11.16.2. Monitoring Programme

11.16.2.1. Monitoring in the River Basin

At this stage, it is important to monitor the water quality and life in the river basin. To identify environmental change in the reservoir, it is necessary to monitor not only water quality changes but also how physical and chemical changes of the environment would affect aquatic-ecosystem.

The following items are the Japanese Standard for an investigation related to this kind of development.

(1) Baseline investigation : Catchment area and flow discharge (rainfall, inflow and outflow discharge, and usable discharge)

(2) Reservoir : Water level, reservoir area, capacity, and classification of reservoir bank and bottom layer

(3) Reservoir bed : Physical classification of the constituent materials of the reservoir bed (conglomerate, sand, etc.)

(4) Flora on the reservoir bank:

Biomass, etc.

(5) Water quality : Na, K, Ca, Mg, HCO_3, CO_3, Cl, SO_4, alkalinity, acidity, solidity NO_3, NO_2, PO_4, F, SiO_2, NH_4, Fe, Mn, Al, BOD, COD, SS, DO, CO_2, Water temperature, pH, conductivity, Hazardous article, H_2S, mudiness, clearness, grain distribution)

(6) Aquatic life : Floral and faunal planktons, life in the bed, adhesive life, aquatic weeds, fish (composition, distribution, quantities, growth status, etc.)

Screening of the monitoring items is considered unnecessary, because many reports and research references have been published and are readily available. However, undue emphasis to one particular point should be avoided, for example, to the water quality monitoring. The programme should be established to provide a balanced correlation of the many factors forming the aquatic-ecosystem.

Given below are items where the measurement of change in aquatic-ecosystem is required:

(a) Physical and chemical considerations in the riservoir

(i) Extent and depth of the reservoir

The depth of water in the reservoir fluctuates depending on the discharges from the dam, and the extent of the reservoir fluctuates accordingly.

Therefore, it is required to investigate seasonal fluctuations (each dry and rainy season, hereinafter referred to as seasonal fluctuations) including the mechanism of inflow and outflow at the reservoir.

(ii) Distribution of water quality

Vertical and horizontal distribution of the water quality in the reservoir should be studied considering the seasonal fluctuations. In particular, by observing the data on the vertical distribution collected at other dams, remarkable differences of distribution of the water temperature and dissolved oxygen have been found. Therefore, for studing the water quality model in this reservoir, two layer structures should be adopted.

(iii) When preparing the environmental water quality model of the reservoir, data on the transportation of organic matter and wind direction should be incorporated, to obtain the correlations between these factors.

(iv) Fluctuation of retention period

Environmental change is effected by the amount of inflow and outflow at the reservoir and the operational conditions, thus a sensibility analysis should be carried out.

(v) Amount of nutritious salts in the reservoir and life

When the model study of the ecosystem is carried out, the balance of these organic matters should be studied. For studying the internal production within the reservoir, a model which includes the parameters on aquatic life is required to be established. It will depend on past records whether the parameters can be incorporated or not. For implementation, it is intended to carry out a sensibility analysis by in-putting the parameters of past modelling of other river basins to adopt a simulation method. However, there is little such data for large reservoirs.

(vi) Inflow and outflow

The measurement of present inflow and outflow is one of the important factors which relates to the study of the future land development scheme around the reservoir area in the future and the model of the environmental change in the basin.

(b) Balance of organic matter and modelling of the reservoir

(i) Existing amount of the organic matter in vertical and horizontal directions in the reservoir

The fluctuation of each water quality parameter at monitoring stations in the reservoir should be studied by establishing a model. The study shall also include the parameters on aquatic life in the reservoir.

(ii) Influence on loading due to inflow and outflow at the reservoir

An inflow model is to be prepared based on the water quality model of the river, and the adjustment of overflow conditions as an operational model.

Inflow conditions relate to rainfall and the problem is, whether inflow fluctuation can be related to the distribution of organic matter over the area of diffusion in view of the effect of time lag.

(iii) Balance of organic matters

It is required to study the balance of organic matter after taking the steps as mentioned above.

(iv) The water quality model required will include an ecosystem having two vertical layers, i.e., a eutrophication model. These models are described in many publications, and the practical methods of using the model will be studied later, because it depends on the field record to be used.

Fig. 11-16 shows a flow chart of the environmental monitoring in the river basin.

11.16.2.2. Monitoring of Land Fauna and Flora

The monitoring of the relocated animals is one of the important matters among the monitoring of the land fauna and flora. It is considered reasonable to adopt the popular method which uses the identification card for the relocated animals, thus the population of animals in the new habitats can be monitored continuously. However, the method to be used should be decided in consulation with the Wildlife Department.

The impacts to flora are an unavoidable factor in the implementation of this type of dam project. Therefore, from the botanical point of view, it is recommended to carry out a scientific survey prior to impoundment for the preservation and recording of valuable species of plants.

11.16.2.3. Other monitoring

The socio-economic monitoring, which should be carried out by the government administrative office, is required to continuously monitor trends of the regional industry, economy and life environment.

As shown above, the attention to be paid for establishing an outline and detailed programme of the monitoring to be carried out, followed by the environmental assessment has been detailed above. Some detailed programmes should be implemented by the managing authority in the region, because They include fundamental problems which can not be settled within the scope a project. For instance, the land use in the region is not a matter to be studied only within the scope of works for the Lebir Dam Project. Environmental impacts are determined by the factors external to a project. The smaller the project area, the less is the extent of fluctuations in the

environment. In case of the Lebir Dam Project, its impact is large in extent which creates difficulty in accurate forecasting. Trends should therefore be considered in the evaluation of the scale of environmental change, on the basis of other similar experience.

Therefore, NEB should carry out the monitoring work within the framework of cooperation with the State and the Federal governments. It is important to consider the existing environment as a national resource and that the development project must contribute in the most effective way to human life.

Table 11-12-1 Studied Cases of Various Discharge Pattern

Case No.	With or without the re-regulating pondage	Initial sea water level	Discharge Pattern 1		Discharge Pattern 2	
			Discharge	Operating Hours	Discharge	Operating Hours
			m^3/s	hr	m^3/s	hr
1	Without	H.H.W.L (= 1.524 m)	320	6	-	-
	Without	L.L.W.L. (= 0.762 m)	320	6	-	-
2	With	H.H.W.L.	80	3	320	6
	With	L.L.W.L.	80	3	320	6
3	Without	H.H.W.L.	480	4	-	-
	Without	L.L.W.L.	480	4	-	-
4	Without	H.H.W.L.	640	3	-	-
	Without	L.L.W.L.	640	3	-	-

Table 11-12-2(1)

Summary Table of Analysis Results

Case 1 Discharge Pattern of Lebir Dam
(Without the re-regulating pondage)

Generation Discharge : Q = 320 m^3/s Duration of discharge: 6 hours

In case starting from W.L. = H.H.W.L. = 1.524 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	150.8	142.5-150.8	2.33-2.38
LEMAL (20.0 km)	150.3	140.9-150.3	2.86-2.90
SALOR (22.0 km)	150.6	140.7-150.6	3.09-3.13
KEMUBU (33.0 km)	151.8	139.3-151.8	5.16-5.22

Case 1 Discharge Pattern of Lebir Dam
(Without the re-regulating pondage)

Generation Discharge : Q = 320 m^3/s Duration of discharge: 6 hours

In case starting from W.L. = L.L.W.L. = 0.762 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	149.7	140.4-149.7	2.33-2.38
LEMAL (20.0 km)	150.6	141.3-150.6	2.86-2.90
SALOR (22.0 km)	150.8	140.8-150.8	3.09-3.13
KEMUBU (33.0 km)	151.8	139.3-151.8	5.16-5.22

Table 11-12-2(2)

Case 2 Discharge Pattern of Lebir Dam

(With the re-regulating pondage of the capacity of 1,000,000m^3)

Discharge from the re-regulating pondage : Q = 80 m^3/s

Duration of discharge: 3 hours

Afterwards, discharge from the re-regulating pondage : Q = 320 m^3/S

Duration of discharge: 5 hours

In case starting from W.L. = H.H.W.L. = 1.524 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	150.3	142.2-150.3	2.33-2.37
LEMAL (20.0 km)	150.0	140.9-150.0	2.86-2.90
SALOR (22.0 km)	150.3	140.4-150.3	3.08-3.13
KEMUBU (33.0 km)	151.3	139.0-151.3	5.16-5.22

Case 2 Discharge Pattern of Lebir Dam

(With the re-regulating pondage of the capacity of 1,000,000m^3)

Discharge from the re-regulating pondage : Q = 80 m^3/s

Duration of discharge: 3 hours

Afterwards, discharge from the re-regulating pondage : Q = 320 m^3/s

Duration of discharge: 5 hours

In case starting from W.L. = H.H.W.L. = 0.762 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	149.2	140.1-149.2	2.34-2.38
LEMAL (20.0 km)	150.0	140.7-150.0	2.86-2.90
SALOR (22.0 km)	150.3	140.4-150.3	3.08-3.13
KEMUBU (33.0 km)	151.3	139.0-151.3	5.16-5.22

Table 11-12-2(3)

Case 3 Discharge Pattern of Lebir Dam

Generation Discharge : Q = 480 m^3/s Duration of discharge: 4 hours

In case starting from W.L. = H.H.W.L. = 1.524 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	149.7	140.7-149.7	2.33-2.38
LEMAL (20.0 km)	149.2	139.9-149.2	2.86-2.90
SALOR (22.0 km)	149.7	139.7-149.6	3.08-3.13
KEMUBU (33.0 km)	150.9	138.3-150.9	5.16-5.22

Case 3 Discharge Pattern of Lebir Dam

Generation Discharge : Q = 480 m^3/s Duration of discharge: 4 hours

In case starting from W.L. = L.L.W.L. = 0.762 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	149.2	139.8-149.2	2.33-2.38
LEMAL (20.0 km)	149.7	140.3-149.7	2.86-2.90
SALOR (22.0 km)	149.8	139.8-149.8	3.08-3.13
KEMUBU (33.0 km)	150.9	138.3-150.9	5.16-5.22

Table 11-12-2(4)

Case 4 Discharge Pattern of Lebir Dam

Generation Discharge : Q = 640 m^3/s Duration of discharge: 3 hours

In case starting from W.L. = H.H.W.L. = 1.524 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	148.4	139.4-148.4	2.33-2.37
LEMAL (20.0 km)	148.0	138.9-148.0	2.85-2.90
SALOR (22.0 km)	148.5	139.7-138.6	3.08-3.12
KEMUBU (33.0 km)	149.7	137.3-149.7	5.15-5.21

Case 4 Discharge Pattern of Lebir Dam

Generation Discharge : Q = 640 m^3/s Duration of discharge: 3 hours

In case starting from W.L. = L.L.W.L. = 0.762 m at sea water level T =0.

Pumping Station	Peak Discharge (m^3/s)	Fluctuation of Daily Discharge (m^3/s)	Fluctuation of Water Level (W.L.)(m)
PASIR MAS (15.0 km)	148.2	139.0-148.2	2.32-2.37
LEMAL (20.0 km)	148.4	139.3-148.4	2.85-2.90
SALOR (22.0 km)	148.7	138.7-148.6	3.08-3.12
KEMUBU (33.0 km)	149.7	137.3-149.7	5.15-5.21

Table 11-12-3 Summary of Results

Return period	Time condition	Discharge (m^3/s)		With or without Lebir Dam	Generation discharge (640 m^3/s)	Water Level (EL.m)		W.L. at Kuala Kerai Gauging Station (No. 29)	Case No.
		Lebir River	Kelantan River			Immediate downstream of Lebir Dam (No. 66)	Downstream end of Lebir River (No. 2)		
1/100	At the time of peak discharge in Lebir River	5,951	18,455	Without	-	39.024	30.153	EL 29.865 m	5
		4,029	12.315	With	including	36.132	27.567	27.282	1-2
		3,389	11,675		-	35.044	27.255	26.974	1-1
	At the time of peak discharge at Guillemard	5,823	18,752	Without	-	38.869	30.266	29.977	6
		3,382	15.435	With	including	35.185	28.957	28.667	2-2
		2,745	14,795		-	34.014	28.684	28.396	2-1
1/50	At the time of peak discharge in Lebir River	5,260	16,569	Without	-	38.060	29.418	29.131	7
		3,587	11,039	With	including	35.370	26.941	26.658	3-2
		2,947	10,399		-	34.201	26.607	26.330	3-1
	At the time of peak discharge at Guillemard	5,144	16,851	Without	-	37.910	29.532	29.243	8
		3,009	13,919	With	including	34.452	28.300	28.016	4-2
		2,369	13,279		-	33.187	28.011	27.729	4-1

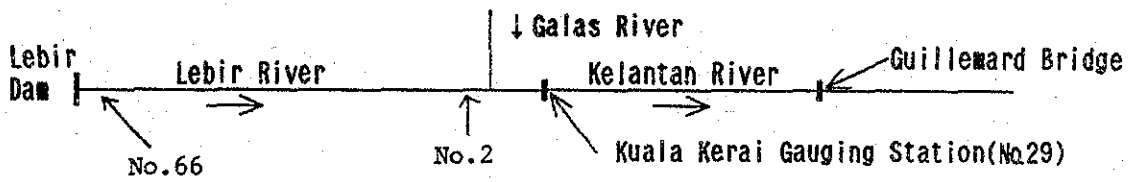


Table 11-12-4(1) Flow Discharge, Water Level and Flow Velocity at Various Sections on the Downstream Course of the Lebir River at the time of Power Generation

Time	No. 2 (0.74km)			No. 4 (2.64km)			No. 9 (8.46km)		
	Q	H	U	Q	H	U	Q	H	U
	㎥/s	m	m/s	㎥/s	m	m/s	㎥/s	m	m/s
000	7.029	1.963	0.221	7.189	1.124	0.236	8.357	0.962	0.217
30	572.340	6.034	2.068	386.539	3.771	1.786	7.740	0.890	0.224
100	620.025	6.876	1.741	584.606	5.129	1.643	140.371	2.424	1.107
30	634.429	7.053	1.696	620.381	5.388	1.610	343.804	3.760	1.309
200	632.207	7.175	1.635	613.976	5.660	1.471	436.687	4.559	1.268
30	631.943	7.318	1.574	615.230	5.905	1.376	494.707	5.001	1.261
300	217.068	6.518	0.676	414.781	5.805	0.954	532.546	5.284	1.256
30	30.554	5.687	0.124	70.153	4.914	0.211	292.054	4.738	0.803
400	25.846	5.107	0.129	64.476	4.363	0.235	232.488	4.273	0.739
30	21.805	4.694	0.128	52.451	3.947	0.225	176.364	3.862	0.647
500	17.845	4.343	0.122	41.903	3.598	0.209	140.800	3.527	0.587
30	15.336	4.051	0.119	35.113	3.305	0.201	115.309	3.243	0.541
600	13.531	3.801	0.119	29.962	3.055	0.195	96.376	2.997	0.505
30	12.199	3.585	0.120	26.059	2.838	0.191	81.855	2.783	0.476
700	11.175	3.396	0.122	22.993	2.648	0.188	70.414	2.595	0.452
30	10.371	3.231	0.125	20.532	2.481	0.187	61.201	2.428	0.431
800	9.733	3.085	0.128	18.521	2.333	0.186	53.652	2.279	0.413
30	9.227	2.955	0.132	16.861	2.202	0.186	47.378	2.147	0.397
900	8.827	2.840	0.136	15.477	2.085	0.187	42.110	2.028	0.382
30	8.512	2.738	0.141	14.316	1.980	0.188	37.649	1.922	0.369
1000	8.263	2.647	0.146	13.337	1.887	0.189	33.845	1.826	0.356
30	8.063	2.567	0.151	12.504	1.803	0.191	30.584	1.740	0.345
1100	7.902	2.495	0.157	11.793	1.729	0.192	27.776	1.662	0.334
30	7.769	2.432	0.162	11.182	1.662	0.194	25.347	1.593	0.324
1200	7.659	2.375	0.167	10.654	1.602	0.197	23.241	1.530	0.314
30				10.198	1.549	0.199	21.407	1.473	0.305
1300	7.489	2.281	0.176	9.802	1.501	0.201	19.808	1.421	0.297
30				9.457	1.458	0.203	18.409	1.374	0.289
1400	7.367	2.207	0.185	9.157	1.420	0.206	17.182	1.332	0.282
30				8.895	1.386	0.208	16.103	1.294	0.275
1500	7.278	2.149	0.192	8.666	1.355	0.210	15.153	1.259	0.269
30				8.466	1.327	0.212	14.314	1.227	0.264
1600	7.212	2.104	0.199	8.291	1.302	0.214	13.572	1.198	0.259
30				8.137	1.280	0.216	12.913	1.172	0.254
1700	7.162	2.068	0.204	8.003	1.260	0.218	12.328	1.147	0.250
30				7.885	1.243	0.220	11.807	1.125	0.246
1800	7.125	2.040	0.208	7.782	1.227	0.221	11.341	1.105	0.242
30							10.925	1.087	0.239
1900	7.097	2.019	0.212	7.611	1.199	0.224	10.552	1.070	0.236
30							10.217	1.054	0.233
2000	7.075	2.002	0.215	7.479	1.177	0.227	9.916	1.040	0.231
30							9.645	1.027	0.228
2100	7.059	1.988	0.217	7.378	1.160	0.230	9.401	1.051	0.226
30							9.181	1.005	0.224
2200	7.046	1.978	0.219	7.299	1.145	0.232	8.981	0.995	0.222
30									
2300	7.037	1.969	0.220	7.230	1.133	0.234	8.638	0.977	0.219
30	7.033	1.966	0.221	7.212	1.128	0.235	8.491	0.969	0.218

Q=Flow discharge
H=Water level
U=Flow velocity

Table 11-12-4(2) continued

Time	No.19 (17.9km)			No.28 (28.75km)			No.36 (35.25km)		
	Q	H	U	Q	H	U	Q	H	U
	㎥/s	m	m/s	㎥/s	m	m/s	㎥/s	m	m/s
000	11.817	1.524	0.220	18.971	1.808	0.287	28.571	1.409	0.337
30	11.390	1.503	0.217	18.017	1.776	0.281	27.111	1.390	0.327
100	11.012	1.483	0.214	17.139	1.745	0.276	25.752	1.371	0.316
30	10.664	1.466	0.211	16.329	1.716	0.270	24.486	1.353	0.307
200	10.496	1.455	0.211	15.583	1.688	0.266	23.306	1.336	0.297
30	35.742	1.765	0.524	14.906	1.662	0.261	22.206	1.320	0.288
300	204.765	3.213	1.135	14.289	1.637	0.257	21.181	1.305	0.280
30	332.593	4.193	1.197	13.875	1.616	0.255	20.225	1.291	0.271
400	346.471	4.604	1.071	24.276	1.687	0.414	19.332	1.277	0.263
30	308.023	4.665	0.932	105.341	2.380	0.989	18.557	1.265	0.257
500	268.092	4.593	0.832	200.809	3.225	1.113	18.965	1.264	0.262
30	233.661	4.466	0.759	230.242	3.730	0.991	29.450	1.344	0.373
600	204.664	4.361	0.702	234.554	3.955	0.912	72.824	1.631	0.694
30	180.185	4.159	0.657	226.376	4.044	0.847	134.239	1.951	0.984
700	159.394	4.004	0.618	213.222	4.063	0.792	174.927	2.149	1.112
30	141.641	3.852	0.585	199.034	4.037	0.747	193.630	2.252	1.150
800	126.395	3.707	0.556	185.027	3.982	0.711	198.569	2.305	1.140
30	113.234	3.568	0.530	171.537	3.906	0.682	195.750	2.329	1.107
900	101.808	3.435	0.506	158.700	3.818	0.656	188.758	2.333	1.064
30	91.829	3.309	0.485	146.598	3.723	0.633	179.653	2.325	1.018
1000	83.063	3.189	0.466	135.283	3.625	0.612	169.615	2.306	0.973
30	75.324	3.075	0.449	124.770	3.526	0.592	159.330	2.281	0.929
1100	68.461	2.966	0.432	115.052	3.428	0.574	149.192	2.250	0.887
30	62.353	2.863	0.417	106.101	3.331	0.556	139.422	2.216	0.848
1200	56.903	2.765	0.403	97.877	3.237	0.539	130.140	2.180	0.811
30	52.026	2.673	0.389	90.335	3.146	0.523	121.402	2.142	0.776
1300	47.656	2.585	0.376	83.425	3.057	0.507	113.225	2.102	0.744
30	43.773	2.501	0.364	77.099	2.972	0.429	105.604	2.063	0.713
1400	40.208	2.422	0.353	71.310	2.890	0.478	98.520	2.023	0.685
30	37.037	2.348	0.342	66.012	2.811	0.464	91.948	1.983	0.658
1500	34.181	2.277	0.332	61.165	2.735	0.451	85.858	1.944	0.633
30	31.609	2.210	0.322	56.728	2.662	0.439	80.218	1.905	0.609
1600	29.289	2.147	0.313	52.667	2.592	0.426	74.998	1.868	0.586
30	27.197	2.087	0.304	48.948	2.525	0.415	70.165	1.831	0.564
1700	25.308	2.031	0.296	45.541	2.461	0.404	65.693	1.795	0.544
30	23.603	1.978	0.288	42.418	2.399	0.393	61.553	1.760	0.525
1800	22.062	1.928	0.281	39.556	2.341	0.382	57.719	1.726	0.506
30	20.670	1.881	0.274	36.932	2.284	0.372	54.169	1.694	0.488
1900	19.411	1.837	0.267	34.524	2.230	0.363	50.876	1.662	0.472
30	18.273	1.795	0.261	32.314	2.179	0.354	47.830	1.632	0.455
2000	17.242	1.756	0.255	30.285	2.129	0.345	45.003	1.603	0.440
30	16.309	1.720	0.250	28.421	2.082	0.336	42.381	1.575	0.425
2100	15.464	1.686	0.245	26.709	2.073	0.328	39.947	1.548	0.411
30	14.699	1.654	0.240	25.136	1.995	0.321	37.687	1.522	0.397
2200	14.005	1.624	0.235	23.689	1.954	0.313	35.589	1.497	0.384
30	13.376	1.596	0.231	22.358	1.914	0.306	33.639	1.474	0.372
2300	12.805	1.570	0.227	21.134	1.877	0.300	31.826	1.451	0.360
30	12.287	1.546	0.224	20.008	1.842	0.293	30.140	1.430	0.348

