

Table 7-1 INVENTORY OF REAL-TIME HYDROLOGICAL GAUGING STATIONS FOR OPERATIONAL SYSTEM  
(DID Gauging Stations and Relating Facilities for FFW)

GAUGING STATIONS		Station Name	River	Gauging Item		Discharge Rating Curve	Location		Year Installed	Radio Frequency (MHz)		Water Level for FFW (EL, m)		Remarks
Number				Rainfall	River stage		Latitude	Longitude		TX	RX	Alert	Warning	
Telemetry Station														
1		Kg. Lalang	Perak	X	-	-	05 36 15	101 04 50	1974	75.475	71.900	-	-	Stn. No. 5610063
2		Kuala Kenderong	Perak	X	-	-	05 25 00	101 09 15	1974	75.475	71.900	-	-	Stn. No. 5411066
3		Kg. Lintang	Pelus	-	X	X	04 56 15	100 06 10	1974	72.125	75.625	53.64	54.25	Stn. No. 4911445
4		Jam. Iskandar	Perak	-	X	X	04 49 10	100 57 55	1974	72.125	75.625	34.8	35.4	Stn. No. 4809443
5		Pant	Perak	X	-	-			1997	Telephone circuit		19.8	21.3	
6		Telok Sena	Perak	X	-	-			1997	Telephone circuit		11.0	11.6	
7		Kg. Gajah	Perak	X	-	-			1997	Telephone circuit		6.4	6.4	
8		Tg. Tualang	Kinta	X	X	X	04 19 20	101 04 30	1997	72.125	75.625	-	-	Stn. No. 4310401, #
9		Tg. Rambutan	Kinta	X	X	X	04 40 10	101 09 30	1997	72.125	75.625	-	-	Stn. No. 4611463, #
10		Kuala Pati	Kinta	X	X	X			1997	75.625	72.125	-	-	#
Non-telemetry Station (Flood Monitoring Station)														
1		Bota Kanan	Perak	-	X	-			1974	-	-	15.5	17.1	18.3
2		Telok Intan	Perak	-	X	-			1974	-	-	2.4	2.6	2.7

# : Data logger

Legend X : available, - : not available

FFW FACILITIES

Number	Name	Nos.
1	Terminal Station	1
2	Repeater Station	2
3	Flood Warning Board	0
4	Flood Warning Siren	4
5	VHF (permanent)	0
6	VHF (mobile)	0
7	Boat (engine)	11
8	Boat/small boat (no engine)	4

Table 7-2 INVENTORY OF NON REAL-TIME HYDROLOGICAL GAUGING STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Present Gauging Items	Station		No. by DID	Location			Present Competent Authority	Remarks
		No.	Name		River System	Latitude	Longitude		
<b>RAINFALL STATION</b>									
Class 1	Point rainfall (Automatic)	Operating DID 12 Principal and 2 Secondary stations			Refer to Table 7-4			DID	Existing DID Principal and Secondary stations
Class 2	Point rainfall (Manual)	Operating DID 48 Secondary stations							
<b>METEOROLOGICAL STATION</b>									
Class 1	General meteorological information	1-1	Ipoh Airport		Perak	04 34	101 06	MMS	Existing MMS Principal meteorological stations
		1-2	Lubok Merbau		Perak	04 48	100 54		
<b>STREAM GAUGING STATION</b>									
Class 1	1) River stage (Automatic)	1-1	Tg. Tualang (Weir G)	4310401	Kinta	04 19 20	101 04 30	DID	Existing DID Principal stations
	2) Discharge	1-2	Jam. Iskandar	4809443	Perak	04 49 10	100 57 55		
	3) Suspended sediment	1-3	Kg. Lintang	4911445	Pelus	04 56 15	101 06 10		
Class 2	1) River stage (Automatic) 2) Discharge 3) Suspended sediment	2-1	Sungkai	3913458	Sungkai	03 59 15	101 18 50	DID	Existing DID Secondary stations
		2-2	Malayan Bidor Bhd.	4012401	Bidor	04 04 30	101 14 40		
		2-3	Tg. Keramat	4111455	Btg. Padang	04 08 05	101 08 50		
		2-4	Bt. 32 Jalan Tapah	4212467	Cenderiang	04 13 55	101 13 10		
		2-5	Keramat Pulai	4511468	Raia	04 32 00	101 08 20		
		2-6	Jln. Silibin, Ipoh	4610466	Pari	04 36 20	101 04 00		
		2-7	Jam. Jalan Raya	5610401	Rui	05 36 10	101 03 45		
Class 3	1) River stage (Automatic) 2) Discharge	3-1	Kg. Lamjut	4311464	Kampar	04 20 10	101 06 05	DID	
		3-2	Tg. Rambutan	4611463	Kinta	04 40 10	101 09 30		
Class 4	Dam outflow information	4-1	Chenderoh Dam	-	Perak	04 57	100 59	TNB	

