

THE REPUBLIC OF INDONESIA

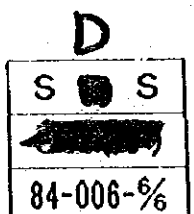
**THE FEASIBILITY STUDY ON THE VOLCANIC DEBRIS
CONTROL AND WATER CONSERVATION PROJECT IN
THE SOUTHEASTERN SLOPE OF MT. SEMERU**

SUPPORTING REPORT (5)

**INVESTIGATION
AND
ANALYSIS**

FEBRUARY, 1984

JAPAN INTERNATIONAL COOPERATION AGENCY



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PART - A
SOCIO-ECONOMIC INVESTIGATIONS

FEBRUARY, 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

A. SOCIO-ECONOMIC INVESTIGATION

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1. OBJECTIVE

The objective of the socio-economic investigation is to clarify the significance of the execution of the project in Lumajang Prefecture in view of the National Development Plan, local development programs, the local socio-economic situation and characteristics of the project. Furthermore, identification of scale as well as content of the socio-economic effect, which is indispensable in evaluating the project, is sought while project policies are determined in light of the significance of the above-mentioned.

Firstly, characteristics of sediment control work must be recognized in understanding its socio-economic effect. To be more precise, the purpose of sediment control work is to prevent disaster and preserve the land. Concrete objectives are the protection from and the mitigation of damage caused by sediment yield and its run-off upon human lives and properties.

Sediment control work as a public investment occupies a part of the social capital formation of the country and its actual investment cost is borne by the Government.

Accordingly, when a decision to execute the work is made solely on the basis of its investment effect, this presumed effect must be calculated as far as possible. Therefore, not only the preservation benefit, where damage is reduced by the execution of sediment control work, but also the development benefit, which is the result of increased socio-economic activities, are considered in this socio-economic investigation.

2. METHOD OF INVESTIGATION

The method of investigation is shown as follows:

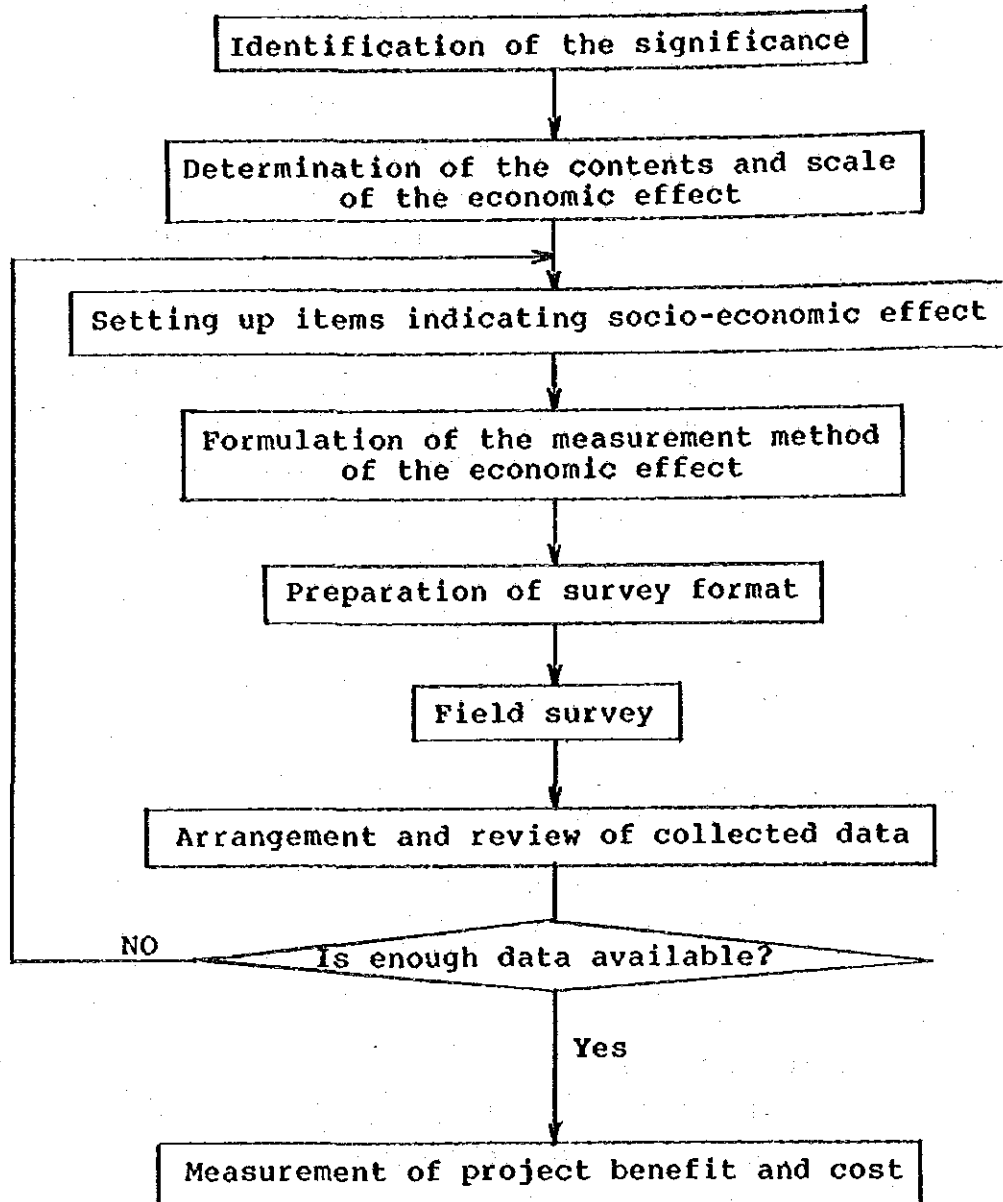


Fig.-1 Study Flowchart

2.1 Determination of the Contents and Scale of Socio-economic Effect

The content of socio-economic effect is given below on the basis of the significance of the project.

- ① Economic effect as a result of sediment control work
Mitigation of the possible damage amount owing to the prevention of debris flow is considered as a benefit. Based on the general condition of the studied area, damage is classified into agricultural, various structures, and facilities, public works, human and the cost of restoration.
- ② Economic effect as a result of water resource development
Increased agricultural production in an irrigated area owing to the consolidation of irrigation facilities is also considered as a benefit.

2.2 Setting-up Items Indicating Socio-economic Effect

Items are decided based on such criteria as that they can be measured in one way or another and that their importance deserves consideration.

At the time of the field investigation, as many items as possible were considered. However, they were selected at the arrangement stage in view of the availability of sufficient data for project evaluation.

2.3 Formulation of the measurement method of the economic effect.

As for the economic effect sediment control is described below. A possible disaster area is decided on the basis of study on past disasters. The study also shows the size of the area and the degree of damage to the area under certain discharge volumes and certain consolidation standards of dam facilities.

An annual mean damage amount is given by multiplying the possible damage amount by the annual probability value, which varies according to the volume of discharge. An annual mean damage amount is then given as the sum of the debris damage caused by various discharge volume in the possible disaster area from the largest volume to the smallest volume.

Finally, the difference in the annual mean possible damage amount with the current level of sediment control facilities and with the planned level of facilities is given as the damage mitigation effect.

As for the economic effect of water resources development, the measurement is made by the difference between an increase of agricultural production with the improvement of irrigation facilities and without the improvement of that.

For more detail, refer to Supporting Report (2).

2.4 Preparation of Survey Format

The following points were noted when the investigation questionnaire was prepared.

- ① The socio-economic effect in view of sediment control work should be classified as direct damage mitigation effect and indirect effect.
- ② In regard to direct damage, it was decided that the study of properties in a Kecamatan, which was the same as the possible disaster area in this study, would be carried out on an Desa unit basis, and the questionnaire was made accordingly.

- ③ The damage ratio would be calculated in view of possible sediment deposit depth given by the results of past disasters.
- ④ In the case of indirect damage, the questionnaire was made in view of studying the cases of the 'May 14, 1981 disaster', the 'November 13, 1976 disaster' and the 'Mt. Galunggung disaster.'

2.5 Field Survey

The survey was carried out by handing pre-made investigation questionnaires to counter-parts and other local people concerned at the beginning of the investigation while the objective and the method of study were being explained, and collecting them at the end of the investigation.

Additional questioning was made from time to time whenever it became necessary as a result of classification and review of collected data. In addition to data collection, opinions from those officials in the various organizations and Government offices concerned were heard, subject to necessity.

2.6 Arrangement and Review of Data

After the collected data by the field survey was classified into appropriate items based on the measurement method of economic effect, the data was arranged and reviewed for the purpose of project evaluation.

Re-examination and collection of data was also carried out on those items where data was insufficient or there were changes in the original study outline.

3. CONTENT OF INVESTIGATION

The content of investigation is described below.

3.1 Significance of the Project

Data gathering on the following items was carried out to clarify the significance of the project.

- ① General socio-economic statistics in Lumajang Prefecture.
- ② National Development Plan in Lumajang Prefecture as well as East Java. (In particular, their relation with sediment control work is focused.)
- ③ Objective and enforcement plan of sediment control work by the Ministry of Public Works.
- ④ Inspection of past disaster areas and understanding of damage caused.

3.2 Direct Damage Mitigation Effect

The socio-economic effect in view of sediment control work was classified into direct and indirect damage based on the effect measurement method. The study on properties in the possible disaster area, the study on the unit price of each property and the study of the possible damage ratio form three main pillars of the investigation.

- ① Study on Property in the Possible Disaster Area
Property in the area was classified into general property, agricultural products and public engineering works. The latest situation on property possession was studied in each Desa.

In regard to agricultural products, the yield and the cultivated areas of main crops for the last five years were studied while the study on cattle grazing was also carried out.

② Study on Unit Price

The study items were classified into general property, agricultural products and cattle and public engineering works.

For general properties a sampling survey was conducted in Lumajang city for each item. The facilities and household goods inside the buildings were also studied as well as the buildings themselves.

In the case of agricultural products, the market price, production cost per unit area, border price and producer's direct sale price were studied, although the studied items varied from one product to another.

As far as cattle grazing is concerned, not only the market price but also the labour profit as well as the reproduction profit were studied.

The unit price for construction and the remaining value of the facilities in the year of 1982 were studied for public engineering works. Those Kecamatons which had suffered extensive damage in past disasters were given special attention.

③ Study on Damage Ratio

Collection of data, which showed the extent of past disasters and inspection of disaster areas were carried out to find an estimated damage ratio.

3.3 Indirect Damage Mitigation Effect

The following items were listed in connection with the May 14, 1981 disaster, the November 13, 1976 disaster and the Mt. Galunaggunng disaster for the purpose of studying the indirect damage mitigation effect.

- ① Cost of safety compensation measure
- ② Water control activities
- ③ Public hygiene emergency activities
- ④ Damage investigation
- ⑤ Cost of substitution measures
- ⑥ Detour road construction
- ⑦ Material supply
- ⑧ Temporary house construction cost
- ⑨ Water supply activity
- ⑩ Compensation cost
- ⑪ Damage resulting in a lowered production rate
- ⑫ Situation of business stoppage in the
- ⑬ Other indirect damage

3.4 Water Resource Development Effect

The following items were studied.

- ① The intake rate from the river (K. Mujur and K. Rejali.)
- ② The extent of irrigation during each season, situation of rice cultivation (period of cultivation, productivity and total production) and the situation of the cultivation of agricultural products other than rice (type of product, period of cultivation and productivity) in each irrigation area.

Monthly mean intake volume at each intake.

- ③ Existing cropping pattern throughout a year.
- ④ Data on agricultural products of each kecamatan, level and yield per unit area.
- ⑤ Supply demand and situation for each agricultural product.

3.5 Other

The administrative map of Lumajang Prefecture, the land use map and related statistical data covering the Republic of Indonesia were also collected.

4. INVESTIGATION RESULT

4.1 Socio-economic Summary of Kab. Lumajang

Kab. Lumajang (Lumajang Prefecture) is a typical middle-size prefecture on Java island, located in the East Java State and facing the Indian Ocean. It covers an area of 1,791 km and currently consists of 16 kecamatans. The names and location of these kecamatans are given in Fig.-2.

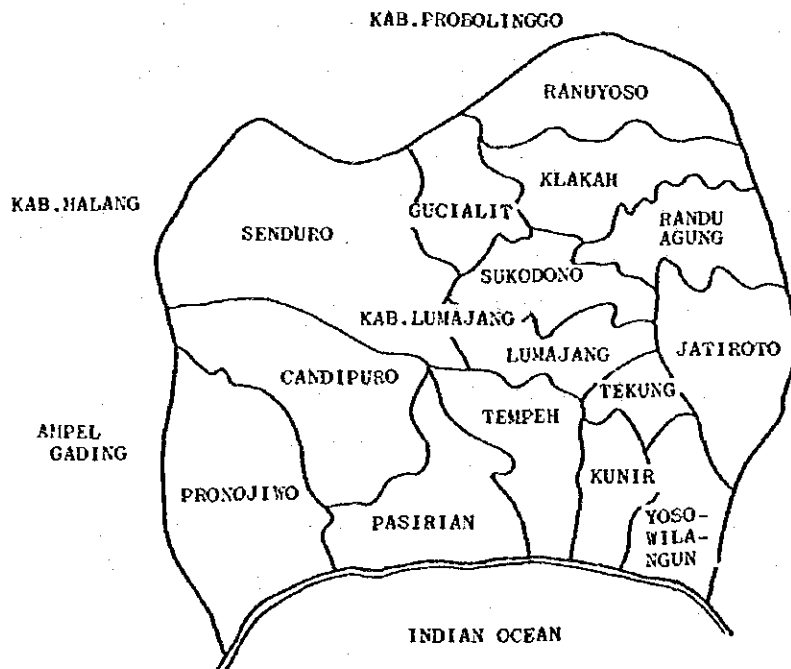


Fig.-2 Location of Kecamatan in Kab. Lumajang

Pronojiwo kecamatan was recently divided into Pronojiwo and Tempursari to make a total of 16 kecamatans. Out of these, the kecamatans which are included in the possible disaster areas are Candipuro, Pasirian, Pronojiwo and Ampel Gading in Kab. Malang for the first-priority project.

(1) Population

The population of Kab. Lumajang in 1980 was 87,000 and the annual average growth rate was 1.17% between 1971 and 1980 and 1.36% between 1976 and 1980. These rates are conspicuously low in comparison with the population growth rate of the Republic of Indonesia as a whole (2.32% between 1971 - 80) and the East Java State (1.49% between 1971 - 80). Its population density is also low at 488/km compared to 609/km of the East Java State.

The distribution of the population in terms of kecamatan shows that 10.8% of the entire population lives in Lumajang where the population density is as high as 1,167/km and the annual population growth rate between 1976 - 80 was also high at 3.1%.

As far as three kecamatans in the possible disaster areas are concerned, the population density is lower than the prefectural average except for Pronojiwo. However, the population survey shows a decline in population in Pronojiwo from 66,100 in 1976 to 63,500 in 1980.

(Population Migration)

According to migration statistics prepared by the Migration Bureau of Kab. Lumajang, the number of households which migrated to other areas from Kab. Lumajang was 654 in 1979/80, 988 in 1980/81 and 877 in 1981/82.

With regard to sediment disasters caused by Mt. Semeru, 791 households in Kec. Candipuro and 722 households in Kec. Pasirian migrated in 1976/77 after they were hit by the large flood in 1976.

In fact, the outflow of the population during the same period amounted to 1,676 households (6,298 people) in Kab. Lumajang as a whole. On top of this, as many as 155, 336, 147 and 160 households in 1980/81 and 53, 199, 134 and 247 households in 1981/82 migrated from Kec. Yosowilangun, Kec. Pronojiwo, Kec. Candipuro and Kec. Senduro respectively, due to the large flood in May, 1981.

Those obliged to migrate due to the Mt. Semeru disaster resettled largely in Sulawesi and North Sumatra.

Other factors, such as the seeking of employment opportunities and marriage, other than disasters have also accelerated the outflow of the population from the area.

(Agricultural Population)

According to the 1980 census, the number of agricultural households was about 100,000 and some 17,000 households were engaged in poultry raising. A further 500 households were engaged in fishing. There were about 207,000 households in Kab. Lumajang as a whole and those agricultural households occupy some 57%.

(2) Agriculture

i) Land Use

Land use by kecamatan in Kab. Lumajang is shown in the following figure. Rice fields account for 32.7% of all land and maize field occupies 36.9%.

In Kec. Pasirian, which belongs to the possible disaster area, rice fields and maize fields put together account for 42.5% of the entire area. In Kec. Candipro where the ratio of rice fields is the largest among all kecamatans of Kab. Lumajang, it covers 70% of all land where maize is also accounted for. In Kec. Pronojiwo, the coffee growing area is relatively larger than those in other kecamatans.

There are 35,673 ha and 118,888 ha of wet and dry land respectively in Kab. Lumajang.

Irrigation methods are classified according to the method of water intake into Technical, Semi-technical and Non-technical. Very few paddy fields use rainwater and 99% of all paddy fields are irrigated in some way. Fig. shows the cropping patterns drawn from information collected by field research and a land utilization map on a scale of 1 to 50,000. According to the cropping pattern, in Kab. Lumajang, double-and-half or triple cropping at the most is possible and maize and tobacco are cultivated as secondary crops.

In addition, at least double cropping is carried out on more than 80% of all farmland where the method of irrigation is Technical or Semi-technical. On the other hand, where the method of irrigation use is Non-technical, only 60% of the land is possible for double cropping. Kec. Lumajang and Kec. Sukodono are mainly irrigated by the Technical method while Kec. Senduro, Kec. Pasirian, Kec. Cadipiro and Kec. Kunir are mainly irrigated by the Non-technical method.

ii) Agricultural Production

As formerly mentioned, the main crops in Kab. Lumajang are paddy rice and maize. It is difficult to maintain a steady level of agriculture production every year since production is not only dependent on the change of land utilization and the progress of production techniques but also on the weather and damage caused by blight or insects. According to 1980 statistics, 270 thousand tons of paddy rice was yielded from a harvest acreage of 59 thousand hectares. Field information findings lead to an estimate of an average harvest of 4.7 tons per hectare of dry ear paddy rice (padi kering). After threshing into dried unhulled rice (gabah kering) with a ratio of 80:65 (Note 1), the results is 3.8 tons.

In Kab. Lumajang in 1980, 80 thousand tons of maize was yielded from an acreage of 65 thousand hectares. The average yield per hectare of maize with tassel and husk was estimated at 1.6 tons. Although the exact value of maize on the

weight conversion ratio is unknown, it is conceivable that the weight of dried corn is halved after the removal of tassel and husk. The average harvest of dried corn (pipilan kering) is, therefore, 0.8 tons per hectare.

Most of the rice and maize is for own consumption, and the surplus is sold at the local market. The main buyers are door to door brokers and the village market brokers. The field research conducted in 10 Kecamatan in Kab. Lumajang on the purchase price of such buyers revealed that the price of dried unhulled rice was some 135 Rp/ton and that of dried corn was some 120 Rp/ton.

Note 1: According to the weight conversion table of paddy, unhulled rice and rice prepared by Food Agency (BULOG).

A comparison of the productivity in Kab. Lumajang with the national average of Indonesia shows that the productivity of paddy rice and cassava in Kab. Lumajang is high and of maize slightly low. The same result is given when compared with the average productivity in Jawa Timur.

The production of paddy rice per capita in 1980 shows 307 kg per capita in Kab. Lumajang as against 260 kg per capita in Indonesia as a whole and 209 kg per capita in Jawa Timur.

Three kecamatans in the possible disaster areas produce 32%, 33% and 62% of prefectural production of paddy rice, cassava and coffee respectively. These areas are, therefore, very important for agricultural production in Kab. Lumajang.

Table-1 Production of Major Crops - 1980

(Ton)

Kecamatan	Rice	Maize	Soy Bean	Cassava	Coffee
1. Lumajang	29,839	2,485	570	830	-
2. Sukodono	19,196	6,374	2,136	4,013	-
3. Senduro	14,045	7,207	977	780	759
4. Gucialit	133	4,846	354	3,107	140
5. Klakah	7,314	14,918	2,978	8,553	10
6. Ranuyoso	-	10,488	2,742	8,393	4
7. Randuagung	15,979	8,403	2,250	920	8
8. Pasirian	32,437	6,126	11	1,187	21
9. Tempeh	21,274	3,742	281	1,661	-
10. Candipuro	41,334	2,020	17	1,362	580
11. Pronojiwo	11,814	423	-	14,697	904
12. Yosowilangun	26,636	4,478	1,647	594	-
13. Jatiroto	25,404	2,543	676	4,400	-
14. Kunir	11,109	4,968	1,587	880	-
15. Tekung	12,012	1,849	805	590	-
Total	268,094	80,870	17,032	51,966	2,426

Source: Statistic Lumajang 1980

Table-2 Comparison of Agricultural Production, 1980

	Paddy			Maize			Cassava		
	Area (HA)	Production (Ton)	Yield Rate Ton/Ha	Area (HAS)	Production (Ton)	Yield Rate Ton/Ha	Area (HA)	Production (Ton)	Yield Rate Ton/Ha
Indonesia	9,005,065	29,651,905	3.3	2,734,940	3,990,939	1.5	1,412,481	13,726,336	9.9
Java Timur	1,421,381	6,111,937	4.3		1,659,999	1.53		4,190,161	9.6
Kab. Lumajang	58,619	269,094	4.6	66,075	80,870	1.2	4,673	51,966	12.5
3 Kecamatan	18,710	85,585	4.6	5,975	8,569	1.43	1,522	17,246	11.33

Source: Statistik Lumajang 1980
Statistical Yearbook of Indonesia 1982

(LIVESTOCK AND POULTRY)

Cattle are extensively raised with 94,000 head in 1981. Used for farming and the transportation of agricultural products; their service life is about 8 years, after which they are sold for slaughter. In general, the service life of buffaloes is the same and both are usually leased.

As there is no form of leasing system for horses, the owner of a horse will use it himself to pull a carriage.

In regard to poultry, domestic fowls and ducks are raised for eggs and food. The sale of eggs is an important source of additional income.

Table-3 Head of Cattle in Kab. Lumajang

Year	Buffalo	Cow & Ox	Horse	Goat	Sheep	Pig	Duck	Chicken
1976	3,900	108,140	2,603	42,680	24,858	3,452	45,520	280,761
1977	4,150	113,569	2,697	44,569	26,931	3,653	49,471	616,504
1978	4,315	113,763	2,806	46,467	28,970	4,394	45,295	664,657
1979	5,099	87,351	2,224	27,895	23,537	2,652	83,644	620,390
1980	5,830	90,105	2,369	40,838	20,196	2,915	68,241	688,724

(Land Ownership)

The study on agricultural land ownership in terms of the amount of farmland shows that 86% of farmers cultivating less than 0.25 hectares own their farmland. This ratio is lowered to 71% in the case of cultivating more than 0.5 hectares.

As a whole, some 80% of farmers own their farmland and those who do not own the land account for only 10%. The remaining 10% is accounted for by those who own the land as well as lease the land for their agricultural activities.

Apart from full-time farmers, some are involved in peddling fruit, poultry raising and shopkeeping.

Table-4 Agricultural Land Ownership by Amount of Farmland

(Unit: Household)

Hectares	Self-owned Land	Leased Land	Self-owned & Leased Land	Total
-0.25HA	29,249	3,805	1,039	34,093
0.25-0.50HA	29,937	3,681	2,755	34,373
0.50HA-	23,940	1,897	6,427	35,264
Total	84,126	9,383	10,221	103,730

Source : PENDUK JAWA MANURUT PROPINSI DAN KABUPATEN/KOTAWADAYA HASIL PENCACAHAN LENGKAP SENSUS PUNDUK 1980.

(3) Industry

The following table shows the number of factories and the volume of production for the major industries in Kab. Lumajang in 1980. Only those industries which have more than 10 factories in the area are listed in the table.

The total number of factories amounts to 187 and some 70% of them are concentrated in Kec. Lumajang. Kec. Pasion, in the possible disaster area, has more factories than the other two kecamatans in the area.

In terms of production volume, the ice industry is by far the largest followed by the rice industry.

The economy of Kab. Lumajang is centered on the primary industry. The lack of a large manufacturing industry there makes Kab. Lumajang a relatively undeveloped area within Java island in terms of industrial activities.

Table-4 Major Industries in Lumajang 1980

No of Factory, Production Volume

Kecamatan	Ice		Rice		Kurupuk		Wood		Lasery		Bicycle		Silver		Total
	No.	(Biji)	No.	Ton	No.	Ton	No.	M ³	No.	Biji	No.	Biji	No.	Kg	
1. Lumajang	6	6,380,000	8	82	7	78.5	7	10,330	7	31,200	11	18,575	15	15,756	132
2. Sukodono	1	1,700,000	-	-	-	-	1	15,000	-	-	-	-	-	-	7
3. Senduro	-	-	-	-	-	-	1	9,000	-	-	-	-	-	-	1
4. Gucialit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Iclukuh	1	600,000	1	4,500	-	-	-	-	-	-	-	-	-	-	5
6. Ranayoso	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Ranadugung	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
8. Yosowilangun	2	1,550,000	-	-	1	15	1	3,600	1	3,000	1	700	-	-	10
9. Jatiroto	-	-	1	3,300,000	1	108	-	-	-	-	3	4,000	-	-	6
10. Kunir	1	600,000	-	-	-	-	-	-	-	-	-	-	-	-	2
11. Tekung	-	-	-	-	-	-	1	9,600	-	-	-	-	-	-	2
12. Pasilian	2	1,200,000	-	-	-	-	1	120	2	12,000	1	750	1	0.96	11
13. Tempoh	-	-	1	10	2	27	1	100	-	2,500	-	-	1	0.85	10
14. Condipuro	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
15. Pronojiwo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	13	12,030,000	11	3,304,592	11	228.5	13	47,750	11	48,700	17	24,200	17	17,566	187

Source: STATISTIC LUMAJANG 1980

(4) Facilities for Maintaining Life

The main transportation network in Kab. Lumajang consists of the railway line which runs north to south and connects Drobolinggo and Pasirian via Lumajang and another railway line which runs east to west as branching out from Lumajang towards Jember. Trunk roads are running almost parallel to these railway lines.

The electricity supply is not enough to meet the demand and therefore the demand is adjusted by regular blackouts.

Waterworks and a sewer system are almost nonexistent. As a result, the drinking water comes from well or rain and the drainage goes to the irrigation channels in and around the village or nearby rivers.

Location Map of Roads and Public Facilities is to be inserted.

The influence of these facilities on the daily life in Kec. Pasirian, Pronojiwo and Candipoo in view of possible disasters is to be described here.

4.2 Significance of the Project

In regard to the Third Five Year Plan (1979/80 - 1983/84), the Indonesian Government put forward an economic efficiency priority policy and listed a fair distribution of development results as one of the seven national targets. To achieve this objective, eight principles are introduced such as (i) to insure food, clothing and housing for the public, (ii) fair distribution of income, (iii) correction of differentials between local areas and so on.

Furthermore, the Directorate General of Water Resources Development of the Ministry of Public Works has been conducting various measure to secure the above-mentioned national targets on three items i.e. (i) to maintain security in the agricultural areas, (ii) to do justice to inhabitants through maintaining local security and (iii) to maintain production activities through protecting the industrial areas from disasters.

Against this background, the Directorate General considered sediment control work in the area around N.T. Semeru as an urgent task and decided to put the work into operation.

Since 1809, Mt Semeru has caused a series of large debris flow disasters. The recent example is the debris flow that occurred on May 14, 1981 and caused not only casualties of 400 people including those missing but also extensive damage to many houses, farmland, intake facilities etc.

The sediment control work is largely divided into two categories i.e. head-water sediment control and sediment flow control. Characteristics of the present project classify it as one of the latter. In other words, the objective of the project is to enhance local security by checking the damage from debris flow run-off, which has a large destructive power and causes destruction to houses, farmland etc.

Kab. Lumajang enjoys relatively high productivity while its economic structure centers around agriculture. Nevertheless, 40% of its wet land is still under semi-technical and non-technical irrigation methods. Improvement in irrigation technique in this area is expected to bring about double or triple cropping, as seen in the technical irrigation area.

As such, the protection of agricultural villages implies not only the prevention of damage to people and property and the population migration out of Kab. Lamajang but an increase of agricultural productivity. This is specially because these three kecamatans, which are included in the possible disaster areas, occupy an important place in the economy of Kab. Lumajang, therefore, the execution of the project should exert a positive influence on the economic development of Kab. Lumajang.

4.3 Content of Economic Effect

The content of economic effect is studied on the following items based on the examination of collected data. For detail, refer to Supporting Report (4).