Table 11-12-5 Calculation of Tractive Force and Critical Size of River Bank Material for Movement

Section No.	Distance from the dam site	ϕ	K	H	I	$U*_L$	U*s	dcL	dcs
				m		cm/s	cm/s	cm	cm
2	0.74	20.53	0.791	7.5	1/312	15.35	12.14	2.91	1.82
4	2.64	26.78	0.619	6.0	1/10386	7.52	4.65	0.70	1.27
9	8.46	36.88	-	5.5	"	7.20	-	0.64	-
19	17.9	39.82	-	4.5	"	6.52	-	0.53	-
28	28.75	10.33	0.950	4.0	"	6.14	5.83	0.47	0.42
36	35.25	53.09	-	2.5	"	4.86	-	0.29	-

Table 11-12-6 Characteristics of Lebir River

Sec No.	Commulative distance	River width B_1	Minimum river bed elevation Z_B	Mean river bed elevation Z_{13}
	km	m	m	m
RS-01	36.850	75	23.550	24.9
02	36.110	70	21.891	22.4
03	35.310	85	18.958	20.8
04	34.810	60	19.161	20.9
05	34.210	60	17.289	19.2
06	33.860	60	17.154	20.15
07	33.510	92	18.342	21.1
08	33.070	90	20.163	21.2
09	32.410	91	19.913	21.2
10	30.790	100	14.777	18.6
11	28.390	93	18.968	19.8
12	25.830	90	18.675	19.3
13	23.620	110	18.145	19.1
14	22.490	61	16.691	17.0
15	20.950	148	17.230	18.4
16	18.950	100	16.008	17.5
17	17.250	150	16.389	17.9
18	15.250	110	16.203	17.4
19	12.450	100	15.036	16.6
20	11.400	100	14.828	16.0
21	9.500	110	15.014	16.2
22	8.100	100	12.332	14.4
23	6.530	100	14.969	15.6
24	4.930	105	12.201	14.0
25	2.750	110	14.095	15.2
26	1.600	145	14.048	15.0

Table 11-13-1 Measured Plantation Area and Inundation

Area Upstream of Lebir Dam by JICA

unit:Ha

Location	Total Area	Inundation Area					
		WL 70 m		WL 80 m		WL 90 m	
KESEDAR			%		%		%
Paloh 1	1,739	0	0	0	0	0	0
Paloh 2	2,390	0	0	0	0	0	0
Paloh 3	3,629	88	2.4	194	5.3	424	11.7
Paloh 4-1	1,608	0	0	0	0	0	0
Paloh 4-2	448	5	1.1	22	4.9	88	19.6
Lebir 1	3,287	468	14.2	939	28.6	1,472	44.8
Lebir 2	2,894	505	17.4	802	27.7	1,271	43.9
Lebir 3	2,458	1,068	43.4	1,504	61.2	1,813	73.8
Chalil	3,358	1,592	47.4	1,877	55.9	2,384	71.0
Ulbi	1,951	0	0	0	0	0	0
Private Area 1	2,741	70	2.5	211	7.7	485	17.7
Private Area 2	672	43	6.4	110	16.4	192	28.6
Private Area 3	451	0	0	8	1.8	56	12.4
Subtotal	27,626	3,839	13.9	5,667	20.5	8,185	29.6
FELDA							
Aring 1	2,172	0	0	0	0	0	0
Aring 2	1,911	10	0.5	80	4.2	269	14.1
Aring 3	1,618	42	2.6	240	14.8	492	30.4
Aring 4	2,360	43	1.8	192	8.1	539	22.8
Aring 5	1,970	377	19.1	433	22.5	1,014	51.5
Aring 6	2,119	408	19.3	942	44.5	1,274	60.1
Aring Timur 1	1,736	102	5.9	246	14.2	522	30.1
Aring Timur 2	1,599	20	1.3	99	6.2	290	18.1
Aring Timur 3	1,907	42	2.2	213	11.2	507	26.6
Aring Timur 4	2,136	10	0.5	139	6.5	492	23.0
Aring Timur 5	2,458	81	3.3	350	14.2	972	39.5
Aring Timur 6	1,979	37	1.9	150	7.6	514	26.0
Subtotal	23,965	1,240	5.1	3,094	12.9	6,885	28.7
Total	51,591	5,079	9.8	8,761	17.0	15,070	29.2
FELCRA	405	30	7.4	77	19.0	129	31.9
ADB project	—	363	—	750	—	1,180	—

Table 11-13-2 Measured Plantation Area and Inundation Area
Upstream of Lebir Dam by USM

Extract from USM Sub-study Report. Dec. 1987

Table 7.2. Land Schemes Impacted by the LDP

Scheme	Total Area		Area Submerged	
	Planted	Total	70m	90m
1.Chalil	1598	(1946)	1159	1489
2.Paloh 3	2394	(2574)	41	740
3.Lebir 1	1105	(1127)		
4.Lebir 2	1200*	(1200)	3823	5553
3.Lebir 3	1200*	(1200)		
4.Aring 1 (5)**	1354	(1505)	—	—
5.Aring 2 (6)	1911	(1911)	10	270
6.Aring 3 (4)	1801	(2014)	43	145
7.Aring 4 (3)	1752	(2105)	330	1076
8.Aring 5 (1)	2152	(2179)	432	806
9.Aring 6 (2)	2004	(2182)	199	606
10.Aring Timur 1 (Aring 1)	1654	(1797)	185	470
11.Aring Timur 2 (Aring 2)	1517	(1600)	181	345
12.Aring timur 3	1471	(1870)	103	740
13.Aring Timur 4	2136*	(2136)	—	137
14.Aring Timur 5	2458*	(2458)	32	806
15.Aring Timur 6	1948*	(1948)	33	695

* Tentative ; ** JICA labels scheme as 7 instead of 5 (FELDA)

Total Inundated 90m = 25,086 ha
Total Land Schemes Affected 90m = 13,878 ha
Total Inundated 70m = 11,241 ha
Total Land Schemes Affected 70m = 6,571 ha
Total Land Scheme Area= 31,752
Total Planted Area for Land Scheme=29,655 ha

Table 11-13-3 Breakdown of Reservoir Area by Land Use to be submerged by Lebir Dam estimated by JICA

unit:Ha

Item		WL 60m	WL 70m	WL 80m	WL 90m
Plantation	Rubber	936	2,014	3,305	5,094
	Oil Palm	1,720	3,458	6,283	11,285
	Subtotal	2,656 (57.7%)	5,472 (61.5%)	9,588 (62.3%)	16,379 (66.3%)
Forestry	Logged	963	1,599	2,643	3,725
	Unlogged	981	1,829	3,167	4,596
	Subtotal	1,944 (42.3%)	3,428 (38.5%)	5,812 (37.7%)	8,321 (33.7%)
Total		4,600	8,900	15,400	24,700

Note ; Figure in parenthesis shows percentage against the total reservoir area.
Areas in the ADB project and FELCRA are tentatively included in rubber and oil palm of plantation, respectively.

Table 11-13-4 Estimated Number of Household to be Resettled due to Inundation of Plantation Area (Maximum Extent)

unit:household

Item	WL 60m	WL 70m	WL 80m	WL 90m
Rubber plantation	117	238	359	605
Oil Palm plantation	430	956	1,700	3,235
Total	547	1,194	2,059	3,840

Number of settlers per hectare on rubber plantation and oil palm plantation is assumed at 0.125 and 0.25 respectively These numbers will not be used for the basis of amount of compensation, but for reference only.

Table 11-13-5 Plantation Area to be Compensated for Lebir Dam
(Maximum Extent)

unit:Ha

Location	Total Plantation Area	Area to be Compensated					
		WL 70 m		WL 80 m		WL 90 m	
KESEDAR			%		%		%
Paloh 1	1,739	0	0	0	0	0	0
Paloh 2	2,390	0	0	0	0	0	0
Paloh 3	3,629	88	2.4	194	5.3	471*	13.0
Paloh 4-1	1,608	0	0	0	0	0	0
Paloh 4-2	448	5	1.1	22	4.9	88	19.6
Lebir 1	3,287	547*	16.6	1,081*	32.9	2,563*	78.0
Lebir 2	2,894	574*	19.8	984*	34.0	1,683*	58.2
Lebir3	2,458	1,385*	56.3	1,767*	71.9	2,303*	93.7
Chalil	3,358	1,760*	52.4	2,037*	60.7	2,531*	75.4
Ulbi	1,951	0	0	0	0	0	0
Private Area 1	2,741	70	2.6	211	7.7	458	17.7
Private Area 2	672	43	6.4	110	16.4	192	28.6
Private Area 3	451	0	0	8	1.8	56	12.4
Subtotal	27,626	4,472	16.2	6,414	23.2	10,372	37.5
FELDA							
Aring 1	2,172	0	0	0	0	0	0
Aring 2	1,911	10	0.5	80	4.2	269	14.1
Aring 3	1,618	42	2.6	324*	20.0	549*	33.9
Aring 4	2,360	43	1.8	192	8.1	554*	23.5
Aring 5	1,970	407*	20.7	465*	23.6	1,219*	61.9
Aring 6	2,119	465*	21.9	998*	47.1	1,405*	66.3
Aring Timur 1	1,736	102	5.9	246	14.2	522	30.1
Aring Timur 2	1,599	20	1.3	99	6.2	290	18.1
Aring Timur 3	1,907	42	2.2	213	11.2	507	26.6
Aring Timur 4	2,136	10	0.5	139	6.5	492	23.0
Aring Timur 5	2,458	81	3.3	350	14.2	1,025*	41.7
Aring Timur 6	1,979	37	1.9	150	7.6	571*	28.9
Subtotal	23,965	1,259	5.3	3,256	13.6	7,403	30.9
Total	51,591	5,731	11.1	9,670	18.7	17,775	34.5
FELCRA	405	30	7.4	77	19.0	129	31.9
ADB project	——	363	——	750	——	1,180	——

* includes inaccessable area such as island peninsula.

Table 11-13-6 Estimated Compensation Cost for Lebir Dam Construction by JICA at the stage of Interim Report

Item	WL 70m			WL 80m			WL 90m		
	Q'ty	Rate	Amount	Q'ty	Rate	Amount	Q'ty	Rate	Amount
		ringgit	x10³ ringgit		ringgit	x10³ ringgit		ringgit	x10³ ringgit
A. Houses									
(1)Lebir Riverine Settlers	100	2,087	209	100	2,087	209	100	2,087	209
(2)Land Scheme Setters	675	4,500	3,038	675	4,500	3,038	675	4,500	3,038
(3)Renovation	472	368	174	472	368	174	472	368	174
(4)Staff Huose	60	20,000	1,200	60	20,000	1,200	60	20,000	1,200
Subtotal			4,621			4,621			4,621
B. Agricultural Holdings									
(1)Lebir Area	809	0	0	809	0	0	809	0	0
(2)Land Scheme Rubber	1,906	0	0	2,869	0	0	4,837	0	0
(3)Land Scheme Oil Palm	3,825	0	0	6,801	0	0	12,938	0	0
Subtotal	6,540			10,479	0	0	18,584		
C. Land									
(1)Land Scheme Rubber	1,906ha	5,900	11,245	2,869ha	5,900	16,927	4,837ha	7,500	28,538
(2)Land Scheme Oil Palm	3,825	7,500	28,688	6,801	7,500	51,008	12,938	7,500	97,035
Subtotal	5,731		39,933	9,670		67,935	17,775		125,573
D. Social Amenities									
(1)Mosque	3	100,000	300	3	100,000	300	3	100,000	300
(2)School	3	100,000	300	3	100,000	300	3	100,000	300
(3)Public Hall	3	20,000	60	3	20,000	60	3	20,000	60
Subtotal			660			660			660
E. Transportation			100			100			100
F. Roads	30Km	450,000	13,500	50Km	450,000	22,500	75Km	450,000	33,800
G. Orang Asli			325			325			325
H. Forest Land	3,821ha			6,639ha	0	0	9,630ha		
Total			59,139			96,141			165,079

Table 11-13-7 Estimated Compensation Cost for Lebir Dam Construction by USH

Item	WL 70m			WL 80m			WL 90m		
	Q'ty	Rate	Amount	Q'ty	Rate	Amount	Q'ty	Rate	Amount
		ringgit	x10³ ringgit					ringgit	x10³ ringgit
A. Houses									
(1)Lebir Riverine Settlers	100	2,087	209				100	2,087	209
(2)RKT Kesedar Settlers	675	4,500	3,038				675	4,500	3,038
(3)Renovation	472	368	174				472	368	174
(4)Staff Houses	60	20,000	1,200				60	20,000	1,200
Subtotal			4,621						4,621
B. Agricultural Holdings									
(1)Lebir Area (Crops only)	809 ha	2,472	2,000				809 ha	2,472	2,000
(2)RKT Kesedar (Crops)	2,744	24,709	67,801				5,095	24,709	125,892
(3)Felda	1,482	24,709	36,619				5,990	24,709	148,007
Subtotal	5,035		106,420				11,894		275,899
C. Land									
(1)Kesedar (Dev.Cost)	3,072	7,413	22,773				5,666	7,413	42,002
(2)Felda (Dev.Cost)	1,482	7,413	10,986				7,487	7,413	55,501
(3)Felcra (Dev.Cost)	337	7,413	2,498				337	7,413	2,498
Subtotal	4,891		36,257				13,490		100,001
D. Social Amenities									
(1)Mosque	3	100,000	300				3	100,000	300
(2)School	3	100,000	300				3	100,000	300
(3)Public Hall	3	20,000	60				3	20,000	60
Subtotal			660						660
E. Transportation			100						100

Table 11-13-7 Continued

Item	WL 70m			WL 80m			WL 90m		
	Q'ty	Rate	Amount	Q'ty	Rate	Amount	Q'ty	Rate	Amount
		ringgit	X10³ ringgit					ringgit	X10³ ringgit
F. Road									
(1)K.Kerai/G.Musang			0				5Km	1,000,000	5,000
(2)Kesedar			0				100	6,000	600
(3)Felda			0				100	6,000	600
Subtotal			0						6,200
G. Bridges							sgft		
(1)Sg.Aring			0				8,485	150	1,273
(2)Sg.Lebir			0				8,563	150	1,284
(3)Sg.Relai			0				6,976	150	1,046
Subtotal			0						3,603
H. Orang Asli	ha						ha		
(1)Pasir Linggi	22.3	12,332	275				22.3	12,332	275
(2)Kg.Sedahan			50						50
Subtotal			325						325
I. Forest Land	4,670ha	450	2,100				11,208ha	450	5,000
Total			150,483						396,409

Table 11-13-8 Estimated Compensation Cost for Lebir Dam Construction by JICA for the Final Report

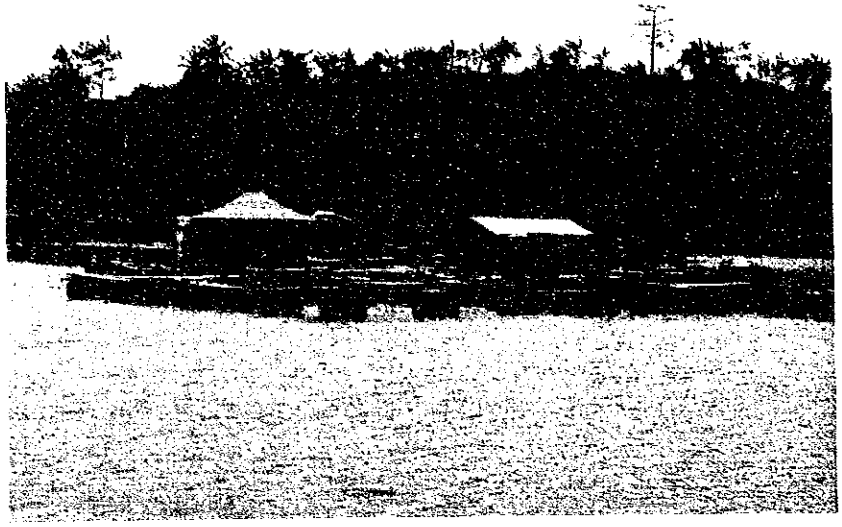
Item	WL.88.1 m		
	Q'ty	Rate	Amount
		ringgit	x10³ ringgit
A. Houses			
(1)Lebir Riverine Settlers	100	2,087	209
(2)Land Scheme Settlers	675	4,500	3,038
(3)Renovation	472	368	174
(4)Staff Huose	60	20,000	1,200
Subtotal			4,621
B. Agricultural Holdings			
(1)Lebir Area	809	0	0
(2)Land Scheme Rubber	4,837	0	0
(3)Land Scheme Oil Palm	12,938	0	0
Subtotal	18,584		
C. Land			
(1)Land Scheme Rubber	3,100 ha	7,500	23,250
(2)Land Scheme Oil Palm	6,900	7,500	51,750
Subtotal	10,000		75,000
D. Social Amenities			
(1)Hosque	3	100,000	300
(2)School	3	100,000	300
(3)Public Hall	3	20,000	60
Subtotal660			660
E. Transportation			100
F. Roads	75 Km	350,000	26,250
G. Orang Asli			325
H. Forest Land	7,800 ha	0	0
Total			106,956

Table 11-14-1 Construction Cost of fish Ladder

	Quantity	Rate (N$)	Amount (N$)
EXC. Open	37,500 ㎥	7,25	271,875
EXC. Tunnel	2,625 ㎥	68,00	178,500
Concrete	3,750 ㎥	177,00	663,750
Re-bar	113 ton	1,920	216,960
Gate Steel	8 ton	4,060	32,480
Miscell (3 %)			43,435
Total			1,407,000

Table 11-15 Relation between Project Activities and Environmental Factors for the Implementation of the Lebir Dam Project

Environmental factors		Construction works: Felling of forest	Burning	River improvement	Collection of rock materials	Collection of fill materials	Transportation of construction materials	Filling	Explosion	Excavation	Piling	Concreting	Manpower	Structures, etc.: Revetment	Reservoir	Road	Structure	Afforestation	Disposal	Operation: Manpower	Drainage	Storage of dangerous materials	Relative Activities: Water usage	Transmission line	Resettlement	Tourism	Land use in catchment area
Land	Topography				0	0		0	0						0												0
	Soil	0			0	0		0	0																		
	Erosion of surface soil	0	0		0	0		0	0						0			0									0
	Land subsidence																										
	Land vibration								0						0												
	Mineral resources				0	0									0												
Water	Flow status surface water	0	0	0	0	0		0						0	0			0			0		0				0
	Ground water	0			0	0				0					0						0						
	Culture	0	0		0	0									0			0					0				0
	Flood	0	0	0	0	0		0							0												0
	Water quality	0	0		0	0						0			0						0						0
	Water temperature	0	0		0	0									0			0			0						0
	Quality in bottom layer	0	0		0	0		0						0	0				0		0						0
Air	Air quality		0				0									0			0								
	Temperature	0													0			0									0
	Sunshine	0																0									0
	Wind direction/ velocity	0	0												0			0									0
	Noise						0	0	0	0	0					0											
	Vibration						0	0	0	0	0					0											
	Offensive smell		0																0								
Lives	Land flora	0	0		0	0									0			0						0		0	0
	Land fauna	0	0		0	0	0		0						0	0		0						0		0	0
	Land habitat	0	0		0	0	0		0						0	0		0						0		0	0
	Land crowd	0	0		0	0									0	0		0						0		0	0
	Aquatic life	0	0	0	0	0								0	0				0		0		0				0
	Aquatic habitat	0	0	0	0	0								0	0				0		0		0				0
	Estuary life	0	0												0						0						0
	Estuary habitat	0	0												0						0						0
Public health	Parasite												0		0				0	0							
	Infectious disease												0		0				0	0							
	Safety						0						0		0	0				0		0					
Socio-economy	Employment												0							0						0	0
	Housing												0		0					0							
	Education												0		0					0							
	Amenity								0				0		0	0		0	0	0		0				0	0
	Village structure												0		0	0				0			0		0	0	0
	Archaeological remains	0	0		0	0									0											0	
	Mosques												0		0					0						0	
	Scenery	0	0	0	0	0						0		0	0	0	0	0	0							0	0
	Regional economy																						0	0	0		0



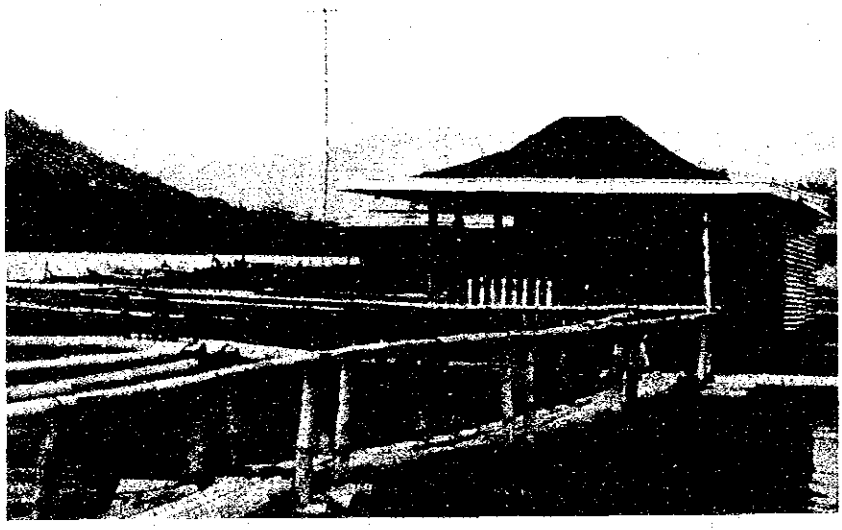


Photo 11-1 (1) Fishery by floating net method being adopted in the Saguling Reservoir, West Java, Indonesia