\* : According to interview survey, the coordinates of newly installed stations in 1997 are not measured yet by DID, and to be measured in 3rd field survey by the Study Team.

Table 7-3(1/3) INVENTORY OF NON REAL-TIME DID RAINFALL STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
					latitude	longitude	manual	auto	from	to	manual	auto	
Class I	4010001	PA	JPS. Telok Intan	VD380445	04 01 00	100 02 10	01/50	01/60			M8	HW. #	JPS
	4012143	PA	Ldg. Bikam	VD674480	04 02 55	101 18 00	01/12	03/64			M8	HL, #	JPS
	4311001	PA	Pejabat Daerah Kampar	VD515765	04 18 20	101 09 20	07/74	07/74			M8	HW. #	JPS
	4409091	PA	Rumah Pam Kubang Haji	VD233997	04 27 40	100 54 05	11/54	04/65			M8	HW. #	JPS
	4511111	PA	Politeknik Ungku Omar, Ipoh	QY482079	04 35 20	101 07 30	04/72	04/72			M8	OTAW. #	JPS
	4611001	PA	Ldg. Kuda Keb. Ulu Kinta	QY530180	04 40 50	101 10 10	07/74	07/74			M8	HW. #	JPS
	4708084	PA	Ibu Bekalan Talang, Kuala Kangsar	QY225284	04 46 30	100 53 40	10/59	10/59			M8	HW	JPS
	4811075	PA	Ranc. Bejia Perlop Sg. Siput	QY538414	04 53 34	101 10 30	08/69	07/74			M8	HL	JPS
	5210069	PA	Sin. Pemereksaan Hutan Lawin	QY411863	05 17 55	101 03 30	07/60	08/71			M8	HW. #	JPS
	5710061	PA	Dispensari Kroh	QT348315	05 42 30	101 00 00	08/71	08/71			M8	HL	JPS
	5411066	PAT	Kuala Kenderong	QY517994	05 25 00	101 09 15	06/72	06/72			M8	HL	JPS
	5610063	PAT	Kg. Lalang	QT435200	05 36 15	101 04 50	01/72	08/71			M8	HL	JPS
	4111137	SA	Ibu Bekalan Sg. Manik	VD490557	04 07 05	101 08 05	12/35	06/62	02/77	02/77	M8	KW	JPS
	4209093	SA	JPS. Telok Sena	VD231712	04 15 20	100 54 00	12/61	06/77	01/73	03/75	M8	OTAW. #	JPS

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal station

S: Secondary station

Manual Or Automatic Recording

M: Manual

A: Automatic (It is assumed that manual observation are also taken)