(Direct Damage Items)

o General Property

Mosques (Large)	Factories (Large)	Other Shops
Mosques (Small)	Factories (Small)	Office Buildings
Churches	Foodstores	Houses (Upper Class)
Hospitals (Large)	Clothing Sotres	Houses (Middle Class)
Hospitals (Small)	Grain Stores	Houses (Lower Class)
Schools	General Stores	

o Agricultural Products

Paddy Rice	Maize	Coffee
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o Livestock and Paultry

Buffalo	Goat	Duck
Cattle	Sheep	Chicken
Horse	Pig	

o Reduction in Public Facilities

River	Check Dams	Road	State Roads
"	Consolidation Dams	"	Prefectural Road
"	Dikes	"	Village Roads
"	Revetments	"	Others
"	Groynes	Bridges	

o Human Damage (Inhabitants)

(Indirect Damage Items)

Food Supply from the Food Supply Enter
Purchase of Sugar
Construction of Temporary Houses
Purchase of kerosene for Temporary Houses
voluntary Rescue Activities
Security Work
Set-up of communication Facilities
Nursing of Wounded and Sick People, Cost for Funerals
Rice (Given in kind)

(Water Resource)

Increase of production on account of a switch-over of
crops
Increase of production by expansion of farmland
(Generation of new production)

4.4 List of Collected Data

(1) Statistic for the following 10 kecamatans by Desa

- | | |
|-------------|----------------|
| ① Pronojiwo | ⑥ Lumajang |
| ② Senduro | ⑦ Kunir |
| ③ Candipuro | ⑧ Tekung |
| ④ Pasirian | ⑨ Yosowilangun |
| ⑤ Tempeh | ⑩ Sukodono |

Items:

Area

Population

Number of Households

Cultivation Area for Each Crop

Yield for Each Crop

Spread of Houses, Stores, Factories and Hospitals
(detailed data for Stores is required)

Scale of Stores and Evaluation of commodities

Number of Cattle (for each kind)

(2) Data by Basic Unit

- Agriculture

- ① Consumption of Service Water by Each Crop/Yield by Unit
- ② Consumption of Fertilizer by Each Crop/Yield by Unit
- ③ Consumption of Insecticide by Each Crop/Yield by Unit
- ④ Market Price of Crop

- ⑤ Cost for Fertilizer
- ⑥ Cost for Insecticide

- ⑦ Productivity of Irrigated Agriculture (Yield/Unit Area)
- ⑧ Productivity of Non-Irrigated Agriculture (Yield/Unit Area)

- Assessment of Property (Movable Property + Immovable Property)
 - ① Houses (Upper Class, Middle Class, Lower Class)
 - ② Stores (classified in detail)
 - ③ Offices
 - ④ Hospitals
 - ⑤ Factories
 - ⑥ Scholls

- Unit Price for Construction
 - ① Houses (Upper Class, Middle Class, Lower Class)
 - ② Stores (classified in detail)
 - ③ Hospitals
 - ④ Factories
 - ⑤ Scholls

- Scale of Stores and Factories
 - ① Sales Amount of Stores (classified in detail)
 - ② Production Scale of Factories (classified in detail)

General Data for Agriculture Production

- ① Cropping Pattern by Each Region
 - ② Cropping Pattern by Each Crop
 - ③ Damage upon Agriculture at the Time of the Disaster in May, 1981
 - ④ Transition of Production/Month by Each Crop
 - ⑤ Ratio of Irrigation Area (by Each Kecamatan)
 - ⑥ Water System for Irrigation (Location of Intakes)
 - ⑦ Sectional Map of Agricultural Land to be Irrigated
- (3) Report by the Directorate General of Water Resources Development I.D.A. Irrigation Rehabilitation Programme Pekalen Sampean Sub Project, East Java
- ① Report on Irrigation Rehabilitation Programme (PROS IDA)
 - ② Agriculture Data wet Season (Nov. 1980 - Apr. 1982 Wet Season)
 - ③ Agriculture Semi Annual Report (May 1981 - Oct. 1981 Dry Season)
 - ④ Irrigation Rehabilitation Programme (Nov. 1980 - Apr. 1981 Wet Season)
 - ⑤ Agroeconomic Data (May 1980 - Oct. 1980 Dry Season)
 - ⑥ Agroeconomic Data (Nov. 1979 - Apr. 1980 Wet Season)
- (4) Market Prices (August, 1981)
- Farm Crops: Rice, Cassava, Peanuts, Soybean, Coffee, Conconuts, Cloves, Pepper, Tabacco
 - Cattle : Water Buffalo, Milch, Horse, Sheep, Goat, Duck Hen, Pig

- House : Brick, Brick-Bamboo, Wood, Bamboo

(5) List of Budget for M.T. Semeru Project

(6) Statistics for East Java

- ① Gross Regional Product (1976-80)
- ② Transition of Population and Forecast
- ③ Population of Farmers (by each cultivation area)
- ④ Cultivation Area and Yield for Major Crops (1978 and 1979)
- ⑤ Employed Population for Each Industry
- ⑥ GDP Composition for Each Industry
- ⑦ Population for Each Kabupaten
- ⑧ Planted Area and Yield for Each Vegetable
- ⑨ Income per Capita.
- ⑩ Planted Area and Yield for Each Crop (Rice, Maize Sweet Potatoes, Cassava, Peanuts, Soybeans)
- ⑪ Production-Conditions for Plantation Crops Rubber, Coffee, Tea, cocoa, cloves, Coconuts, Sugar Cane)
- ⑫ Transition of Demand and Yield of Rice (1976 - 1980)
- ⑬ Forecast of Demand and Yield of Rice (1981 - 1985)

(7) General Data

- Restoration cost for Flood Disaster

- ① Medical cost
- ② Food Cost
- ③ Personnel Expenses
- ④ Construction Cost ofr Restoration
- ⑤ Temporary Houses
- ⑥ Cost for Migration

- Period for Restoration
 - ① Agricultural (Agricultural Land and Irrigation Facilities)
 - ② Infrastructures (Road, Bridge, Electricity etc.)
 - ③ Buildings (Houses, Stores, Factories etc.)
 - budget
 - Data for Development Planning
 - The Presidential Budget Statement
 - ① January, 1981 as already issued - in Indonesian and English
 - ② January, 1982 scheduled to be issued in August - in Indonesian and English
-
- | | | |
|------|--|--|
| (8) | Penanggulangan Bencand Alam
(Report on Natural Disasters) | Min. of Pablic Works
(April, 1983) |
| (9) | Report on Great Flood Disaster
of May 14, 1981 | Kab. Lumajang
(June, 1981) |
| (10) | Minutes of Provincial
Parliamentary Session on
Disaster of May 14, 1981 | Kab. Lumajang
(June, 1981) |
| (11) | Disaster Rehabilitation
Budgetary Plan in Kec. Tempeh | Kec. Tempeh (1983) |
| (12) | Report on May, 1981 Disaster
by Kec. Tempeh | Kec. Tempeh (May,
1981) |
| (13) | Disaster Report for Kab.
Lumajang in 1981 | Kab. Lumajang
(May, 1981) |
| (14) | Report on Disaster Relief
Activities by Women's
Association in Kec. Tempeh | Kec. Tempeh (May
1981) |
| (15) | Report on Disaster Relief
Activities in Kec. Tempeh | The Army Squad in
kec. Tempeh (May
1981) |

- | | | |
|------|---|--|
| (16) | National Disaster budget for Each Province | Min. of Public Works
(August, 1982) |
| (17) | Survie Sosial Ekonomi National | Central Bureau of
Statistics (1980) |
| (18) | Population of Java-Madura | C.B.S. (1981) |
| (19) | Penduduk Jawa Menerut Province
San Kabupaten/Katamadya
(Polpulation in Java Island by
city, Province and State) | C.B.S. (1980) |
| (20) | Produk i Tanaman Bahan
Makanan
di Jawa - Madura
(Production of Food Crops in
Java-Madura) | C.B.S. (1980) |
| (21) | Statistik Lumajang | Kab. Lumajang (1981) |
| (22) | Statistik Lumajang (Part) | Kab. Lumajang (1982) |
| (23) | Statistik Indonesia | C.B.S. (1982) |
| (24) | Production of Food Crops in
Indonesia | C.B.S. (1981) |
| (25) | Provincial Income in Indonesia
1975-1979 | C.B.S. (1982) |
| (26) | Peternakan
(Livestock Statistics) 1979 | C.B.S. (1982) |
| (27) | Luds Tanah Menurut Penggunaanya
di Jawa & Madura 1980
(Land Use and Area of Java-
Madura in 1980) | C.B.S. (1982) |
| (28) | National Income of Indonesia
1978-1981 | C.B.S. (1982) |
| (29) | Report and Recommendation of
the National Workshop on Mt.
Galunggung Volcanic Risk
Management Held in Bandung
(3 volumes) | Central Committee for
Disaster Prevention
(1982) |
| (30) | Raporan Bencana Alam Gunung
Galunggung | Kab. Tosikmalaje
(1982) |

- | | | |
|------|---|---|
| (31) | The Main Pattern for Preventive and Rehabilitative Actions Against Natural Disaster in Indonesia | Min. of Social Welfare (1982) |
| (32) | Raparan Merubus Gunung Golunggung | West Java State (1982) |
| (33) | International Emergency Assistance Mt. Glunggung Requirements as of 10 September, 1982 | U.N. (1982) |
| (34) | Mt. golunggung Relief Report | Indonesian Red Cross (1982) |
| (35) | Kabupaten Garut, Ceamis General Statistic | (1980) |
| (36) | Bencana Alam Gunung Galunggung dan Bencana Alam Lainnya di Jawa Barat Takun Kerja 1982/83
(Natural Disaster Report in West Java, Galunggung and Others.) | West Java Committee for Disaster Preention (1983) |

THE REPUBLIC OF INDONESIA

THE FEASIBILITY STUDY ON THE VOLCANIC DEBRIS
CONTROL AND WATER CONSERVATION PROJECT
IN THE SOUTHEASTERN SLOPE OF MT. SEMERU

SUPPORTING REPORT (5)

PART - B
HYDROLOGY

FEBRUARY, 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

B. HYDROLOGY

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1. INTRODUCTION

1.1 STUDY AREA

The study area is located, as shown in Fig.-1.1, on the south eastern slope of Mt. Semeru in the state of East Java in the Republic of Indonesia. The area from east to west is divided into three basins i.e. the K. Mujur basin (about 170 km²), the K. Rejali basin (about 130 km²) and the K. Glidik basin (about 330 km²).

The south eastern slope of Mt. Semeru is covered by volcanic ash like the southern slope of Mt. Fuji in Japan, and is divided into a steep slope and a gentle slope at an elevation of about 1,500 m.

1.2 PURPOSE OF STUDY

The hydrological study reported here is a part of the Main Study and was carried out to investigate the following items.

- ① To determine the planned flood discharge by means of flood discharge analysis. The flood discharge value so attained will be used for a "balance of sidement" analysis, a calculation of the sediment volume to be controlled, a decision of the design conditions for various structures, etc. of the sediment control plan.
- ② To determine the long-term base flow discharge by means of base flow analysis. The base flow value so attained will be then used for the water conservation preliminary plan.

1.3 STUDY ITEMS

The study items to be dealt with in this report are given below.

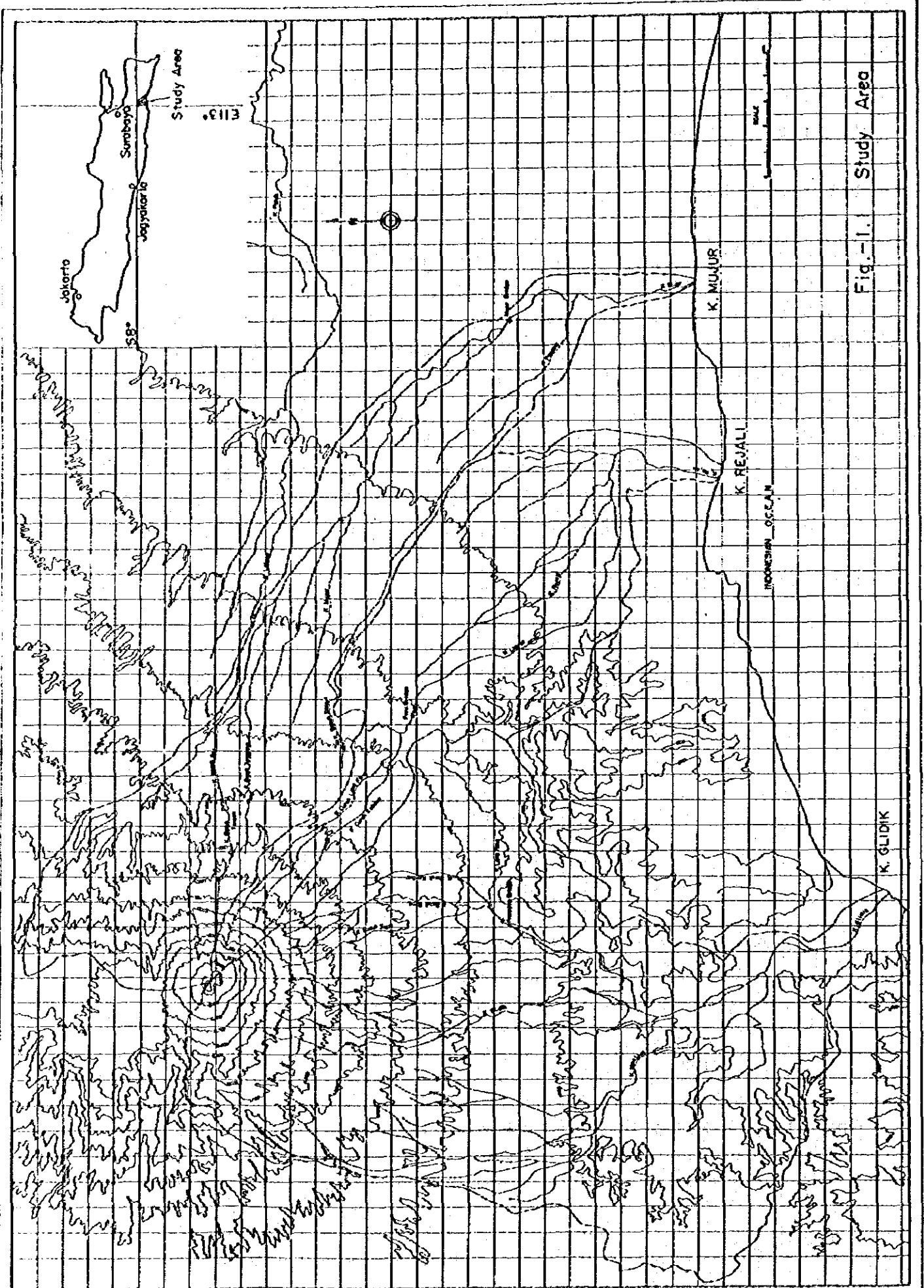


Fig.-I. Study Area

① Collection of Data

- (1) Collection of the existing rainfall data.
- (2) Collection of the existing discharge data.
- (3) Collection of other existing meteorological data.

② Observation

- (1) Rainfall observation.
- (2) Flood discharge observation.
- (3) Base flow observation.

③ Analysis

- (1) Rainfall analysis.
- (2) Flood discharge analysis.
- (3) Base flow analysis.

1.4 FLOW CHART

The hydrological study reported here was conducted according to the order given by the flow chart i.e. Fig.-1.2.

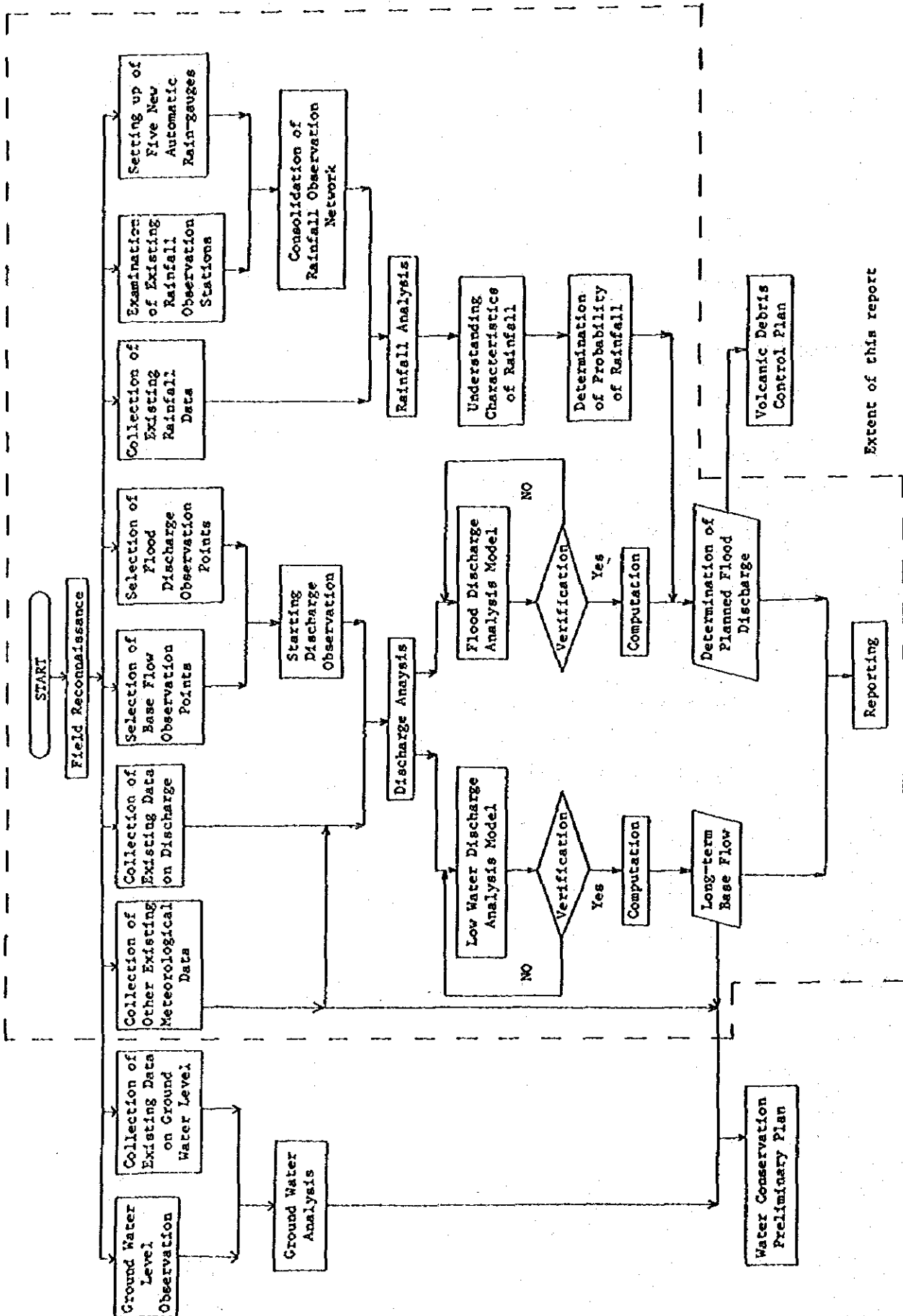


Fig.-1.1.2 Flow Chart of Hydrological Study

2. COLLECTION OF EXISTING DATA

2.1 RAINFALL DATA FOR STUDY AREA

Table-2.1 shows the available data on rainfall in the study area while Fig.-2.1 shows the locations of rainfall observation stations.

A summary of Table-2.1 is described below.

① Type of Rain-gauge

- (i) Manual rain-gauge 30 stations
- (ii) Automatic rain-gauge 15 stations

② Observation Stations with Solid Rainfall Data

(i) Manual Rain-gauge Stations

Eighteen observation stations including the Gucialit station have provided rainfall data for more than thirty years (1952 - 1982).

(ii) Automatic Rain-gauge Stations

The periods of observation are generally short and the stations with the longest record of observation at Besuk Sat and Curah Kobo'an only possess data for the last five years i.e. 1978 - 1983. This data is not satisfactory for use in the study as their observation period is not only short but they suffer from frequent interruption.

Table-2.1 (1) List of Collected Data (Manual Type)

NO.	STATION	OBS. NO.	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
0.	BLUKON	224																																			
1.	BESUK SAT	158																																			
2.	PASRUJAMBE	161																																			
3.	SUMBER DUREN (BENDO)	162																																			
4.	KERTOSARI	160																																			
5.	KEDUNG WRINGIN	186																																			
6.	BESUK	150																																			
7.	BEDOG (TEMPERLOR)	190																																			
8.	PASIRIAN	189																																			
9.	CANDIPURO	188a																																			
10.	CUNDUNG SANDUR	188b																																			
11.	CURAH KORO'AN	164																																			
12.	SEHENDU																																				
13.	SUPIT URANG (SUMBER RADANG)	166																																			
14.	SUMBER ROMO (PONGAJIMO)	167																																			
15.	KEDUNG SANGGU	89																																			
16.	SENDURO	159																																			
17.	BANTUAN LOR	183																																			
18.	TEMPUR SARI (RAHAAN)	167a																																			
19.	GUGIALIT	157																																			
20.	MUNGGER																																				
21.	PACOMAN																																				
22.	UTIBUL																																				
23.	SUKODONO																																				
24.	SUKOSARI (TEMPUR KIDUL)	192																																			
25.	JOKARTO																																				
26.	MONOKERTO																																				
27.	TEKUNG	223																																			
28.	NOCOSARI																																				
29.	LUWAJANG (LABUK LOR)	185																																			

LEGEND:

O: Available for the whole year

Δ: Not available for the whole year (the figure means the number of unobserved months)

[illegible]

LEGEND: O: Available

Note: * Mark means new automatic rainfall station installed in 1982.

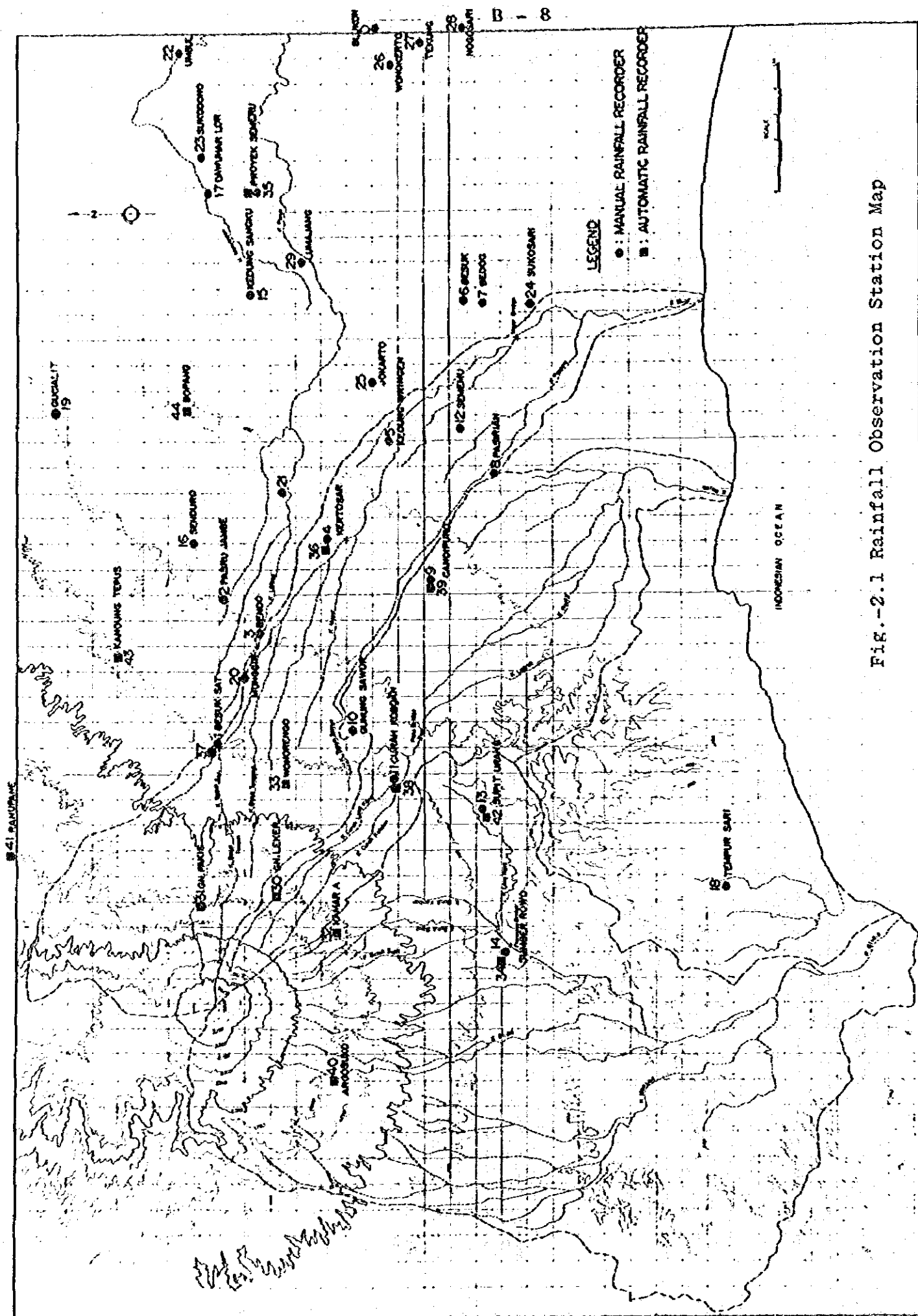


Fig.-2.1 Rainfall Observation Station Map

2.2 DISCHARGE DATA OF K. BONDOYUDO

Discharge data for the study area was non-existent. A search for discharge data, therefore, was extended to nearby areas in view of using it as a reference. As a result, the discharge data of K. Bondoyudo, which runs in the north east of the study area as shown in Fig.-2.2, observed by two stations since 1976 or 1977 was found and duly collected. Table-2.2 shows the availability of data at these two stations.

The hydrograph at the Dam Umbul observation station and the daily rainfall at the Gucialit rainfall observation station are shown in Fig.-2.3 for reference purposes.

2.3 OTHER METEOROLOGICAL DATA

Meteorological data was also virtually non-existent in the study area. It became known, however, that an agricultural project called the "Proyek Prosida" had set up ten observation stations to the east of the study area as shown in Fig.-2.4, and was gathering meteorological data. This was collected by the study team as shown in Table-2.3.

Fig.-2.5 shows a summary of the meteorological data for 1981 for the following three stations, all of which are located near the study area, and is for reference.

- (i) Gubug Damas Hilir. Lumajang.
- (ii) P.G. Wonolangan. Probolinggo.
- (iii) P.G. Semboro. Jember.