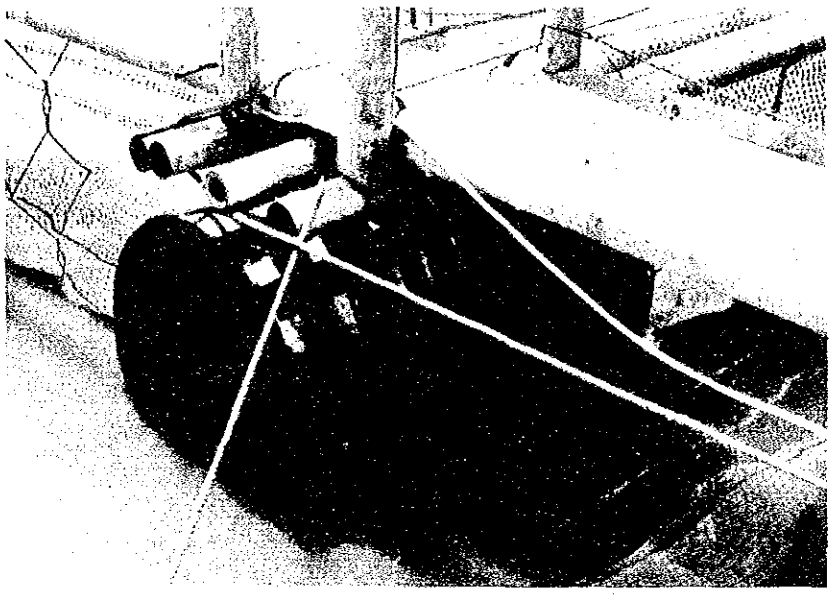
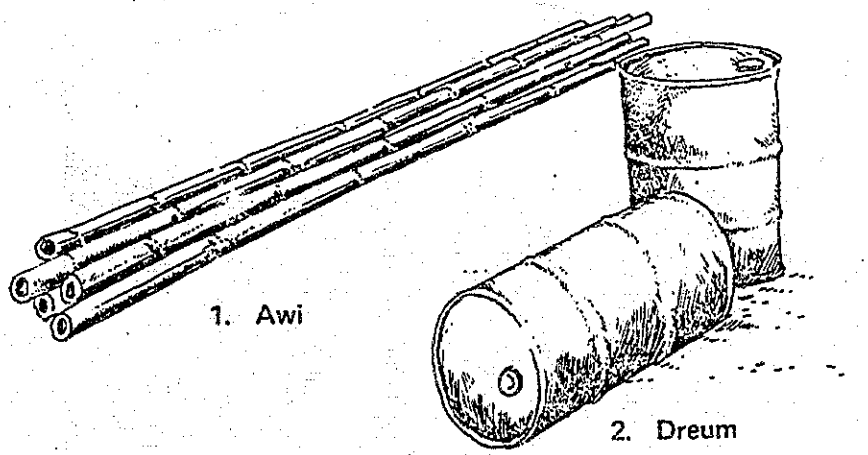


Photo 11-1 (2) Structure of floating net unit

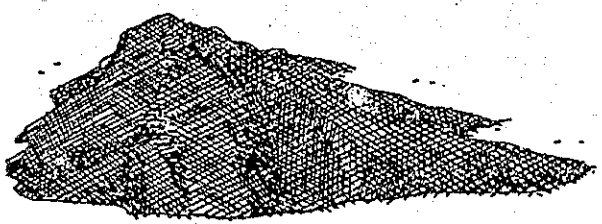
Bahan jeung cara nyieun jaring terapung

Bahanna :

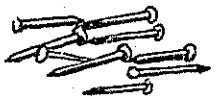


1. Awi

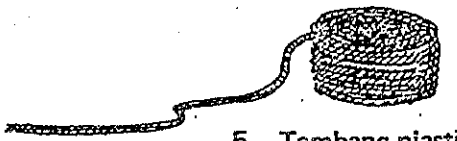
2. Dreum



3. Jaring



4. Paku



5. Tambang piastik

5. Kai nu teuas.

Cara nyieunna :

- Awi golondongan dijieun 4 rakit, diatur jadi pasagi opat.
- Dreum dipake ngambangkeun rakit.

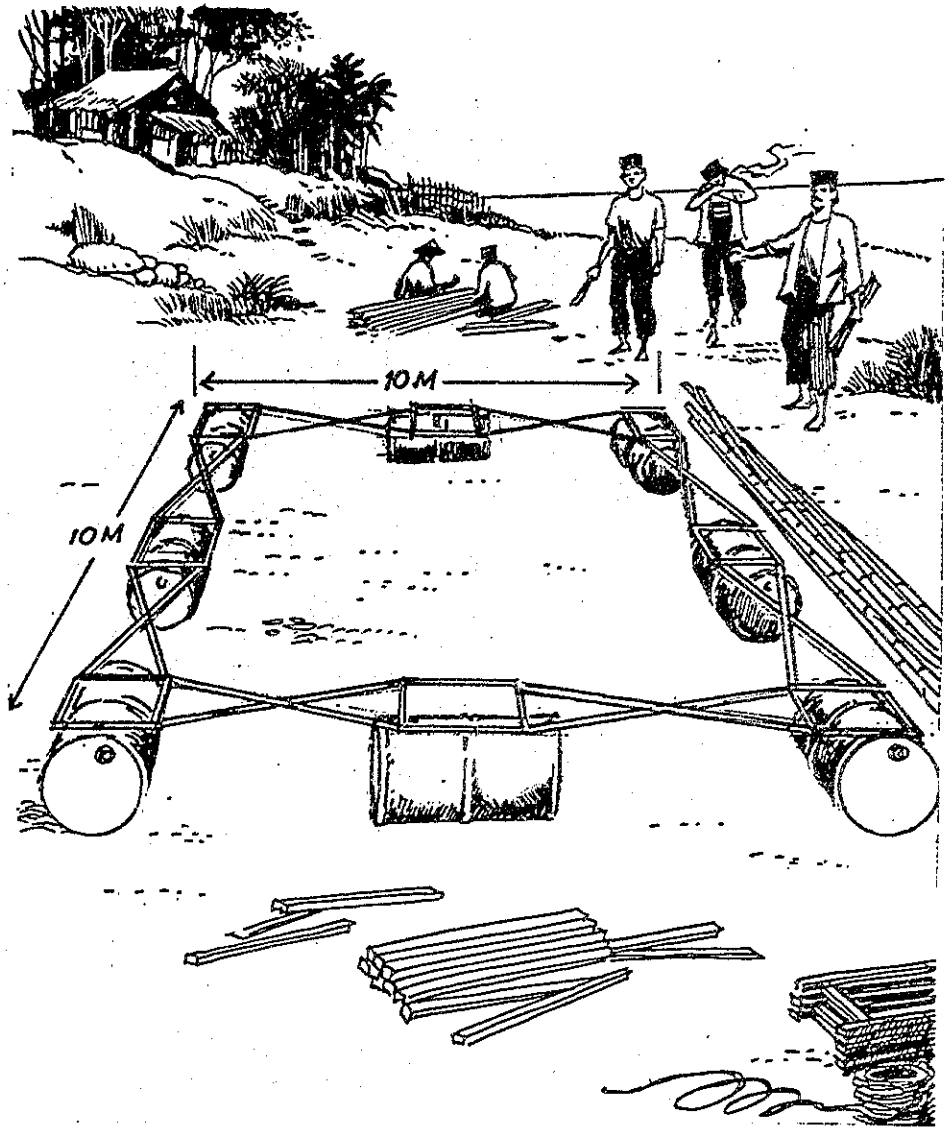
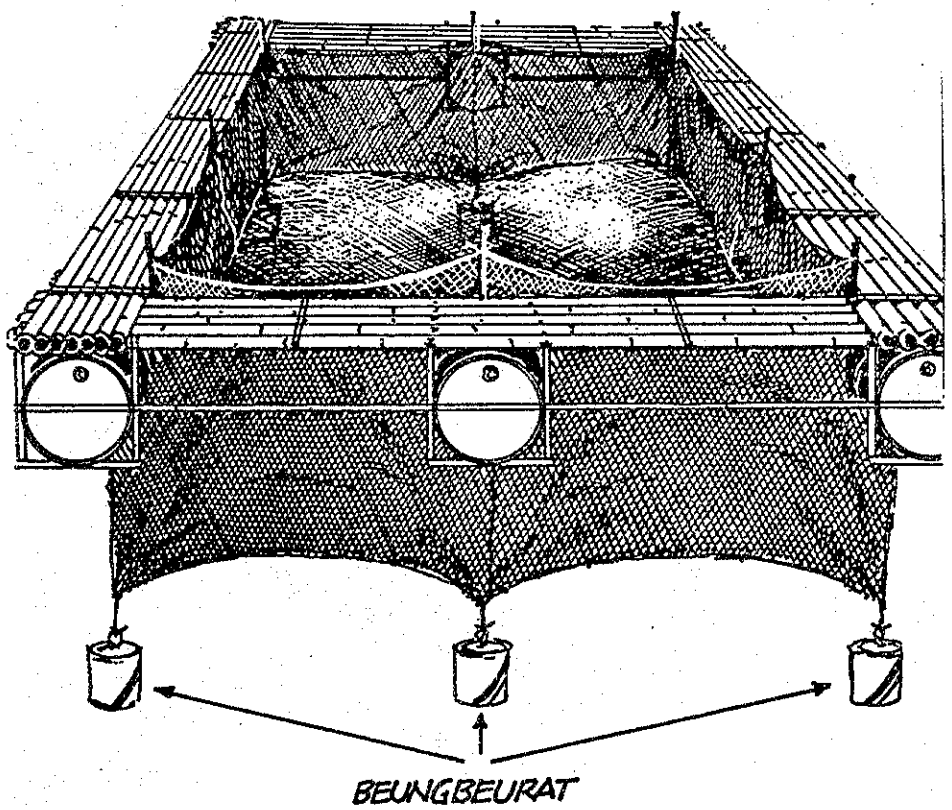


Fig.11-11-1(1) Materials and Assembly of Floating Net Unit

Supaya jaring bisa ngambang :

- Sisi-sisi dasar jaring jeung tengahna digantungan beungbeurat
- Jumlah beungbeurat 9 siki
- Beuratna tiap-tiap beungbeurat 2 Kg.



Ukuran jeung bangun jaring

- Bangunan kudu pasagi
- Panjangna 9 M, lebarna, 9 M jeung jangkungna 2,5 M.

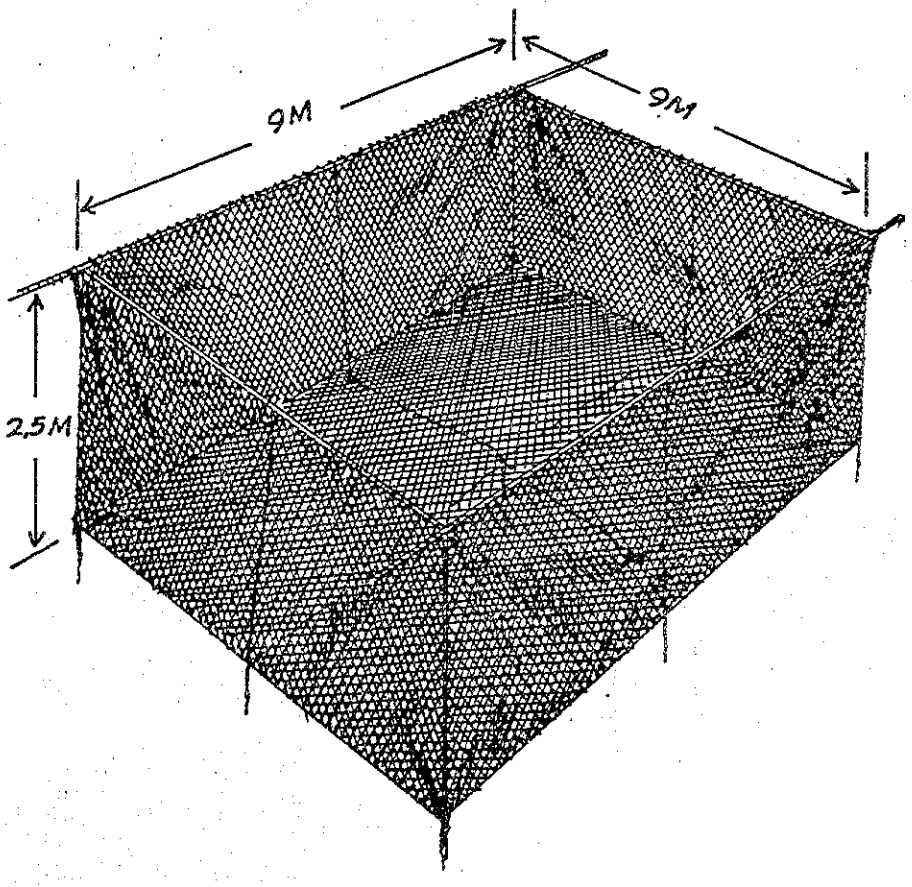


Fig. 11-11-1(2) Arrangement of Net

- Hiji unit rakit diambangkeun ku 8 dreum
- Masangkeun dreum kana rakit dijepit ku rarancang kai.

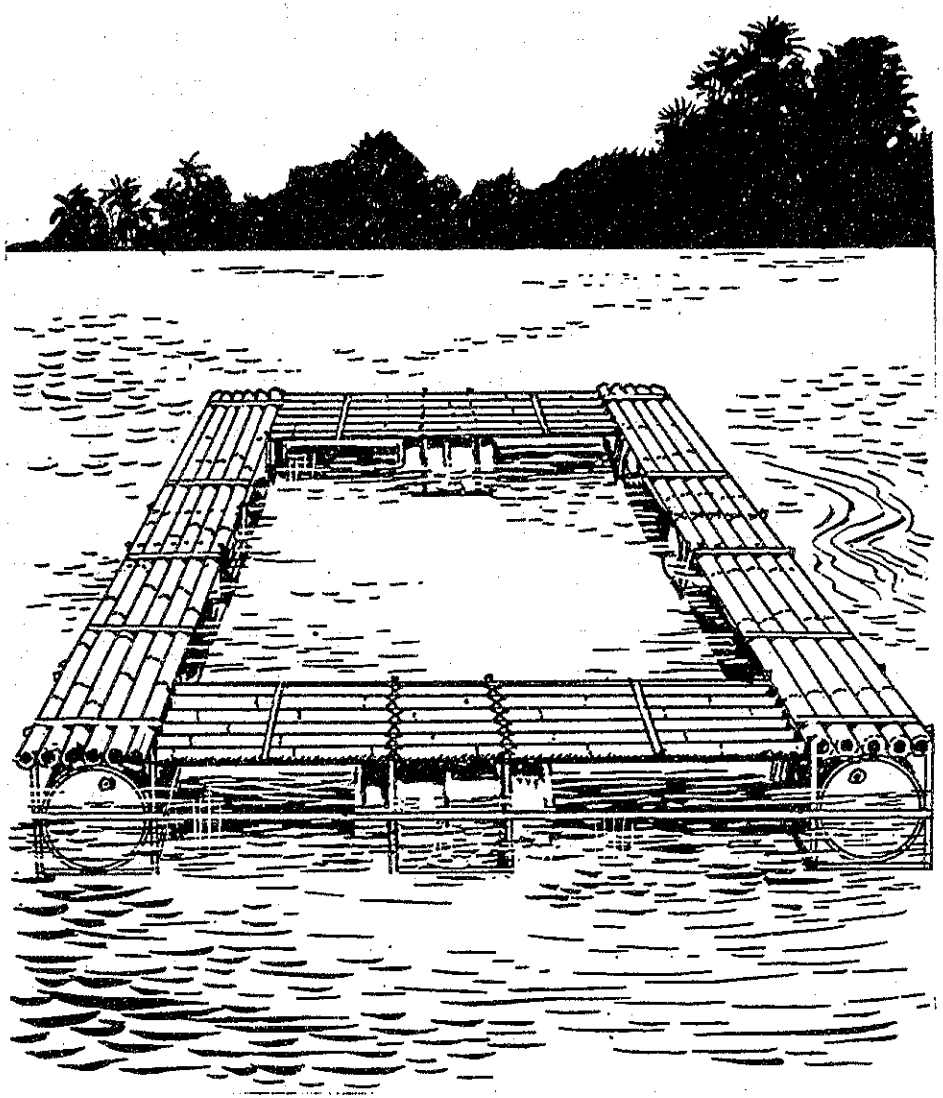


Fig.11-11-1(3) Completed Floating Net Unit

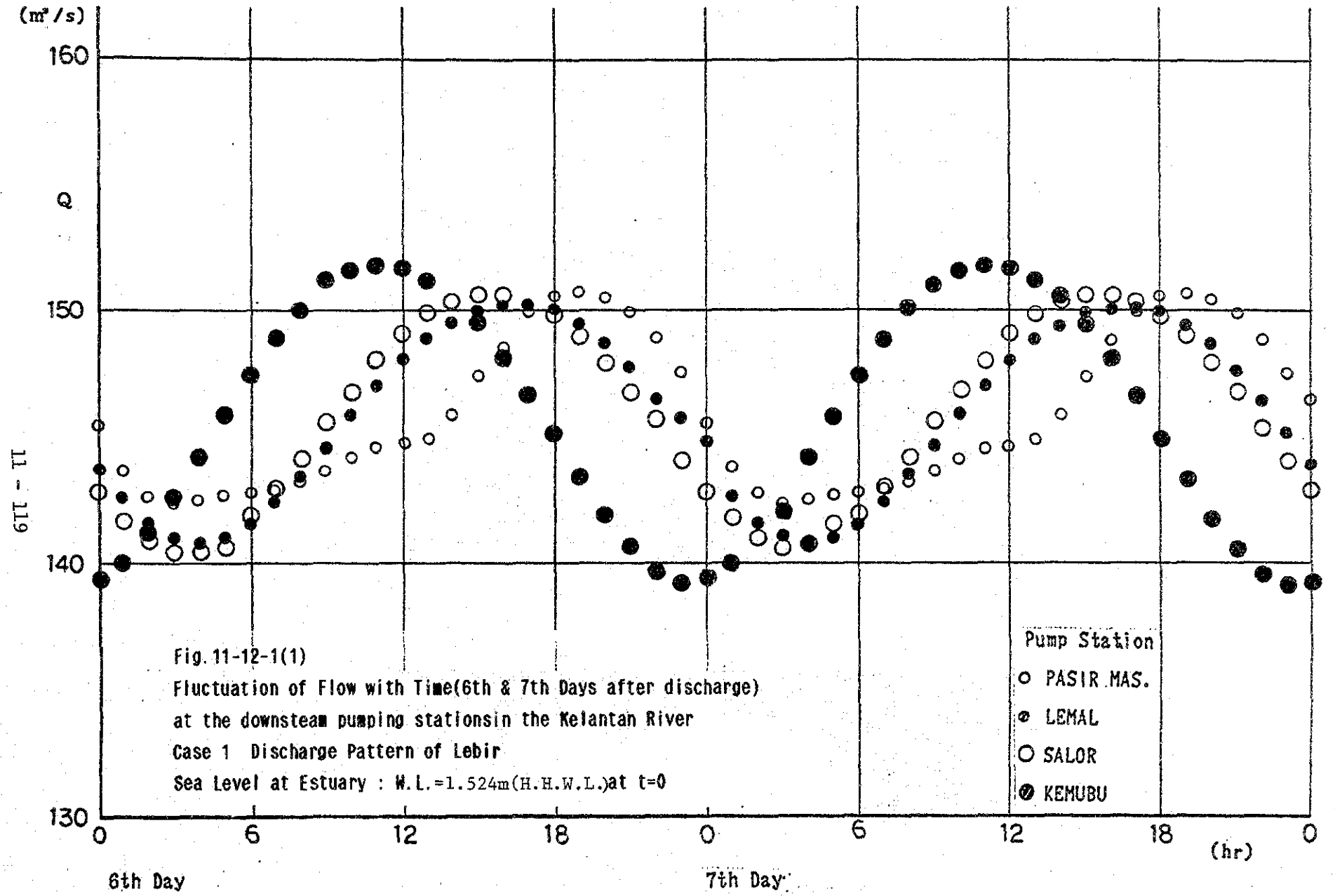


Fig. 11-12-1(1)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 1 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=1.524m(H.H.W.L.)at t=0

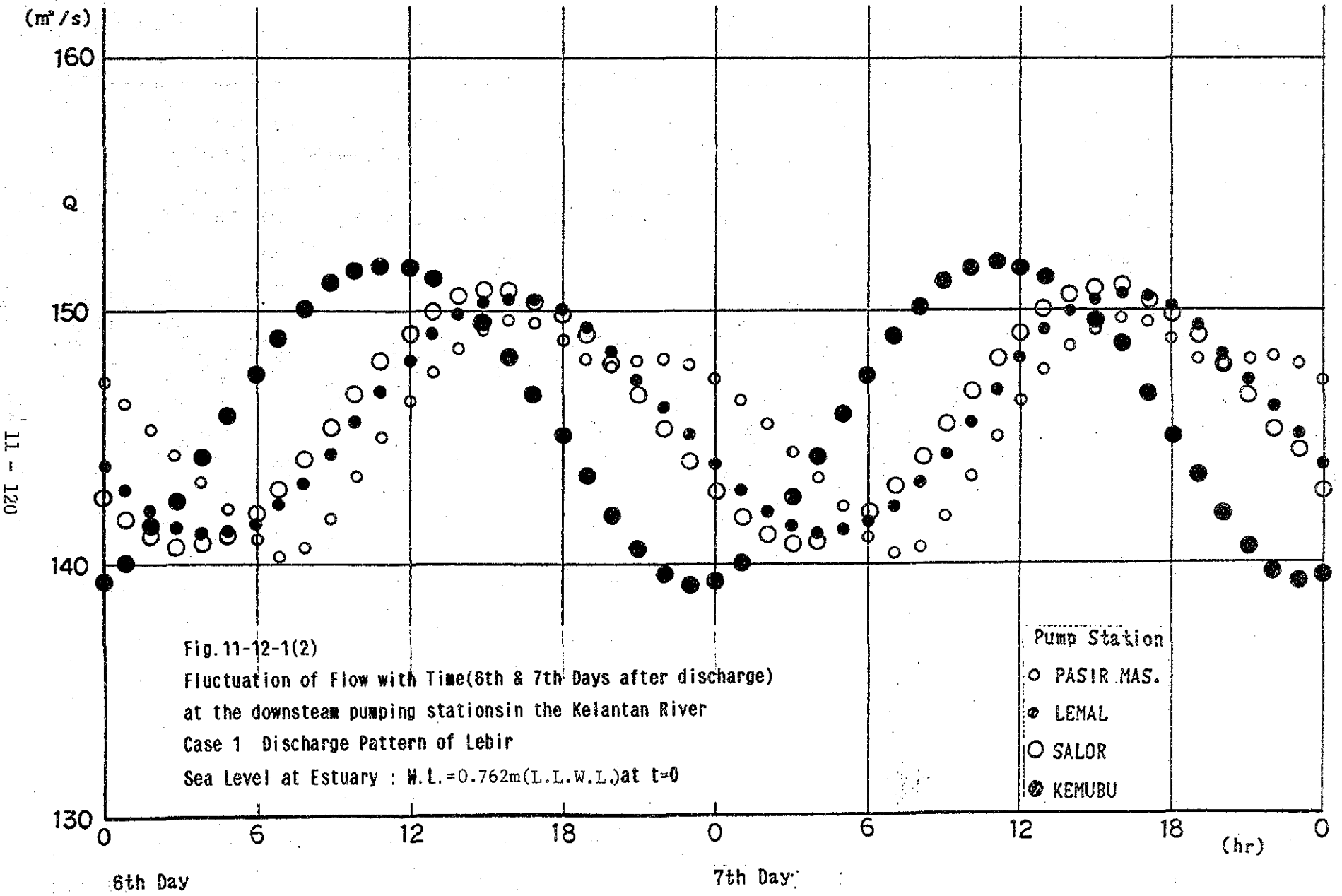


Fig. 11-12-1(2)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 1 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=0.762m(L.L.W.L.)at t=0