Other Details

T: Telemetric

Equipment

Daily Read Manual Raingauges

M5: 5 inch (127 mm) orifice

M8: 8 inch (203 mm) orifice

Type of Automatic Graphical Recorders

HD: Hattori daily

HW: Hattori weekly

HL: Hattori long-term

KW: Kent weekly

OTAW: Ota weekly

#: Data logger

Table 7-3(2/3) INVENTORY OF NON REAL-TIME DID RAINFALL STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
					latitude	longitude	manual	auto	from	to	manual	auto	
	3907103	SM	JPS. Bagan Datoh	VD108408	03 58 55	100 47 30	09/32				M8		JPS
	3908101	SM	Ldg. New Coconut, Bagan Datoh	VD194363	03 56 30	100 52 05	01/26				M8		LDG
	3909100	SM	Bt. 5 Ldg. Nova Scotia	VD324385	03 57 45	100 59 10	01/13				M8		LDG
	3939104	SM	Ldg. Jendarata Telok Intan	VD301330	03 54 40	100 57 50	01/07				M8		LDG
	3911149	SM	Ldg. Susex	VD482422	03 59 40	101 07 40	01/14				M8		LDG
	3913146	SM	Ldg. Sg. Klah	VD698385	03 57 45	101 19 20	01/13				M8		LDG
	3913147	SM	Ldg. Sg. Sungkai	VD673394	03 58 15	101 18 00	01/18				M8		LDG
	4008102	SM	Ldg. Arcadia	VD119488	04 03 15	100 48 00	04/11				M8		LDG
	4009096	SM	JPS. Sg. Dedap	VD260510	04 04 30	100 55 40	02/64				M8		JPS
	4010097	SM	Ldg. Sabrang	VD348437	04 00 35	101 00 25	01/14				M8		LDG
	4010098	SM	Hospital Telok Intan	VD364460	04 01 50	101 01 15	1888				M5		RS
	4010138	SM	Peringkat 1 Sg. Manik	VD428492	04 03 30	101 04 40	02/35				M8		JPS
	4011139	SM	Rumah JPS. Sg. Megkuang	VD493434	04 00 20	101 08 10	07/19				M8		JPS
	4011144	SM	Rumah Kerajaan JPS. Chui Chak	VD533478	04 02 50	101 10 20	11/54				M8		JPS
	4012142	SM	Ldg. Bidor Bahru, Bidor	VD600523	04 05 15	101 17 10	01/09				M8		LDG
	4109094	SM	Kg. Gajah	VD276632	04 11 05	100 56 30	01/60				M8		JPS
	4109095	SM	Kg. Pulau Besar	VD329584	04 08 30	100 59 20	01/60				M8		JPS
	4110129	SM	Peringkat IV Sg. Manik	VD370548	04 06 35	101 01 35	01/53				M8		JPS
	4110136	SM	Rumah JPS. Labu Kubong	VD451576	04 08 05	101 05 05	12/63				M8		JPS
	4111135	SM	Ldg. Tai Seng	VD506594	04 09 35	101 08 55	11/63				M8		LDG
	4112141	SM	Ldg. Gedong, Bidor	VD670557	04 07 10	101 17 45	04/35				M8		JPS
	4209001	SM	Rumah Pam Telok Sarek	VD245712	04 15 20	100 54 45	09/36				M8		JKR
	4212128	SM	SRK Sri Kinjang Chendriang	VD607721	04 16 00	101 14 20	10/25				M5		JKR
	4212133	SM	Hospital Tapan	VD630648	04 12 00	101 15 35	1889				M5		RS

Class 2

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal

S: Secondary

Manual or Automatic Recording

M: Manual

A: Automatic (It is assumed that manual observation are also taken)

Other Details

T: Telemetric

Equipment

Daily Read Manual Raingauges

M5: 5 inch (127 mm) orifice

M8: 8 inch (203 mm) orifice

Type of Automatic Graphical Recorders

HD: Hattori daily

HW: Hattori weekly

HL: Hattori long-term

KW: Kent weekly

OTAW: Ota weekly

#: Data logger

Table 7-3(3/3) INVENTORY OF NON REAL-TIME DID RAINFALL STATIONS FOR OPERATIONAL SYSTEM.