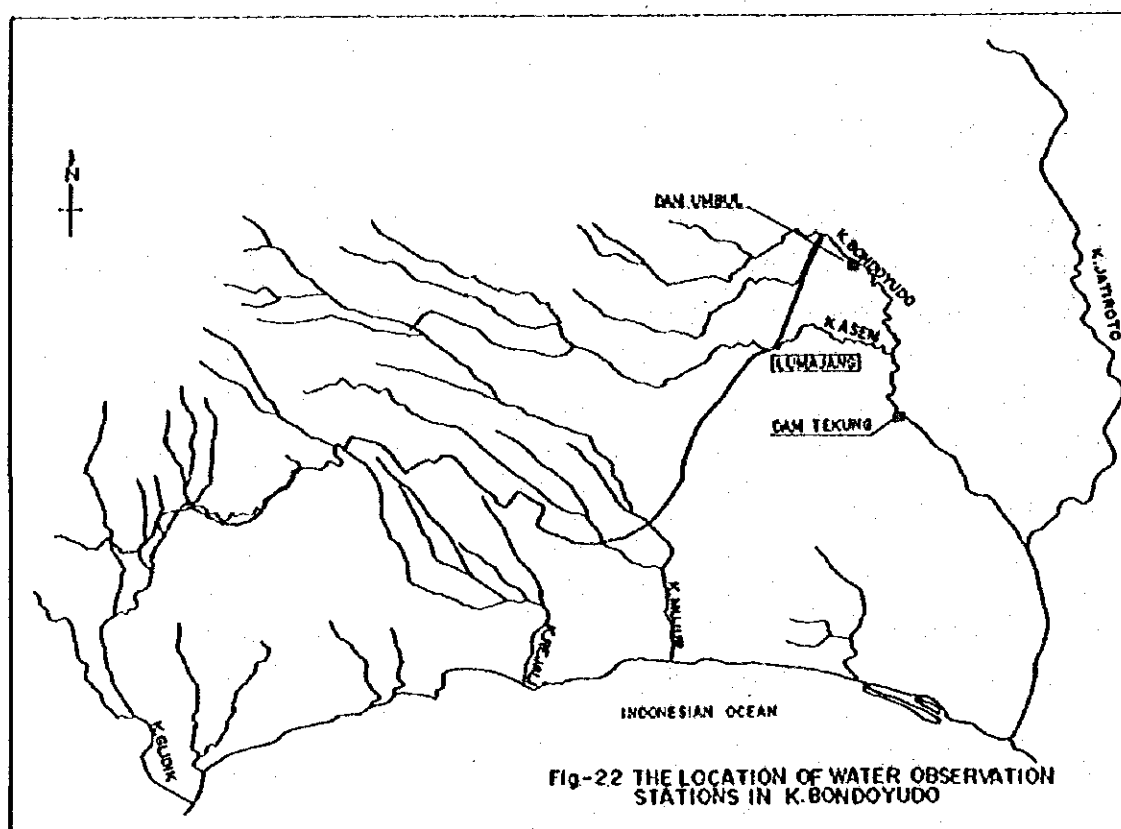


Table-2.2 The List of Collected Water Level Data
in K. Bondoyudo

STATION	CATCHMENT AREA	76	77	78	79	80	81
DAM UMBUL	412.75 km ²		△	△	△	○	○
DAM TEKUNG	677.50 km ²	△	△	△	△	△	△

Legend ;

○; Available for the whole year

△; Not available for the whole year

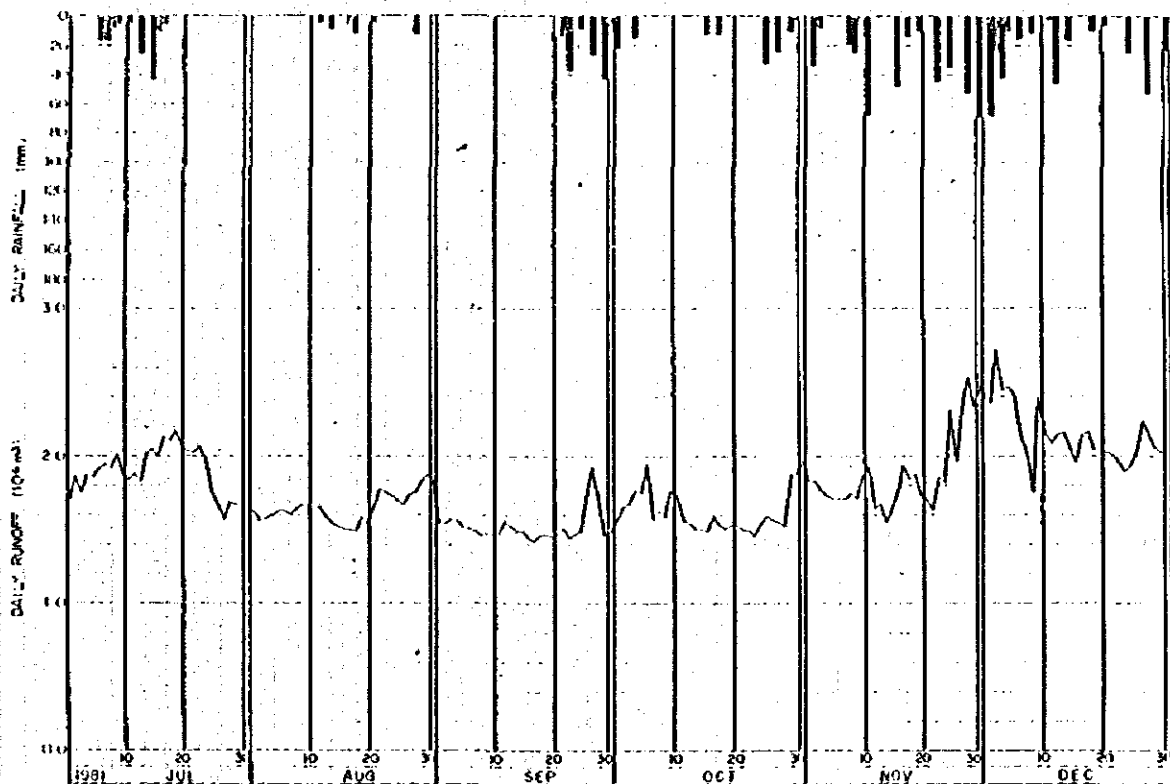
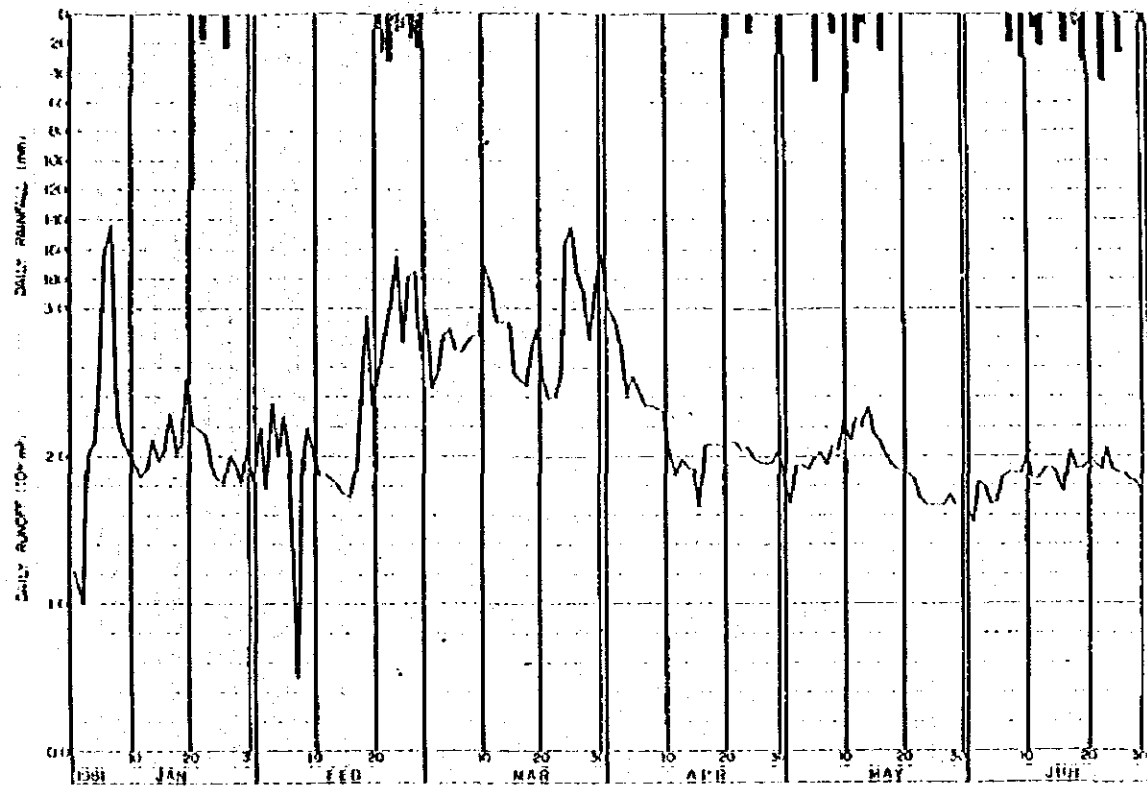


Fig.-2.3 Hydrograph at Dam Umbul

Table-2.3 List of Collected Meteorological Data

STATION	LOCATION			OBSERVATION ITEMS	YEAR					REMARKS
	LATITUDE	LONGITUDE	ALTITUDE		'77	'78	'79	'80	'81	
1 JUBUNG	S 8°11'	E 113°36'	36 M	1. RAINFALL	x	o	o	o	o	
				2. EVAPORATION	x	o	o	o	o	
				3. TEMPERATURE	x	o	o	o	o	
				4. R. HUMIDITY	x	o	o	o	o	
				5. WIND SPEED	x	o	o	x	o	
				6. S. HOUR	x	x	x	o	o	
				7. S. RADIATION	x	o	o	x	x	
2 JENOGAWAH/K. LOMP	S 8°13'	E 113°40'	64 M	1. RAINFALL	Δ ¹	o	o	o	o	
				2. EVAPORATION	o	o	o	o	o	
				3. TEMPERATURE	o	o	o	o	o	
				4. R. HUMIDITY	o	o	o	o	o	
				5. WIND SPEED	o	o	o	Δ ¹	Δ ¹	
				6. S. HOUR	x	x	x	o	o	
				7. S. RADIATION	Δ ¹	o	o	x	x	
3 GUBUNG DOMAS HILIR	S 8°14'	E 113°26'	12 M	1. RAINFALL	Δ ¹	o	Δ ¹	Δ ¹	Δ ¹	
				2. EVAPORATION	o	o	Δ ¹	o	o	
				3. TEMPERATURE	o	o	o	o	o	
				4. R. HUMIDITY	o	o	Δ ¹	o	o	
				5. WIND SPEED	o	o	Δ ¹	o	o	
				6. S. HOUR	x	x	x	Δ ¹	o	
				7. S. RADIATION	o	o	Δ ¹	x	x	
4 DAM SANPEAN BURU	S 7°47'	E 113°57'	125 M	1. RAINFALL	Δ ¹	o	x	Δ ¹	Δ ¹	
				2. EVAPORATION	o	o	Δ ¹	Δ ¹	o	
				3. TEMPERATURE	o	o	Δ ¹	Δ ¹	o	
				4. R. HUMIDITY	o	o	x	Δ ¹	o	
				5. WIND SPEED	o	o	Δ ¹	Δ ¹	o	
				6. S. HOUR	x	x	x	Δ ¹	o	
				7. S. RADIATION	Δ ¹	o	Δ ¹	x	x	
5 LP3. CETANG	S 8°21'	E 114°13'	168 M	1. RAINFALL	o	o	Δ ¹	o	o	
				2. EVAPORATION	o	o	o	o	o	
				3. TEMPERATURE	o	o	Δ ¹	o	o	
				4. R. HUMIDITY	o	o	Δ ¹	o	o	
				5. WIND SPEED	o	Δ ¹	o	o	o	
				6. S. HOUR	x	x	x	o	o	
				7. S. RADIATION	Δ ¹	o	Δ ¹	x	x	
6 LPTL. ASEMBAGUS	S 7°39'	E 114°13'	6 M	1. RAINFALL	x	Δ ¹	Δ ¹	Δ ¹	Δ ¹	
				2. EVAPORATION	x	o	Δ ¹	Δ ¹	o	
				3. TEMPERATURE	x	o	Δ ¹	Δ ¹	o	
				4. R. HUMIDITY	x	o	Δ ¹	Δ ¹	o	
				5. WIND SPEED	x	o	Δ ¹	Δ ¹	o	
				6. S. HOUR	x	x	x	Δ ¹	o	
				7. S. RADIATION	x	o	Δ ¹	x	x	
7 PG. WRINGIN ANOM	S 7°47'	E 113°44'	13 M	1. RAINFALL	x	o	Δ ¹	Δ ¹	Δ ¹	
				2. EVAPORATION	x	o	o	o	Δ ¹	
				3. TEMPERATURE	x	Δ ¹	o	o	Δ ¹	
				4. R. HUMIDITY	x	o	o	o	o	
				5. WIND SPEED	x	o	o	o	Δ ¹	
				6. S. HOUR	x	x	x	o	Δ ¹	
				7. S. RADIATION	x	Δ ¹	o	x	x	
8 PG. WONOLANGAN	S 7°14'	E 113°12'	20 M	1. RAINFALL	x	Δ ¹	Δ ¹	Δ ¹	o	
				2. EVAPORATION	x	o	o	o	o	
				3. TEMPERATURE	x	o	o	o	o	
				4. R. HUMIDITY	x	o	o	o	o	
				5. WIND SPEED	x	o	o	Δ ¹	Δ ¹	
				6. S. HOUR	x	x	x	o	o	
				7. S. RADIATION	x	o	o	x	x	
9 JATISARI	S 7°45'	E 114°06'	119 M	1. RAINFALL	x	Δ ¹	Δ ¹	Δ ¹	Δ ¹	
				2. EVAPORATION	x	Δ ¹	o	o	o	
				3. TEMPERATURE	x	Δ ¹	o	o	o	
				4. R. HUMIDITY	x	Δ ¹	o	o	o	
				5. WIND SPEED	x	x	x	x	x	
				6. S. HOUR	x	x	x	x	x	
				7. S. RADIATION	x	x	x	x	x	
10 SEMBORO	S 8°17'	E 113°37'	29 M	1. RAINFALL	x	x	x	Δ ¹	o	
				2. EVAPORATION	x	x	x	o	o	
				3. TEMPERATURE	x	x	x	o	o	
				4. R. HUMIDITY	x	x	x	o	o	
				5. WIND SPEED	x	x	x	o	o	
				6. S. HOUR	x	x	x	o	o	
				7. S. RADIATION						

NOTE: o : FULL MONTH - DATA AVAILABLE, Δ : FEW MONTH - DATA AVAILABLE, x : NOT AVAILABLE

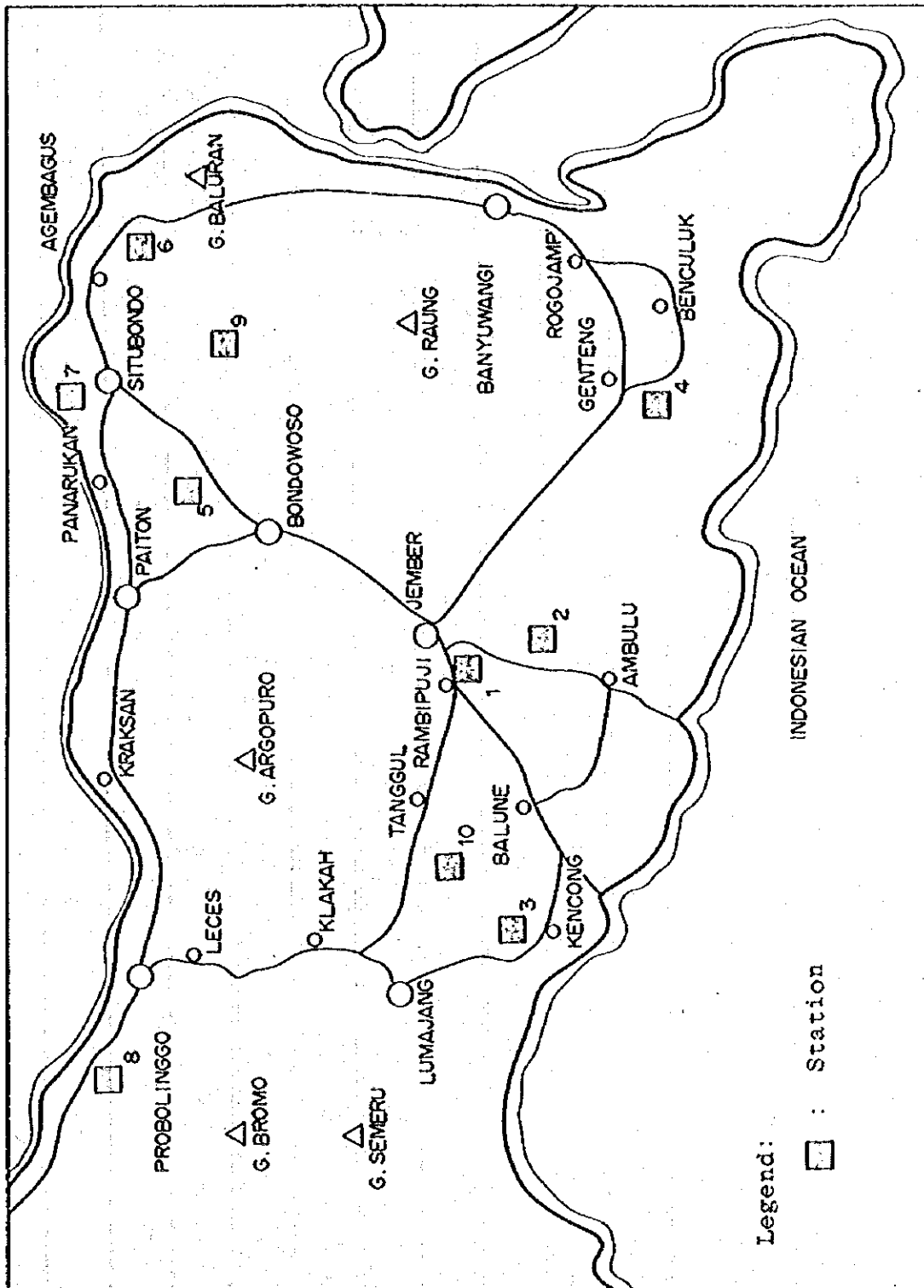


Fig. - 2.4 The location of the climatological observation stations

GUBUNG DOMAS HILIR.
STATION : LUMAJANG.

YEAR : 1981

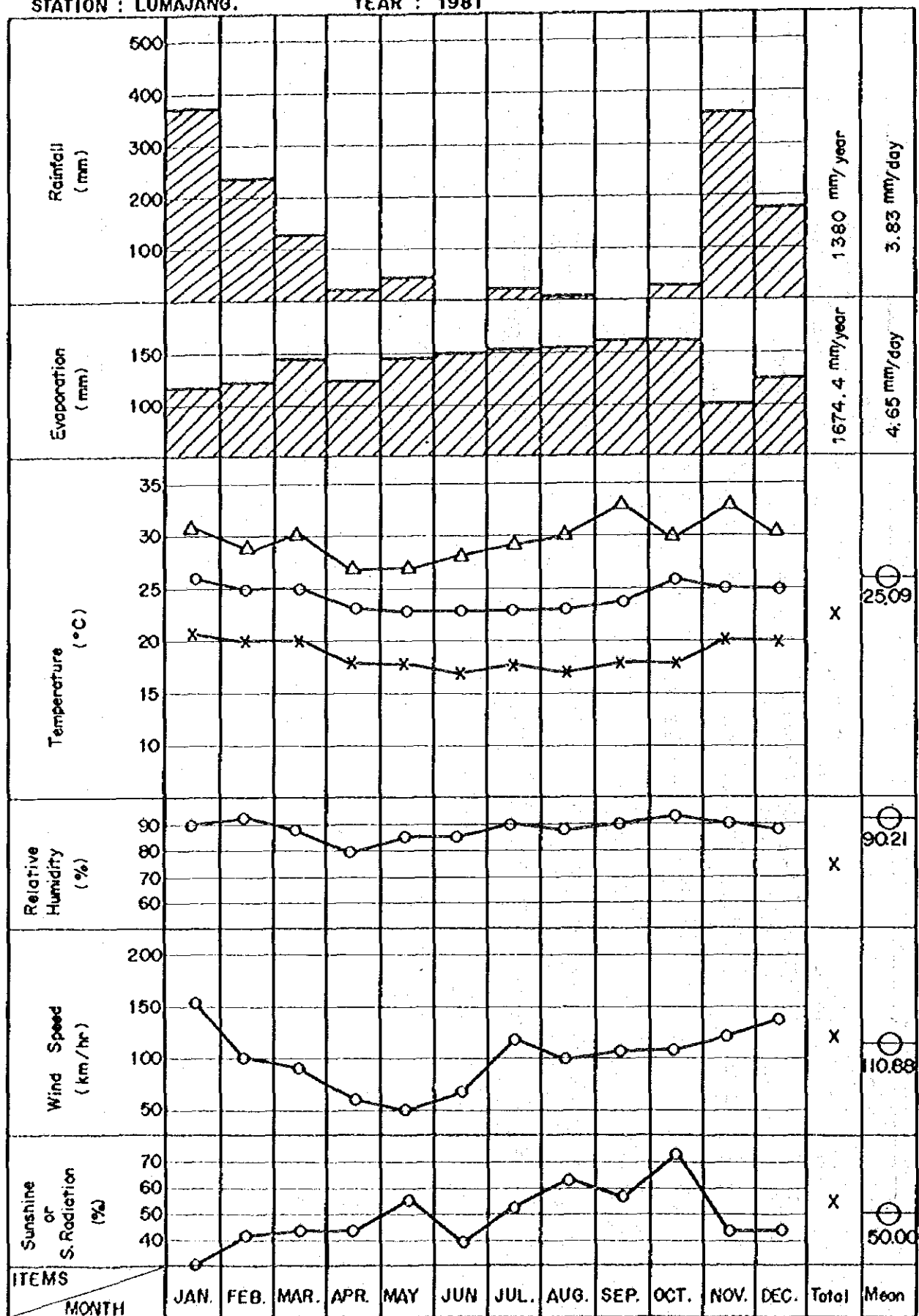


Fig. - 2.5 (1) Meteorological Data at Gubung Domas Hilir

PG. WONOLANGAN.
 STATION : PROBOLINGGO.

YEAR : 1981

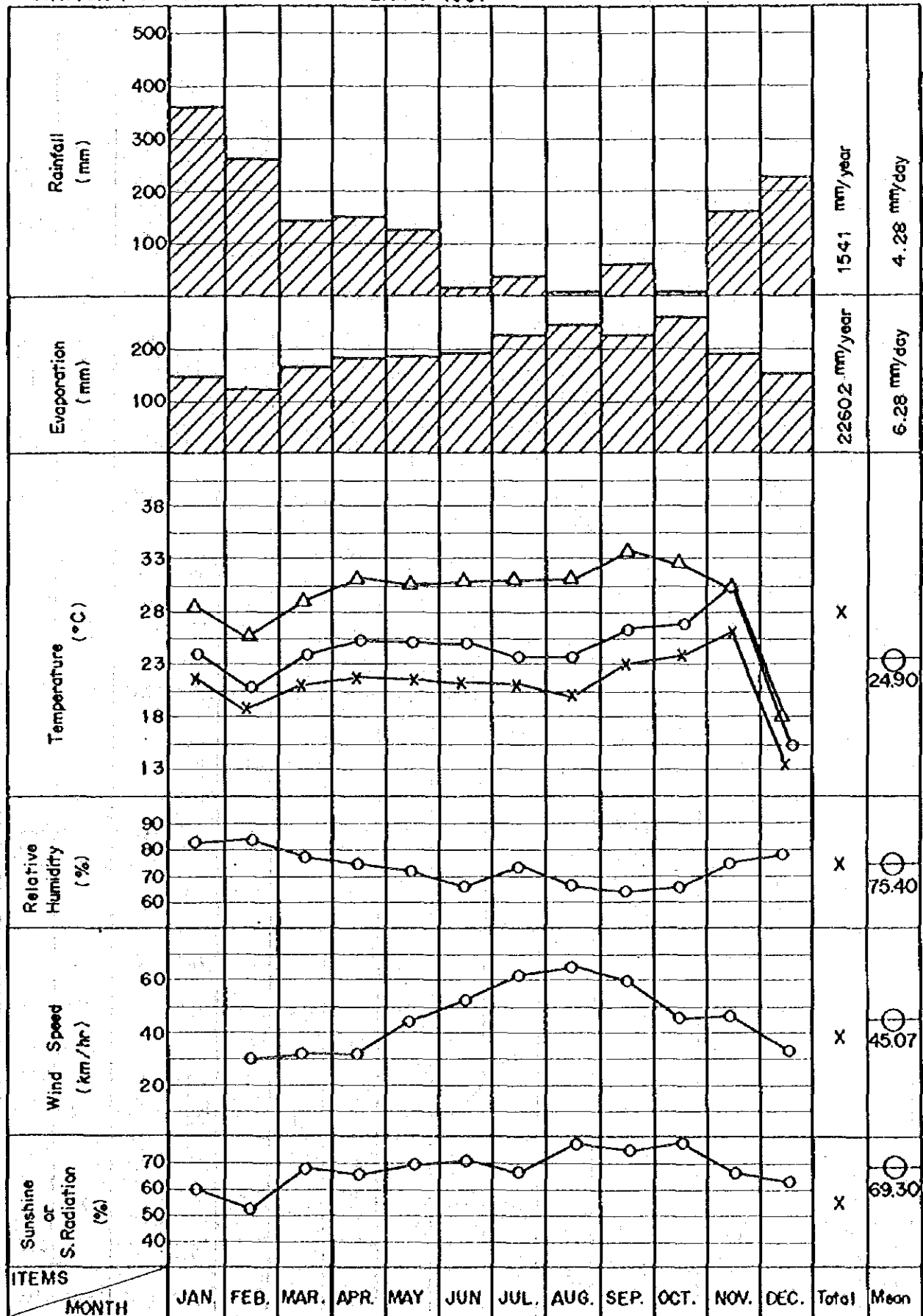


Fig. - 2.5 (2) Meteorological Data at PG Wonolangan

STATION : P.O. SEMBORO,
JEMBER.

YEAR : 1981

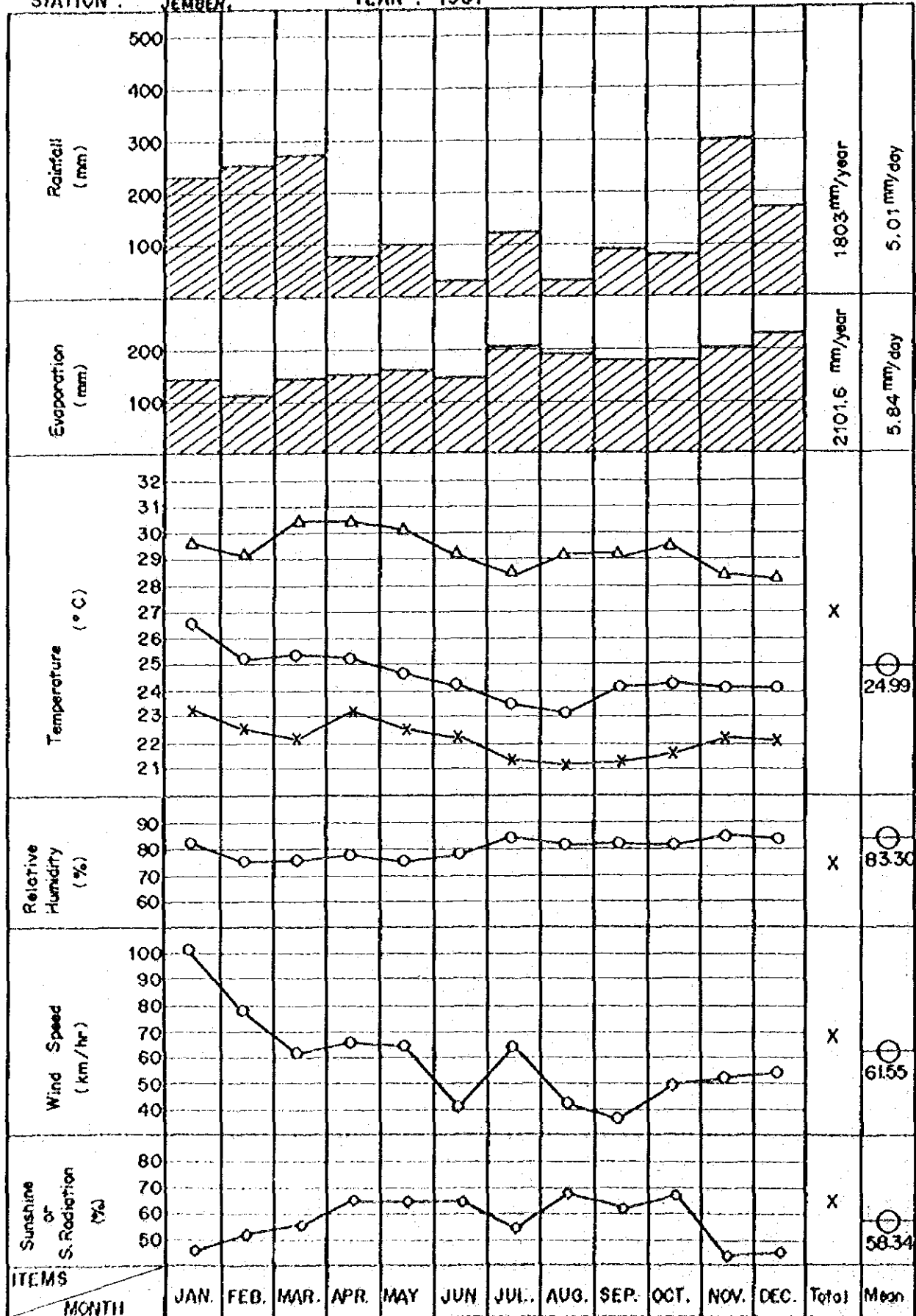


Fig.-2.5 (3) Meteorological Data at P.O. Semboro

3. OBSERVATION

3.1 RAINFALL OBSERVATION

3.1.1 OUTLINE OF WORK

The following work was carried out to improve the work of the rainfall observation stations in the area, in view of an eventual analysis of the rainfall and discharge in the area.

- (i) Inspection of the existing rainfall observation stations.
- (ii) Setting-up of five new automatic rain-gauges (1982).
- (iii) Supply of three additional automatic rain-gauges (1983).
- (iv) Collection of Observed Data.

3.1.2 NETWORK OF RAINFALL OBSERVATION STATIONS

Fig.-3.1 shows the result of work aimed at consolidating the network of the rainfall observation stations in the area. The content of work will be described later.