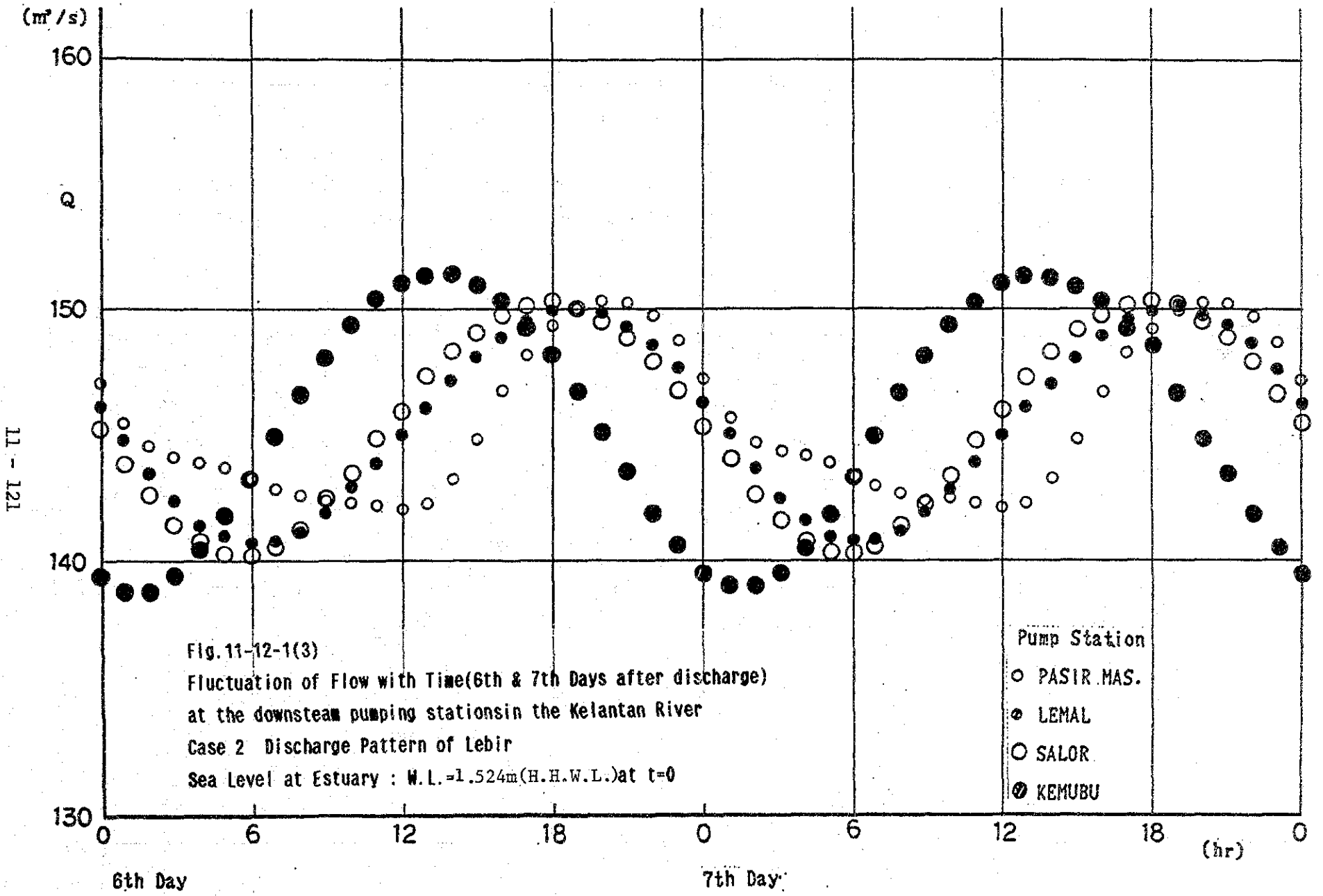


Fig.11-12-1(3)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 2 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=1.524m(H.H.W.L.)at t=0

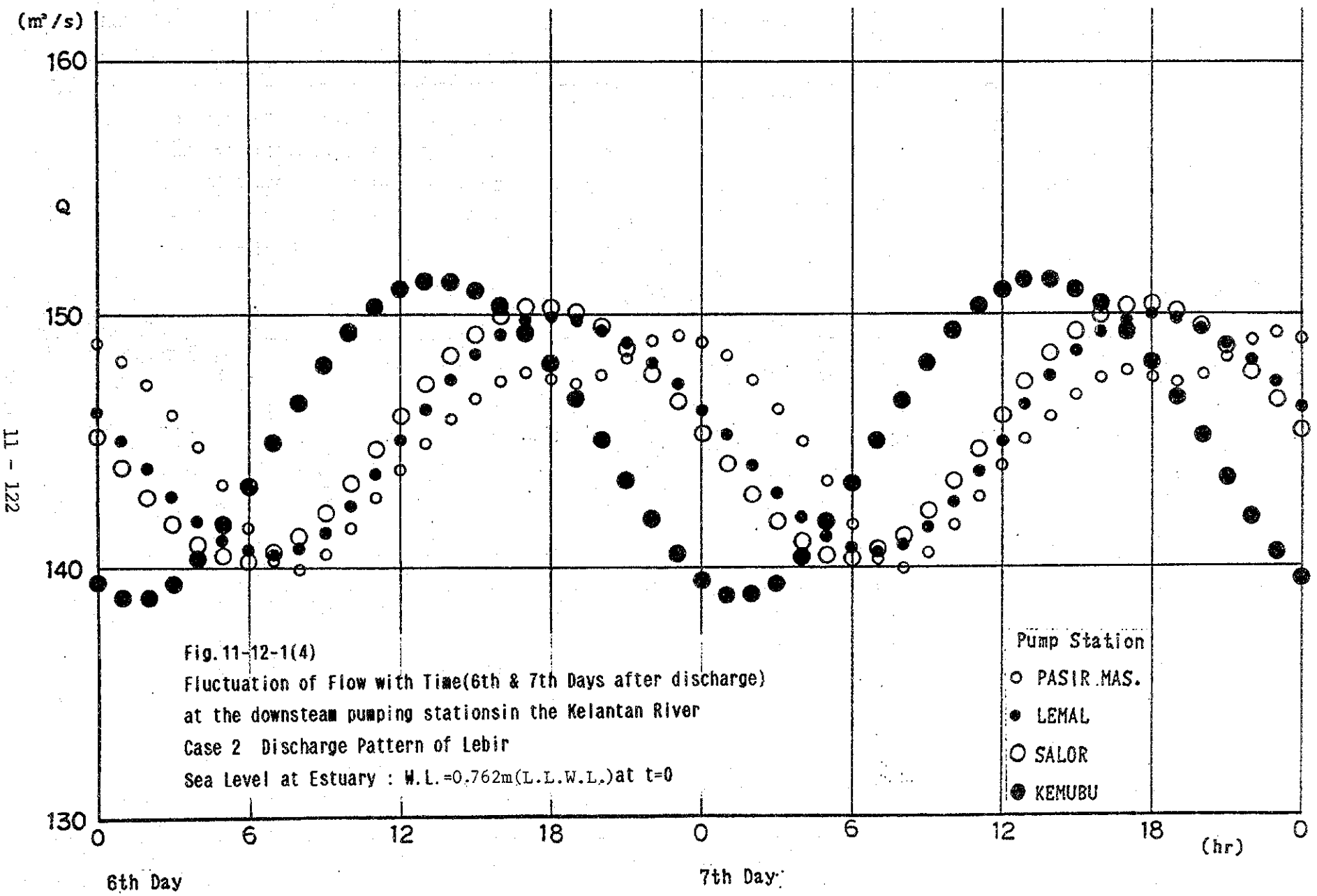


Fig. 11-12-1(4)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 2 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=0.762m(L.L.W.L.)at t=0

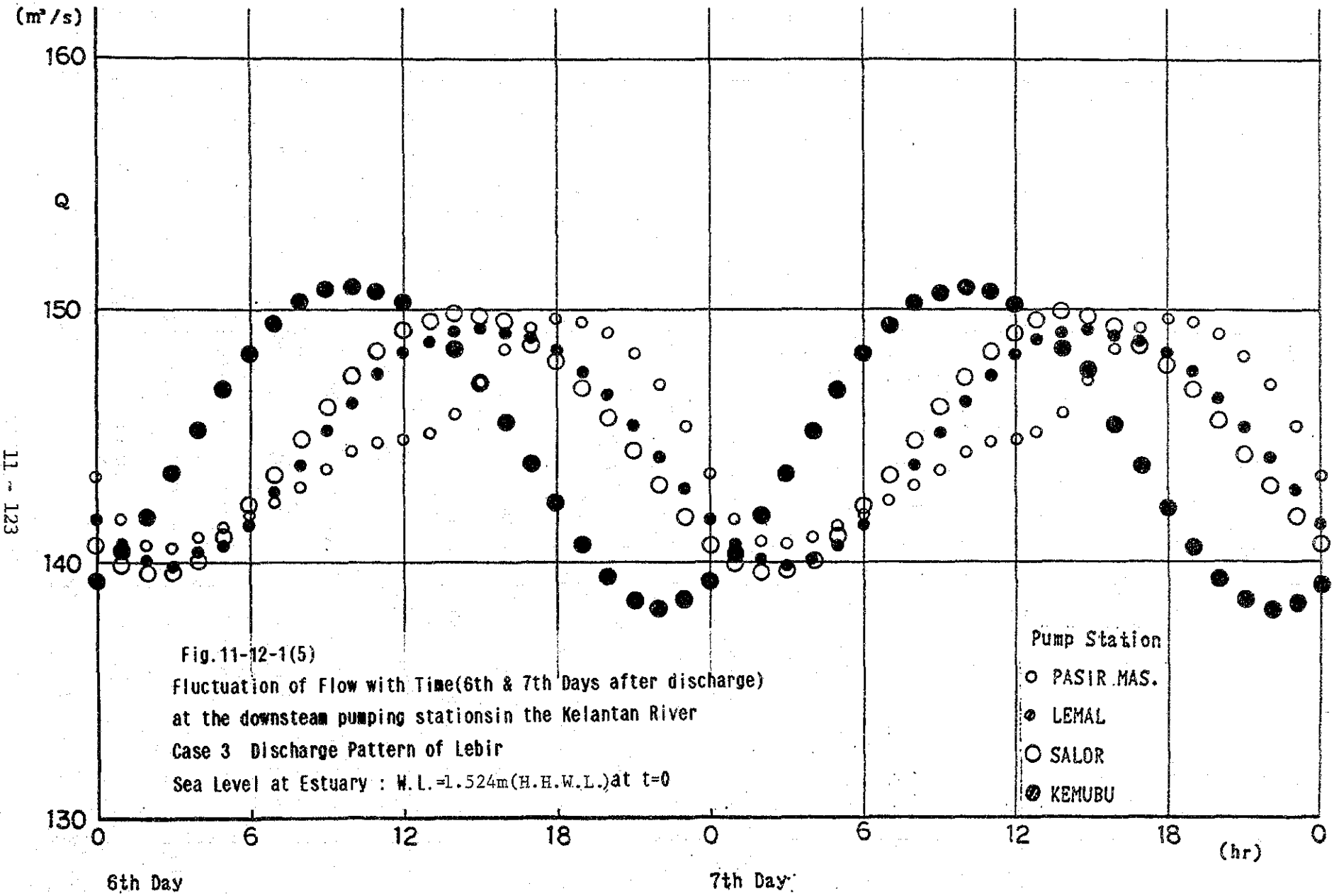


Fig.11-12-1(5)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 3 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=1.524m(H.H.W.L.)at t=0

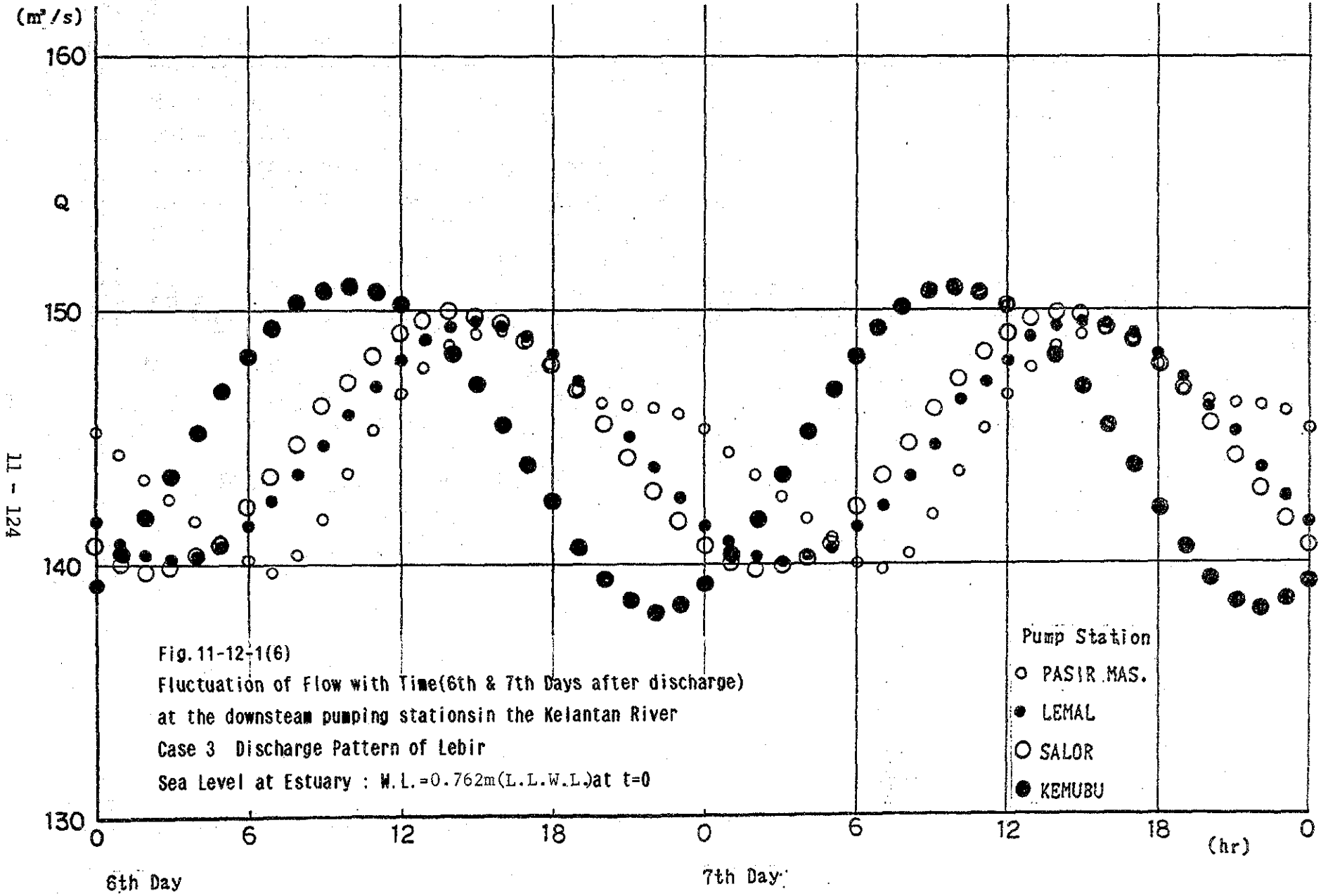


Fig. 11-12-1(6)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 3 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=0.762m(L.L.W.L.)at t=0

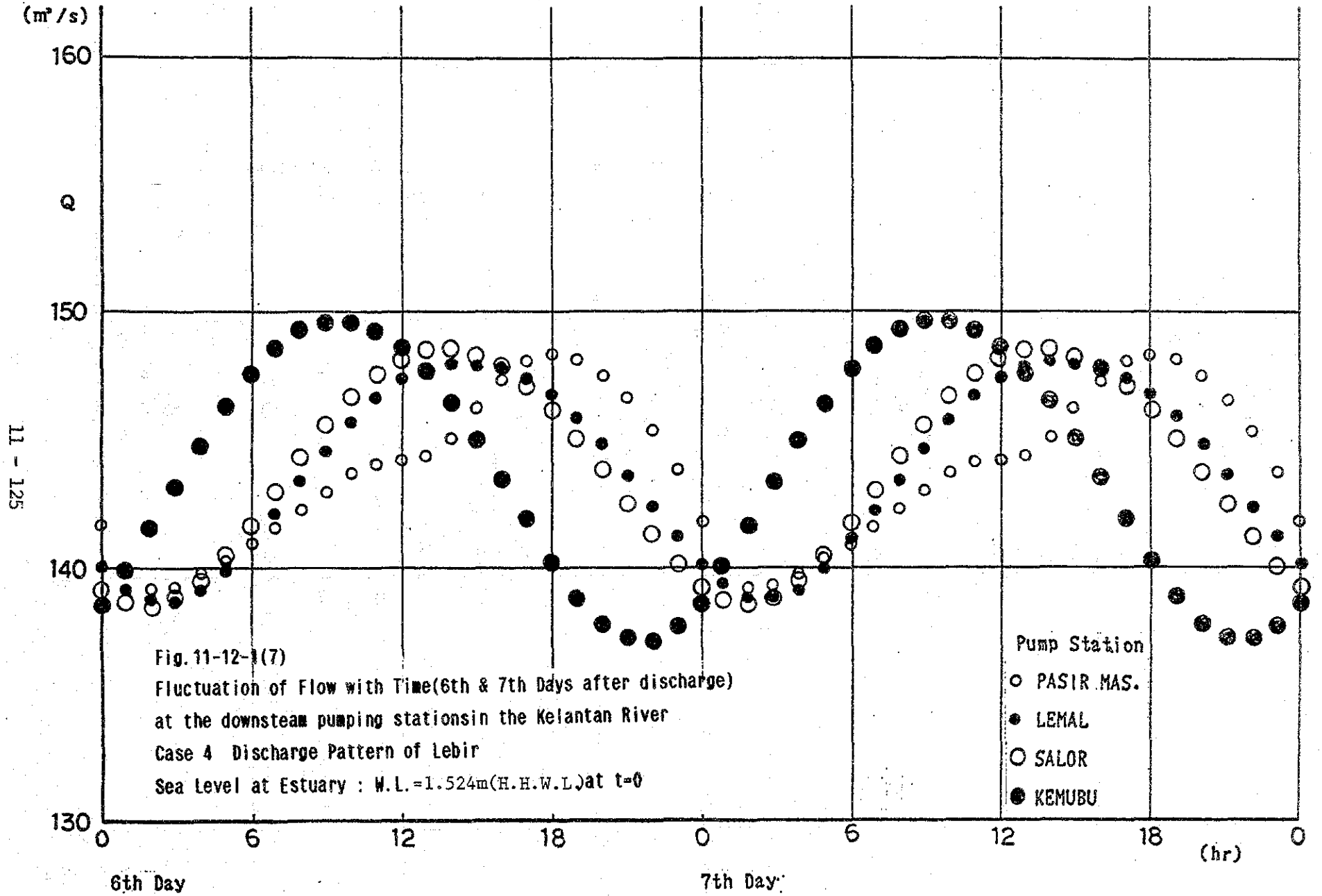


Fig. 11-12-1(7)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 4 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=1.524m(H.H.W.L)at t=0