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities
					latitude	longitude	manual	auto	from	to	manual	auto	
Class 2	4309092	SM	Rumah Pam Bota	VD234847	04 22 40	100 54 10	3/53				M8		JPS
	4311127	SM	Hospital Kampar	VD515773	04 18 50	101 09 20	1897				M8		RS
	4409090	SM	Ldg. Glenealy	VD265936	04 27 30	100 55 50	1/11				M8		LDG
	4409121	SM	Ldg. Nalia, Tronoh	VD294886	04 24 50	100 57 25	01/26				M8		LDG
	4410120	SM	Hospital Batu Gajah	VD381948	04 28 10	101 02 00	1888				M8		RS
	4410122	SM	Ldg. Hill Rise, Batu Gajah	VD383900	04 25 40	101 02 10	01/27				M8		LDG
	4508087	SM	Ldg. Sadang	QY199006	04 31 20	100 52 15	06/47				M8		LDG
	4509088	SM	Ldg. Parit	QY241010	04 31 35	100 54 30	05/13				M8		LDG
	4510117	SM	Ldg. Pnji	QY423014	04 31 50	101 04 20	10/12				M8		LDG
	4610112	SM	Ldg. Strathisla, Jelapang	QY432179	04 40 50	101 04 50	06/14				M8		LDG
	4610116	SM	Hospital Ipoh	QY442094	04 36 10	101 05 20	1891				M5		RS
	4611115	SM	Taman Bahagia, Tg. Rambutan	QY515173	04 40 30	101 09 15	01/16				M5		RS
	4708082	SM	Ldg. Bukit Berapi	QY150289	04 45 45	100 49 30	01/12				M8		LDG
	4710081	SM	Kolam Air JKR, Sg. Siput	QY420308	04 47 50	101 04 10	01/19				M8		JKR
	4711113	SM	Ldg. Chemor	QY488242	04 44 10	101 07 50	01/26				M8		JKR
	4810079	SM	Ldg. Changkat Salak	QY350373	04 51 20	101 00 15	15/47				M8		LDG
	4810080	SM	Ldg. Kemuning, Sg. Siput	QY411343	04 49 40	101 03 45	02/10				M8		LDG
	4811078	SM	Ldg. Elphil	QY460409	04 53 20	101 06	01/13				M8		LDG
	4909072	SM	Kolam Takongan Air Chendroh	QY321490	04 57 40	100 58 45	01/48				M8		JPS
	4909073	SM	Ldg. Kati, Kuala Kangsar	QY254446	04 55 15	100 55 10	01/26				M8		LDG
4910077	SM	Ldg. Sg. Krudda, Sg. Siput	QY447434	04 54 40	101 05 30	03/63				M8		LDG	
4911076	SM	Balai Polis Kg. Lintang	QY459464	04 56 15	101 06 10	06/68				M8		POLIS	
5009071	SM	Ldg. Kota Lima	QY315601	05 03 40	100 58 25	01/14				M8		LDG	
5109070	SM	Pekan Lenggong	QY326665	05 07 10	100 59 00	12/62				M8		JPS	

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

P: Principal  
S: Secondary

Manual or Automatic Recording

M: Manual

A: Automatic (It is assumed that manual observation are also taken)

Other Details

T: Telemetric

Equipment

Daily Read Manual Raingauges

M5: 5 inch (127 mm) orifice

M8: 8 inch (203 mm) orifice

Type of Automatic Graphical Recorders

HD: Hattori daily

HW: Hattori weekly

HL: Hattori long-term

KW: Kent weekly

OTAW: Ota weekly

#: Data logger

Table 7-4 INVENTORY OF NON REAL-TIME DID RIVER STAGE AND DISCHARGE STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Equipment Installed		No Operation Period		Current Equipment		Operation Authorities	Catchment Area (km <sup>2</sup> )
					latitude	longitude	manual	auto	from	to	manual	auto		
Class 1	4310401	PAHDSQ	Sg. Kinta at Weir G. Tg. Tualang	VD423785	04 19 20	101 04 30	09/73	09/73			S	OTFL	JPS	1,700
	4809443	PAHDSQT	Sg. Perak at Jam. Iskandar	QY304333	04 49 10	100 57 55	1915	09/67			S	SEFL	JPS	7,770
	4911445	PAHDSQT	Sg. Plus at Kg. Lintang	QY458463	04 56 15	101 06 10	1936	12/64	07/65	12/73	S	SEFL	JPS	1,090
Class 2	3913458	SAHDSQ	Sg. Sungkai at Sungkai	VD688414	03 59 15	101 18 50	1930	11/67			S	OTFL	JPS	289
	4012401	SAHDSQ	Sg. Bidor at Malayan Bidor Bhd.	VD615510	04 04 30	101 14 40	02/80	02/80			S	OTFL	JPS	210
	4111455	SAHDSQ	Sg. Btg. Padang at Tg. Keramat	VD504576	04 08 05	101 08 50	1930	12/62			S	OTFL	JPS	445
	4212467	SAHDSQ	Sg. Cendaniang at Bt. 32 Jalan Tapah	VD586683	04 13 55	101 13 10	1964	05/67	10/91	06/93	S	OTFL, #	JPS	119
	4511468	SAHDSQ	Sg. Pari at Jln. Siliabin, Ipoh	QY497018	04 32 00	101 08 20	02/72	02/72			S	OTFL	JPS	192
	4610466	SAHDSQ	Sg. RUI at Jam. Jalan Raya	QY418097	04 36 20	101 04 00	1915	06/64	04/70	11/72	S	OTFL	JPS	245
Class 3	5610401	SAHDSQ	Sg. Rui at Jam. Jalan Raya	QY419200	05 36 10	101 03 45	02/87	02/87			S	SEFL, #	JPS	352
	4311464	SAHDQ	Sg. Kampar at Kg. Lamjut	VD456798	04 20 10	101 06 05	1930	07/69			S	OTFL	JPS	432
	4611463	SAHDQ	Sg. Kinta at Tg. Rambutan	QY518166	04 40 10	101 09 30	1930	07/60			S	OTFL, #	JPS	246