3.1.3 INSPECTION OF EXISTING RAINFALL OBSERVATION STATIONS

(i) Method Used

All the stations were visited and inspected during the end of April, 1982 and the beginning of May, 1982.

(ii) Inspection Items

① Suitability of Location

- . A point at the center of a flat, square area of 10 m x 10 m free from un-natural causes of rain.

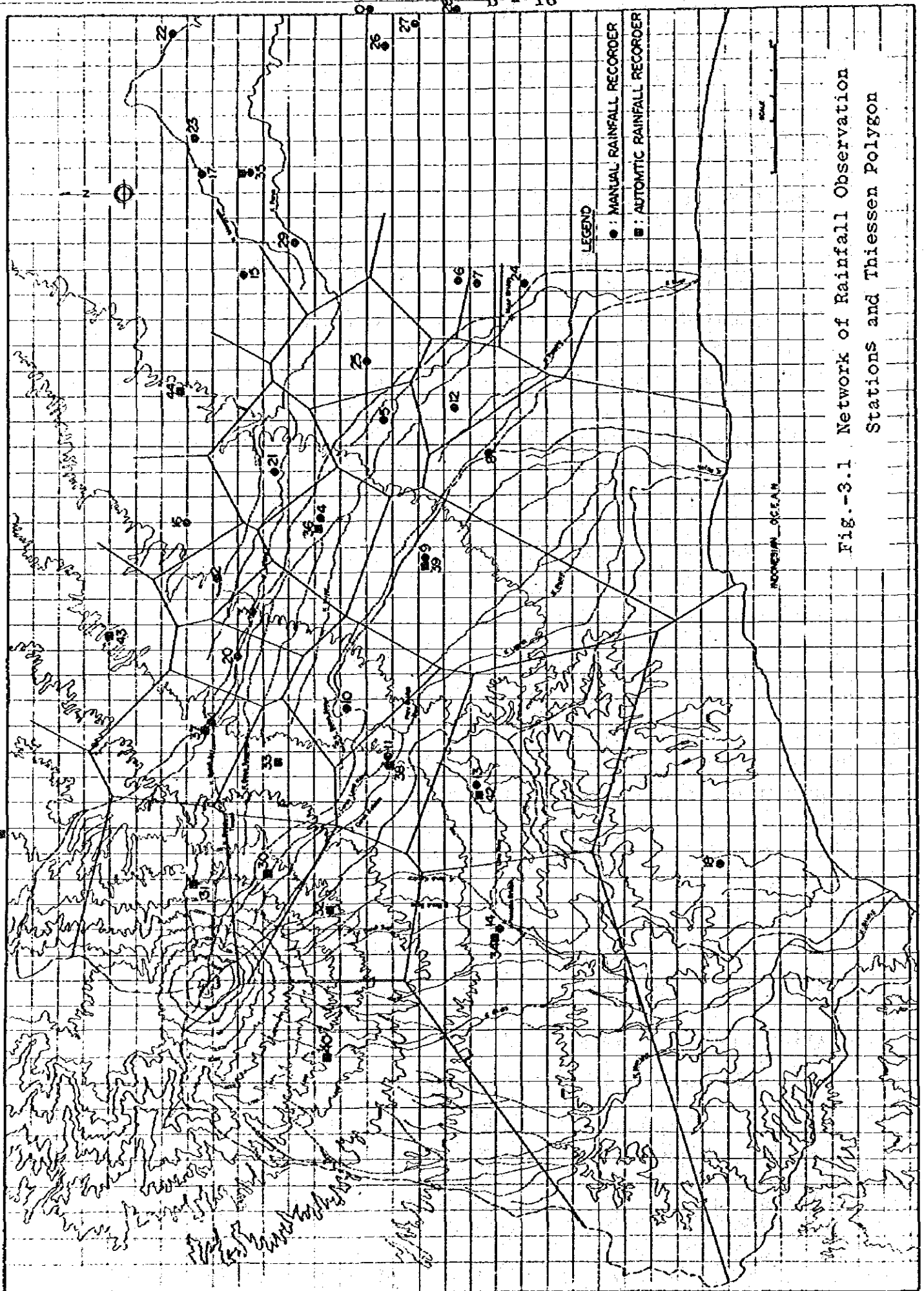


Fig.-3.1 Network of Rainfall Observation Stations and Thiessen Polygon

Table-3.1(1) Rainfall Observation Stations (1)

OBS. NO.	STATION	LOCATION		EL. (m)	OBS. COND.	BELONGING	TYPE OF EQUIP.	AVAILABLE DATA	INSTALLED DAY	REMARKS
		LATITUDE	LONGITUDE							
1. 158	BESUK SAT	S8° 6'37"	E113° 1' 0"	+795	○	DEP IRRIGASI	MANUAL	1951 - 1983	-	
2. 161	PASRU JAMBE	S8° 6'50"	E113° 3'36"	+481	○	- DITTO -	- DITTO -	1951 - 1983	-	
3. 162	BENDO	S8° 2'40"	E113° 2'51"	+510	○	- DITTO -	- DITTO -	1951 - 1983	-	SUMBER DUREN
4. 160	KERTOSARI	S8° 8'30"	E113° 5' 1"	+345	○	- DITTO -	- DITTO -	1951 - 1983	1974/1975	
5. 186	KEDUNG WRINGIN	S8° 10'19"	E113° 7'44"	+103	○	- DITTO -	- DITTO -	1952-59, 62-1983	1974/1975	
6. 190	BESUK	S8° 9' 8"	E113° 11' 4"	+ 93	○	- DITTO -	- DITTO -	1978 - 1983	-	
7. 190	BEDOG	S8° 11'55"	E113° 0' 3"	+ 93	○	- DITTO -	- DITTO -	1980 - 1983	1974/1975	
8. 189	PASTIRAN	S8° 12'30"	E113° 6'53"	+155	○	- DITTO -	- DITTO -	1952 - 1983	1974/1975	
9. 188a	CANDIPURO	S8° 11'13"	E113° 4' 6"	+322	○	- DITTO -	- DITTO -	1951 - 1983	1974/1975	
10. 188b	GUNUNG SAWUR	S8° 10' 0"	E113° 0'24"	+682	○	- DITTO -	- DITTO -	1952 - 1983	-	
11. 164	CURAH KORO'AN	S8° 10'16"	E113° 0'16"	+734	○	- DITTO -	- DITTO -	1952 - 1983	-	
12.	SEMEMU	S8° 11'55"	E113° 7'54"	+ 38	○	- DITTO -	- DITTO -	1977 - 1983	-	
13. 165	SUPIT URANG	S8° 13' 9"	E112° 58' 4"	+675	○	- DITTO -	- DITTO -	1971 - 1983	-	SUMBER BADANG
14. 167	SUMBER ROWO	S8° 12'45"	E112° 56'37"	+600	○	- DITTO -	- DITTO -	1974 - 1983	1975/1976	PRONOJINO
15. 89	KEDUNG SANGKU	S8° 7'12"	E113° 11' 1"	+ 60	○	- DITTO -	- DITTO -	1952-59, 62-1982	-	
16. 169	SENDURO	S8° 5'55"	E113° 5'26"	+435	○	- DITTO -	- DITTO -	1952-59, 62-1983	-	
17. 183	DAWARAN LOR	S8° 5'42"	E113° 13' 6"	+ 97	○	- DITTO -	- DITTO -	1949 - 1983	-	
18. 167	TEMPUR SARI	S8° 16'56"	E112° 58'48"	+ 5	×	- DITTO -	- DITTO -	1952-59, 62-1983	-	RAWAAN
19. 157	GUCIALIT	S8° 2'27"	E113° 7'57"	+600	○	- DITTO -	- DITTO -	1951 - 1982	-	
20.	MUNGGER	S8° 7'32"	E113° 3'15"	+600	○	- DITTO -	- DITTO -	1953-59, 62-1983	1974/1975	
21.	PAGOWAN	S8° 7'53"	E113° 6'22"	+115	○	- DITTO -	- DITTO -	1969 - 1982	-	
22.	UMBUL	S8° 5'42"	E113° 15'41"	+ 40	○	- DITTO -	- DITTO -	1972 - 1982	-	
23.	SUKODONO	S8° 6'16"	E113° 13'39"	+ 45	×	- DITTO -	- DITTO -	1976 - 1982	-	

Table-3.1(2) Rainfall Observation Stations (2)

No.	OBS. NO.	STATION	LOCATION		EL. (m)	OBS. COND.	BELONGING	TYPE OF EQUIP.	AVAILABLE DATA	INSTALLED DAY	REMARKS
			LATITUDE	LONGITUDE							
24.		TEMPER KIDUL	S8° 13' 14"	E113° 10' 36"	+ 93	○	DEP IRRIGASI	MANUAL	1954-68, 78-1982	-	
25.		JAKARTA	S8° 9' 52"	E113° 6' 8"	+ 161	○	- DITTO -	- DITTO -	1976 - 1982	-	
26.	222	WONOKERTO	S8° 10' 0"	E113° 16' 21"	+ 34	×	- DITTO -	- DITTO -	1952-59, 62-1983	-	
27.	223	TEKUNG	S8° 10' 32"	E113° 17' 2"	+ 22	○	- DITTO -	- DITTO -	1952 - 1983	-	
28.		NGOSARI	S8° 11' 9"	E113° 17' 22"	+ 17	×	- DITTO -	- DITTO -	1952-59, 62-1982	1974/1975	
29.	185	BRUG PURWO	S8° 8' 36"	E113° 11' 15"	+ 50	○	- DITTO -	- DITTO -	1951 - 80, 1982	-	LUMAJANG
30.	I	GUNUNG LEKER	S9° 7' 42"	E112° 58' 2"	+1400	○	PROYEK G. SEMERU	AUTOMATIC	1982	26 JAN'82	
31.	II	GUNUNG PAKIS	S8° 5' 34"	E112° 58' 50"	+1600	○	- DITTO -	- DITTO -	1982	11 FEB'82	
32.	III	KAMAR A	S8° 8' 56"	E112° 57' 10"	+1300	○	- DITTO -	- DITTO -	1982	2 FEB'82	
33.	IV	WONORENCO	S8° 8' 9"	E113° 0' 11"	+ 800	○	- DITTO -	- DITTO -	1982 - 1983	22 JAN'82	
34.	V	PRONOJITO	S8° 12' 47"	E112° 56' 18"	+ 600	○	- DITTO -	- DITTO -	1979 - 1983	JAN'79	
35.	VI	PROYEK SEMERU	S8° 7' 0"	E113° 12' 50"	+ 52	×	- DITTO -	MANUAL/ AUTOMATIC		MAY'82	
36.	VII	KERTOSARI	S8° 8' 30"	E113° 5' 2"	+ 345	○	- DITTO -	AUTOMATIC	1980 - 1983	JAN'80	
37.	VIII	BESUK SAT	S8° 6' 39"	E113° 1' 0"	+ 795	○	- DITTO -	- DITTO -	1978-79, 80-1983	DEC'77	
38.	IX	CURAH KOBAN	S10° 0' 16"	E113° 0' 10"	+ 734	○	- DITTO -	- DITTO -	1978 - 1983	JAN'78	
39.	X	CANDIPURO	S9° 25' 43"	E113° 19' 31"	+ 122	○	PROYEK G. SEMERU	- DITTO -	1980 - 1983	NOV'79	
40.	XI	POS VULKANOLGY ARGOSUKO	S8° 11' 0"	E112° 53' 0"	+ 900		- DITTO -	- DITTO -	1982 - 1983	13 JUL'82	NEW
41.	XII	POS RANUPANE	S8° 0' 0"	E112° 56' 0"	+2300		- DITTO -	- DITTO -		14 JUL'82	NEW
42.	XIII	SUPIT URANG	S8° 13' 11"	E112° 58' 6"	+ 675		- DITTO -	- DITTO -	1980 - 1983	21 JUN'82	NEW
43.	XIV	DESA KANDANG TEPUS	S8° 5' 25"	E113° 4' 33"	+1000		- DITTO -	- DITTO -	1982 - 1983	27 JUN'82	NEW
44.	XV	DESA BODANG	S8° 6' 27"	E113° 10' 8"	+ 875		- DITTO -	- DITTO -		28 JUN'82	NEW

- . A point where no pool of water will be formed.
- . A point where the possibility of damage to equipment is slight.
- . A point with easy access.

② Observation System

- . Current state of observation work.
- . State of data processing work.

(iii) Inspection Results

The inspection results are shown in Table-.3.1. Refer to Fig.-3.1 for the location of stations.

3.1.4 THE SETTING UP OF FIVE NEW AUTOMATIC RAIN-GAUGES

(i) Summary

At the beginning of April, 1981, five automatic rain-gauges were sent by JICA and the Mt. Semeru Project Office proposed possible sites for this equipment. Accordingly, a Thiessen polygon map was made for these sites and the final sites were decided after an examination of their respective elevations.

(ii) Specifications of Equipment

- | | |
|-----------------|---|
| . Equipment No. | 5 |
| . Model | NAKAASA Remote Recording Rain-gauge (BR31Z) |
| . Detector | Tipping-bucket |

. Rainfall per One Tipping 0.5 mm

. Recording Period 1 month

(iii) Method of Examination

The following work was considered.

- . To prepare a Thiessen polygon map to supplement the areas where observation network is sparse.
- . To supplement the area around EL. 1,500 m on the south-eastern slope of Mt. Semeru since debris flow usually occurs at around EL. 1,500 m.

(iv) Location

The location and other information concerning the five newly established stations is given in Table-3.1, and their respective Thiessen polygons are shown in Fig.-3.1.

3.1.5 THREE ADDITIONAL RAIN-GAUGES

(i) Summary

Fifteen automatic rain-gauges are owned by the Mt. Semeru Project Office including the five new ones presented in April, 1982. The content of these is shown below.

Order of Estab.	Date of Establishment	No. of Equipment	Type	Manufacturer	Supplier
1st	N.A.	3	Monthly, Syphone	Made in Germany	P.U. (JKT)
2nd	1979	3	Weekly, Syphone	Nakaasa Ltd.	"
3rd	N.A.	1	Weekly, Bucket	"	"
4th	August, 1981	3	Monthly, Bucket	"	I.E.C.A. Study Team
5th	April, 1982	5	"	"	JICA

Obstruction began to occur on the observation done by these automatic rain-gauges, however, due to the shortage of spare parts.

Of these spare parts, items such as roll-paper, pens, etc. were purchased by the Mt. Semeru Project Office through the main office of the Mt. Semeru Project Office upon a request made to the study team.

However, such expensive items as the rain-gauge main body, etc. could not be purchased by project office because of budget restrictions since 1982, requests to supply these parts had been made to the JICA and were finally met this time.

(ii) Items Supplied

① NAKAASA Remote Recording Rain-gauge Set

(BR11) 2

. Detector

..... Tipping-bucket

. Rainfall per One Tipping	..... 0.5 mm
. Recording Period	..... 1 month
② NAKAASA Remote Electric Counter Set	
(B-3112)	..... 1
. Detector	..... Tipping-bucket
. Rainfall per One Tipping	..... 0.5 mm
. Recording Period	..... 1 month
③ Dry Battery Sets	..... 2
④ Recording Charts (AN-7)	..... 10
⑤ Recording Charts (AN-9)	..... 60
⑥ Bottles of Ink (Violet, 20 cc)	..... 40
⑦ Bottles of Ink (Red, 100 cc)	..... 20
⑧ Triangle Pens	..... 40
⑨ Drum Clocks	..... 2
⑩ Syphone Pen	..... 20

3.1.6 COLLECTED DATA

The rainfall data since June, 1982 as shown in Table-2.1 was collected after the consolidation of the rainfall observation network was completed.

Not all the automatic rain-gauge stations have complete data on rainfall as Table-2.1 shows.

The reasons for this lack of data are as follows:

- (i) One merit of the automatic rain-gauge is that it does not require manual handling. On the other hand, even if it goes out of order it will remain idle until the next inspection;
- (ii) The recording mechanism of the automatic rain-gauge does not require any particular maintenance but if it goes out of order it may remain idle due to the impossibility of on the spot repair work and/or the lack of spare parts; and
- (iii) On many occasions, run-out of roll-paper, ink, batteries, etc. caused by the lack of sufficient inspection rounds, disrupts continuous observation.

In view of these problems, the transfer of technology with regard to rainfall observation was actively pursued on the spot. As the problems begin to be solved, the amount of data collected is slowly but steadily increasing.

3.2 DISCHARGE OBSERVATION

3.2.1 OUTLINE OF STUDY

The data on discharge in the study area was virtually non-existent. Discharge observation stations, therefore, were set up to prepare data indispensable for discharge analysis and other purposes in this study.

Accordingly, base flow observation and flood discharge observation at these points started in April and the rainy season in 1982 respectively.

3.2.2 NETWORK OF DISCHARGE OBSERVATION STATIONS

(i) Base Flow Observation Points

① Intake points	..... 20
② Others	..... 6

(ii) Flood Discharge Observation Stations

① K. Mujur	..... 2
② K. Rejali	..... 1
③ K. Glidik	..... 1

Fig.-3.2 shows the network of these discharge observation stations.

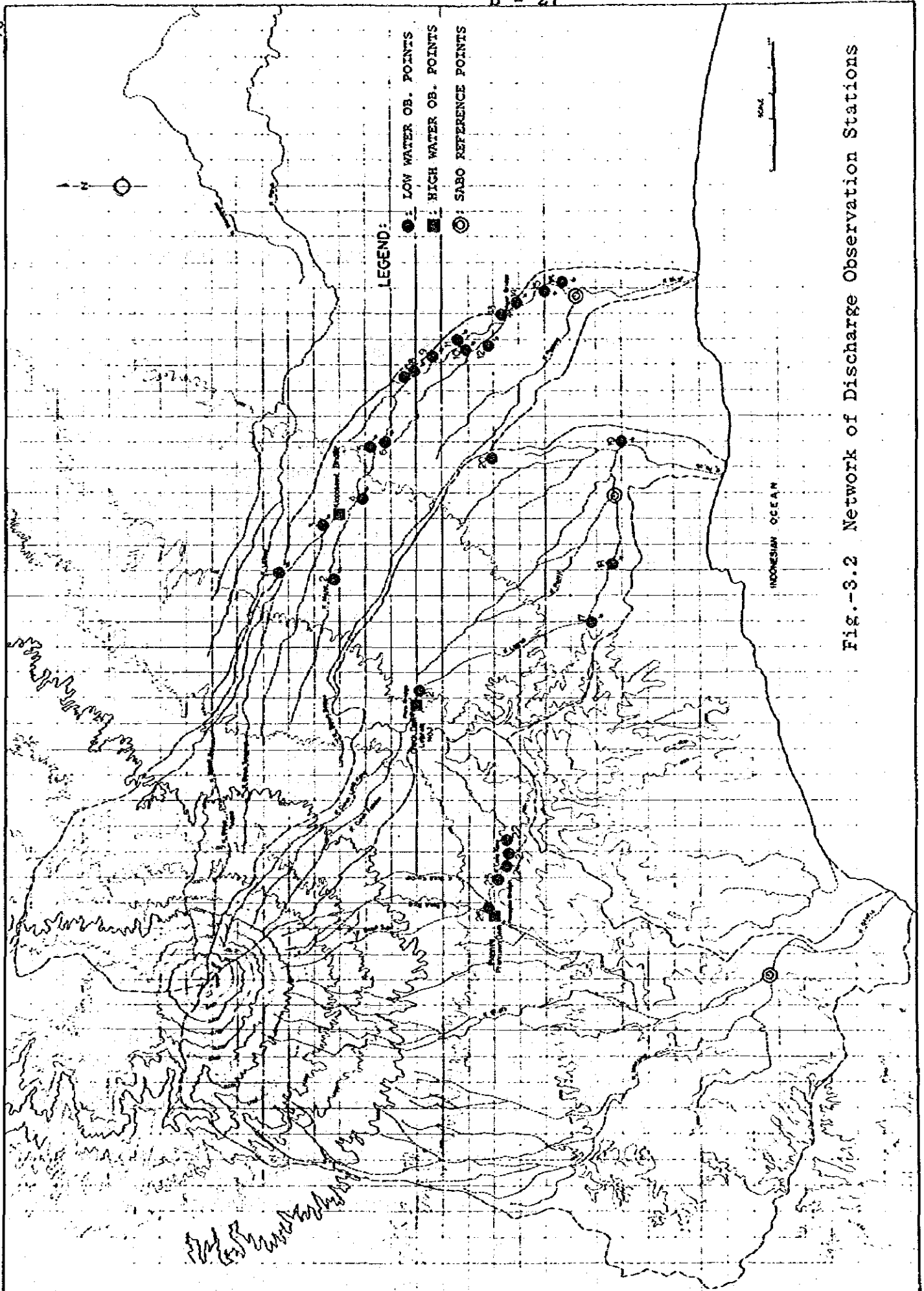


Fig.-3.2 Network of Discharge Observation Stations

3.2.3 BASE FLOW OBSERVATION

(i) Purpose

- ① To provide basic data for long-term discharge analysis.
- ② To understand intake rate fluctuation.

(ii) Observation Points

Observation is carried out at the intakes and the planned check dam sites along the main stream. In respect to K. Glidik, the base flow observation points are located at the planned main check dam sites since there is no intake along the river.

Details of these observation stations are shown in Table-3.2 and Table-3.3.

(iii) Observation Schedule

- ① Period: April, 1982 - June, 1984
- ② Interval: Once a month

(iv) Specification of Equipment

The following equipment is used.

- ① Price current meter
 - (a) Tamaya Universal Desital
Current Meter Set (UC-2) 2 sets
 - Measurement Capacity Approx.
0.1 - 0.2 m/s

Table-3.2 List of Intakes along K.Mujur and K.Rejali

No.	INTAKES	LOCATION	TYPE	BELONGING	COVERED AREA (ha)
1.	ROWOGEDANG	+ 23.1 Km (K. Besuk Tunggang)	SEMI-TECH.	IRRIGATION OFFICE	573
2.	DAM JURANGGEGER	(K. Mujur)	NON-TECH.	KANTOR DESA KLOPOSAWIT	45
3.	DAM PANCUT	+ 21.7 Km (K. Besuk Tunggang)	- ditto -	- ditto -	85
4.	DAM KARAN COLIK	+ 19.6 Km (K. Mujur)	- ditto -	- ditto -	65
5.	LOBANG I	+ 16.9 Km (K. Mujur)	TECHNICAL	IRRIGATION OFFICE	899
6.	LOBANG II	+ 16.9 Km (K. Mujur)	- ditto -	- ditto -	201
7.	KLEREK I	+ 14.5 Km (K. Mujur)	- ditto -	- ditto -	412
8.	KLEREK II	+ 14.5 Km (K. Mujur)	NON-TECH		
9.	KEDUNG CARING	+ 12.9 Km (K. Mujur)	TECHNICAL	IRRIGATION OFFICE	317
10.	JUWENI	+ 10.8 Km (K. Mujur)	NON-TECH.	KANTOR DESA JATISARI	17
11.	SAPARI	+ 10.8 Km (K. Mujur)	- ditto -	- ditto -	40
12.	CARIK	+ 10.0 Km (K. Duren)	- ditto -	KANTOR DESA LEMPENI	200
13.	SOPONYONO	+ 9.1 Km (K. Mujur)	SEMI-TECH.	IRRIGATION OFFICE	66
14.	PONCO	+ 8.9 Km (K. Mujur)	NON-TECH.	KANTOR DESA LEMPENI	15
15.	DAWUHAN KERTI	+ 7.7 Km (K. Mujur)	- ditto -	- ditto -	30
16.	PANDAN WANGI	+ 7.3 Km (K. Mujur)	TECHNICAL	IRRIGATION OFFICE	1,070
17.	RAHAYU	+ 9.2 Km (K. Regoyo)	SEMI-TECH.	IRRIGATION OFFICE	
18.	DAWUHAN MARSO	+ 7.3 Km (K. Regoyo)	NON-TECH.	KANTOR DESA GONDORUSO	30
19.	DAM REJALI	+ 4.1 Km (K. Rejali)	TECHNICAL	IRRIGATION OFFICE	455
20.	TALANG	Spring Water	- ditto -	- ditto -	294

Note: The location shows the distance from the river mouth.

Table-3.3 List of Other Flow Measurement Points

No.	POINT	LOCATION	CATCHMENT AREA (Km ²)	REMARKS
21.	K. Leprak	+ 20.20 Km (K. Leprak)	27.6	K. Leprak Check Dam No. 1
22.	K. Lengkong No. 1	+ 23.40 Km (K. Lengkong)	20.39	
23.	K. Lengkong No. 2	+ 22.28 Km (K. Lengkong)	23.83	Mouth of the pond
24.	K. Lengkong No. 3	+ 22.05 Km (K. Lengkong)	26.99	Exit of the pond
25.	K. Lengkong No. 4	+ 21.15 Km (K. Lengkong)	29.53	Planned NANAS DAM SITE
26.	K. Lengkong No. 5	+ 19.30 Km (K. Lengkong)	54.3	Planned PRONOJIWO DAM SITE

(b) NAKAASA Direct Reading-Type

Water Current Meter Set (J-071) ... 1 set

Measurement Capacity Approx. 2.0

0.5 - 2.0 m/s

or 0.5 - 4.0

m/s (Select-

able)

② One staff (2.0 m long)

③ One tape measure (50 m long)

(v) Method of Observation

Observation is carried out according to the following order by using the Price current meter.

① Establish one reference section each time, which is done in a cross-section survey.

② Intervals between the vertical measuring lines are equivalent to 10% of the river width.

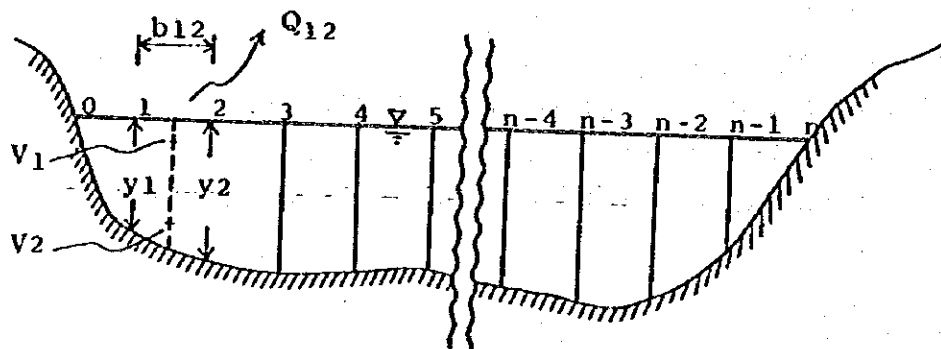
③ Two measuring points for each line are given at 20% and 80% of the water depth of each line. In cases where the water depth is less than 50 cm, the measuring point is at 60% of water depth from the top.

④ Measurements are made twice at each point. The arithmetic mean value indicates the velocity of that point.

- ⑤ The arithmetic mean value in the case of two measuring points are the measured value in the case of one measuring point indicate the average velocity of the measuring line.
- ⑥ The cross-section area which one measuring line dominates extends up to the centering line between the neighbouring lines and the line in question.
- ⑦ The total discharge is the sum of the individual discharge which is obtained by multiplying the average velocity of each line by its area.

$$Q_{12} = b_{12} \cdot \left(\frac{y_1 + y_2}{2} \right) \cdot \left(\frac{V_1 + V_2}{2} \right)$$

$$Q = \sum_{i=1}^n Q_{i-1,i}$$



3.2.4 FLOOD DISCHARGE OBSERVATION

(i) Purpose

- ① To provide verifying data for flood discharge analysis.
- ② To provide basic data for determining sediment volume.

(ii) Observation Stations

The following considerations were made when flood discharge observation stations were selected.

- ① Indispensable points for flood discharge analysis.
- ② Points with easy access.
- ③ Points with high security.
- ④ Points where a water-level observer can be found nearby.

Details of flood discharge observation stations thus selected are shown in Table-.3.4.

Table-3.4 Flood Discharge Observation Stations

Station	Location *	Catchment Area (km ²)
Kloposawit Bridge	+19.929 km (K. Besuk Tunggang)	82.20
Mujur Bridge	+8.653 km (K. Mujur)	125.70
Check Dam Leprak No. 1	+20.337 km (K. Leprak)	27.60
Panned Pronojiwo Dam	+19.300 km (K. Lengkong)	54.30

* Distance from river-mouth.

(iii) Observation Schedule

Period: Rainy Season of the 1982/83 and 83/84 hydrological years.

Time : 13:00 - 18:00

(iv) Observation Items

① Flood Discharge Observation

- Method Used

- (a) Surface float method.
- (b) Radio current meter method.
- (c) Weir method.

② Flood Water-level Observation

Observation of the flood water-level by a staff-gauge at 15 minute intervals between 13:00 and 18:00.