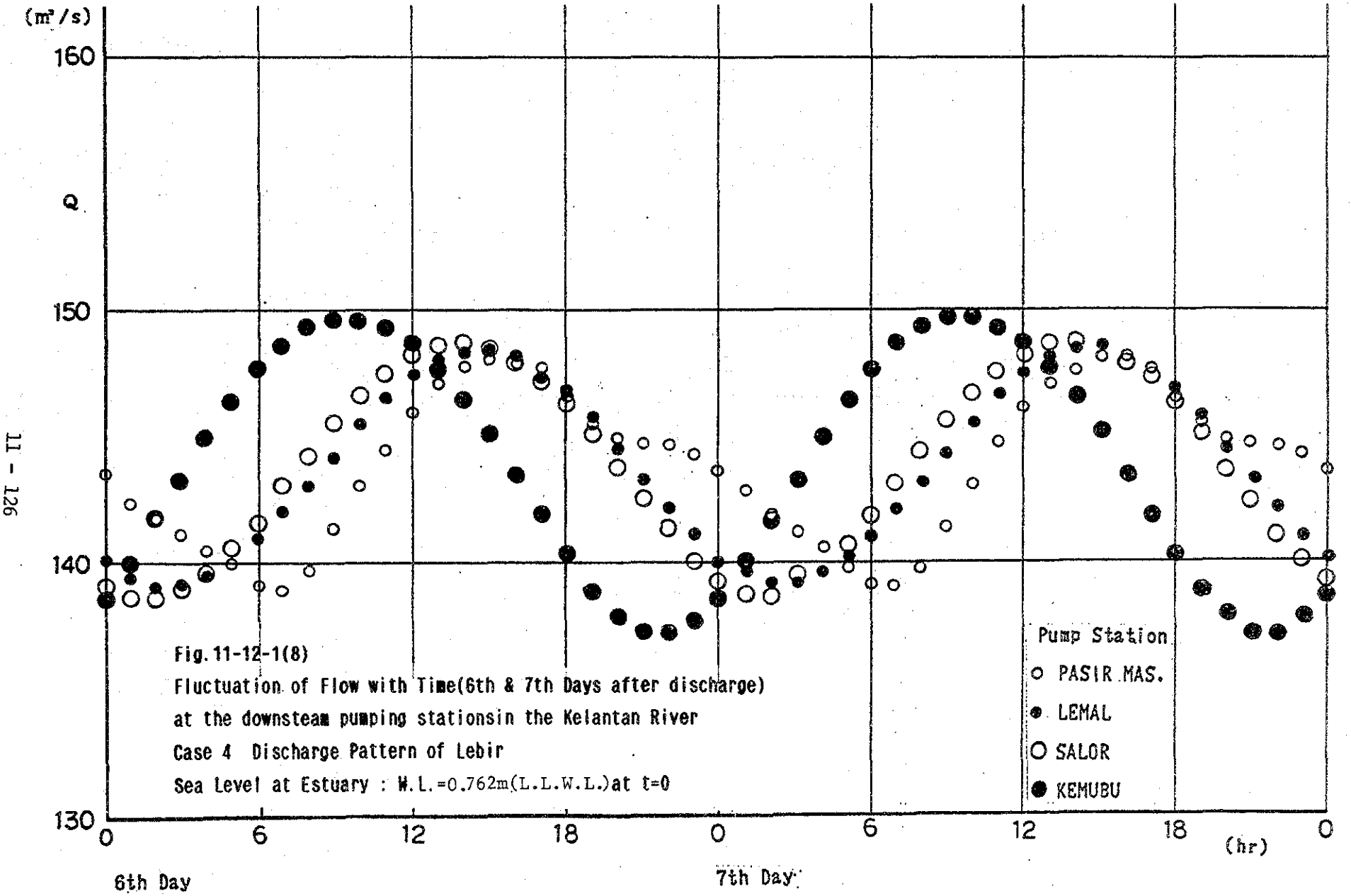
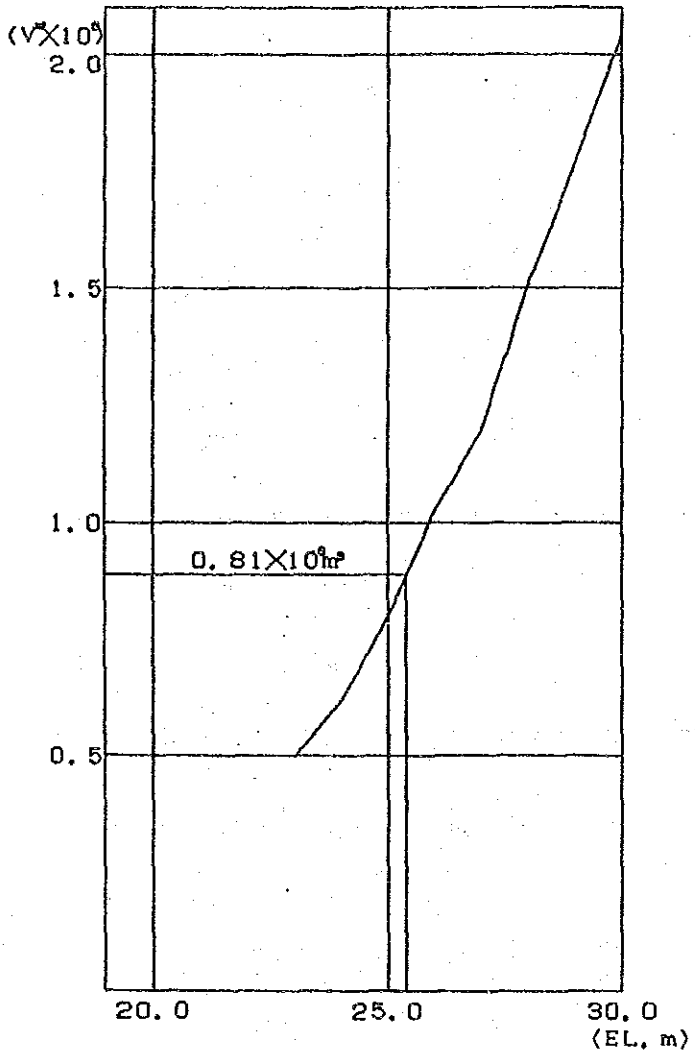
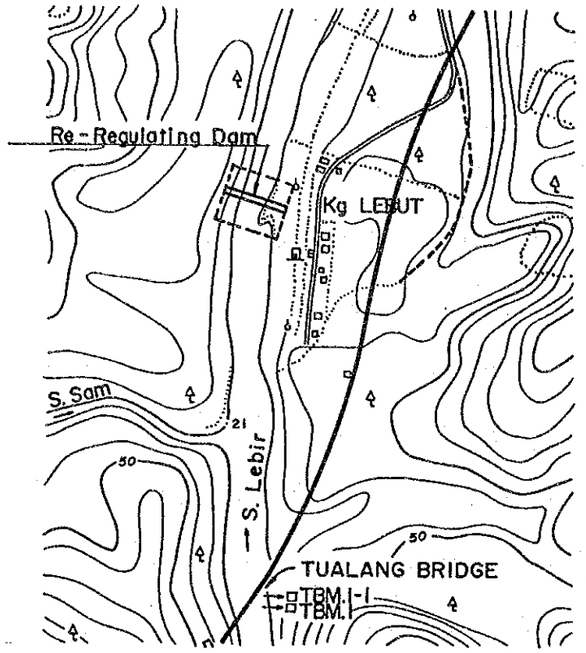


Fig. 11-12-1(8)
Fluctuation of Flow with Time(6th & 7th Days after discharge)
at the downsteam pumping stationsin the Kelantan River
Case 4 Discharge Pattern of Lebir
Sea Level at Estuary : W.L.=0.762m(L.L.W.L.)at t=0

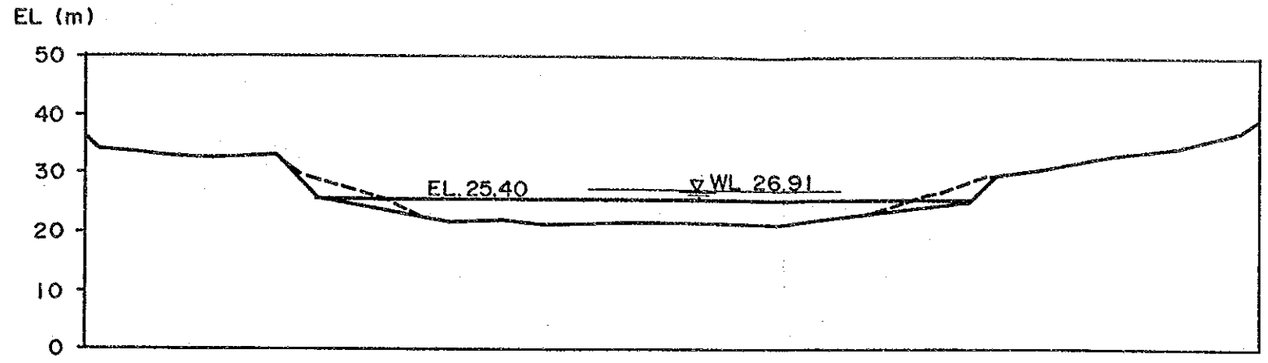
Fig. 11-12-2 Relationship between Water Level and Re-regulating Pondage Volume



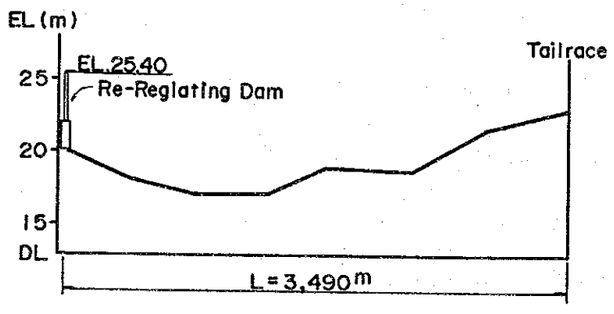
EL.	V×10⁶
30	2.04
29	1.78
28	1.52
27	1.20
26	1.02
25	0.80
24	0.62
23	0.50
22	0.78



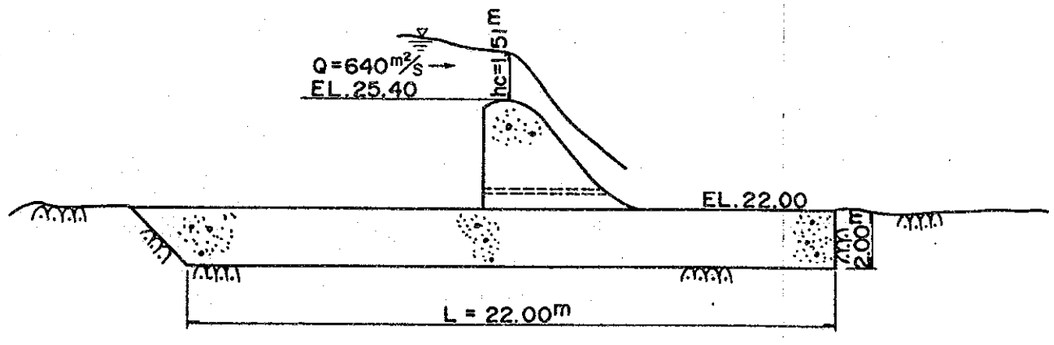
Plan
S= 1/10,000



Profile
S= 1/1,000



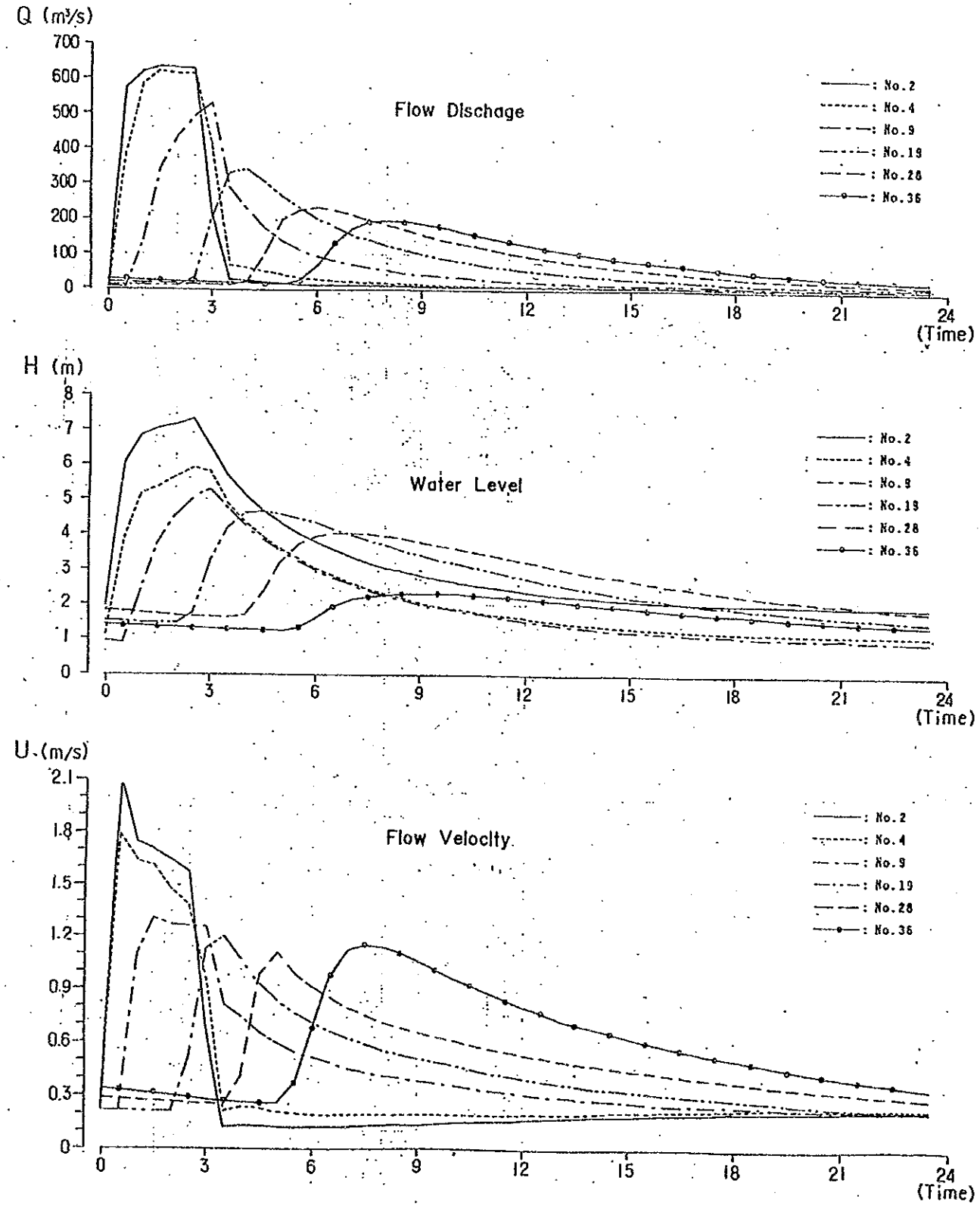
Longitudinal Section
non - Scale



Typical Cross Section
S= 1/200

Fig. 11-12-3 Re-Regulating Pond

Fig. 11-12-4 FLOW DISCHARGE, WATER LEVEL AND FLOW VELOCITY AT VARIOUS SECTION ON DOWNSTREAM COURSE OF THE LEBIR RIVER AT THE TIME OF POWER GENERATION



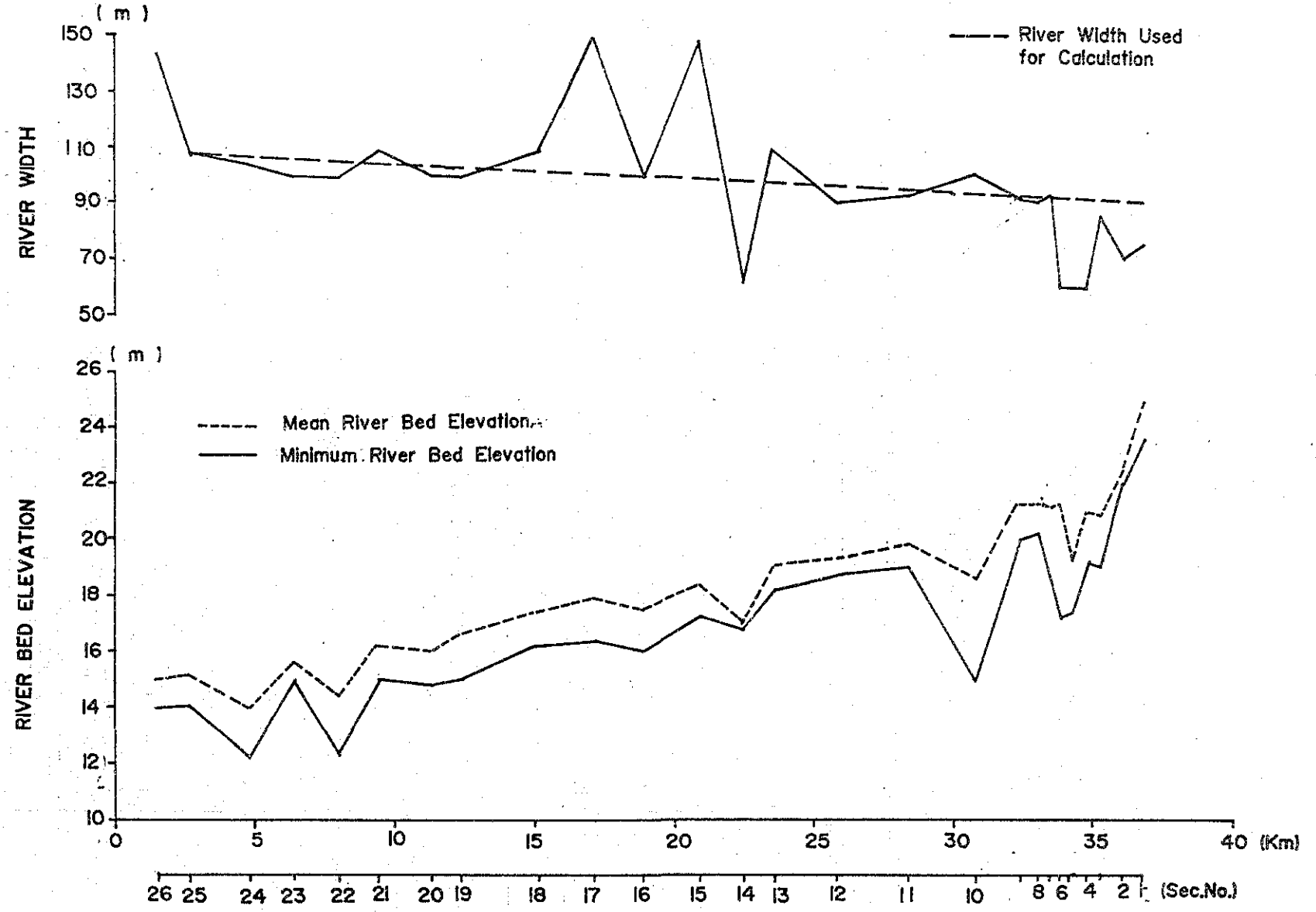
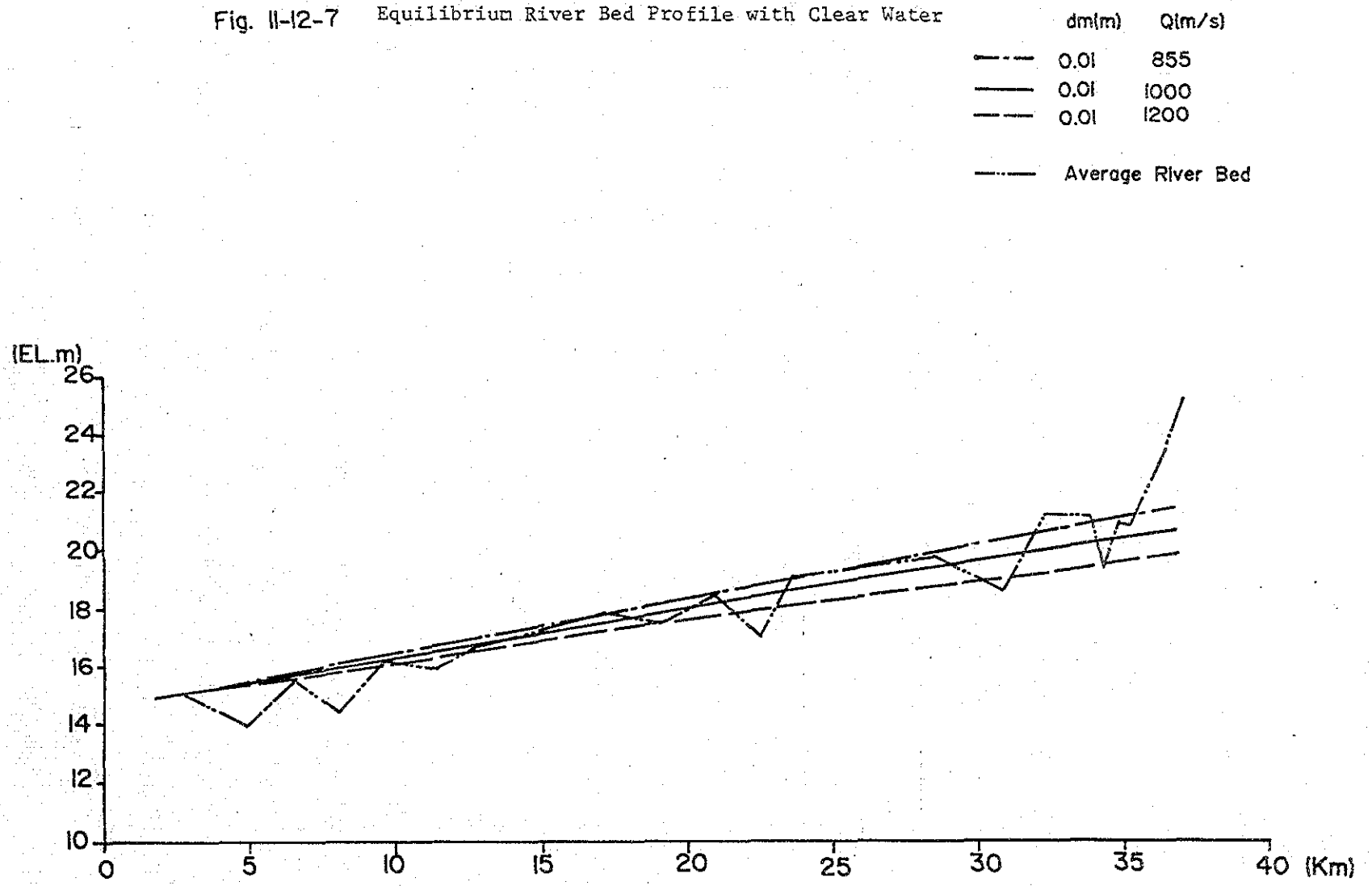
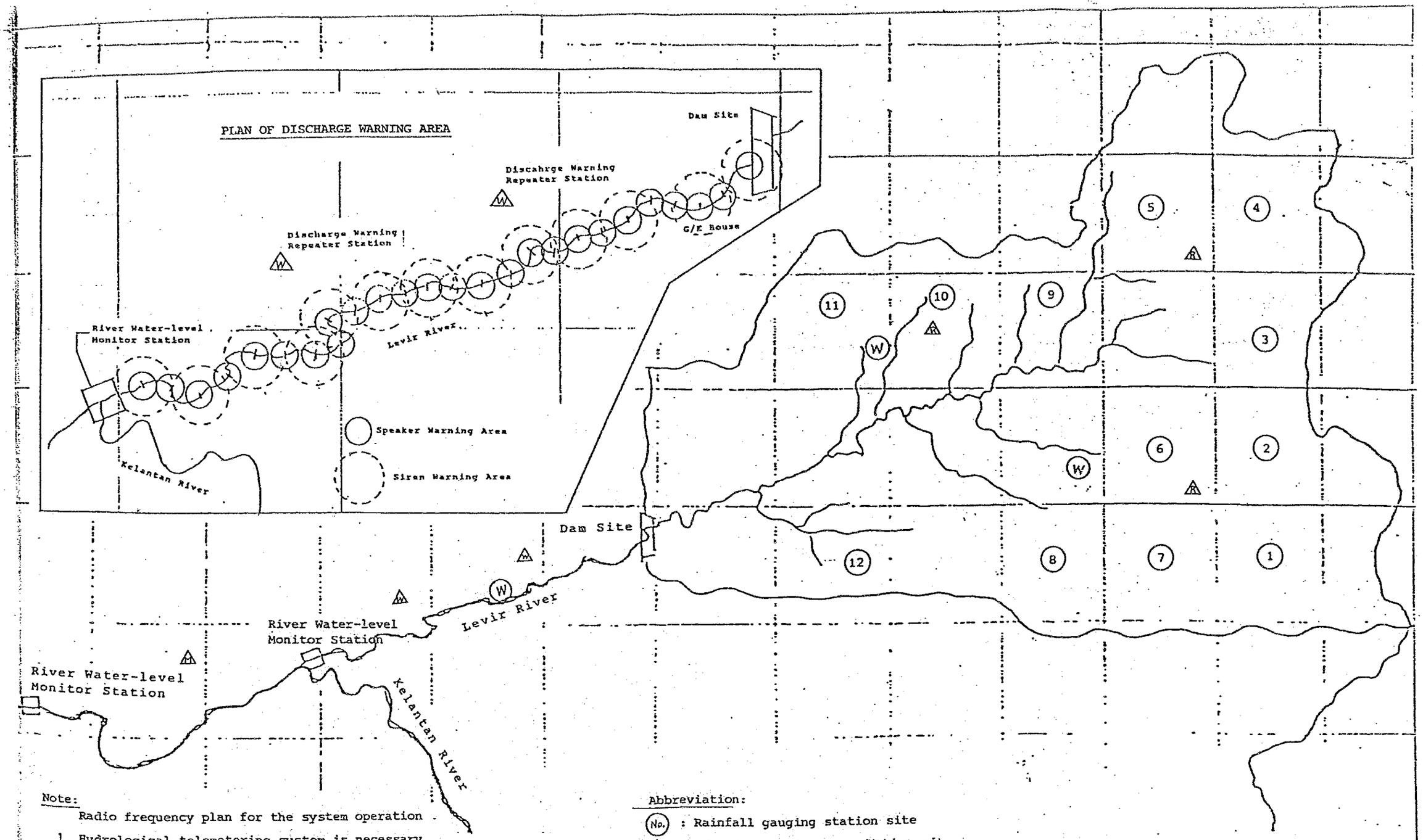


