

Ministry of Energy and Regional Development

1. Mr. A. Vienna : Deputy Secretary

JICA

1. Mr. M. Nagatomo : Tokyo Headquarters
2. Mr. S. Kaiho : Assistant Resident Representative,
JICA Kenya Office

JICA STUDY TEAM

1. Mr. T. Sakamoto : Team Leader
2. Mr. N. Ariga : Agronomist
3. Mr. A. Honda : Irrigation/Drainage Engineer

**MEMBERS LIST OF COUNTERPARTS CONCERNED, PRELIMINARY SURVEY
TEAM AND JICA STUDY TEAM**

I. COUNTERPARTS CONCERNED (Phase I)

(1)	Mr. J.P. Olum	Assistant Chief Engineer, NIB
(2)	Mr. C.T. Kimani	Senior Agricultural Officer, NIB
(3)	Mr. S. N. Alukonya	Senior Agricultural Officer, NIB
(4)	Mr. A.A. Ali	Senior Engineer, NIB
(5)	Mr. F.K. Njoroge	Assistant Engineer, NIB
(6)	Mr. A. Buigut	Assistant Engineer, NIB
(7)	Mr. J. Marete	Assistant Engineer, NIB
(8)	Mr. N. Gichohi	Works Officer, NIB

II. COUNTERPARTS CONCERNED (Phase II)

(1)	Mr. J.P. Olum	Assistant Chief Engineer, NIB
(2)	Mr. I.J.O. Ogombe	Senior Agricultural Officer, NIB
(3)	Mr. S.N. Aluknoya	Senior Agricultural Officer, NIB
(4)	Mr. F.K. Njoroge	Assistant Engineer, NIB
(5)	Mr. A. Buigut	Assistant Engineer, NIB
(6)	Mr. J. Marete	Assistant Engineer, NIB
(7)	Mr. P.K. Njurumba	Dam Engineer, Ministry of Water Development

III. Preliminary Survey Team

(1)	Mr. T. Nasu	Leader	Hokkaido Development Bureau, Hokkaido Development Agency
(2)	Mr. K. Ishikawa	Irrigation/ Drainage	National Land Agency
(3)	Mr. K. Maruyama	Agriculture	Agriculture Research Station
(4)	Mr. T. Sasaki	Coordinator	Japan International Cooperation Agency

IV. STUDY TEAM (Phase I)

(1)	Mr. T. Sakamoto	Team Leader
(2)	Mr. N. Ariga	Agronomist
(3)	Mr. A. Honda	Irrigation/Drainage Engineer
(4)	Mr. K. Noda	Hydrologist
(5)	Mr. S. Miyake	Pedologist
(6)	Mr. Y. Ishizaki	Agricultural Economist
(7)	Mr. H. Mizuno	Soil Mechanical Engineer
(8)	Mr. T. Kajimoto	Design Engineer
(9)	Mr. S. Susa	Survey Expert

V. STUDY TEAM (Phase II)

(1)	Mr. T. Sakamoto	Team Leader
(2)	Mr. N. Ariga	Agronomist
(3)	Mr. A. Honda	Irrigation/Drainage Engineer
(4)	Mr. K. Noda	Hydrologist
(5)	Mr. K. Yamada	Water Management Expert
(6)	Mr. K. Kondo	Dam Engineer
(7)	Mr. S. Miyake	Pedologist
(8)	Mr. Y. Ishizaki	Agricultural Economist
(9)	Mr. H. Mizuno	Soil Mechanical engineer
(10)	Mr. M. Ichikawa	Construction Planner
(11)	Mr. T. Kajimoto	Design Engineer
(12)	Mr. T. Yamazaki	Project Economist

JICA