- ③ Flood Trace Study
- ④ Collection of Rainfall Data during Flood
- ⑤ Sediment Concentration during Flood

(v) Specifications for Observation Equipment

- ① Radio Current Meter (KS-400, made by Ikegami Communication Equipment Ltd.) 1 set
 - . Measurement Capacity 0.5 - 10 m/s
(2, 4, 7, & 10 m/s selectable)
 - . Measurement Distance 0 - 20 m
- ② Surface Float
 - . 300 mm (L) x 50 mm (H) x 50 mm (W)
 - . Wood, painted white (Made on the spot)
- ③ Citizen Digital Stop Watches 2
 - . Crystal Frequency 32,768 Hz
 - . Accuracy 99.99957% (24°C)
 - . Display FE type liquid crystal display
 - . Display Method 7 digits (9h. 59m. 99s. 99 with 1/100 second service mark)
- ④ Sampling Bottles (capacity 0.5ℓ)
- ⑤ Binoculars

⑥ Painted-Mark-Scale (Fixed at each observation station)

(a) Klopasawit Bridge Station

Fixed on bridge pier with 5 cm pitch.

(b) Mujur Bridge Station

Fixed on bridge pier with 1 cm pitch.

(c) Check Dam Leprak No. 1 Station

Fixed on right-bank wing with 5 cm pitch.

(d) Planned Pronojiwo Dam Station

Fixed on right-bank rock surface with 5 cm pitch.

(vi) Cross Section and H-Q, H-A Curve

Cross section, H-Q curve and H-A curve of each observation station are shown in Fig.-3.3 through Fig.-3.6.

The relation between the water-level (H) on the painted-mark-scale and the discharge (Q) at each observation station is shown in Table-3.5 through Table-3.8.

3.2.5 COLLECTED DATA

(i) Data on Base Flow

Table-3.9 shows the main stream discharge observed once a month for fifteen months from April, 1982 until June, 1983.

Despite the short observation period, the following conclusion that the main river base flow tends to decline

STATION : MUJUR BRIDGE
CATCHMENT AREA : 125.7 Km²

ELEVATION (m)	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625

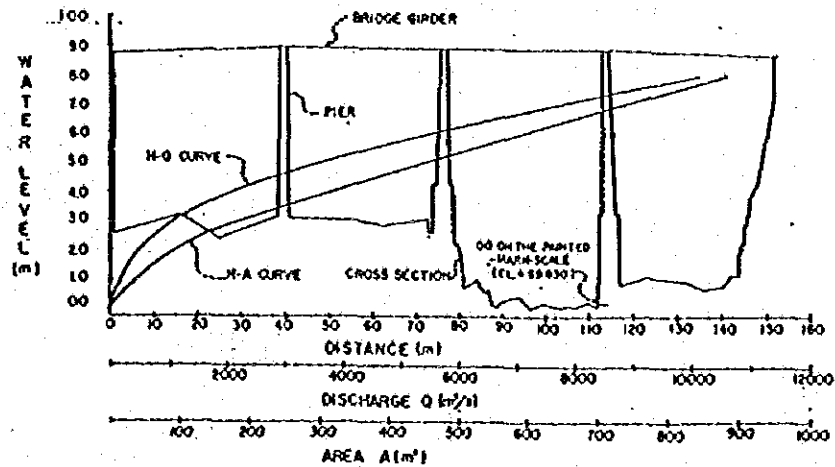


Fig.- 3.3(1) CROSS SECTION & H-Q, H-A CURVE AT MUJUR BRIDGE STATION.

No. 2

STATION : MUJUR BRIDGE
CATCHMENT AREA : 125.7 Km²

ELEVATION (m)	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625

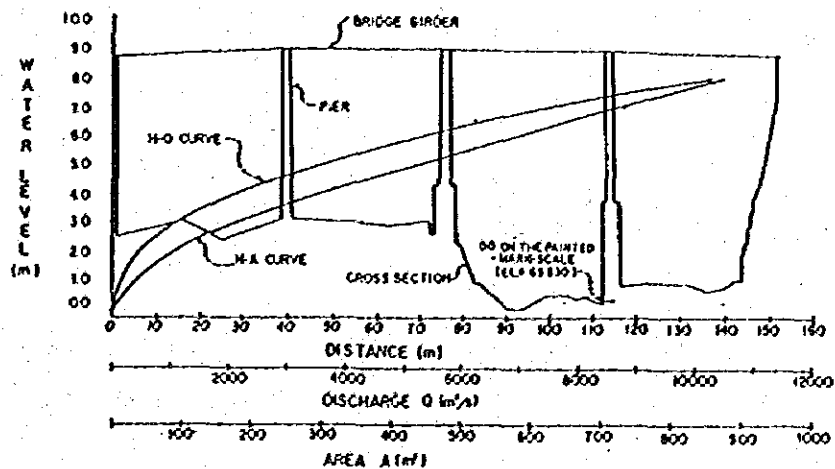


Fig.- 3.3(2) CROSS SECTION & H-Q, H-A CURVE AT MUJUR BRIDGE STATION.

No. 3

STATION : MUJUR BRIDGE
CATCHMENT AREA : 125.7 Km²

ELEVATION (m)	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625
	EL. 878.625

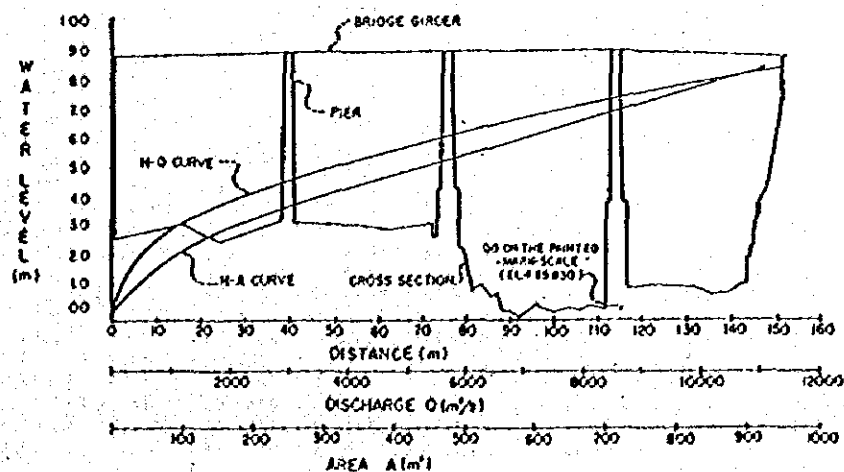


Fig.- 3.3(3) CROSS SECTION & H-Q, H-A CURVE AT MUJUR BRIDGE STATION.

Table - 3.5(1) TABLE OF WATER LEVEL (H m) - DISCHARGE (Q m³/s)

STATION : MUJUR BRIDGE

CATCHMENT AREA : 125.7 km²

ICM IOCM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
0.0	2.64	2.77	2.89	3.02	3.14	3.27	3.39	3.52	3.64	3.77
0.1	3.89	4.02	4.14	4.26	4.39	4.53	4.67	4.81	4.95	5.08
0.2	7.62	8.16	8.70	9.24	9.78	10.32	10.86	11.39	11.93	12.47
0.3	13.01	13.93	14.85	15.78	16.70	17.62	18.54	19.47	20.39	21.32
0.4	22.23	23.16	24.08	25.00	25.92	26.85	27.77	28.69	29.61	30.54
0.5	31.46	32.38	33.30	34.23	35.15	36.07	36.99	37.91	38.84	39.76
0.6	40.68	41.60	42.53	43.45	44.37	45.29	46.22	47.14	48.06	48.98
0.7	49.91	50.83	51.75	52.67	53.59	54.52	55.44	56.36	57.29	58.21
0.8	59.13	61.84	64.56	67.27	69.98	72.70	75.41	78.13	80.84	83.55
0.9	86.27	88.98	91.69	94.41	97.12	99.83	102.55	105.26	107.97	110.69
1.0	113.40	116.12	118.83	121.54	124.26	126.97	129.68	132.40	135.11	137.82
1.1	140.54	143.25	145.97	148.68	151.39	154.11	156.82	159.53	162.25	164.96
1.2	167.67	170.39	173.10	175.81	178.53	181.24	183.96	186.67	189.38	192.10
1.3	194.81	198.74	202.68	206.61	210.55	214.48	218.42	222.35	226.29	230.22
1.4	234.16	238.09	242.03	245.96	249.90	253.83	257.77	261.70	265.64	269.57
1.5	273.51	277.44	281.38	285.31	289.25	293.18	297.11	301.05	304.98	308.92
1.6	312.85	316.79	320.72	324.66	328.59	332.53	336.46	340.40	344.33	348.27
1.7	352.20	356.14	360.07	364.01	367.94	371.88	375.81	379.75	383.68	387.62
1.8	391.55	396.58	401.61	406.64	411.68	416.71	421.74	426.77	431.80	436.83
1.9	441.86	446.90	451.93	456.96	461.99	467.02	472.05	477.08	482.12	487.15
2.0	492.18	497.21	502.24	507.27	512.30	517.34	522.37	527.40	532.43	537.46
2.1	542.49	547.52	552.55	557.59	562.62	567.65	572.68	577.71	582.74	587.77
2.2	592.81	597.84	602.87	607.90	612.93	617.96	622.99	628.02	633.06	638.09
2.3	643.12	649.41	655.70	662.00	668.29	674.58	680.87	687.17	693.46	699.75
2.4	706.04	712.34	718.63	724.92	731.21	737.51	743.80	750.09	756.38	762.68
2.5	768.97	775.26	781.55	787.85	794.14	800.43	806.72	813.01	819.31	825.60
2.6	831.89	838.18	844.48	850.77	857.06	863.35	869.65	875.94	882.23	888.52
2.7	894.82	901.11	907.40	913.69	919.99	926.28	932.57	938.86	945.16	951.45
2.8	957.74	966.64	975.54	984.44	993.34	1002.24	1011.14	1020.04	1028.94	1037.84
2.9	1046.74	1055.64	1064.54	1073.44	1082.34	1091.24	1100.14	1109.04	1117.94	1126.84
3.0	1135.74	1144.64	1153.54	1162.44	1171.34	1180.24	1189.13	1198.03	1206.93	1215.83
3.1	1224.73	1233.63	1242.53	1251.43	1260.33	1269.23	1278.13	1287.03	1295.93	1304.83
3.2	1313.73	1322.63	1331.53	1340.43	1349.33	1358.23	1367.13	1376.03	1384.93	1393.83
3.3	1402.73	1413.56	1424.39	1435.22	1446.05	1456.88	1467.71	1478.55	1489.38	1500.21
3.4	1511.04	1521.87	1532.70	1543.53	1554.36	1565.19	1576.02	1586.85	1597.68	1608.52
3.5	1619.35	1630.18	1641.01	1651.84	1662.67	1673.50	1684.33	1695.16	1705.99	1716.82
3.6	1727.65	1738.48	1749.32	1760.15	1770.98	1781.81	1792.64	1803.47	1814.30	1825.13
3.7	1835.96	1846.79	1857.62	1868.45	1879.28	1890.12	1900.95	1911.78	1922.61	1933.44
3.8	1944.27	1957.31	1970.36	1983.40	1996.45	2009.49	2022.54	2035.58	2048.62	2061.67
3.9	2074.71	2087.76	2100.80	2113.84	2126.89	2139.93	2152.98	2166.02	2179.07	2192.11
4.0	2205.15	2218.20	2231.24	2244.29	2257.33	2270.38	2283.42	2296.46	2309.51	2322.55
4.1	2335.60	2348.64	2361.68	2374.73	2387.77	2400.82	2413.86	2426.91	2439.95	2452.99
4.2	2466.04	2479.08	2492.13	2505.17	2518.21	2531.26	2544.30	2557.35	2570.39	2583.44
4.3	2596.48	2611.58	2626.68	2641.77	2656.87	2671.97	2687.07	2702.17	2717.27	2732.37
4.4	2747.46	2762.56	2777.66	2792.76	2807.85	2822.95	2838.05	2853.15	2868.25	2883.35
4.5	2898.44	2913.44	2928.44	2943.44	2958.44	2973.44	2988.43	3003.43	3018.43	3033.43
4.6	3049.43	3064.52	3079.62	3094.72	3109.82	3124.92	3140.02	3155.11	3170.21	3185.31
4.7	3200.41	3215.51	3230.60	3245.70	3260.80	3275.90	3291.00	3306.10	3321.19	3336.29
4.8	3351.39	3368.25	3385.11	3401.97	3418.84	3435.70	3452.56	3469.42	3486.28	3503.14
4.9	3520.00	3536.86	3553.73	3570.59	3587.45	3604.31	3621.18	3638.04	3654.90	3671.76
5.0	3688.62	3705.48	3722.35	3739.21	3756.07	3772.93	3789.79	3806.65	3823.51	3840.38
5.1	3857.24	3874.10	3890.96	3907.82	3924.68	3941.55	3958.41	3975.27	3992.13	4008.99
5.2	4025.85	4042.72	4059.58	4076.44	4093.30	4110.16	4127.03	4143.89	4160.75	4177.61
5.3	4194.47	4213.04	4231.61	4250.18	4268.74	4287.31	4305.88	4324.45	4343.02	4361.59
5.4	4380.16	4398.72	4417.29	4435.86	4454.43	4473.00	4491.57	4510.14	4528.70	4547.27
5.5	4565.84	4584.41	4602.98	4621.55	4640.12	4658.68	4677.25	4695.82	4714.39	4732.96
5.6	4751.53	4770.10	4788.67	4807.23	4825.80	4844.37	4862.94	4881.51	4900.08	4918.65
5.7	4937.31	4955.78	4974.35	4992.92	5011.49	5030.06	5048.63	5067.19	5085.76	5104.33
5.8	5122.90	5143.14	5163.38	5183.62	5203.86	5224.10	5244.34	5264.58	5284.82	5305.05
5.9	5325.29	5345.53	5365.77	5386.01	5406.25	5426.49	5446.73	5466.97	5487.21	5507.45
6.0	5527.69	5547.93	5568.17	5588.41	5608.65	5628.89	5649.12	5669.36	5689.60	5709.84
6.1	5730.08	5750.32	5770.56	5790.80	5811.04	5831.28	5851.52	5871.76	5892.00	5912.24
6.2	5932.48	5952.72	5972.95	5993.19	6013.43	6033.67	6053.91	6074.15	6094.39	6114.63
6.3	6134.87	6156.52	6178.17	6199.81	6221.46	6243.11	6264.76	6286.40	6308.05	6329.70
6.4	6351.35	6372.99	6394.64	6416.29	6437.94	6459.58	6481.23	6502.88	6524.53	6546.17
6.5	6567.82	6589.47	6611.12	6632.76	6654.41	6676.06	6697.71	6719.36	6741.00	6762.65
6.6	6784.30	6805.95	6827.59	6849.24	6870.89	6892.54	6914.18	6935.83	6957.48	6979.13
6.7	7000.77	7022.42	7044.07	7065.72	7087.37	7109.01	7130.66	7152.31	7173.95	7195.60
6.8	7217.25	7240.78	7264.32	7287.85	7311.39	7334.92	7358.46	7381.99	7405.53	7429.06
6.9	7452.59	7476.13	7499.66	7523.20	7546.73	7570.27	7593.80	7617.33	7640.87	7664.40
7.0	7687.94	7711.47	7735.01	7758.54	7782.08	7805.61	7829.15	7852.68	7876.22	7899.75
7.1	7923.28	7946.82	7970.35	7993.89	8017.42	8040.95	8064.49	8088.02	8111.56	8135.09
7.2	8158.63	8182.16	8205.69	8229.23	8252.76	8276.30	8299.83	8323.37	8346.90	8370.44
7.3	8393.97	8418.68	8443.38	8468.09	8492.80	8517.51	8542.21	8566.92	8591.63	8616.33
7.4	8641.04	8665.75	8690.45	8715.16	8739.87	8764.58	8789.28	8813.99	8838.70	8863.40
7.5	8888.11	8912.82	8937.52	8962.23	8986.94	9011.65	9036.35	9061.06	9085.77	9110.47
7.6	9135.18	9159.89	9184.59	9209.30	9234.01	9258.72	9283.42	9308.13	9332.84	9357.54
7.7	9382.25	9406.96	9431.66	9456.37	9481.08	9505.79	9530.49	9555.20	9579.91	9604.61
7.8	9629.32	9653.67	9678.01	9702.36	9726.71	9751.06	9775.40	9800.11	9824.82	9849.53
7.9	9874.29	9899.14	9923.99	9948.83	9973.68	9998.53	10023.37	10048.22	10073.07	10097.91
8.0	10122.76	10147.61	10172.46	10197.30	10222.15	10247.00	10271.85	10296.70	10321.55	10346.40
8.1	10371.25	10396.10	10421.00	10445.90	10470.80	10495.70	10520.60	10545.50	10570.40	10595.30
8.2	10620.20	10645.10	10670.00	10694.90	10719.80	10744.70	10769.60	10794.50	10819.40	10844.30
8.3	10869.20	10894.10	10919.00	10943.90	10968.80	10993.70	11018.60	11043.50	11068.40	11093.30

Table -3.5.(B) TABLE OF WATER LEVEL (H m) - DISCHARGE ($Q \text{ m}^3/\text{s}$) STATION : MUJUR BRIDGECATCHMENT AREA : 125.7 km^2

ICM 10CM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
0.0	0.84	0.95	1.05	1.16	1.26	1.37	1.47	1.58	1.68	1.79
0.1	1.89	1.96	2.03	2.10	2.17	2.40	2.62	2.85	3.07	3.30
0.2	3.52	3.75	3.97	4.20	4.42	4.74	5.06	5.38	5.47	5.57
0.3	5.66	6.46	7.27	8.07	8.87	9.68	10.48	11.29	12.09	12.89
0.4	13.70	14.50	15.30	16.11	16.91	17.71	18.52	19.32	20.12	20.93
0.5	21.73	22.54	23.34	24.14	24.95	25.75	26.55	27.36	28.16	28.96
0.6	29.77	30.57	31.38	32.18	32.98	33.79	34.59	35.39	36.20	37.00
0.7	37.80	38.61	39.41	40.21	41.01	41.82	42.63	43.43	44.23	45.04
0.8	45.84	46.65	47.45	48.26	49.06	49.87	50.67	51.48	52.28	53.09
0.9	71.95	74.56	77.17	79.78	82.39	85.01	87.62	90.23	92.84	95.45
1.0	98.06	100.67	103.28	105.89	108.50	111.12	113.73	116.34	118.95	121.56
1.1	124.17	126.78	129.39	132.00	134.61	137.23	139.84	142.45	145.06	147.67
1.2	150.28	152.89	155.50	158.11	160.72	163.34	165.95	168.56	171.17	173.78
1.3	176.39	180.27	184.14	188.02	191.90	195.77	199.65	203.53	207.40	211.28
1.4	215.16	219.03	222.91	226.79	230.67	234.54	238.42	242.30	246.17	250.05
1.5	253.93	257.80	261.68	265.56	269.43	273.31	277.19	281.06	284.94	288.81
1.6	292.69	296.57	300.45	304.32	308.20	312.08	315.95	319.83	323.71	327.59
1.7	331.46	335.34	339.22	343.09	346.97	350.85	354.72	358.60	362.48	366.35
1.8	370.23	375.41	380.59	385.78	390.96	396.14	401.32	406.51	411.69	416.87
1.9	422.05	427.24	432.42	437.60	442.78	447.97	453.15	458.33	463.51	468.70
2.0	473.88	479.06	484.24	489.43	494.61	499.79	504.97	510.15	515.34	520.52
2.1	525.70	530.88	536.07	541.25	546.43	551.61	556.80	561.98	567.16	572.34
2.2	577.53	582.71	587.89	593.07	598.26	603.44	608.62	613.80	618.99	624.17
2.3	629.35	635.69	642.03	648.37	654.70	661.04	667.38	673.72	680.06	686.40
2.4	692.73	699.07	705.41	711.75	718.09	724.43	730.76	737.10	743.44	749.78
2.5	756.12	762.46	768.79	775.13	781.47	787.81	794.15	800.49	806.83	813.16
2.6	819.50	825.84	832.18	838.52	844.86	851.19	857.53	863.87	870.21	876.55
2.7	882.89	889.22	895.56	901.90	908.24	914.58	920.92	927.25	933.59	939.93
2.8	946.27	952.54	958.81	965.08	971.35	977.62	983.89	990.16	996.43	1002.70
2.9	1015.98	1022.25	1028.52	1034.79	1041.06	1047.33	1053.60	1059.87	1066.14	1072.41
3.0	1125.69	1131.96	1138.23	1144.50	1150.77	1157.04	1163.31	1169.58	1175.85	1182.12
3.1	1215.39	1221.66	1227.93	1234.20	1240.47	1246.74	1253.01	1259.28	1265.55	1271.82
3.2	1305.10	1311.37	1317.64	1323.91	1330.18	1336.45	1342.72	1348.99	1355.26	1361.53
3.3	1394.81	1401.08	1407.35	1413.62	1419.89	1426.16	1432.43	1438.70	1444.97	1451.24
3.4	1504.07	1510.34	1516.61	1522.88	1529.15	1535.42	1541.69	1547.96	1554.23	1560.50
3.5	1613.34	1619.61	1625.88	1632.15	1638.42	1644.69	1650.96	1657.23	1663.50	1669.77
3.6	1722.60	1728.87	1735.14	1741.41	1747.68	1753.95	1760.22	1766.49	1772.76	1779.03
3.7	1831.87	1838.14	1844.41	1850.68	1856.95	1863.22	1869.49	1875.76	1882.03	1888.30
3.8	1941.13	1947.40	1953.67	1959.94	1966.21	1972.48	1978.75	1985.02	1991.29	1997.56
3.9	2072.77	2079.04	2085.31	2091.58	2097.85	2104.12	2110.39	2116.66	2122.93	2129.20
4.0	2204.42	2210.69	2216.96	2223.23	2229.50	2235.77	2242.04	2248.31	2254.58	2260.85
4.1	2336.06	2342.33	2348.60	2354.87	2361.14	2367.41	2373.68	2379.95	2386.22	2392.49
4.2	2467.71	2473.98	2480.25	2486.52	2492.79	2499.06	2505.33	2511.60	2517.87	2524.14
4.3	2599.35	2605.62	2611.89	2618.16	2624.43	2630.70	2636.97	2643.24	2649.51	2655.78
4.4	2751.77	2758.04	2764.31	2770.58	2776.85	2783.12	2789.39	2795.66	2801.93	2808.20
4.5	2904.20	2910.47	2916.74	2923.01	2929.28	2935.55	2941.82	2948.09	2954.36	2960.63
4.6	3056.62	3062.89	3069.16	3075.43	3081.70	3087.97	3094.24	3100.51	3106.78	3113.05
4.7	3209.05	3215.32	3221.59	3227.86	3234.13	3240.40	3246.67	3252.94	3259.21	3265.48
4.8	3361.47	3367.74	3374.01	3380.28	3386.55	3392.82	3399.09	3405.36	3411.63	3417.90
4.9	3513.89	3520.16	3526.43	3532.70	3538.97	3545.24	3551.51	3557.78	3564.05	3570.32
5.0	3702.00	3708.27	3714.54	3720.81	3727.08	3733.35	3739.62	3745.89	3752.16	3758.43
5.1	3872.26	3878.53	3884.80	3891.07	3897.34	3903.61	3909.88	3916.15	3922.42	3928.69
5.2	4042.53	4048.80	4055.07	4061.34	4067.61	4073.88	4080.15	4086.42	4092.69	4098.96
5.3	4212.79	4219.06	4225.33	4231.60	4237.87	4244.14	4250.41	4256.68	4262.95	4269.22
5.4	4400.32	4406.59	4412.86	4419.13	4425.40	4431.67	4437.94	4444.21	4450.48	4456.75
5.5	4587.85	4594.12	4600.39	4606.66	4612.93	4619.20	4625.47	4631.74	4638.01	4644.28
5.6	4775.38	4781.65	4787.92	4794.19	4800.46	4806.73	4813.00	4819.27	4825.54	4831.81
5.7	4962.91	4969.18	4975.45	4981.72	4987.99	4994.26	5000.53	5006.80	5013.07	5019.34
5.8	5150.44	5156.71	5162.98	5169.25	5175.52	5181.79	5188.06	5194.33	5200.60	5206.87
5.9	5337.97	5344.24	5350.51	5356.78	5363.05	5369.32	5375.59	5381.86	5388.13	5394.40
6.0	5525.50	5531.77	5538.04	5544.31	5550.58	5556.85	5563.12	5569.39	5575.66	5581.93
6.1	5713.03	5719.30	5725.57	5731.84	5738.11	5744.38	5750.65	5756.92	5763.19	5769.46
6.2	5900.56	5906.83	5913.10	5919.37	5925.64	5931.91	5938.18	5944.45	5950.72	5956.99
6.3	6088.09	6094.36	6100.63	6106.90	6113.17	6119.44	6125.71	6131.98	6138.25	6144.52
6.4	6275.62	6281.89	6288.16	6294.43	6300.70	6306.97	6313.24	6319.51	6325.78	6332.05
6.5	6463.15	6469.42	6475.69	6481.96	6488.23	6494.50	6500.77	6507.04	6513.31	6519.58
6.6	6650.68	6656.95	6663.22	6669.49	6675.76	6682.03	6688.30	6694.57	6700.84	6707.11
6.7	6838.21	6844.48	6850.75	6857.02	6863.29	6869.56	6875.83	6882.10	6888.37	6894.64
6.8	7025.74	7032.01	7038.28	7044.55	7050.82	7057.09	7063.36	7069.63	7075.90	7082.17
6.9	7213.27	7219.54	7225.81	7232.08	7238.35	7244.62	7250.89	7257.16	7263.43	7269.70
7.0	7400.80	7407.07	7413.34	7419.61	7425.88	7432.15	7438.42	7444.69	7450.96	7457.23
7.1	7588.33	7594.60	7600.87	7607.14	7613.41	7619.68	7625.95	7632.22	7638.49	7644.76
7.2	7775.86	7782.13	7788.40	7794.67	7800.94	7807.21	7813.48	7819.75	7826.02	7832.29
7.3	7963.39	7969.66	7975.93	7982.20	7988.47	7994.74	8001.01	8007.28	8013.55	8019.82
7.4	8150.92	8157.19	8163.46	8169.73	8176.00	8182.27	8188.54	8194.81	8201.08	8207.35
7.5	8338.45	8344.72	8351.00	8357.27	8363.54	8369.81	8376.08	8382.35	8388.62	8394.89
7.6	8525.98	8532.25	8538.52	8544.79	8551.06	8557.33	8563.60	8569.87	8576.14	8582.41
7.7	8713.51	8719.78	8726.05	8732.32	8738.59	8744.86	8751.13	8757.40	8763.67	8769.94
7.8	8901.04	8907.31	8913.58	8919.85	8926.12	8932.39	8938.66	8944.93	8951.20	8957.47
7.9	9088.57	9094.84	9101.11	9107.38	9113.65	9119.92	9126.19	9132.46	9138.73	9145.00
8.0	9276.10	9282.37	9288.64	9294.91	9301.18	9307.45	9313.72	9320.00	9326.27	9332.54
8.1	9463.63	9469.90	9476.17	9482.44	9488.71	9494.98	9501.25	9507.52	9513.79	9520.06
8.2	9651.16	9657.43	9663.70	9669.97	9676.24	9682.51	9688.78	9695.05	9701.32	9707.59
8.3	9838.69	9844.96	9851.23	9857.50	9863.77	9870.04	9876.31	9882.58	9888.85	9895.12

Note : This table can be applied on period between 24 mar. and 27 apr. '83.