Fig. II-12-5 LEBIR RIVER BED PROFILE AND VARIATION OF RIVER WIDTH

Figure 11.6 Relationship between Peak Discharge and Return Period
after Lebed Dam Construction
Spillway Width 150 m
Crest Elevation 80 m
1240m³/s
855m³/s
2 Year
1 Year
RETURN PERIOD (T), IN YEARS
DISCHARGE IN 1000 CUBIC METERS PER SECOND
0
1
2
3
4
5
1.5
2
5
20
50
100
200
1000
10000 (Year)

Fig. II-12-7 Equilibrium River Bed Profile with Clear Water





Note:

Radio frequency plan for the system operation

1. Hydrological telemetering system is necessary three frequencies in 70MHz band.
2. Discharge warning system is necessary three frequencies in 70MHz band.
3. Mobile warning car is necessary five frequencies in 150MHz band.
4. Radio telecommunication system will be employed the same frequencies with mobile warning car.
5. Data monitoring system is necessary three frequencies in 70MHz band.
6. Definite radio frequencies to be assigned for system operation will be arranged in accordance with actual data of the site survey and radio propagation test.

Abbreviation:

(No.) : Rainfall gauging station site
: Telemetering repeater station site
: Warning repeater station site
: Monitoring repeater station site
(W) : Water-level gauging station site

Fig. II-12-8 PLAN OF RAINFALL GAUGING STATION SITE AND DISCHARGE WARNING AREA

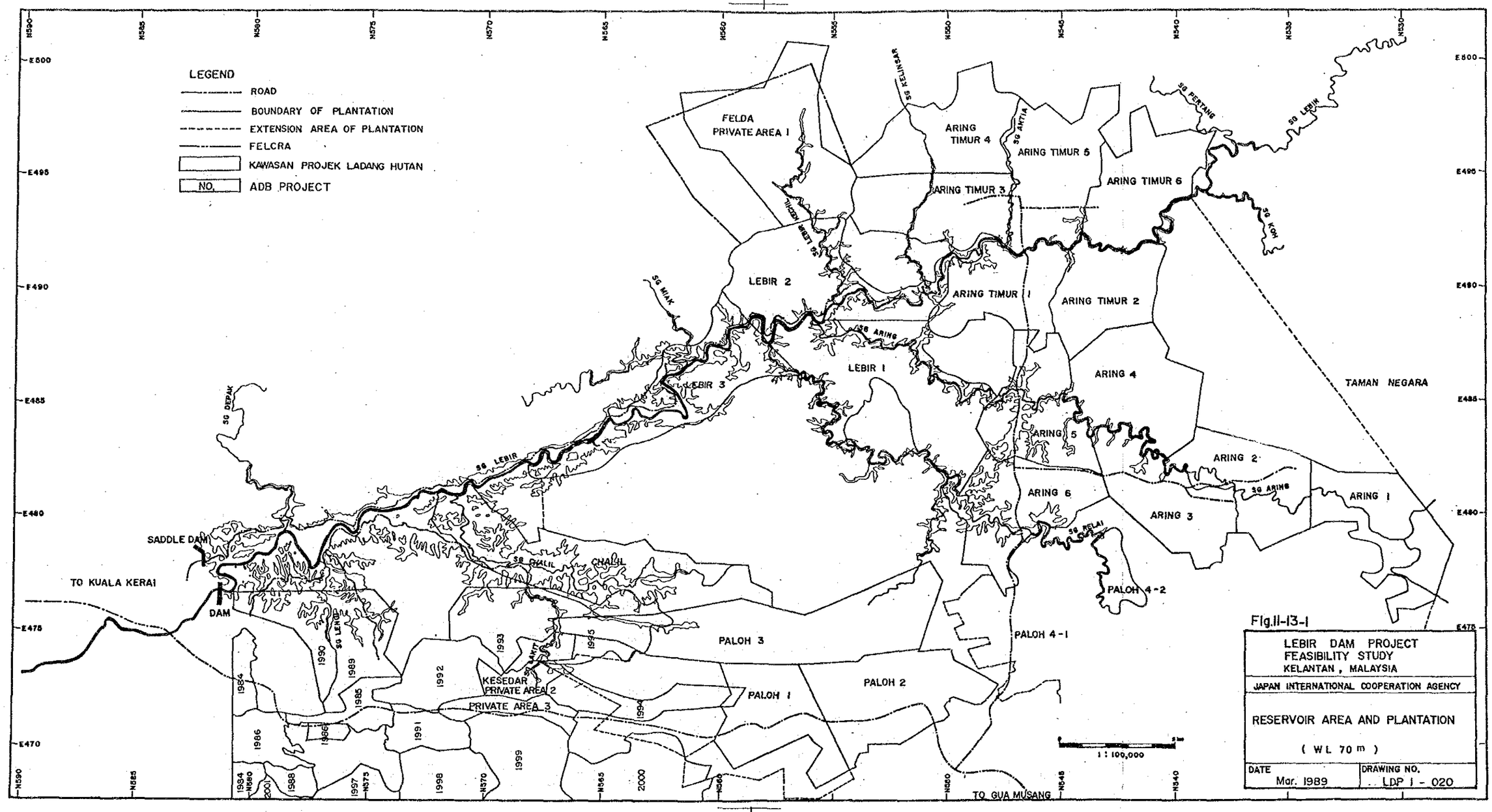
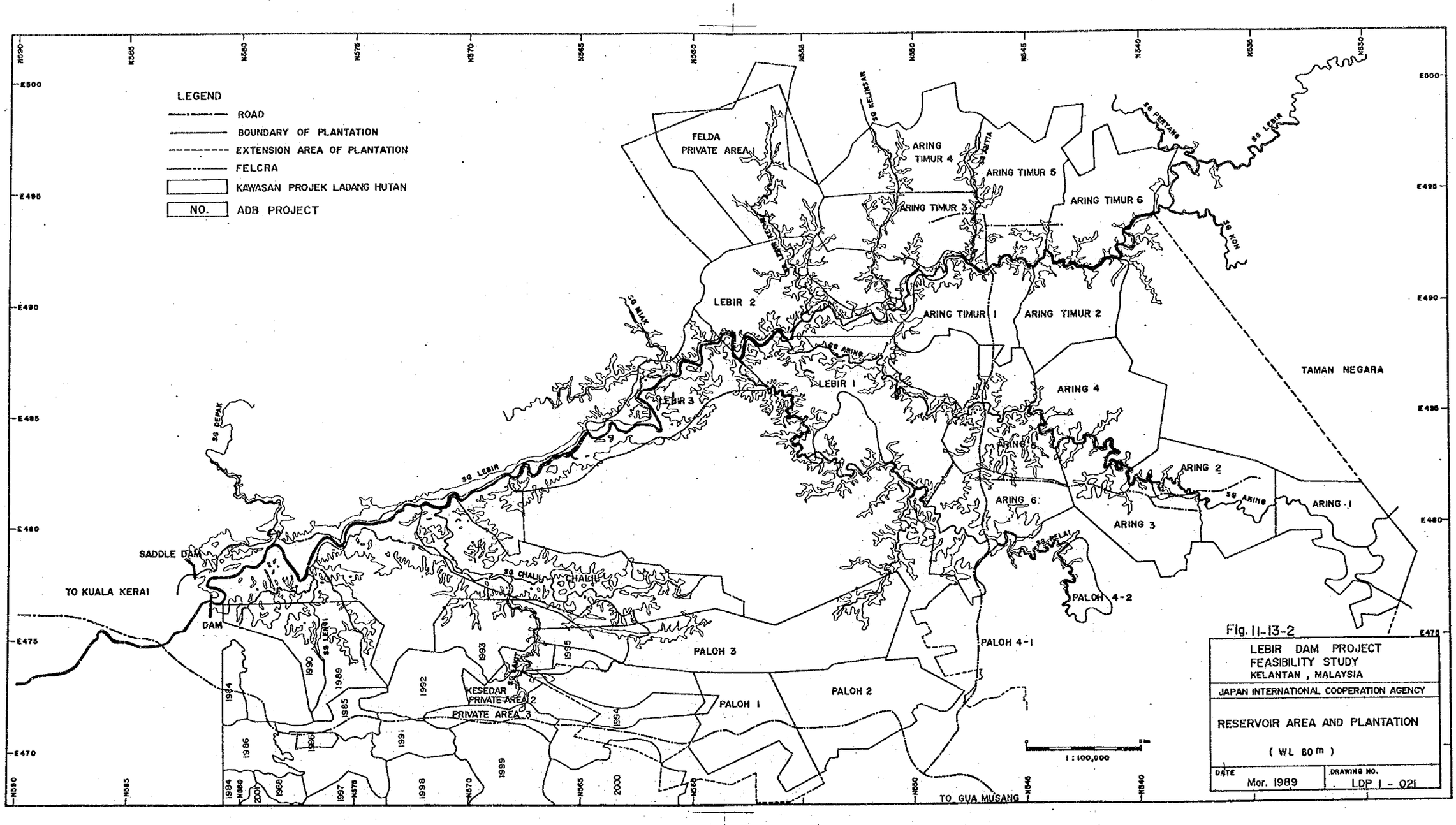


Fig.II-13-1

LEBIR DAM PROJECT FEASIBILITY STUDY KELANTAN, MALAYSIA	
JAPAN INTERNATIONAL COOPERATION AGENCY	
RESERVOIR AREA AND PLANTATION (WL 70 m)	
DATE Mar. 1989	DRAWING NO. LDP 1 - 020


LEGEND
ROAD
BOUNDARY OF PLANTATION
EXTENSION AREA OF PLANTATION
FELCRA
KAWASAN PROJEK LADANG HUTAN
NO. ADB PROJECT
FELDA PRIVATE AREA 1
ARING TIMUR 4
ARING TIMUR 5
ARING TIMUR 6
ARING TIMUR 3
ARING TIMUR 1
ARING TIMUR 2
LEBIR 2
LEBIR 1
LEBIR 3
ARING 4
ARING 5
ARING 6
ARING 2
ARING 3
ARING 1
TAMAN NEGARA
SG KELINSAR
SG PERTIA
SG PERTANG
SG LEBIR
SG HOH
SG LEMIR
SG MIAK
SG ARING
SG REPAK
SG CHALIL
SG KELAI
SADDLE DAM
TO KUALA KERAI
DAM
CHALIL
PALOH 3
PALOH 1
PALOH 2
PALOH 4-1
PALOH 4-2
KESEDAR PRIVATE AREA 2
PRIVATE AREA 3
TO GUA MUSANG
1 : 100,000
Fig. II-13-2
LEBIR DAM PROJECT
FEASIBILITY STUDY
KELANTAN , MALAYSIA
JAPAN INTERNATIONAL COOPERATION AGENCY
RESERVOIR AREA AND PLANTATION
(WL 80 m)
DATE Mar. 1989
DRAWING NO. LDP I - 021

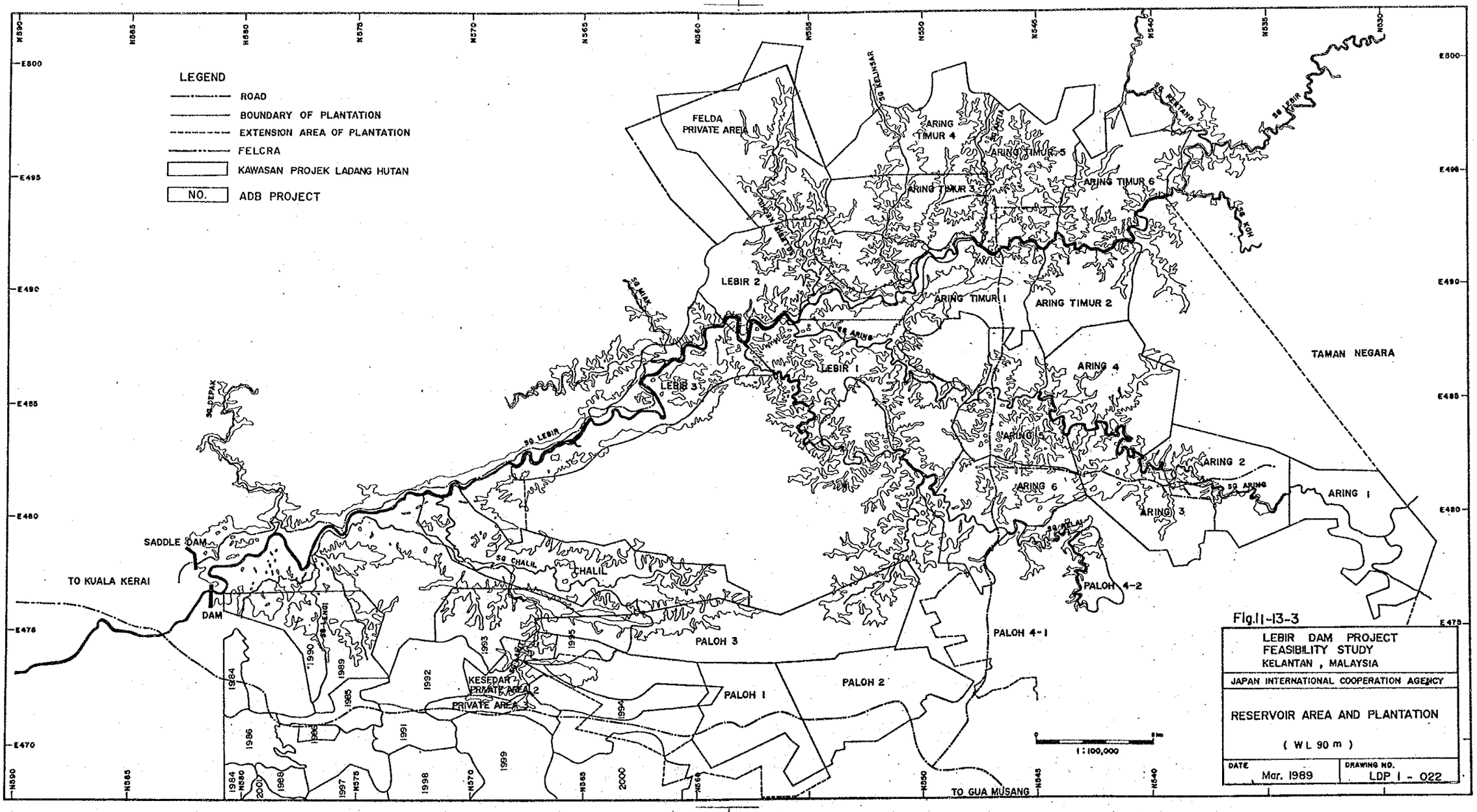
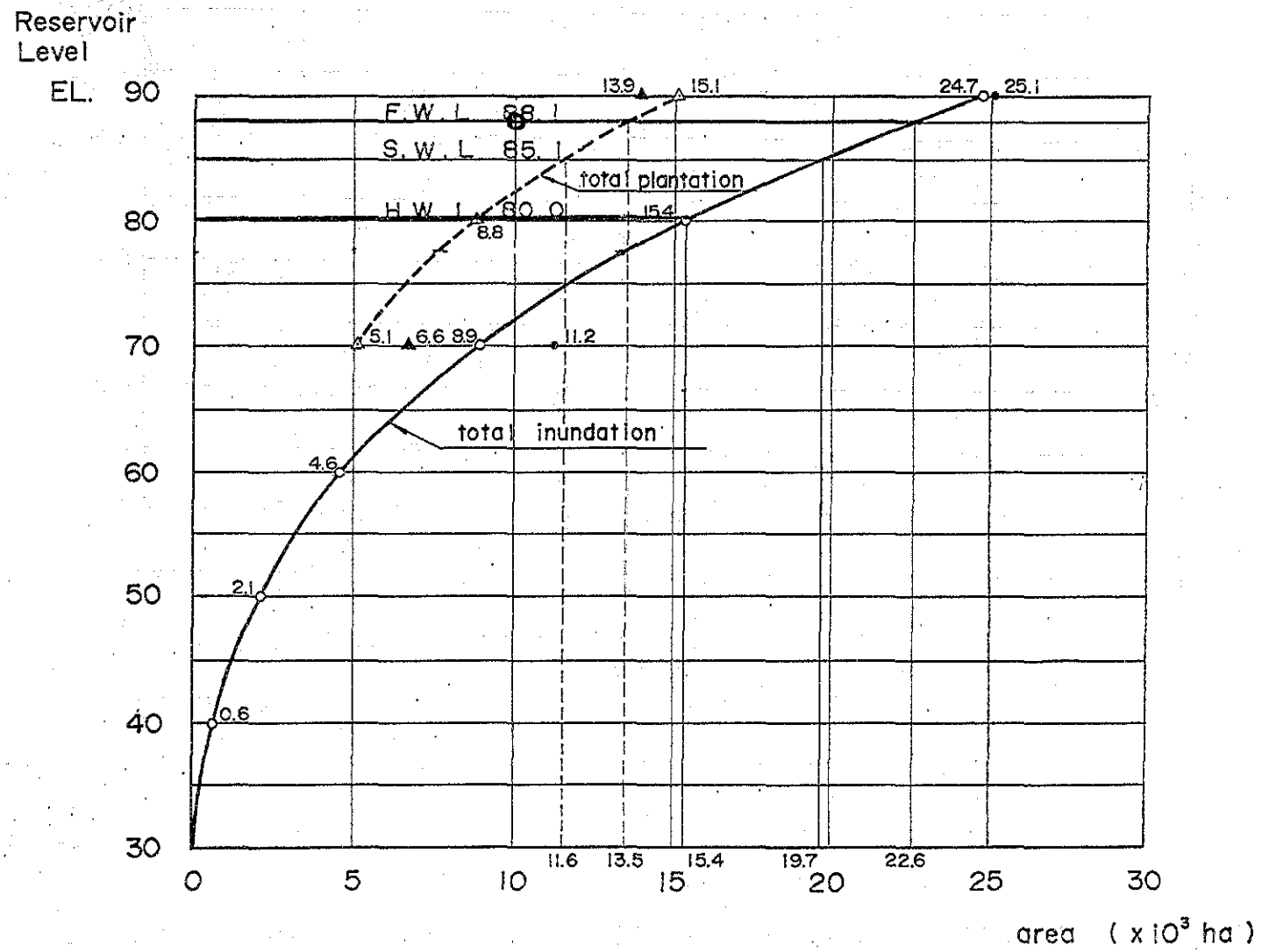

LEGEND
ROAD
BOUNDARY OF PLANTATION
EXTENSION AREA OF PLANTATION
FELCRA
KAWASAN PROJEK LADANG HUTAN
NO. ADB PROJECT
FELDA PRIVATE AREA
SG KELINGAR
ARING TIMUR 4
ARING TIMUR 5
ARING TIMUR 3
ARING TIMUR 6
SG PERTANG
SG LEBIR
SG KOH
LEBIR 2
ARING TIMUR 1
ARING TIMUR 2
SG MAK
SG ARING
LEBIR 1
LEBIR 3
TAMAN NEGARA
ARING 4
ARING 5
ARING 2
ARING 6
ARING 3
ARING 1
SG DEPAK
SG LEBIR
SADDLE DAM
SG CHALIL
CHALIL
TO KUALA KERAI
DAM
PALOH 4-2
PALOH 4-1
PALOH 3
PALOH 1
PALOH 2
KESEDAR 2 PRIVATE AREA
KESEDAR 3 PRIVATE AREA
1 : 100,000
TO GUA MUSANG
Fig.11-13-3
LEBIR DAM PROJECT
FEASIBILITY STUDY
KELANTAN , MALAYSIA
JAPAN INTERNATIONAL COOPERATION AGENCY
RESERVOIR AREA AND PLANTATION
(W L 90 m)
DATE
Mar. 1989
DRAWING NO.
LDP I - 022