Table -3.5(3) TABLE OF WATER LEVEL (H a) - DISCHARGE (Q m³/s)STATION : MUJUR BRIDGE
CATCHMENT AREA : 125.7 km²

ICM LOCM	+0.00	+0.01	+0.02	+0.03	+0.04	+0.05	+0.06	+0.07	+0.08	+0.09
0.0	1.20	1.42	1.64	1.87	2.09	2.31	2.53	2.92	3.30	3.69
0.1	4.07	4.57	5.08	5.58	6.08	6.59	7.09	7.59	8.09	8.59
0.2	9.10	9.75	10.40	11.05	11.70	12.35	13.01	13.66	14.31	14.96
0.3	15.61	16.44	17.26	18.09	18.91	19.74	20.56	21.39	22.21	23.03
0.4	24.25	25.27	26.28	27.30	28.32	29.34	30.36	31.38	32.40	33.41
0.5	34.43	35.45	36.47	37.49	38.51	39.53	40.54	41.56	42.58	43.60
0.6	44.62	45.64	46.66	47.67	48.69	49.71	50.73	51.75	52.77	53.79
0.7	54.80	55.82	56.84	57.86	58.88	59.90	60.92	61.93	62.95	63.97
0.8	64.99	67.80	70.62	73.43	76.25	79.06	81.87	84.69	87.50	90.32
0.9	93.13	95.94	98.76	101.57	104.39	107.20	110.01	112.83	115.64	118.46
1.0	121.27	124.08	126.90	129.71	132.53	135.34	138.15	140.97	143.78	146.60
1.1	149.41	152.22	155.04	157.85	160.67	163.48	166.29	169.11	171.92	174.74
1.2	177.55	180.36	183.18	185.99	188.81	191.62	194.43	197.25	200.06	202.88
1.3	205.69	209.74	213.78	217.83	221.87	225.92	229.97	234.01	238.06	242.10
1.4	246.15	250.20	254.24	258.29	262.33	266.38	270.43	274.47	278.52	282.56
1.5	286.81	290.66	294.70	298.75	302.79	306.84	310.89	314.93	318.98	323.02
1.6	327.07	331.12	335.16	339.21	343.25	347.30	351.35	355.39	359.44	363.48
1.7	367.53	371.58	375.62	379.67	383.71	387.76	391.81	395.85	399.90	403.94
1.8	407.99	413.41	418.83	424.25	429.67	435.10	440.52	445.94	451.36	456.78
1.9	462.20	467.62	473.04	478.46	483.88	489.31	494.73	500.15	505.57	510.99
2.0	516.41	521.83	527.25	532.67	538.09	543.52	548.94	554.36	559.78	565.20
2.1	570.62	576.04	581.46	586.88	592.30	597.73	603.15	608.57	613.99	619.41
2.2	624.83	630.25	635.67	641.09	646.51	651.94	657.36	662.78	668.20	673.62
2.3	679.04	685.61	692.18	698.75	705.32	711.89	718.46	725.04	731.61	738.18
2.4	744.75	751.32	757.89	764.46	771.03	777.60	784.17	790.74	797.31	803.89
2.5	810.46	817.03	823.60	830.17	836.74	843.31	849.88	856.45	863.02	869.59
2.6	876.16	882.73	889.31	895.88	902.45	909.02	915.59	922.16	928.73	935.30
2.7	941.87	948.44	955.01	961.58	968.16	974.73	981.30	987.87	994.44	1001.01
2.8	1007.58	1016.79	1026.01	1035.22	1044.43	1053.64	1062.86	1072.07	1081.28	1090.50
2.9	1099.71	1108.92	1118.13	1127.35	1136.56	1145.77	1154.98	1164.20	1173.41	1182.62
3.0	1191.84	1201.05	1210.26	1219.47	1228.69	1237.90	1247.11	1256.33	1265.54	1274.75
3.1	1283.96	1293.18	1302.39	1311.60	1320.82	1330.03	1339.24	1348.45	1357.67	1366.88
3.2	1376.09	1385.30	1394.52	1403.73	1412.94	1422.16	1431.37	1440.58	1449.79	1459.01
3.3	1468.22	1479.40	1490.58	1501.76	1512.94	1524.12	1535.30	1546.48	1557.66	1568.84
3.4	1580.02	1591.20	1602.38	1613.57	1624.75	1635.93	1647.11	1658.29	1669.47	1680.65
3.5	1691.83	1703.01	1714.19	1725.37	1736.55	1747.73	1758.91	1770.09	1781.27	1792.45
3.6	1803.63	1814.81	1825.99	1837.17	1848.35	1859.53	1870.71	1881.89	1893.08	1904.26
3.7	1915.44	1926.62	1937.80	1948.98	1960.16	1971.34	1982.52	1993.70	2004.88	2016.06
3.8	2027.24	2040.68	2054.11	2067.55	2080.98	2094.42	2107.85	2121.29	2134.72	2148.16
3.9	2161.59	2175.03	2188.46	2201.90	2215.33	2228.77	2242.20	2255.64	2269.07	2282.51
4.0	2295.94	2309.38	2322.81	2336.25	2349.68	2363.12	2376.56	2389.99	2403.43	2416.86
4.1	2430.30	2443.73	2457.17	2470.60	2484.04	2497.47	2510.91	2524.34	2537.78	2551.21
4.2	2564.65	2578.08	2591.52	2604.95	2618.39	2631.82	2645.26	2658.69	2672.13	2685.56
4.3	2699.00	2714.53	2730.06	2745.58	2761.11	2776.64	2792.17	2807.69	2823.22	2838.75
4.4	2854.28	2869.81	2885.33	2900.86	2916.39	2931.92	2947.44	2962.97	2978.50	2994.03
4.5	3009.56	3025.08	3040.61	3056.14	3071.67	3087.20	3102.72	3118.25	3133.78	3149.31
4.6	3164.83	3180.36	3195.89	3211.42	3226.95	3242.47	3258.00	3273.53	3289.06	3304.58
4.7	3320.11	3335.64	3351.17	3366.70	3382.22	3397.75	3413.28	3428.81	3444.33	3459.86
4.8	3475.39	3492.71	3510.04	3527.36	3544.69	3562.01	3579.33	3596.66	3613.98	3631.31
4.9	3648.63	3665.95	3683.28	3700.60	3717.93	3735.25	3752.57	3769.90	3787.22	3804.55
5.0	3821.87	3839.19	3856.52	3873.84	3891.17	3908.49	3925.81	3943.14	3960.46	3977.79
5.1	3995.11	4012.43	4029.76	4047.08	4064.41	4081.73	4099.05	4116.38	4133.70	4151.03
5.2	4168.35	4185.67	4203.00	4220.32	4237.65	4254.97	4272.29	4289.62	4306.94	4324.27
5.3	4341.59	4360.65	4379.71	4398.78	4417.84	4436.90	4455.97	4475.03	4494.09	4513.15
5.4	4532.22	4551.28	4570.34	4589.40	4608.47	4627.53	4646.59	4665.65	4684.72	4703.78
5.5	4722.84	4741.90	4760.97	4780.03	4799.09	4818.16	4837.22	4856.28	4875.34	4894.41
5.6	4913.47	4932.53	4951.59	4970.66	4989.72	5008.78	5027.84	5046.91	5065.97	5085.03
5.7	5104.09	5123.16	5142.22	5161.28	5180.34	5199.41	5218.47	5237.53	5256.59	5275.66
5.8	5294.72	5313.78	5332.85	5351.91	5370.98	5389.54	5408.59	5427.66	5446.72	5465.78
5.9	5502.37	5521.43	5540.50	5559.56	5578.63	5597.69	5616.76	5635.82	5654.89	5673.95
6.0	5710.02	5730.78	5751.55	5772.31	5793.08	5813.84	5834.60	5855.37	5876.13	5896.90
6.1	5917.66	5938.43	5959.19	5979.96	6000.72	6021.49	6042.25	6063.02	6083.78	6104.55
6.2	6125.31	6146.08	6166.84	6187.61	6208.37	6229.14	6249.90	6270.67	6291.43	6312.20
6.3	6332.96	6355.16	6377.38	6399.57	6421.78	6443.98	6466.18	6488.39	6510.59	6532.79
6.4	6555.09	6577.20	6599.41	6621.61	6643.81	6666.02	6688.22	6710.42	6732.63	6754.83
6.5	6777.04	6799.24	6821.44	6843.65	6865.85	6888.06	6910.26	6932.46	6954.67	6976.87
6.6	6999.07	7021.28	7043.48	7065.69	7087.89	7110.09	7132.30	7154.50	7176.70	7198.91
6.7	7221.11	7243.32	7265.52	7287.72	7309.93	7332.13	7354.33	7376.54	7398.74	7420.95
6.8	7443.15	7465.35	7487.55	7509.75	7531.95	7554.15	7576.35	7598.55	7620.75	7642.95
6.9	7684.36	7706.56	7728.76	7750.96	7773.16	7795.36	7817.56	7839.76	7861.96	7884.16
7.0	7925.56	7947.76	7969.96	7992.16	8014.36	8036.56	8058.76	8080.96	8103.16	8125.36
7.1	8166.77	8188.97	8211.17	8233.37	8255.57	8277.77	8299.97	8322.17	8344.37	8366.57
7.2	8407.97	8430.17	8452.37	8474.57	8496.77	8518.97	8541.17	8563.37	8585.57	8607.77
7.3	8648.98	8671.18	8693.38	8715.58	8737.78	8759.98	8782.18	8804.38	8826.58	8848.78
7.4	8909.99	8932.19	8954.39	8976.59	8998.79	9020.99	9043.19	9065.39	9087.59	9109.79
7.5	9150.80	9173.00	9195.20	9217.40	9239.60	9261.80	9284.00	9306.20	9328.40	9350.60
7.6	9391.81	9414.01	9436.21	9458.41	9480.61	9502.81	9525.01	9547.21	9569.41	9591.61
7.7	9612.82	9635.02	9657.22	9679.42	9701.62	9723.82	9746.02	9768.22	9790.42	9812.62
7.8	9833.83	9856.03	9878.23	9900.43	9922.63	9944.83	9967.03	9989.23	10011.43	10033.63
7.9	10054.64	10076.84	10099.04	10121.24	10143.44	10165.64	10187.84	10210.04	10232.24	10254.44
8.0	10275.65	10297.85	10320.05	10342.25	10364.45	10386.65	10408.85	10431.05	10453.25	10475.45
8.1	10496.66	10518.86	10541.06	10563.26	10585.46	10607.66	10629.86	10652.06	10674.26	10696.46
8.2	10717.67	10739.87	10762.07	10784.27	10806.47	10828.67	10850.87	10873.07	10895.27	10917.47
8.3	10938.68	10960.88	10983.08	11005.28	11027.48	11049.68	11071.88	11094.08	11116.28	11138.48

Note : This table can be applied from 28 apr. '83.

STATION : KLOPOSANIT BRIDGE
CATCHMENT AREA : 82.2 Km²

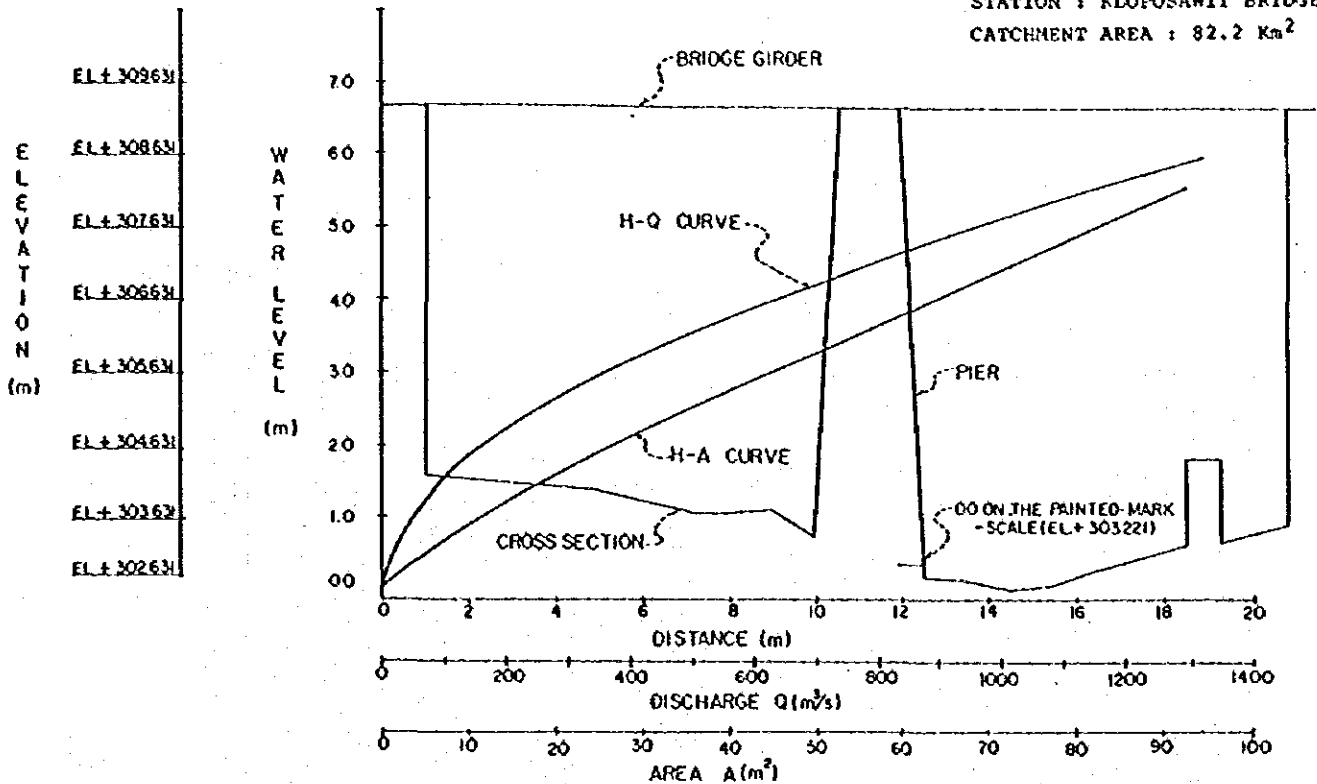


Fig.- 3.4(1) CROSS SECTION & H-Q, H-A CURVE AT KLOPOSANIT BRIDGE STATION.

STATION : KLOPOSANIT BRIDGE
CATCHMENT AREA : 82.2 Km²

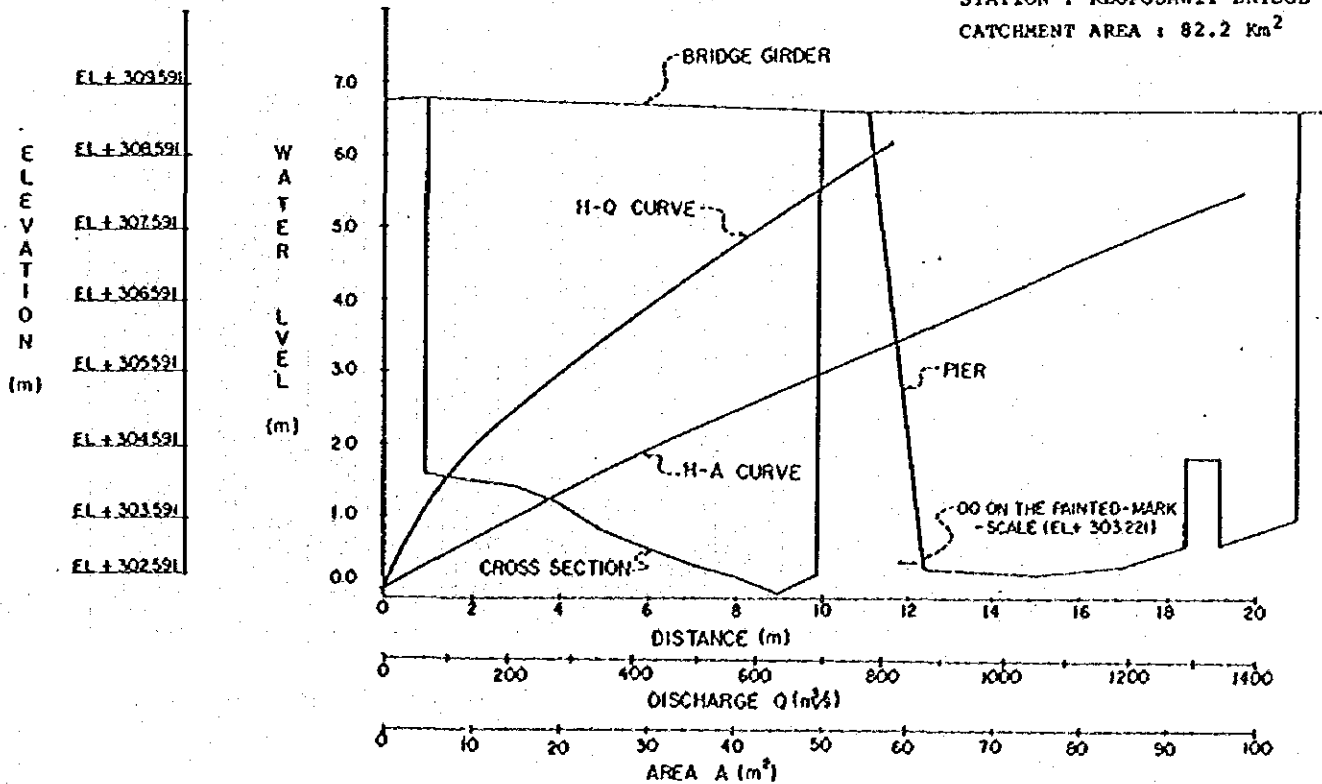


Fig.- 3.4(2) CROSS SECTION & H-Q, H-A CURVE AT KLOPOSANIT BRIDGE STATION.

No.1

Table - 8.4 (U) TABLE OF WATER LEVEL (H m) - DISCHARGE ($Q \text{ m}^3/\text{s}$) STATION : KLOPOSAWIT BRIDGECATCHMENT AREA : 82.20 km^2

ICM IOCM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
0.0	4.94	5.16	5.39	5.61	5.83	6.06	6.28	6.50	6.72	6.95
0.1	7.17	7.39	7.62	7.84	8.15	8.45	8.76	9.06	9.37	9.67
0.2	9.98	10.28	10.59	10.89	11.20	11.50	11.81	12.11	12.42	12.72
0.3	13.03	13.33	13.64	13.94	14.25	14.55	14.86	15.16	15.47	15.77
0.4	16.08	16.38	16.78	17.18	17.58	17.97	18.37	18.77	19.23	19.69
0.5	20.15	20.62	21.08	21.54	22.00	22.46	22.92	23.39	23.85	24.31
0.6	24.77	25.23	25.69	26.15	26.62	27.08	27.54	28.00	28.46	28.92
0.7	29.39	29.85	30.31	30.77	31.36	31.95	32.54	33.13	33.72	34.31
0.8	34.90	35.49	36.08	36.67	37.26	37.85	38.44	39.03	39.62	40.21
0.9	40.80	41.39	42.19	42.99	43.79	44.59	45.39	46.19	46.99	47.79
1.0	48.59	49.39	50.19	50.99	51.79	52.59	53.39	54.19	54.99	55.79
1.1	56.59	57.39	58.19	58.99	59.79	60.59	61.39	62.19	62.99	63.79
1.2	64.59	65.47	66.35	67.23	68.11	68.99	69.86	70.74	71.62	72.50
1.3	73.38	74.26	75.14	76.02	76.90	77.78	78.65	79.53	80.41	81.29
1.4	82.17	83.58	85.00	86.41	87.83	89.24	90.66	92.07	93.48	94.90
1.5	96.31	97.73	99.14	100.56	101.97	103.38	104.80	106.21	107.63	109.04
1.6	110.46	111.87	113.28	114.70	116.11	117.53	118.94	120.36	121.77	123.19
1.7	124.60	126.01	127.43	128.84	130.26	131.67	133.09	134.50	135.91	137.33
1.8	138.74	140.16	141.57	142.99	144.40	145.81	147.22	148.64	150.06	151.47
1.9	152.89	154.30	156.11	157.92	159.73	161.55	163.36	165.17	166.98	168.79
2.0	170.60	172.41	174.23	176.04	177.85	179.66	181.47	183.28	185.09	186.91
2.1	188.72	190.53	192.34	194.15	195.96	197.77	199.59	201.40	203.21	205.02
2.2	206.83	208.64	210.45	212.26	214.08	215.89	217.70	219.51	221.32	223.13
2.3	224.94	226.76	228.57	230.38	232.19	234.00	235.81	237.62	239.44	241.25
2.4	243.06	244.87	247.02	249.17	251.32	253.47	255.62	257.76	259.91	262.06
2.5	264.21	266.36	268.51	270.66	272.81	274.96	277.11	279.25	281.40	283.55
2.6	285.70	287.85	290.00	292.15	294.30	296.45	298.60	300.74	302.89	305.04
2.7	307.19	309.34	311.49	313.64	315.79	317.94	320.09	322.24	324.38	326.53
2.8	328.68	330.83	332.98	335.13	337.28	339.43	341.58	343.72	345.87	348.02
2.9	350.17	352.32	354.49	357.26	359.73	362.20	364.67	367.14	369.61	372.08
3.0	374.55	377.02	379.49	381.96	384.44	386.91	389.38	391.85	394.32	396.79
3.1	399.26	401.73	404.20	406.67	409.14	411.61	414.08	416.55	419.02	421.49
3.2	423.96	426.43	428.90	431.37	433.84	436.31	438.78	441.25	443.72	446.20
3.3	448.67	451.14	453.61	456.08	458.55	461.02	463.49	465.96	468.43	470.90
3.4	473.37	475.84	478.62	481.39	484.17	486.95	489.73	492.50	495.28	498.06
3.5	500.83	503.61	506.39	509.17	511.94	514.72	517.50	520.28	523.05	525.83
3.6	528.61	531.38	534.16	536.94	539.72	542.49	545.27	548.05	550.82	553.60
3.7	556.38	559.16	561.93	564.71	567.49	570.26	573.04	575.82	578.60	581.37
3.8	584.15	586.93	589.71	592.48	595.26	598.04	600.81	603.59	606.37	609.15
3.9	611.92	614.70	617.77	620.84	623.91	626.98	630.06	633.13	636.20	639.27
4.0	642.34	645.41	648.48	651.55	654.62	657.69	660.77	663.84	666.91	669.98
4.1	673.05	676.12	679.19	682.26	685.33	688.40	691.48	694.55	697.62	700.69
4.2	703.76	706.83	709.90	712.97	716.04	719.12	722.19	725.26	728.33	731.40
4.3	734.47	737.54	740.61	743.68	746.75	749.82	752.90	755.97	759.04	762.11
4.4	765.18	768.25	771.61	774.96	778.32	781.67	785.03	788.38	791.74	795.09
4.5	798.45	801.80	805.16	808.51	811.87	815.23	818.58	821.94	825.29	828.65
4.6	832.60	835.96	839.31	842.67	845.42	848.78	852.14	855.49	858.85	862.20
4.7	865.56	868.91	872.27	875.62	878.98	882.33	885.69	889.04	892.40	895.76
4.8	899.11	902.47	905.82	909.18	912.53	915.89	919.24	922.60	925.95	929.31
4.9	932.66	936.02	939.66	943.29	946.93	950.56	954.20	957.84	961.47	965.11
5.0	968.74	972.38	976.02	979.65	983.29	986.92	990.56	994.20	997.83	1001.47
5.1	1005.10	1008.74	1012.38	1016.01	1019.65	1023.28	1026.92	1030.56	1034.19	1037.83
5.2	1041.46	1045.10	1048.74	1052.37	1056.01	1059.64	1063.28	1066.92	1070.55	1074.19
5.3	1077.82	1081.46	1085.10	1088.73	1092.37	1096.00	1099.64	1103.28	1106.91	1110.55
5.4	1114.18	1117.82	1121.73	1125.64	1129.55	1133.46	1137.37	1141.28	1145.19	1149.10
5.5	1153.01	1156.92	1160.83	1164.74	1168.65	1172.56	1176.47	1180.38	1184.29	1188.20
5.6	1192.11	1196.02	1199.93	1203.84	1207.75	1211.66	1215.58	1219.49	1223.40	1227.31
5.7	1231.22	1235.13	1239.04	1242.95	1246.86	1250.77	1254.68	1258.59	1262.50	1266.41
5.8	1270.32	1274.23	1278.14	1282.05	1285.96	1289.87	1293.78	1297.69	1301.60	1305.51
5.9	1309.42	1313.33								

Table - 3.10) TABLE OF WATER LEVEL (H m) - DISCHARGE (Q m³/s) STATION : KLOPOSANIT BRIDGECATCHMENT AREA : 82.20 km²

ICM IOCM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
0.0	5.60	5.79	5.98	6.17	6.36	6.69	7.01	7.34	7.66	7.99
0.1	8.31	8.64	8.96	9.29	9.62	9.94	10.27	10.59	10.92	11.24
0.2	11.57	11.89	12.22	12.66	13.09	13.53	13.96	14.40	14.83	15.27
0.3	15.70	16.14	16.57	17.01	17.44	17.88	18.31	18.75	19.19	19.62
0.4	20.06	20.49	20.93	21.36	21.80	22.23	22.67	23.10	23.54	23.97
0.5	24.41	24.97	25.52	26.08	26.63	27.19	27.75	28.30	28.86	29.42
0.6	29.97	30.53	31.08	31.64	32.20	32.75	33.31	33.87	34.42	34.98
0.7	35.53	36.09	36.65	37.20	37.76	38.32	38.87	39.43	39.98	40.54
0.8	41.09	41.65	42.20	42.76	43.31	43.86	44.42	44.97	45.53	46.08
0.9	46.64	47.19	47.74	48.30	48.85	49.41	49.96	50.52	51.07	51.63
1.0	53.14	53.94	54.74	55.53	56.33	57.12	57.92	58.71	59.51	60.31
1.1	61.10	61.90	62.69	63.49	64.29	65.08	65.88	66.67	67.47	68.26
1.2	69.06	70.09	71.11	72.14	73.17	74.20	75.22	76.25	77.28	78.30
1.3	79.33	80.36	81.38	82.41	83.44	84.47	85.49	86.52	87.55	88.57
1.4	89.60	90.63	91.65	92.68	93.71	94.74	95.76	96.79	97.82	98.84
1.5	99.87	101.03	102.19	103.35	104.50	105.66	106.82	107.98	109.14	110.30
1.6	111.45	112.61	113.77	114.93	116.09	117.25	118.40	119.56	120.72	121.88
1.7	123.04	124.20	125.35	126.51	127.67	128.83	129.99	131.15	132.31	133.46
1.8	134.62	135.78	136.94	138.10	139.26	140.41	141.57	142.73	143.89	145.05
1.9	146.21	147.36	148.52	149.68	150.84	152.00	153.16	154.31	155.47	156.63
2.0	157.79	159.08	160.37	161.67	162.96	164.25	165.64	166.83	168.13	169.42
2.1	170.71	172.00	173.29	174.59	175.88	177.17	178.46	179.75	181.05	182.34
2.2	183.63	184.92	186.21	187.51	188.80	190.09	191.38	192.67	193.97	195.26
2.3	196.55	197.84	199.13	200.43	201.72	203.01	204.30	205.59	206.89	208.18
2.4	209.47	210.76	212.05	213.35	214.64	215.93	217.22	218.51	219.81	221.10
2.5	222.39	223.79	225.18	226.58	227.98	229.38	230.77	232.17	233.57	234.96
2.6	236.36	237.76	239.16	240.55	241.95	243.35	244.75	246.14	247.54	248.94
2.7	250.33	251.73	253.13	254.53	255.92	257.32	258.72	260.11	261.51	262.91
2.8	264.31	265.70	267.10	268.50	269.89	271.29	272.69	274.09	275.48	276.88
2.9	278.28	279.68	281.07	282.47	283.87	285.26	286.66	288.06	289.46	290.85
3.0	292.25	293.74	295.22	296.71	298.19	299.68	301.16	302.65	304.13	305.62
3.1	307.10	308.59	310.07	311.56	313.04	314.53	316.01	317.50	318.98	320.47
3.2	321.95	323.44	324.92	326.41	327.89	329.38	330.87	332.35	333.84	335.32
3.3	336.81	338.29	339.78	341.26	342.75	344.23	345.72	347.20	348.69	350.17
3.4	351.66	353.14	354.63	356.11	357.60	359.08	360.60	362.05	363.54	365.02
3.5	366.51	368.07	369.62	371.18	372.74	374.29	375.85	377.41	378.96	380.52
3.6	382.08	383.63	385.19	386.75	388.30	389.86	391.42	392.97	394.53	396.09
3.7	397.64	399.20	400.75	402.31	403.87	405.43	406.98	408.54	410.09	411.65
3.8	413.21	414.76	416.32	417.88	419.43	420.99	422.55	424.10	425.66	427.22
3.9	428.77	430.33	431.89	433.44	435.00	436.56	438.11	439.67	441.23	442.78
4.0	444.34	445.96	447.58	449.19	450.81	452.43	454.05	455.67	457.29	458.90
4.1	460.52	462.14	463.76	465.38	466.99	468.61	470.23	471.85	473.47	475.09
4.2	476.70	478.32	479.94	481.56	483.18	484.80	486.41	488.03	489.65	491.27
4.3	492.89	494.50	496.12	497.74	499.36	500.98	502.60	504.21	505.83	507.45
4.4	509.07	510.69	512.30	513.92	515.54	517.16	518.78	520.40	522.01	523.63
4.5	525.25	526.92	528.60	530.27	531.94	533.62	535.29	536.96	538.64	540.31
4.6	541.98	543.66	545.33	547.00	548.68	550.35	552.02	553.70	555.37	557.04
4.7	558.72	560.39	562.06	563.74	565.41	567.09	568.76	570.43	572.11	573.78
4.8	575.45	577.13	578.80	580.47	582.15	583.82	585.49	587.17	588.84	590.51
4.9	592.19	593.86	595.53	597.21	598.88	600.55	602.23	603.90	605.57	607.25
5.0	608.92	610.64	612.36	614.08	615.80	617.52	619.24	620.97	622.69	624.41
5.1	626.13	627.85	629.57	631.29	633.01	634.73	636.45	638.17	639.89	641.62
5.2	643.34	645.06	646.78	648.50	650.22	651.94	653.66	655.38	657.10	658.82
5.3	660.54	662.26	663.99	665.71	667.43	669.15	670.87	672.59	674.31	676.03
5.4	677.75	679.47	681.19	682.91	684.64	686.36	688.08	689.80	691.52	693.24
5.5	694.96	696.73	698.49	700.26	702.02	703.79	705.55	707.32	709.08	710.85
5.6	712.61	714.38	716.14	717.91	719.68	721.44	723.21	724.97	726.74	728.50
5.7	730.27	732.03	733.80	735.56	737.33	739.10	740.86	742.63	744.39	746.16
5.8	747.92	749.69	751.45	753.22	754.98	756.75	758.51	760.28	762.05	763.81
5.9	765.58	767.34	769.11	770.87	772.64	774.40	776.17	777.93	779.70	781.46
6.0	783.23									

Note : This table can be applied from the 5th, May '83.

STATION : CHECK DAM LEPRAK No.1
CATCHMENT AREA : 27.6 Km²

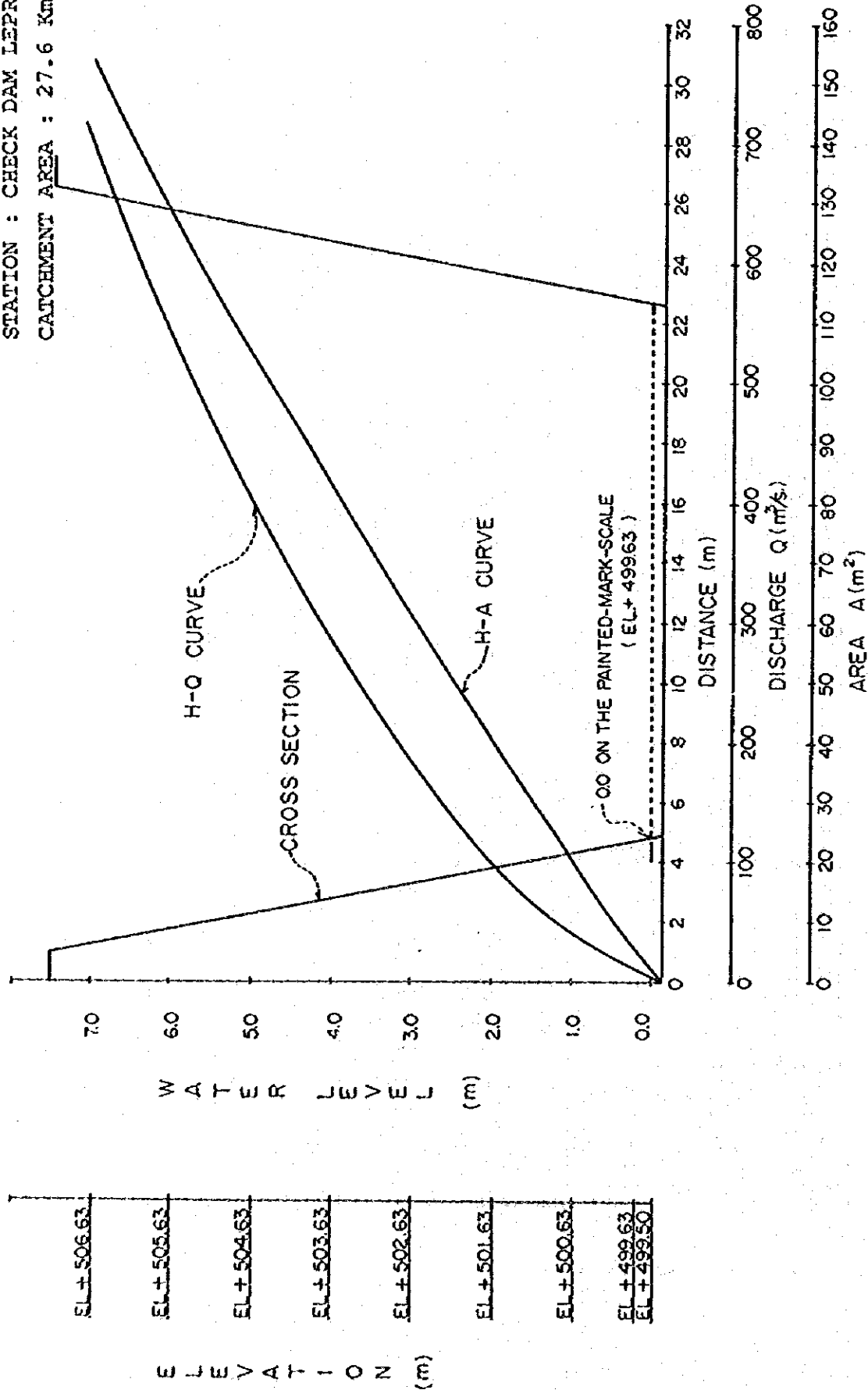


Fig.- 3.5 CROSS SECTION & H-Q, H-A CURVE AT CHECK DAM LEPRAK No.1 STATION.

Table - 3.7 TABLE OF WATER LEVEL (H m) - DISCHARGE (Q m³/s) STATION : CHECK DAM LEPRAK NO.1CATCHMENT AREA : 27.60 km²

ICM 10 CM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
0.0	2.65	3.20	3.75	4.30	4.85	5.40	5.95	6.50	7.05	7.60
0.1	8.15	8.70	9.25	9.80	10.35	10.90	11.45	12.00	12.41	12.82
0.2	13.23	13.64	14.06	14.47	14.88	15.29	15.70	16.11	16.52	16.93
0.3	17.34	17.75	18.17	18.58	18.99	19.40	19.81	20.22	21.06	21.90
0.4	22.74	23.58	24.42	25.25	26.09	26.93	27.77	28.61	29.45	30.29
0.5	31.13	31.97	32.81	33.64	34.48	35.32	36.16	37.00	37.70	38.40
0.6	39.10	39.80	40.50	41.20	41.90	42.59	43.29	43.99	44.64	45.39
0.7	46.09	46.79	47.49	48.19	48.89	49.59	50.29	50.99	51.69	52.39
0.8	53.08	53.78	54.48	55.18	55.88	56.58	57.28	57.98	58.83	59.68
0.9	60.53	61.38	62.24	63.09	63.94	64.79	65.64	66.49	67.34	68.19
1.0	69.04	69.89	70.75	71.60	72.45	73.30	74.15	75.00	76.00	77.00
1.1	78.00	78.99	79.99	80.99	81.99	82.99	83.99	84.98	85.98	86.98
1.2	87.98	88.98	89.98	90.97	91.97	92.97	93.97	94.97	95.97	96.96
1.3	97.96	98.96	99.96	100.96	101.96	102.95	103.95	104.95	106.28	107.60
1.4	108.93	110.26	111.58	112.91	114.24	115.56	116.89	118.22	119.54	120.87
1.5	122.20	123.52	124.85	126.18	127.50	128.83	130.16	131.48	132.81	134.14
1.6	135.46	136.79	138.12	139.44	140.77	142.09	143.42	144.75	146.07	147.40
1.7	148.73	150.05	151.38	152.71	154.03	155.36	156.69	158.01	159.34	160.67
1.8	161.99	163.32	164.65	165.97	167.30	168.63	169.95	171.28	172.83	174.39
1.9	175.94	177.50	179.05	180.61	182.16	183.71	185.27	186.82	188.38	189.93
2.0	191.48	193.04	194.59	196.15	197.70	199.26	200.81	202.36	203.92	205.47
2.1	207.03	208.58	210.14	211.69	213.24	214.80	216.35	217.91	219.46	221.01
2.2	222.57	224.12	225.68	227.23	228.79	230.34	231.89	233.45	235.00	236.56
2.3	238.11	239.66	241.22	242.77	244.33	245.88	247.44	248.99	250.76	252.52
2.4	254.29	256.06	257.82	259.59	261.36	263.12	264.89	266.66	268.42	270.19
2.5	271.96	273.73	275.49	277.26	279.03	280.79	282.56	284.33	286.09	287.86
2.6	289.63	291.39	293.16	294.93	296.69	298.46	300.23	301.99	303.76	305.53
2.7	307.29	309.06	310.83	312.59	314.36	316.13	317.90	319.66	321.43	323.20
2.8	324.96	326.73	328.50	330.26	332.03	333.80	335.56	337.33	339.30	341.27
2.9	343.24	345.21	347.18	349.15	351.12	353.09	355.06	357.03	359.00	360.97
3.0	362.93	364.90	366.87	368.84	370.81	372.78	374.75	376.72	378.69	380.66
3.1	382.63	384.60	386.57	388.54	390.51	392.48	394.45	396.42	398.39	400.36
3.2	402.33	404.30	406.27	408.24	410.21	412.17	414.14	416.11	418.08	420.05
3.3	422.02	423.99	425.96	427.93	429.90	431.87	433.84	435.81	437.98	440.14
3.4	442.31	444.47	446.64	448.81	450.97	453.14	455.30	457.47	459.64	461.80
3.5	463.97	466.13	468.30	470.47	472.63	474.80	476.96	479.13	481.30	483.46
3.6	485.63	487.79	489.96	492.13	494.29	496.46	498.62	500.79	502.96	505.12
3.7	507.29	509.45	511.62	513.79	515.95	518.12	520.28	522.45	524.62	526.78
3.8	528.95	531.11	533.28	535.45	537.61	539.78	541.94	544.11	546.47	548.83
3.9	551.18	553.54	555.90	558.26	560.61	562.97	565.33	567.69	570.04	572.40
4.0	574.76	577.12	579.47	581.83	584.19	586.55	588.90	591.26	593.62	595.98
4.1	598.33	600.69	603.05	605.41	607.77	610.12	612.48	614.84	617.20	619.55
4.2	621.91	624.27	626.63	628.98	631.34	633.70	636.06	638.41	640.77	643.13
4.3	645.49	647.84	650.20	652.56	654.92	657.27	659.63	661.99	664.34	667.08
4.4	669.63	672.17	674.72	677.27	679.81	682.36	684.90	687.45	690.00	692.54
4.5	695.09	697.63	700.18	702.73	705.27	707.82	710.36	712.91	715.46	718.00
4.6	720.55	723.09	725.64	728.19	730.73	733.28	735.82	738.37	740.92	743.46
4.7	746.01	748.55	751.10	753.65	756.19	758.74	761.28	763.83	766.38	768.92
4.8	771.47	774.01	776.56	779.11	781.65	784.20	786.74	789.29	792.02	794.75
4.9	797.49	800.22	802.95	805.68	808.41	811.15	813.88	816.61	819.34	822.07
5.0	824.81	827.54	830.27	833.00	835.73	838.47	841.20	843.93	846.66	849.39
5.1	852.13	854.86	857.59	860.32	863.05	865.79	868.52	871.25	873.98	876.71
5.2	879.45	882.18	884.91	887.64	890.37	893.11	895.84	898.57	901.30	904.03
5.3	906.77	909.50	912.23	914.96	917.69	920.43	923.16	925.89	928.81	931.72
5.4	934.64	937.56	940.47	943.39	946.30	949.22	952.14	955.05	957.97	960.89
5.5	963.80	966.72	969.64	972.55	975.47	978.39	981.30	984.22	987.13	990.05
5.6	992.97	995.88	998.80	1001.72	1004.63	1007.55	1010.47	1013.38	1016.30	1019.21
5.7	1022.13	1025.05	1027.96	1030.88	1033.80	1036.71	1039.63	1042.55	1045.46	1048.38
5.8	1051.30	1054.21	1057.13	1060.04	1062.96	1065.88	1068.79	1071.71	1074.81	1077.91
5.9	1081.01	1084.11	1087.21	1090.31	1093.41	1096.51	1099.61	1102.71	1105.81	1108.91
6.0	1112.00	1115.10	1118.20	1121.30	1124.40	1127.50	1130.60	1133.70	1136.80	1139.90
6.1	1143.00	1146.10	1149.20	1152.30	1155.40	1158.50	1161.60	1164.70	1167.70	1170.90
6.2	1174.00	1177.10	1180.20	1183.30	1186.40	1189.49	1192.59	1195.69	1198.79	1201.89
6.3	1204.99	1208.09	1211.19	1214.29	1217.39	1220.49	1223.59	1226.69	1229.79	1233.25
6.4	1236.54	1239.82	1243.10	1246.38	1249.67	1252.95	1256.23	1259.51	1262.80	1266.08
6.5	1269.36	1272.64	1275.92	1279.21	1282.49	1285.77	1289.06	1292.34	1295.62	1298.90
6.6	1307.19	1310.47	1313.75	1317.03	1320.31	1323.59	1326.88	1330.16	1333.44	1336.73
6.7	1335.01	1338.29	1341.57	1344.86	1348.14	1351.42	1354.70	1357.99	1361.27	1364.55
6.8	1367.83	1371.12	1374.40	1377.68	1380.96	1384.25	1387.53	1390.81	1394.27	1397.74
6.9	1401.20	1404.67	1408.13	1411.60	1415.06	1418.53	1421.99	1425.46	1428.92	1432.39
7.0	1433.83	1437.31	1440.78	1444.24	1447.71	1451.17	1454.64	1458.10	1461.57	1465.03
7.1	1470.50	1473.96	1477.43	1480.89	1484.35	1487.82	1491.28	1494.75	1498.21	1501.68
7.2	1505.14	1508.61	1512.07	1515.54	1519.00	1522.46	1525.93	1529.39	1532.86	1536.32
7.3	1539.79	1543.25	1546.72	1550.18	1553.65	1557.11	1560.58	1564.04		

STATION : PLANNED PRONOJIWO DAM
CATCHMENT AREA : 54.3 Km²

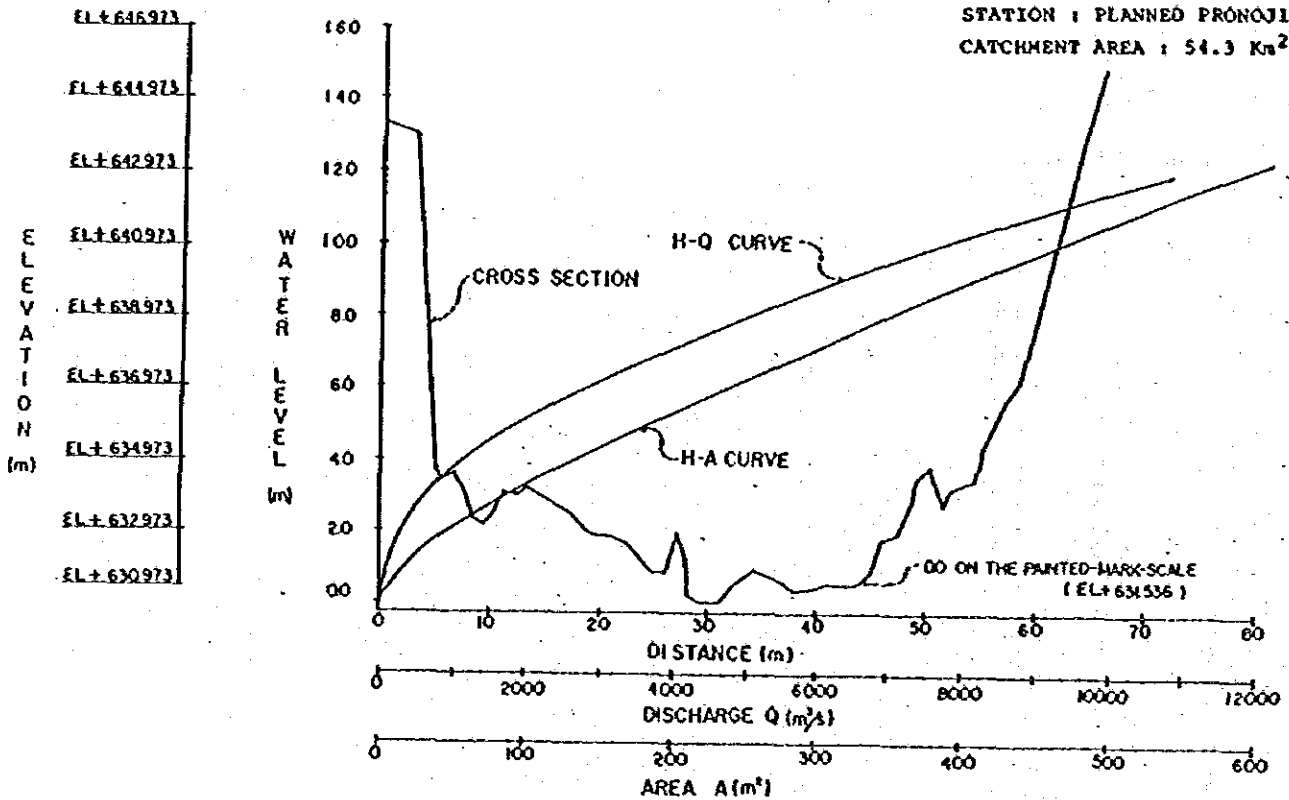


Fig.- 3.6(1) CROSS SECTION & H-Q, H-A CURVE AT PLANNED PRONOJIWO DAM STATION.

STATION : PLANNED PRONOJIWO DAM
CATCHMENT AREA : 54.4 Km²

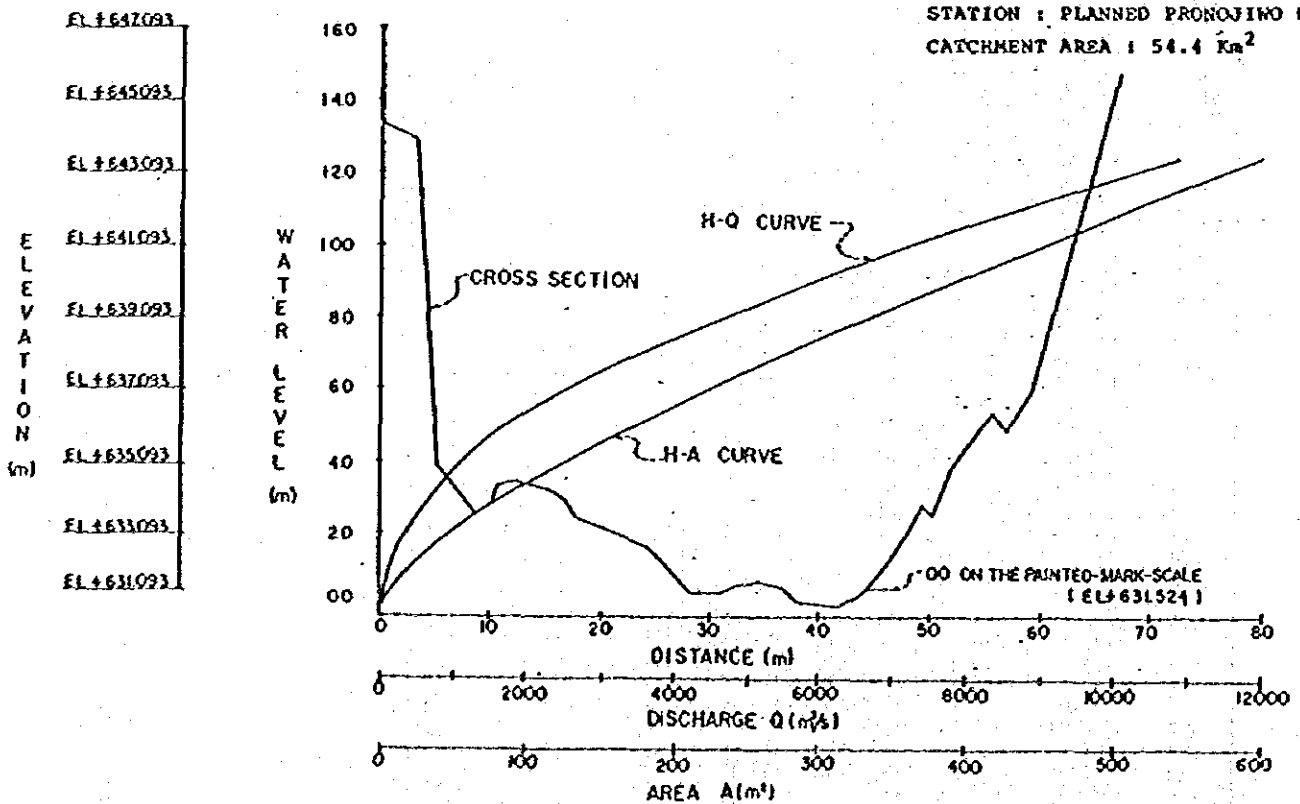


Fig.- 3.6(2) CROSS SECTION & H-Q, H-A CURVE AT PLANNED PRONOJIWO DAM STATION.

Table - 38. (1) TABLE OF WATER LEVEL (H m) - DISCHARGE (Q m³/s) STATION : PLANNED PRONOJIWO DAMCATCHMENT AREA : 54.30 km²

ICM IOCM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
0.0	3.52	3.97	4.42	4.86	5.31	5.76	6.21	6.66	7.10	7.55
0.1	8.00	8.40	8.80	9.20	9.60	10.00	10.40	10.80	11.20	11.60
0.2	12.00	12.44	12.88	13.32	13.76	14.20	14.64	15.08	15.52	15.96
0.3	16.40	16.96	17.52	18.08	18.64	19.20	19.76	20.32	20.88	21.44
0.4	22.00	22.60	23.20	23.80	24.40	25.00	25.60	26.20	26.80	27.40
0.5	28.00	28.65	29.30	29.95	30.60	31.25	31.90	32.55	33.20	33.85
0.6	34.50	35.35	36.20	37.05	37.90	38.75	39.60	40.45	41.30	42.15
0.7	43.00	44.00	45.00	46.00	47.00	48.00	49.00	50.00	51.00	52.00
0.8	53.00	54.22	55.44	56.66	57.88	59.10	60.32	61.54	62.76	63.98
0.9	65.20	66.48	67.76	69.04	70.32	71.60	72.88	74.16	75.44	76.72
1.0	78.00	79.40	80.80	82.20	83.60	85.00	86.40	87.80	89.20	90.60
1.1	92.00	93.55	95.10	96.65	98.20	99.75	101.30	102.85	104.40	105.95
1.2	107.50	109.15	110.80	112.45	114.10	115.75	117.40	119.05	120.70	122.35
1.3	124.00	126.00	128.00	130.00	132.00	134.00	136.00	138.00	140.00	142.00
1.4	144.00	146.00	148.00	150.00	152.00	154.00	156.00	158.00	160.00	162.00
1.5	164.00	166.40	168.80	171.20	173.60	176.00	178.40	180.80	183.20	185.60
1.6	188.00	190.40	192.82	195.20	197.60	200.00	202.40	204.80	207.20	209.60
1.7	212.00	214.40	216.80	219.20	221.60	224.00	226.40	228.80	231.20	233.60
1.8	236.00	238.80	241.60	244.40	247.20	250.00	252.80	255.60	258.40	261.20
1.9	264.00	266.80	269.60	272.40	275.20	278.00	280.80	283.60	286.40	289.20
2.0	292.00	294.88	297.76	300.64	303.52	306.40	309.28	312.16	315.04	317.92
2.1	320.80	323.68	326.56	329.44	332.32	335.20	338.08	340.96	343.84	346.72
2.2	349.60	352.48	355.36	358.24	361.12	364.00	366.88	369.76	372.64	375.52
2.3	378.40	381.28	384.16	387.04	389.92	392.80	395.68	398.56	401.44	404.32
2.4	407.20	410.08	412.96	415.84	418.72	421.60	424.48	427.36	430.24	433.12
2.5	436.00	439.24	442.48	445.72	448.96	452.20	455.44	458.68	461.92	465.16
2.6	468.40	471.64	474.88	478.12	481.36	484.60	487.84	491.08	494.32	497.56
2.7	500.80	504.04	507.28	510.52	513.76	517.00	520.24	523.48	526.72	529.96
2.8	533.20	536.44	539.68	542.92	546.16	549.40	552.64	555.88	559.12	562.36
2.9	565.60	568.84	572.08	575.32	578.56	581.80	585.04	588.28	591.52	594.76
3.0	598.00	602.90	607.80	612.70	617.60	622.50	627.40	632.30	637.20	642.10
3.1	647.00	651.90	656.80	661.70	666.60	671.50	676.40	681.30	686.20	691.10
3.2	696.00	700.90	705.80	710.70	715.60	720.50	725.40	730.30	735.20	740.10
3.3	745.00	749.90	754.80	759.70	764.60	769.50	774.40	779.30	784.20	789.10
3.4	794.00	798.90	803.80	808.70	813.60	818.50	823.40	828.30	833.20	838.10
3.5	843.00	847.97	852.94	857.91	862.88	867.85	872.82	877.79	882.76	887.73
3.6	907.96	912.93	917.90	922.87	927.84	932.81	937.78	942.75	947.72	952.69
3.7	972.93	977.90	982.87	987.84	992.81	997.78	1002.75	1007.72	1012.69	1017.66
3.8	1037.90	1042.87	1047.84	1052.81	1057.78	1062.75	1067.72	1072.69	1077.66	1082.63
3.9	1107.88	1112.85	1117.82	1122.79	1127.76	1132.73	1137.70	1142.67	1147.64	1152.61
4.0	1167.81	1172.78	1177.75	1182.72	1187.69	1192.66	1197.63	1202.60	1207.57	1212.54
4.1	1237.76	1242.73	1247.70	1252.67	1257.64	1262.61	1267.58	1272.55	1277.52	1282.49
4.2	1311.68	1316.65	1321.62	1326.59	1331.56	1336.53	1341.50	1346.47	1351.44	1356.41
4.3	1384.28	1389.25	1394.22	1399.19	1404.16	1409.13	1414.10	1419.07	1424.04	1429.01
4.4	1456.89	1461.86	1466.83	1471.80	1476.77	1481.74	1486.71	1491.68	1496.65	1501.62
4.5	1529.49	1534.46	1539.43	1544.40	1549.37	1554.34	1559.31	1564.28	1569.25	1574.22
4.6	1608.70	1613.67	1618.64	1623.61	1628.58	1633.55	1638.52	1643.49	1648.46	1653.43
4.7	1687.91	1692.88	1697.85	1702.82	1707.79	1712.76	1717.73	1722.70	1727.67	1732.64
4.8	1767.11	1772.08	1777.05	1782.02	1786.99	1791.96	1796.93	1801.90	1806.87	1811.84
4.9	1846.32	1851.29	1856.26	1861.23	1866.20	1871.17	1876.14	1881.11	1886.08	1891.05
5.0	1925.53	1930.50	1935.47	1940.44	1945.41	1950.38	1955.35	1960.32	1965.29	1970.26
5.1	2013.01	2017.98	2022.95	2027.92	2032.89	2037.86	2042.83	2047.80	2052.77	2057.74
5.2	2100.48	2105.45	2110.42	2115.39	2120.36	2125.33	2130.30	2135.27	2140.24	2145.21
5.3	2187.96	2192.93	2197.90	2202.87	2207.84	2212.81	2217.78	2222.75	2227.72	2232.69
5.4	2275.43	2280.40	2285.37	2290.34	2295.31	2300.28	2305.25	2310.22	2315.19	2320.16
5.5	2362.91	2367.88	2372.85	2377.82	2382.79	2387.76	2392.73	2397.70	2402.67	2407.64
5.6	2458.52	2463.49	2468.46	2473.43	2478.40	2483.37	2488.34	2493.31	2498.28	2503.25
5.7	2554.13	2559.10	2564.07	2569.04	2574.01	2578.98	2583.95	2588.92	2593.89	2598.86
5.8	2649.73	2654.70	2659.67	2664.64	2669.61	2674.58	2679.55	2684.52	2689.49	2694.46
5.9	2745.34	2750.31	2755.28	2760.25	2765.22	2770.19	2775.16	2780.13	2785.10	2790.07
6.0	2840.95	2845.92	2850.89	2855.86	2860.83	2865.80	2870.77	2875.74	2880.71	2885.68
6.1	2943.61	2948.58	2953.55	2958.52	2963.49	2968.46	2973.43	2978.40	2983.37	2988.34
6.2	3046.27	3051.24	3056.21	3061.18	3066.15	3071.12	3076.09	3081.06	3086.03	3091.00
6.3	3148.92	3153.89	3158.86	3163.83	3168.80	3173.77	3178.74	3183.71	3188.68	3193.65
6.4	3251.58	3256.55	3261.52	3266.49	3271.46	3276.43	3281.40	3286.37	3291.34	3296.31
6.5	3354.24	3359.21	3364.18	3369.15	3374.12	3379.09	3384.06	3389.03	3394.00	3398.97