Fig. 11-13-4 Inundationdrea in Upstream of Lebir Dam



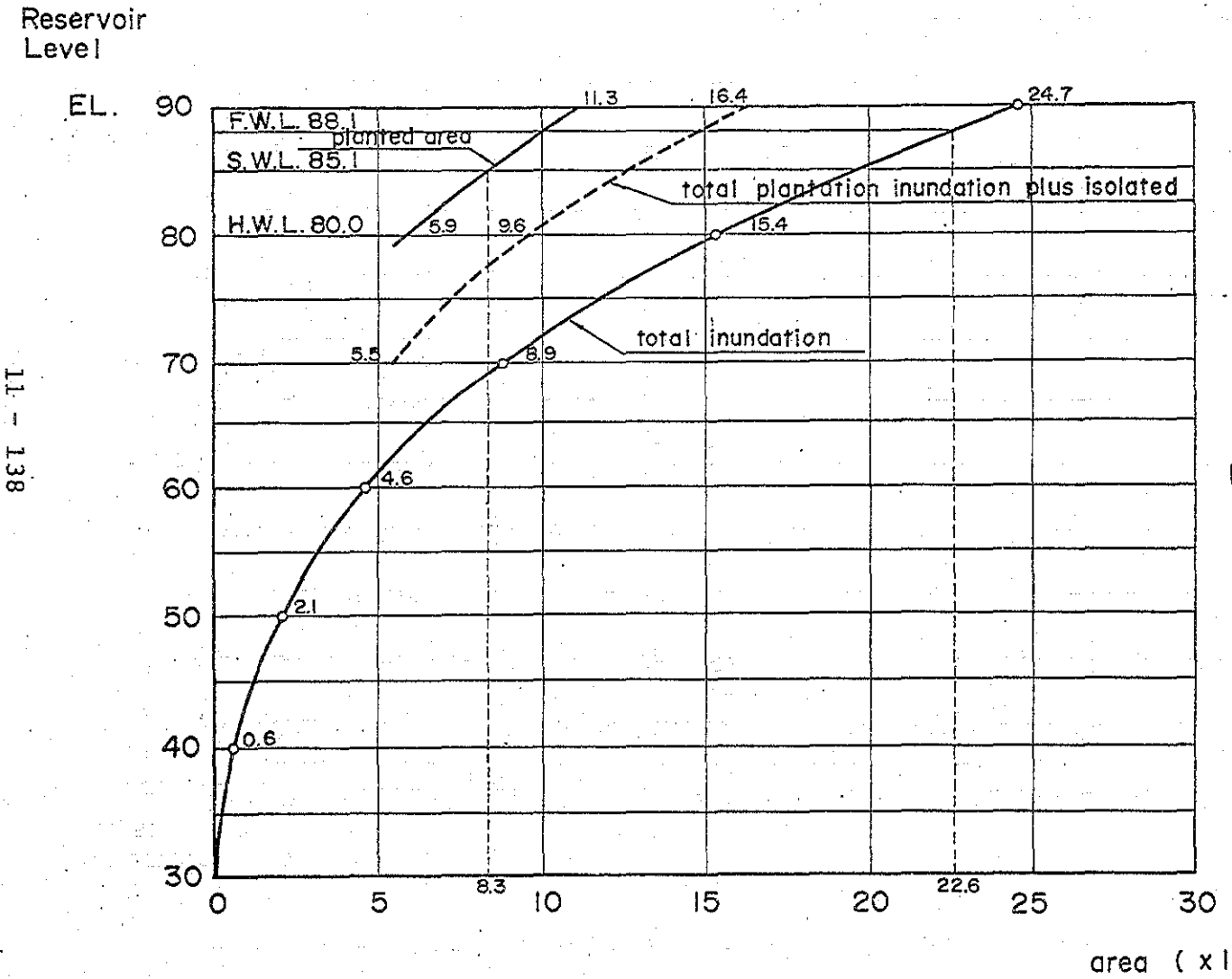
- USM Report December 1987 Page 121, Table 7-3

--△--JICA Interim Report February 1988 Page 11-30, Table 11-1 Inundation area of Felda and Kesedar Land Scheme

▲ USM Report December 1987 Page 120, Table 7-2 Inundation area of Felda and Kesedar Land Scheme

Fig. 11-13-5 Plantation Area to be Compensated due to Inundation of Lebir Dam

(based on the current development)



Area at F.W.L 88.1 = 10,000ha
Rubber (31%) 3,100 ha
Oil Palm (69%) 6,900ha

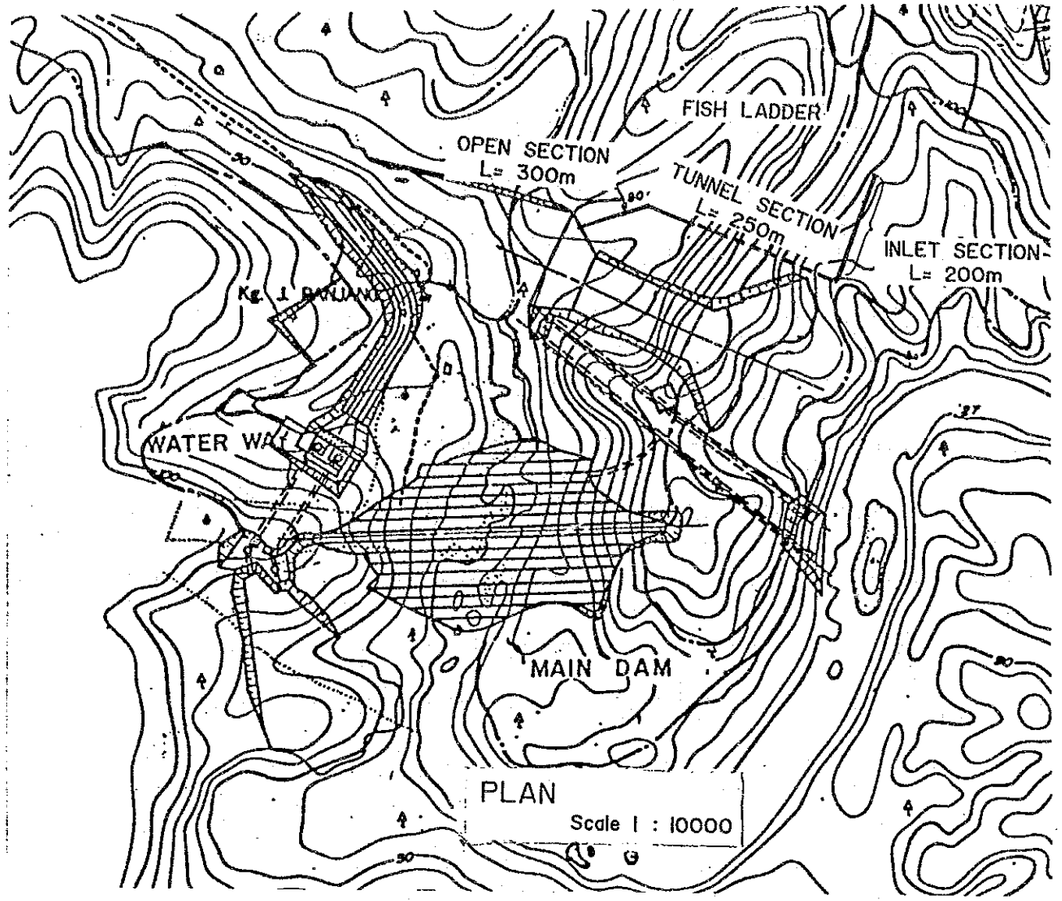
Location	WL 80	WL 90
Kesedar	3,312ha	5,565ha
Felda	1,758	4,402
Felcra	77	129
ADB project	750	1,180
total	5,897ha	11,276ha

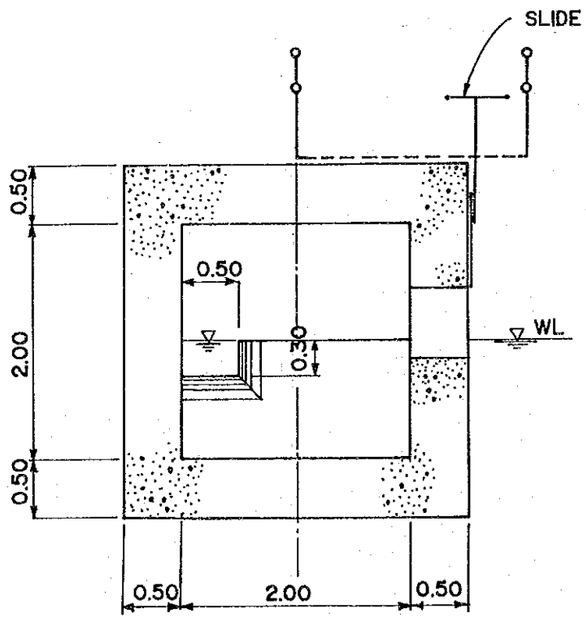
Note:

Kesedar includes Paloh 3, Lebir 1 and Chalil.

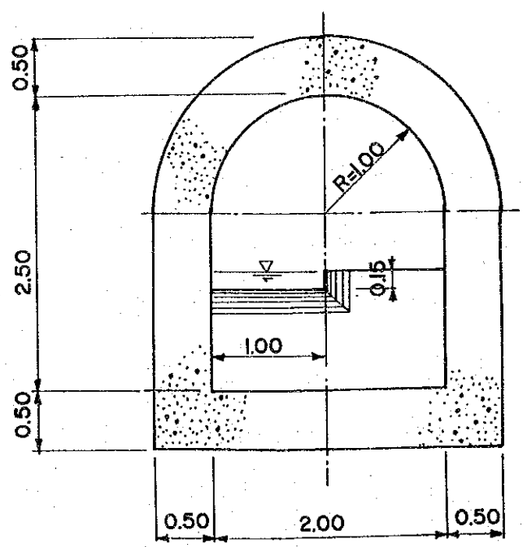
Felda includes Aring 1, 2, 3, 4 and 5, Aring Timur 1, 2, 3 and 4. (refer to Table 11 - 5)

Fig. II-14-1 Fish Ladder. Arrangement

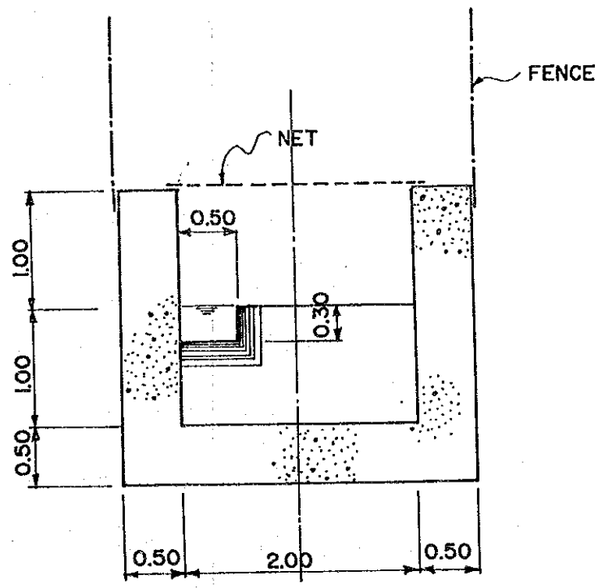




INLET SECTION Scale 1 : 50

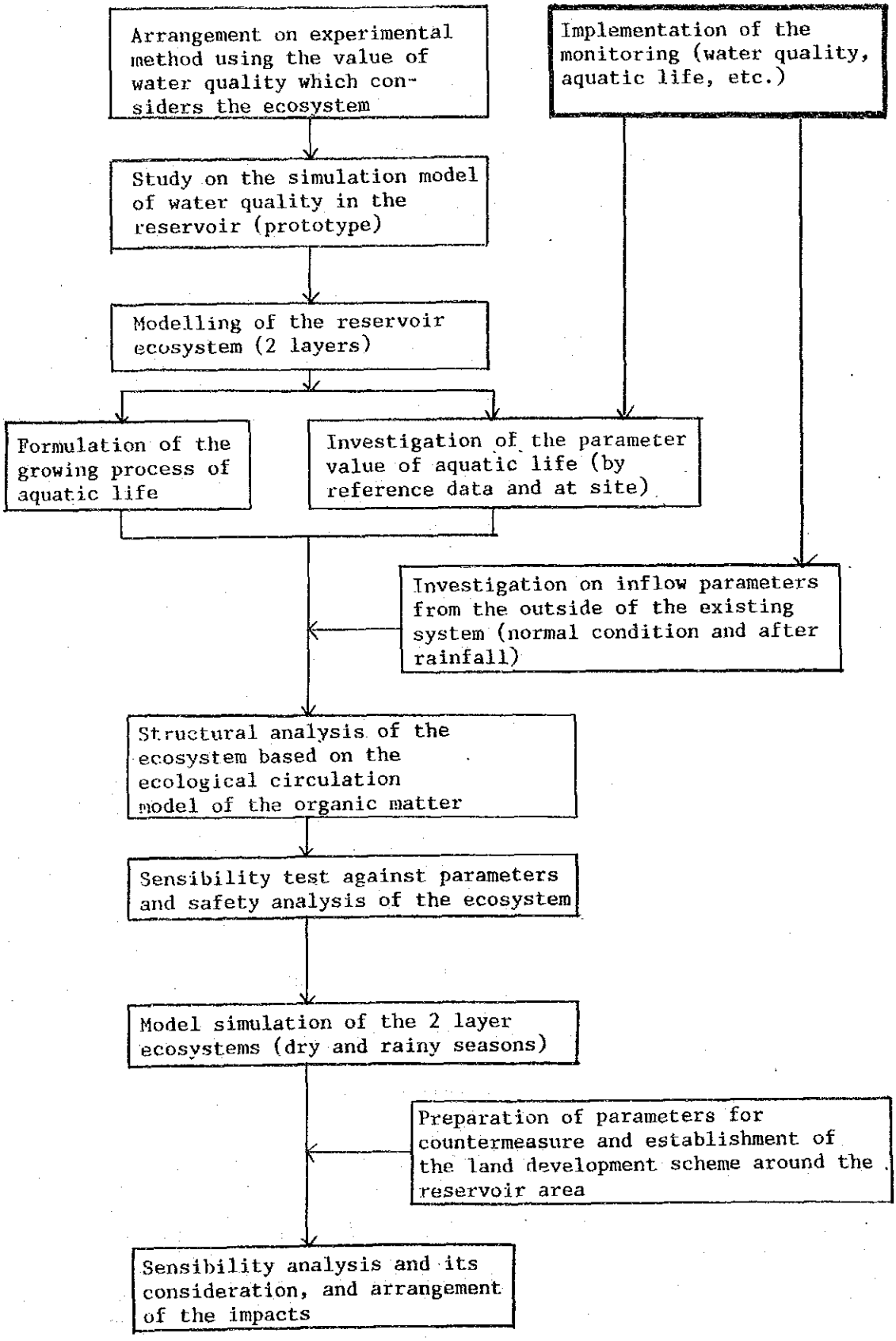


TUNNEL SECTION Scale 1 : 50



OPEN SECTION Scale 1 : 50

Fig. 11-16 Flow chart of the Environmental Monitoring



12. Construction Schedule and Project Implementation Programme

(Refer to Volume 1)

13. Cost Estimate for the Project

(Refer to Volume 1)

14. Economic and Financial Analyses

(Refer to Volume 1)

APPENDIX

APPENDIX FIGURE LIST

(VOLUME 2)

APPENDIX TABLE LIST

(VOLUME 2)

APPENDIX ATTACHMENT LIST

(VOLUME 2)

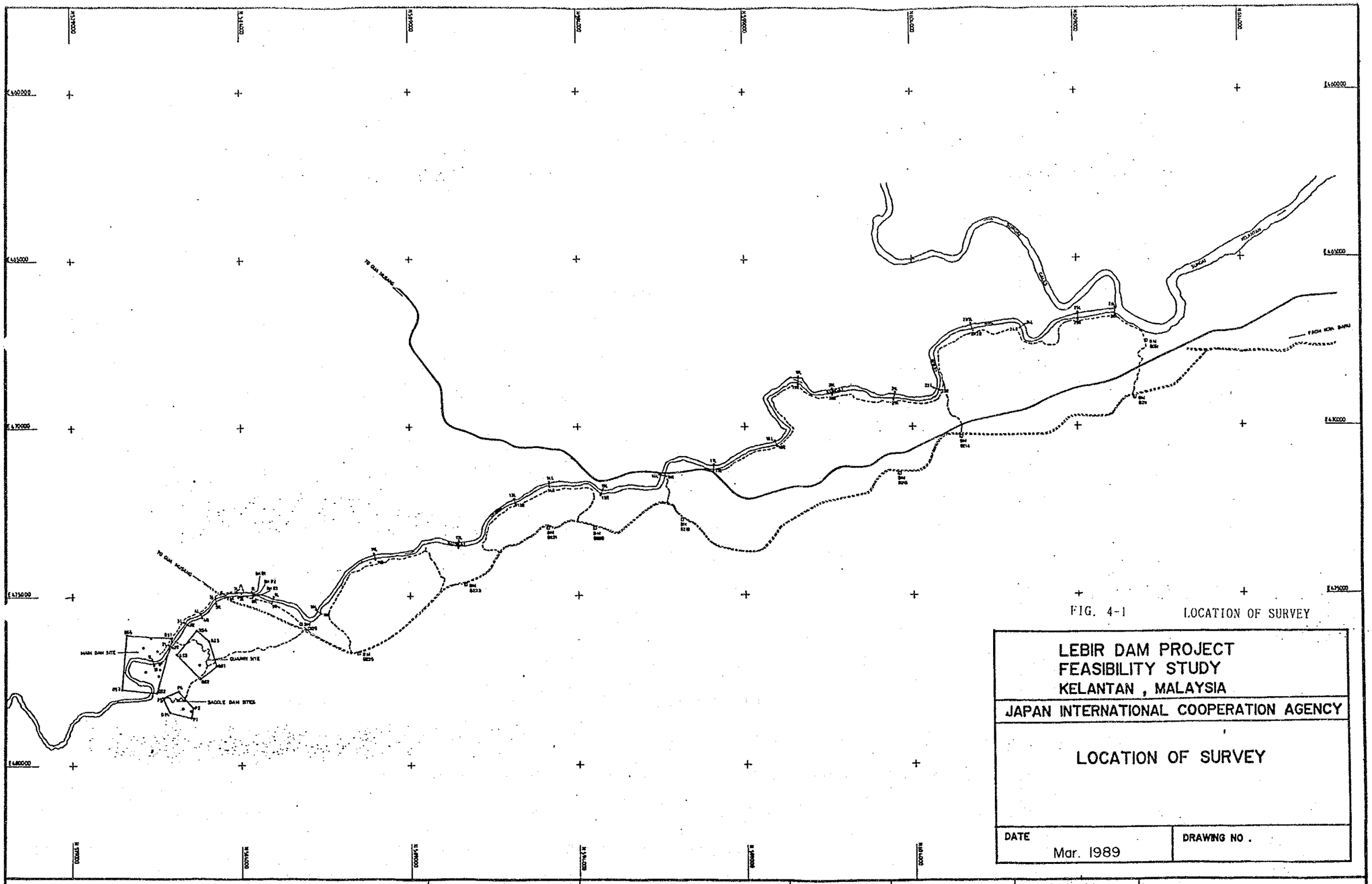


FIG. 4-1 LOCATION OF SURVEY

LEBIR DAM PROJECT
FEASIBILITY STUDY
KELANTAN , MALAYSIA

JAPAN INTERNATIONAL COOPERATION AGENCY

LOCATION OF SURVEY

DATE	DRAWING NO .
Mar. 1989	

LEGEND

RIVER CROSS SECTION SURVEY
EARTH TRACK
TAR ROAD
TOPOGRAPHIC SURVEY
RAIL WAY LINE
BENCH MARK

ABBREVIATION

SL — TOWARDS LEFT
SR — TOWARDS RIGHT
BHH — BORE HOLE
SUNGAI — RIVER

DESCRIPTION

LOCATION AND SITE PLAN

SCALE : 1 : 50 000

JURUKUR TEKNIK SDN BHD	JAPAN INTERNATIONAL COOPERATION AGENCY
SURVEYED BY :	APPROVED BY : HEWJEC
DRAWN BY :	SUPERVISOR : Y. KISHI
CHECK BY :	

LEBIR DAM PROJECT
FEASIBILITY STUDY
KELANTAN, MALAYSIA.

DATE : OCT 88 DRAWING NO : LDP-SL-01

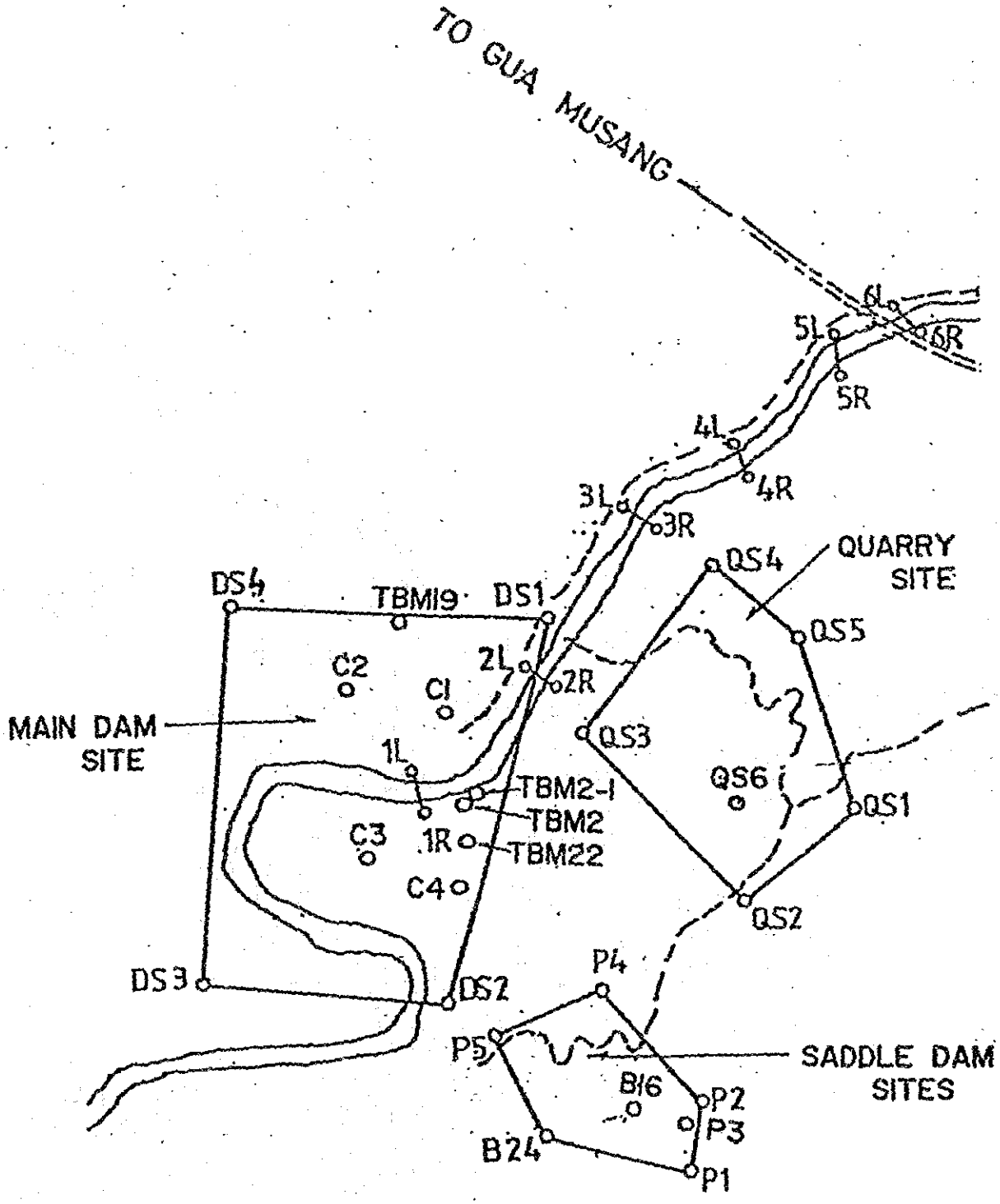


FIG. 4-2 LOCATION MAP OF TBM AND BM

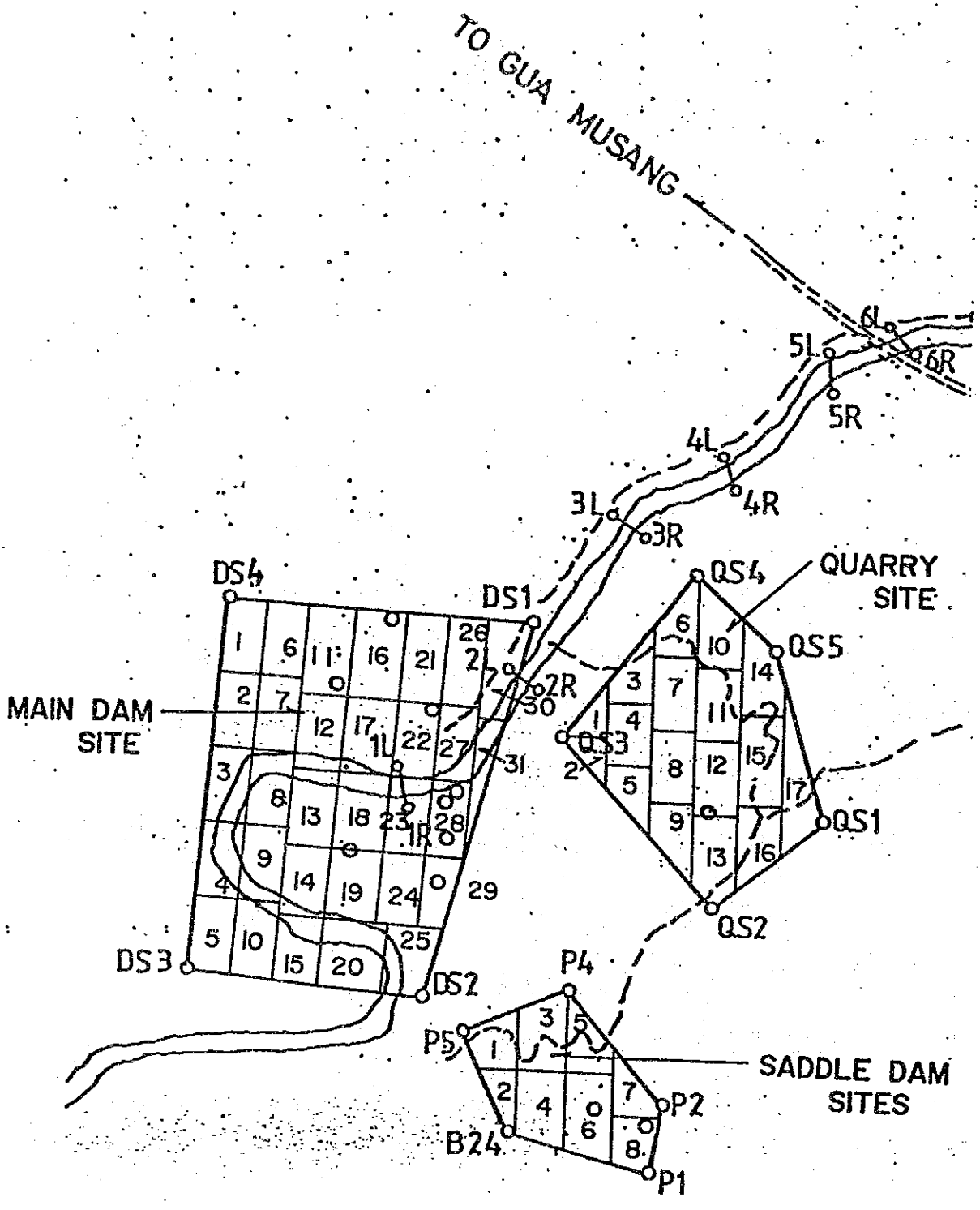
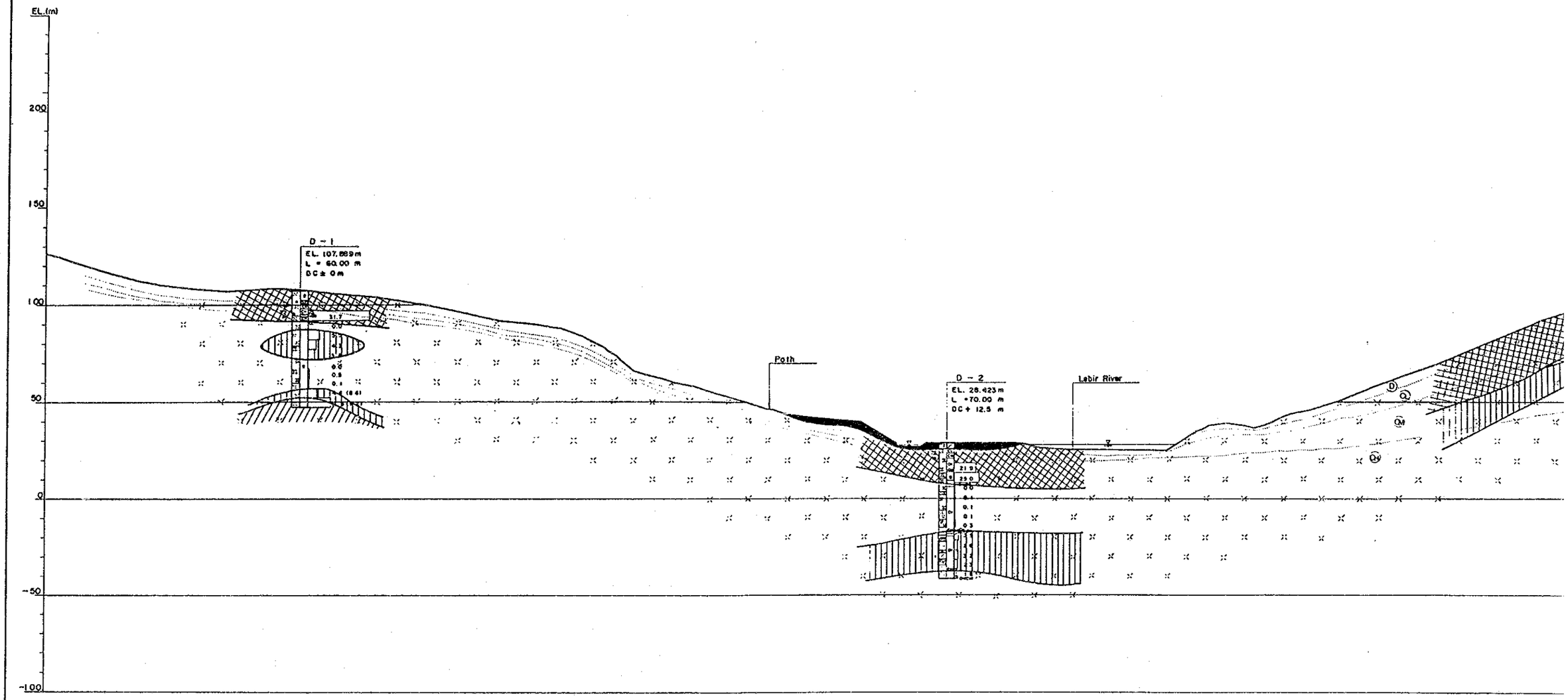


Fig4-3 INDEX MAP OF TOPOGRAPHIC MAP

Main Dam Axis Lugeon Map

S = 1 : 2,000

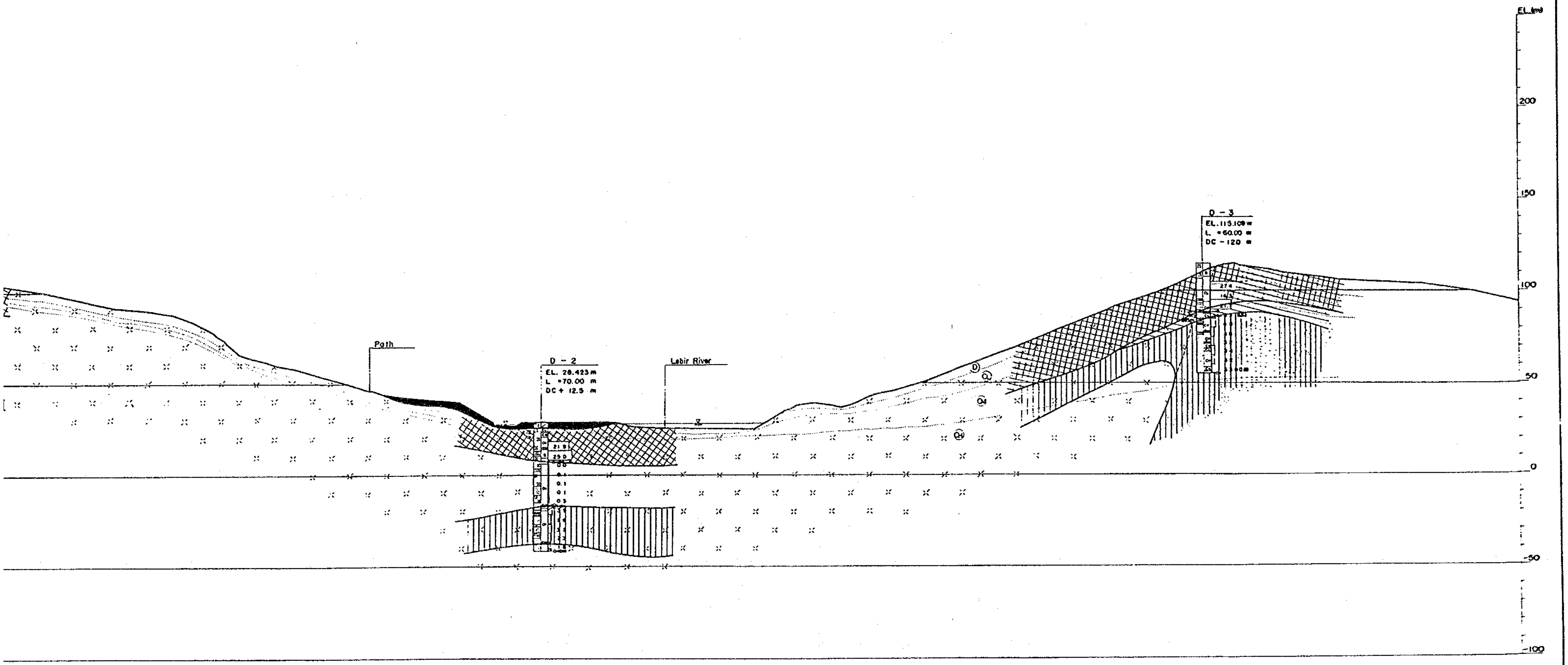


Legend

- Sediments
- 20 ≤ Lugeon zone
- 10 ≤ Lugeon < 20 zone
- 5 ≤ Lugeon < 10 zone
- 2 ≤ Lugeon < 5 zone
- Lugeon < 2 zone
- Lugeon zone boundary

Main Dam Axis Lugeon Map

S = 1 : 2,000



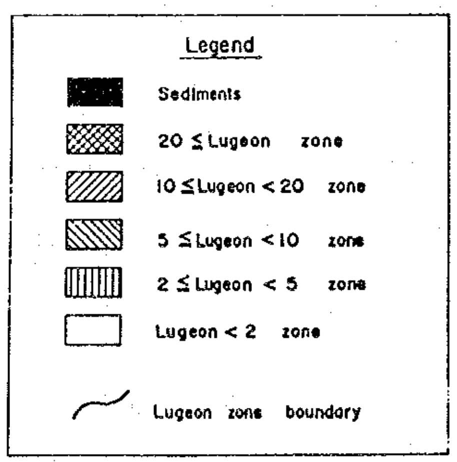
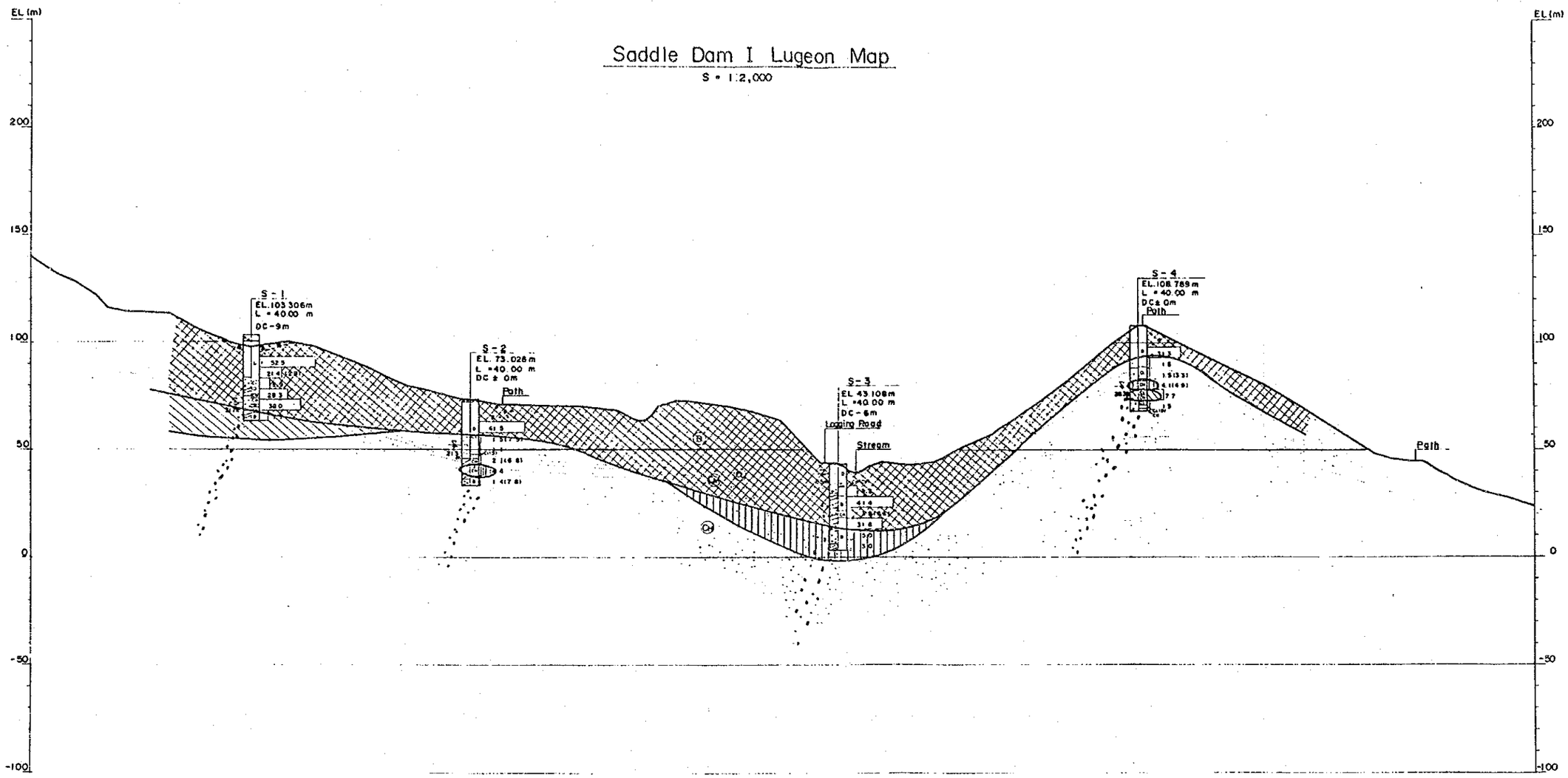


Fig. 4-4

LEBIR DAM PROJECT FEASIBILITY STUDY KELANTAN, MALAYSIA	
JAPAN INTERNATIONAL COOPERATION AGENCY	
Title Lugeon Map along the main dam axis	
DATE Mar. 1989	DRAWING NO LDP-G-008

Saddle Dam I Lugeon Map

S = 1:2,000



Legend

- 20 ≤ Lugeon zone
- 10 ≤ Lugeon < 20 zone
- 5 ≤ Lugeon < 10 zone
- 2 ≤ Lugeon < 5 zone
- Lugeon < 2 zone
- Lugeon zone boundary

Fig. 4-5

LEBIR DAM PROJECT FEASIBILITY STUDY KELANTAN, MALAYSIA	
JAPAN INTERNATIONAL COOPERATION AGENCY	
Title Lugeon Map along the saddle dam I axis	
DATE Mar. 1989	DRAWING NO. LDP-G-009

Geological log	Depth (m)	Rock Classification	Core Particulars: Core Shape	Weathering	Colour	Hardness	Core Size: R.Q.D	Core Recovery	Max. Core	Permiability: G.W.L	Lugeon Value ( ): Critical Pressure (kgf/cm²)	Casing	Drilling Method
▲▲	0.80			VI	Brown	Soft	0	100	0				D
		D			Pale Brown		0	100	0				r
				V			0	100	0				i
	5.00						0	100	0				l
	6.55	CL		IV	Pale Green-ish Blue	Mode	24	100	24				l
	6.70	CL		V			0	100	0				W
	7.00	D		IV			0	100	0	▽			a
	7.30			V			12	100	12				t
	9.00	CM		III			26	100	13	7.2 (27/8)			e
	10 9.60	CL					70	100	25				r
	9.65	CH		II	Green-ish		16	100	16				
	12.30	CL		IV	Blue		57	100	38				
	12.70	CM		III			36	100	15		31.7		
	13.80	CH			Grey		82	100	40				
	15.50	CH					49	100	25				
	15.90	CL			Green-ish Blue		71	100	30				
							91	100	32		0.0		
	20			I			83	100	30				
							59	100	23				
							77	100	21				
							92	100	51		5.5		
							97	100	50				
					Pur-ple		80	100	31				
							75	100	45				
							70	100	30				
							78	100	33				
	28.90						45	100	25		4.3		
	30	B		II		Hard	74	100	21				
							63	100	34				
							48	100	26				
							45	100	45		3.8		
					Green-ish Blue		64	100	31				
							46	100	29				
							74	100	23				
							82	100	70				
							76	100	24				
							77	100	28		0.0		
							87	100	54				
	40						25	100	25				
							71	100	37				
							83	100	46				
							57	100	27		0.5		
							66	100	36				
							60	100	25				
							89	100	36				
							80	100	56				
	47.80						82	100	44		0.1		
							51	100	29				
	50						78	100	32				
							69	100	36				
							84	100	38		4.4 (8.6)		
							35	100	35				
					Pur-ple		77	100	31				
							86	100	26				
							57	100	29				
							49	100	23		11.6 (16.2)		
							76	100	30				
							69	100	21				
	60						60	100	27				

Description

0.00～0.80m
Soft, brown, sandy silty clay.

0.80～5.00m
Loose to dense, clayey silty sand.

5.00～9.60m
Weak to moderately weak, highly fractured. Cracks are filled with limonite and sand.

9.60～12.30m
Moderately strong to strong, slightly fractured.

9.65m minor fault gouge 5cm thickness, 20° inclination.

9.65～13.80m This section is undergone by metamorphism, brown～grayish yellowish green clay adheres to cracks which is apt to be opened.

12.30～15.90m
Moderately weak to moderately strong, partly fractured.

13.80～14.30m Undergone by metamorphism.

15.60～15.90m No corerecovery.

15.90～24.50m
Moderately strong to very strong, partly fractured. Cracks are filled with calcite veins.

24.50～60.00m
Very strong, slightly fractured. Cracks are filled with calcite veins.

52.00～52.40m, 59.40～59.60m Steep angled cracks which are metamorphied heavily.

27.20m, 26.90m Opened cracks are recognised along calcite veins.

Geological Log
- Top Soil
- Tuff Breccia ～ Tuff
- Tuff (Purple)
- Tuff (Greenish Blue)

Core Shape
- Clay ～ Sand
- Fragment ～ Rhomb

Weathering
- I No visible signs of weathering. Rock fresh, crystals bright. Few discontinuities may show slight staining.
- II Penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material. Discontinuities are discoloured and discolouration can extend into rock up to a few mm from discontinuity surface.
- III Slight discolouration extends through the greater part of the rock mass. The

I Unweathered rock
II Slightly weathered rock
III Moderately weathered rock
IV Highly weathered rock
V Completely weathered rock
VI Residual soil