ICM LOC	+0.00	+0.01	+0.02	+0.03	+0.04	+0.05	+0.06	+0.07	+0.08	+0.09
6.6	3463.22	3474.12	3485.01	3495.91	3506.81	3517.71	3528.60	3539.50	3550.40	3561.30
6.7	3572.20	3583.09	3594.00	3604.89	3615.79	3626.69	3637.58	3648.48	3659.38	3670.28
6.8	3681.17	3692.07	3702.97	3713.87	3724.77	3735.66	3746.56	3757.46	3768.36	3779.25
6.9	3790.15	3801.05	3811.95	3822.85	3833.74	3844.64	3855.54	3866.44	3877.33	3888.23
7.0	3899.13	3910.62	3922.11	3933.60	3945.09	3956.59	3968.08	3979.57	3991.06	4002.55
7.1	4014.04	4025.53	4037.02	4048.52	4060.01	4071.50	4082.99	4094.48	4105.97	4117.46
7.2	4128.95	4140.45	4151.94	4163.43	4174.92	4186.41	4197.90	4209.39	4220.88	4232.37
7.3	4243.87	4255.36	4266.85	4278.34	4289.83	4301.32	4312.81	4324.30	4335.80	4347.29
7.4	4358.78	4370.27	4381.76	4393.25	4404.74	4416.23	4427.73	4439.22	4450.71	4462.20
7.5	4473.69	4485.78	4497.87	4509.96	4522.05	4534.13	4546.22	4558.31	4570.40	4582.49
7.6	4594.58	4606.67	4618.76	4630.84	4642.93	4655.02	4667.11	4679.20	4691.29	4703.38
7.7	4715.47	4727.55	4739.64	4751.73	4763.82	4775.91	4788.00	4800.09	4812.18	4824.27
7.8	4836.35	4848.44	4860.53	4872.62	4884.71	4896.80	4908.89	4920.98	4933.06	4945.15
7.9	4957.24	4969.33	4981.42	4993.51	5005.60	5017.69	5029.77	5041.86	5053.95	5066.04
8.0	5078.13	5090.77	5103.41	5116.05	5128.69	5141.34	5153.98	5166.62	5179.26	5191.90
8.1	5204.54	5217.18	5229.82	5242.47	5255.11	5267.75	5280.39	5293.03	5305.67	5318.31
8.2	5330.95	5343.60	5356.24	5368.88	5381.52	5394.16	5406.80	5419.44	5432.08	5444.72
8.3	5457.37	5470.01	5482.65	5495.29	5507.93	5520.57	5533.21	5545.85	5558.50	5571.14
8.4	5583.78	5596.42	5609.06	5621.70	5634.34	5646.98	5659.63	5672.27	5684.91	5697.55
8.5	5710.19	5723.38	5736.57	5749.76	5762.95	5776.14	5789.33	5802.52	5815.71	5828.91
8.6	5842.10	5855.29	5868.48	5881.67	5894.86	5908.05	5921.24	5934.43	5947.62	5960.81
8.7	5974.00	5987.19	6000.38	6013.57	6026.76	6039.96	6053.15	6066.34	6079.53	6092.72
8.8	6105.91	6119.10	6132.29	6145.48	6158.67	6171.86	6185.05	6198.24	6211.43	6224.62
8.9	6237.81	6251.00	6264.20	6277.39	6290.58	6303.77	6316.96	6330.15	6343.34	6356.53
9.0	6369.72	6383.45	6397.17	6410.90	6424.63	6438.36	6452.08	6465.81	6479.54	6493.27
9.1	6506.99	6520.72	6534.45	6548.18	6561.90	6575.63	6589.36	6603.09	6616.81	6630.54
9.2	6644.27	6658.00	6671.72	6685.45	6699.18	6712.91	6726.63	6740.36	6754.09	6767.81
9.3	6781.54	6795.27	6809.00	6822.72	6836.45	6850.18	6863.91	6877.63	6891.36	6905.09
9.4	6918.82	6932.54	6946.27	6960.00	6973.73	6987.45	7001.18	7014.91	7028.64	7042.36
9.5	7056.09	7070.35	7084.61	7098.87	7113.13	7127.39	7141.65	7155.91	7170.17	7184.42
9.6	7198.68	7212.94	7227.20	7241.46	7255.72	7269.98	7284.24	7298.50	7312.76	7327.02
9.7	7341.28	7355.54	7369.80	7384.06	7398.32	7412.58	7426.83	7441.09	7455.35	7469.61
9.8	7483.87	7498.13	7512.39	7526.65	7540.91	7555.17	7569.43	7583.69	7597.95	7612.21
9.9	7626.47	7640.73	7654.98	7669.24	7683.50	7697.76	7712.02	7726.28	7740.54	7754.80
10.0	7769.06	7783.81	7798.56	7813.31	7828.06	7842.81	7857.55	7872.30	7887.05	7901.80
10.1	7916.55	7931.30	7946.05	7960.80	7975.55	7990.30	8005.04	8019.79	8034.54	8049.29
10.2	8064.04	8078.79	8093.54	8108.29	8123.04	8137.79	8152.53	8167.28	8182.03	8196.78
10.3	8211.53	8226.28	8241.03	8255.78	8270.53	8285.28	8300.02	8314.77	8329.52	8344.27
10.4	8359.02	8373.77	8388.52	8403.27	8418.02	8432.77	8447.51	8462.26	8477.01	8491.76
10.5	8506.51	8521.78	8537.06	8552.33	8567.60	8582.87	8598.15	8613.42	8628.69	8643.96
10.6	8659.24	8674.51	8689.78	8705.05	8720.33	8735.60	8750.87	8766.14	8781.42	8796.69
10.7	8811.96	8827.23	8842.51	8857.78	8873.05	8888.33	8903.60	8918.87	8934.14	8949.42
10.8	8964.69	8979.96	8995.23	9010.51	9025.78	9041.05	9056.32	9071.60	9086.87	9102.14
10.9	9117.41	9132.69	9147.96	9163.23	9178.50	9193.78	9209.05	9224.32	9239.59	9254.87
11.0	9270.14	9285.88	9301.62	9317.36	9333.10	9348.84	9364.58	9380.32	9396.06	9411.81
11.1	9427.55	9443.29	9459.03	9474.77	9490.51	9506.25	9521.99	9537.73	9553.47	9569.21
11.2	9584.95	9600.69	9616.43	9632.17	9647.91	9663.66	9679.40	9695.14	9710.88	9726.62
11.3	9742.36	9758.10	9773.84	9789.58	9805.32	9821.06	9836.80	9852.54	9868.28	9884.02
11.4	9899.76	9915.50	9931.25	9946.99	9962.73	9978.47	9994.21	10009.95	10025.69	10041.43
11.5	10057.17	10073.42	10089.67	10105.91	10122.16	10138.41	10154.66	10170.91	10187.16	10203.40
11.6	10219.65	10235.90	10252.15	10268.40	10284.64	10300.89	10317.14	10333.39	10349.64	10365.89
11.7	10382.13	10398.38	10414.63	10430.88	10447.13	10463.38	10479.62	10495.87	10512.12	10528.37
11.8	10544.62	10560.86	10577.11	10593.36	10609.61	10625.86	10642.11	10658.35	10674.60	10690.85
11.9	10707.10	10723.35	10739.59	10755.84	10772.09	10788.34	10804.59	10820.84	10837.08	10853.33
12.0	10869.58									

Note : This table can be applied before 21st Mar. '83.

No.2

Table -38(II) TABLE OF WATER LEVEL (H m) - DISCHARGE ($Q \text{ m}^3/\text{s}$) STATION : PLANNED PROKOJIWO DAM
CATCHMENT AREA : 54.30 km^2

ICM OCM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
0.0	3.88	4.04	4.20	4.35	4.51	4.67	5.11	5.54	5.98	6.41
0.1	6.85	7.17	7.49	7.81	8.13	8.44	8.76	9.08	9.40	9.48
0.2	9.56	9.64	9.71	9.79	9.87	9.95	10.03	10.11	10.19	10.26
0.3	10.34	10.42	10.50	11.77	13.03	14.30	15.56	16.83	18.10	19.36
0.4	20.63	21.90	23.16	24.43	25.69	26.96	28.23	29.49	30.76	32.02
0.5	33.29	34.39	35.50	36.60	37.71	38.81	39.92	41.02	42.13	43.23
0.6	44.33	45.44	46.54	47.65	48.75	49.86	50.96	52.06	53.17	54.27
0.7	55.38	56.48	57.59	58.69	59.80	60.90	62.30	63.70	65.09	66.49
0.8	61.89	62.29	70.69	72.09	73.48	74.88	76.28	77.68	79.08	80.47
0.9	81.87	83.27	84.67	86.07	87.47	88.86	90.26	91.66	93.06	94.46
1.0	95.86	97.25	98.65	100.05	101.45	102.85	104.24	105.64	107.04	108.44
1.1	109.84	111.24	112.63	114.03	115.43	117.13	118.84	120.54	122.25	123.95
1.2	125.66	127.36	129.07	130.77	132.48	134.18	135.89	137.59	139.50	141.00
1.3	142.71	144.41	146.12	147.82	149.53	151.23	152.94	154.64	156.35	158.05
1.4	159.76	161.46	163.17	164.87	166.88	168.90	170.91	172.93	174.94	176.96
1.5	178.97	180.99	183.00	185.02	187.03	189.05	191.06	193.08	195.09	197.30
1.6	199.51	201.71	203.92	206.13	208.34	210.55	212.76	214.96	217.17	219.38
1.7	221.59	223.80	226.00	228.21	230.42	232.63	234.84	237.06	239.27	241.48
1.8	243.69	245.91	248.12	250.33	252.54	254.76	256.97	259.18	261.39	263.61
1.9	265.82	268.03	270.24	272.46	274.67	276.88	280.01	283.15	286.28	289.41
2.0	292.55	295.68	298.81	301.94	305.08	308.21	311.34	314.48	317.61	320.74
2.1	323.88	327.01	330.14	333.28	336.41	339.54	342.67	345.81	348.94	352.07
2.2	355.21	358.34	361.47	364.61	367.74	370.87	374.00	377.14	380.27	383.40
2.3	386.54	389.67	393.16	396.64	400.13	403.61	407.10	410.58	414.07	417.55
2.4	421.04	424.53	428.01	431.50	434.98	438.47	441.95	445.44	448.92	452.41
2.5	456.21	460.01	463.81	467.61	471.41	475.21	479.01	482.81	486.61	490.41
2.6	498.21	498.01	501.81	505.60	509.40	513.20	517.00	520.80	524.60	528.40
2.7	532.20	536.00	539.80	543.60	547.40	551.20	555.00	558.80	562.60	566.40
2.8	565.03	567.79	570.56	573.32	576.09	578.85	581.62	584.38	587.15	589.91
2.9	594.16	598.40	602.65	606.89	611.14	615.39	619.63	623.88	628.12	632.37
3.0	636.61	640.86	645.11	649.35	653.60	657.84	662.09	666.33	670.58	674.82
3.1	701.03	704.81	708.59	712.37	716.14	719.92	723.70	727.48	731.26	735.04
3.2	738.81	742.59	746.37	750.15	753.93	757.71	761.48	765.26	769.04	772.82
3.3	776.60	780.38	784.15	787.93	791.71	795.49	799.27	803.05	806.82	810.60
3.4	814.38	820.19	826.00	831.81	837.61	843.42	849.23	855.04	860.86	866.68
3.5	872.81	878.73	884.65	890.57	896.49	902.42	908.34	914.26	920.18	926.10
3.6	933.64	940.10	946.55	953.01	959.47	965.93	972.39	978.85	985.31	991.77
3.7	998.22	1004.68	1011.14	1017.60	1024.06	1030.52	1036.98	1043.44	1049.89	1056.35
3.8	1062.81	1069.27	1075.73	1082.19	1088.65	1095.11	1101.57	1108.02	1114.48	1120.94
3.9	1127.40	1133.86	1140.32	1146.78	1153.24	1159.69	1166.15	1172.61	1179.07	1185.53
4.0	1191.99	1198.45	1204.91	1211.36	1217.82	1224.28	1230.74	1237.20	1243.66	1250.12
4.1	1246.83	1250.05	1253.26	1256.47	1259.68	1262.89	1266.10	1269.32	1272.53	1275.74
4.2	1278.95	1282.16	1285.37	1288.59	1291.80	1295.01	1298.22	1301.43	1304.64	1307.86
4.3	1311.07	1314.28	1317.49	1320.70	1323.91	1327.12	1330.34	1333.55	1336.76	1339.97
4.4	1343.18	1346.39	1349.61	1352.82	1356.03	1359.24	1362.45	1365.66	1368.88	1372.09
4.5	1375.30	1378.51	1381.72	1384.93	1388.15	1391.36	1394.57	1397.78	1400.99	1404.20
4.6	1418.36	1425.22	1432.08	1438.94	1445.80	1452.66	1459.52	1466.38	1473.24	1480.10
4.7	1486.95	1493.81	1500.67	1507.53	1514.39	1521.25	1528.11	1534.97	1541.83	1548.69
4.8	1555.55	1562.41	1569.27	1576.13	1582.99	1589.85	1596.71	1603.57	1610.43	1617.29
4.9	1624.15	1631.01	1637.87	1644.73	1651.59	1658.44	1665.30	1672.16	1679.02	1685.88
5.0	1692.74	1699.60	1706.46	1713.32	1720.18	1727.04	1733.90	1740.76	1747.62	1754.48
5.1	1766.37	1774.90	1783.44	1791.97	1800.51	1809.04	1817.58	1826.11	1834.65	1843.18
5.2	1851.72	1860.25	1868.79	1877.32	1885.86	1894.39	1902.93	1911.47	1920.00	1928.54
5.3	1937.07	1945.01	1954.14	1962.68	1971.21	1979.75	1988.28	1996.82	2005.35	2013.89
5.4	2022.42	2030.96	2039.49	2048.03	2056.56	2065.10	2073.64	2082.17	2090.71	2099.24
5.5	2107.78	2116.31	2124.85	2133.38	2141.92	2150.45	2158.99	2167.52	2176.06	2184.59
5.6	2193.13	2201.66	2210.20	2218.73	2227.27	2235.80	2244.34	2252.87	2261.41	2269.94
5.7	2283.18	2292.50	2301.82	2311.14	2320.46	2329.77	2339.09	2348.41	2357.73	2367.05
5.8	2376.37	2385.69	2395.00	2404.32	2413.64	2422.96	2432.28	2441.60	2450.92	2460.24
5.9	2469.55	2478.87	2488.19	2497.51	2506.83	2516.15	2525.47	2534.78	2544.10	2553.42
6.0	2562.74	2572.06	2581.38	2590.70	2600.01	2609.33	2618.65	2627.97	2637.29	2646.61
6.1	2657.86	2667.83	2677.79	2687.75	2697.72	2707.68	2717.64	2727.61	2737.57	2747.54
6.2	2757.50	2767.46	2777.43	2787.39	2797.35	2807.32	2817.28	2827.25	2837.21	2847.17
6.3	2857.14	2867.10	2877.07	2887.03	2896.99	2906.96	2916.92	2926.88	2936.85	2946.81
6.4	2956.78	2966.74	2976.70	2986.67	2996.63	3006.59	3016.56	3026.52	3036.49	3046.45
6.5	3056.41	3066.38	3076.34	3086.30	3096.27	3106.23	3116.20	3126.16	3136.13	3146.10

ICM IOCM	+ 0.00	+ 0.01	+ 0.02	+ 0.03	+ 0.04	+ 0.05	+ 0.06	+ 0.07	+ 0.08	+ 0.09
6.6	3157.75	3168.28	3178.81	3189.34	3199.87	3210.40	3220.94	3231.47	3242.00	3252.53
6.7	3263.06	3273.59	3284.12	3294.65	3305.18	3315.71	3326.24	3336.77	3347.30	3357.83
6.8	3368.36	3378.89	3389.43	3399.96	3410.49	3421.02	3431.55	3442.08	3452.61	3463.14
6.9	3473.67	3484.20	3494.73	3505.26	3515.79	3526.32	3536.85	3547.38	3557.91	3568.45
7.0	3578.98	3589.51	3600.04	3610.57	3621.10	3631.63	3642.16	3652.69	3663.22	3673.75
7.1	3686.50	3697.76	3709.03	3720.30	3731.57	3742.84	3754.11	3765.37	3776.64	3787.91
7.2	3799.18	3810.45	3821.72	3832.98	3844.25	3855.52	3866.79	3878.06	3889.33	3900.59
7.3	3911.86	3923.13	3934.40	3945.67	3956.94	3968.21	3979.47	3990.74	4002.01	4013.28
7.4	4024.55	4035.82	4047.08	4058.35	4069.62	4080.89	4092.16	4103.43	4114.69	4125.96
7.5	4137.23	4148.50	4159.77	4171.04	4182.30	4193.57	4204.84	4216.11	4227.37	4239.64
7.6	4250.88	4262.47	4274.06	4285.65	4297.24	4308.83	4320.42	4332.01	4343.60	4365.19
7.7	4366.79	4378.38	4389.97	4401.56	4413.15	4424.74	4436.33	4447.92	4459.51	4471.10
7.8	4482.69	4494.28	4505.87	4517.46	4529.05	4540.64	4552.23	4563.82	4575.41	4587.00
7.9	4598.59	4610.18	4621.77	4633.36	4644.95	4656.54	4668.13	4679.72	4691.31	4702.90
8.0	4714.50	4726.09	4737.68	4749.27	4760.86	4772.45	4784.04	4795.63	4807.22	4818.81
8.1	4831.83	4843.89	4855.96	4868.02	4880.08	4892.15	4904.22	4916.28	4928.35	4940.41
8.2	4952.48	4964.54	4976.61	4988.67	5000.74	5012.80	5024.87	5036.93	5049.00	5061.06
8.3	5073.13	5085.19	5097.26	5109.33	5121.39	5133.46	5145.52	5157.59	5169.65	5181.72
8.4	5193.78	5205.85	5217.91	5229.98	5242.04	5254.11	5266.17	5278.24	5290.30	5302.37
8.5	5314.43	5326.50	5338.56	5350.63	5362.69	5374.76	5386.82	5398.89	5411.95	5424.02
8.6	5437.30	5450.11	5462.91	5475.71	5488.52	5501.32	5514.13	5526.93	5539.73	5552.54
8.7	5565.34	5578.15	5590.95	5603.75	5616.56	5629.36	5642.17	5654.97	5667.77	5680.58
8.8	5693.38	5706.19	5718.99	5731.79	5744.60	5757.40	5770.21	5783.01	5795.81	5808.62
8.9	5821.42	5834.23	5847.03	5859.83	5872.64	5885.44	5898.25	5911.05	5923.85	5936.66
9.0	5949.46	5962.27	5975.07	5987.87	6000.68	6013.48	6026.29	6039.09	6052.07	6065.04
9.1	6078.02	6091.00	6103.98	6116.95	6129.93	6142.91	6155.88	6168.86	6181.84	6194.82
9.2	6207.79	6220.77	6233.75	6246.73	6259.70	6272.68	6285.66	6298.63	6311.61	6324.59
9.3	6337.57	6350.54	6363.52	6376.50	6389.47	6402.45	6415.43	6428.41	6441.38	6454.36
9.4	6467.34	6480.31	6493.29	6506.27	6519.25	6532.22	6545.20	6558.18	6571.16	6584.13
9.5	6597.11	6610.09	6623.07	6636.04	6649.02	6662.00	6674.97	6687.95	6701.93	6714.92
9.6	6728.10	6741.49	6754.87	6768.26	6781.64	6795.03	6808.41	6821.80	6835.18	6848.57
9.7	6861.95	6875.33	6888.72	6902.10	6915.49	6928.87	6942.26	6955.64	6969.03	6982.41
9.8	6995.80	7009.18	7022.57	7035.95	7049.33	7062.72	7076.10	7089.49	7102.87	7116.26
9.9	7129.64	7143.03	7156.41	7169.80	7183.18	7196.56	7209.95	7223.33	7236.72	7250.10
10.0	7263.49	7276.87	7290.26	7303.64	7317.03	7330.41	7343.80	7357.18	7371.34	7385.50
10.1	7399.66	7413.82	7427.98	7442.14	7456.30	7470.46	7484.62	7498.78	7512.94	7527.10
10.2	7541.26	7555.42	7569.58	7583.74	7597.90	7612.06	7626.22	7640.38	7654.54	7668.70
10.3	7682.86	7697.02	7711.18	7725.34	7739.50	7753.66	7767.82	7781.98	7796.14	7810.30
10.4	7824.46	7838.62	7852.78	7866.94	7881.10	7895.26	7909.42	7923.58	7937.74	7951.90
10.5	7966.06	7980.22	7994.38	8008.54	8022.70	8036.86	8051.02	8065.18	8079.34	8093.50
10.6	8108.97	8123.57	8138.17	8152.77	8167.37	8181.96	8196.56	8211.16	8225.76	8240.36
10.7	8254.95	8269.55	8284.15	8298.75	8313.35	8327.94	8342.54	8357.14	8371.74	8386.34
10.8	8400.93	8415.53	8430.13	8444.73	8459.33	8473.92	8488.52	8503.12	8517.72	8532.32
10.9	8546.91	8561.51	8576.11	8590.71	8605.31	8619.90	8634.50	8649.10	8663.70	8678.30
11.0	8692.89	8707.49	8722.09	8736.69	8751.29	8765.88	8780.48	8795.08	8809.68	8824.28
11.1	8838.81	8853.38	8867.96	8882.53	8897.11	8911.68	8926.26	8940.83	8955.41	8969.98
11.2	8984.56	8999.14	9013.71	9028.29	9042.86	9057.44	9072.01	9086.59	9101.16	9115.74
11.3	9130.31	9144.89	9159.47	9174.04	9188.62	9203.19	9217.77	9232.34	9246.92	9261.49
11.4	9276.07	9290.64	9305.22	9319.79	9334.37	9348.95	9363.52	9378.10	9392.67	9407.25
11.5	9421.82	9436.40	9450.97	9465.55	9480.12	9494.70	9509.27	9523.85	9539.26	9554.68
11.6	9570.09	9585.50	9600.91	9616.33	9631.74	9647.15	9662.56	9677.98	9693.39	9708.80
11.7	9724.21	9739.63	9755.04	9770.45	9785.86	9801.28	9816.69	9832.10	9847.51	9862.93
11.8	9878.34	9893.75	9909.17	9924.58	9939.99	9955.40	9970.82	9986.23	10001.64	10017.05
11.9	10032.47	10047.88	10063.29	10078.70	10094.12	10109.53	10124.94	10140.35	10155.77	10171.18
12.0	10186.59	10202.00	10217.42	10232.83	10248.24	10263.65	10279.07	10294.48	10310.02	10325.56
12.1	10341.10	10356.64	10372.18	10387.72	10403.26	10418.80	10434.34	10449.88	10465.42	10480.96
12.2	10496.50	10512.04	10527.58	10543.12	10558.66	10574.20	10589.74	10605.28	10620.81	10636.35
12.3	10651.89	10667.43	10682.97	10698.51	10714.05	10729.59	10745.13	10760.67	10776.21	10791.75
12.4	10807.29	10822.83	10838.37	10853.91	10869.45	10884.99	10900.53	10916.07	10931.61	

Note : This table can be applied after 21-Mar-'83.

from April or May and to increase from December or January, was made.

It should be noted, however, that the observed data represents the results of observation which take place only once a month. It must therefore be examined whether or not the base flow data so attained is affected by the rain-fall, or in other words, whether or not it represents an ordinary base flow, especially in the rainy season.

(ii) Data on Flood Discharge

Table-3.10 shows the list of collected data on flood discharge until the end of June, 1983.

Rainfall and discharge observation data at each of four flood discharge observation stations is also given in Appendix.

Table-3.10 List of Discharge Observation Data

Station	Observation Period	Trace Water-level	Velocity Measurement by Surface Float	Velocity Measurement by Radio Meter	Samples of Floating Sediment
Mujur Bridge	Feb. 14 - Jun. 25	-	11 times	-	9 samples
Kloposawit Bridge	Feb. 9 - Jun. 25	-	10 times	-	4 samples
Check Dam Leprak No.1	Feb. 9 - Jun. 25	-	Twice	-	2 samples
Planned Pronojiwo Dam	Feb. 15 - Jun. 25	2 floods	Once	-	4 samples

Table-3.9 Observed Base Flow in Main Stream

(Unit: m³/s)

NO.	OB. POINT	YEAR														
		MONTH														
1982																
APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUN.		
1.	ROWGEDANG	2.16	1.42	0.85	0.88	0.65	0.43	0.38	0.11	0.14	0.17	0.60	0.53	0.71	0.98	0.83
2.	DAM JURANGGEGER	-	-	0.18	0.22	0.17	0.07	0.06	0.10	0.05	0.07	0.08	0.15	0.17	0.19	0.11
3.	DAM PANCUT	-	-	0.24	0.30	0.32	0.16	0.08	0.05	-	0.14	0.76	0.49	0.49	1.67	1.32
4.	DAM KARAN COLIK	-	-	0.31	0.73	0.52	0.40	0.31	0.14	0.12	0.71	1.11	1.14	1.10	2.25	1.81
5.	LOBANG I	3.13	0.67	0.59	0.38	0.02	0.07	0.18	0.06	0.11	1.14	1.63	1.06	1.48	2.58	2.31
6.	LOBANG II	2.48	1.05	0.79	0.56	0.16	0.12	0.02	0.01	0.04	0.26	1.50	1.03	1.39	2.25	2.33
7.	KLEREK I	2.68	0.38	0.42	-	0.51	0.20	0.43	0.18	0.06	0.13	0.10	0.14	0.61	0.26	0.12
8.	KLEREK II	-	-	0.52	0.47	0.35	0.29	-	-	0.22	0.18	0.99	0.69	1.74	2.96	1.72
9.	KEDUNG CARING	2.12	0.48	0.32	0.31	0.19	0.38	0.10	0.07	0.23	0.17	1.79	0.82	0.76	2.57	3.66
10.	JUWENI	-	-	0.47	0.32	0.24	0.35	0.74	0.14	-	0.21	1.52	0.80	0.69	2.38	3.21
11.	SAPARI	-	-	0.40	0.33	0.23	0.17	0.74	0.07	0.16	0.26	1.92	0.98	0.69	2.41	3.21
12.	CARIK	-	-	0.60	0.60	0.53	0.46	0.26	0.16	0.14	0.51	0.47	0.41	0.56	0.34	0.48
13.	SOPONYONO	1.69	1.18	0.56	0.63	0.45	0.27	0.11	0.04	0.10	0.18	1.56	0.71	0.73	1.41	2.87
14.	PONCO	-	-	0.79	0.70	0.47	0.51	0.30	0.10	-	0.28	1.83	0.48	0.79	1.41	3.10
15.	DAUHAN KERTI	2.06	0.71	1.20	0.74	0.62	0.62	0.22	0.10	0.25	0.55	2.32	0.49	0.73	0.03	1.04
16.	PANDAN WANGI	2.11	0.46	0.96	0.83	0.73	0.55	0.22	0.06	0.22	0.31	0.89	0.46	0.53	1.60	1.04
17.	KAHAYU	1.05	0.67	0.57	0.55	0.42	0.24	0.10	0.04	0.38	0.37	0.66	0.53	0.18	1.23	9.81
18.	DAUHAN MARSO	-	-	0.95	0.68	0.73	0.60	0.11	0.08	0.15	0.36	0.88	0.87	0.92	0.91	9.81
19.	DAM REJALI	4.00	3.81	1.91	1.65	1.34	1.26	0.74	0.26	0.46	1.07	1.47	1.83	1.39	4.28	3.23
20.	TALANG	0.46	0.45	0.43	0.35	0.57	0.71	0.45	0.34	-	0.14	0.26	0.19	0.33	0.54	0.23
21.	K. LEPRAK	-	-	-	0.37	0.36	0.32	0.35	0.33	0.26	0.11	0.37	0.58	0.67	2.91	1.10
22.	K. LENGKONG NO. 1	-	-	-	0.42	0.30	0.17	0.22	0.16	0.13	0.24	1.09	0.70	0.48	2.07	0.88
23.	K. LENGKONG NO. 2	-	-	-	0.48	0.47	0.29	0.26	0.22	0.15	0.35	0.86	0.70	0.58	1.84	0.76
24.	K. LENGKONG NO. 3	-	-	-	0.46	0.39	0.28	0.20	0.14	0.20	0.21	0.98	1.10	0.59	2.44	1.03
25.	K. LENGKONG NO. 4	-	-	-	0.45	0.39	0.30	0.18	0.05	0.10	0.15	1.02	1.37	0.58	-	1.03
26.	K. LENGKONG NO. 5	-	-	-	1.47	1.23	1.22	0.54	0.54	0.32	0.47	1.04	1.38	1.19	5.82	2.48