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

- P: Principal
- S: Secondary

Manual or Automatic Recording

- A: Automatic

Other Details

- H: If stages are taken
- D: If discharge observation are taken
- S: If suspended sediment observation is taken
- Q: Water quality other than suspended sediment is taken
- T: Telemetric

Equipment

- S: Stick type manual gauge
- Type of Automatic Graphical Recorder
  - OTFW: Ott float-type weekly
  - OTFL: Ott float-type long-term
  - SEFL: SEBA float-type long-term
- #: Data logger

Table 7-5 INVENTORY OF NON REAL-TIME DID SUSPENDED SEDIMENT STATIONS FOR OPERATIONAL SYSTEM

Station Classification	Station Number	Station Index	Station Name	Grid Reference	Location		Date Sample Started	No Operation		Operation Authorities	Catchment Area (km <sup>2</sup> )
					latitude	longitude		from	to		
Class 1	4310501	P	Sg. Kinia at Weir G. Jg. Tualang	VD423785	04 19 20	101 04 30	08/77			JPS	1,700
	4809543	P	Sg. Perak at Jam. Iskandar	QY304333	04 49 10	100 57 55	10/77			JPS	7,770
	4911545	P	Sg. Plus at Kg. Lintang	QY438463	04 56 15	101 06 10	08/77	01/65	12/73	JPS	1,090
Class 2	3913558	S	Sg. Sungkai at Sungkai	VD688414	03 59 15	101 18 50	02/79			JPS	289
	4012501	S	Sg. Bidor at Malayan Bidor Bhd	VD615510	04 04 30	101 14 40	02/80			JPS	210
	4111555	S	Sg. Batang Padang at Tg. Keramat	VD504576	04 03 05	101 08 50	02/79			JPS	445
	4212567	S	Sg. Cenderiang at Bt. 32 Jin Tapah	VD586683	04 13 55	101 13 10	10/77			JPS	119
	4511568	S	Sg. Raia at Keramat Pulau	QY497018	04 32 00	101 08 20	02/79			JPS	192
	4610566	S	Sg. Pari at Jln. Siibin Ipoh	QY418097	04 36 20	101 04 00	11/79	04/70	11/72	JPS	245
	5610501	S	Sg. Rui at Jam. Jalan Raya	QT419200	05 36 10	101 06 45	01/80			JPS	352

Source: DID (1997). "Inventory of Hydrological Stations in Malaysia - 25th. Edition"

Type of Station

- P: Principal
- S: Secondary

\*Regular suspended sediment measurements are carried out at river stage and discharge stations in conjunction with discharge measurement at least once a month by using US DH48, DH59 or D49 suspended sediment samplers.

Table 7-6 PROFILE OF RIVER CHANNEL AND PROBABLE WATER LEVEL

Sta. No.	Accumulated Distance	River Bed Level (m above MSL)	Left Bank Level (m above MSL)	Right Bank Level (m above MSL)	Probable Water Level							Remakes	
					700m <sup>3</sup> /s	900m <sup>3</sup> /s	1000 m <sup>3</sup> /s (15-year)	1400 m <sup>3</sup> /s (20-year)	1700 m <sup>3</sup> /s (50-year)	1950m <sup>3</sup> /s (100-year)			
74	47.9	0.0	2.3	1.1	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	
73	51.7	3.8	2.7	2.7	2.16	2.16	2.16	2.16	2.17	2.17	2.18	2.19	
72	57.7	9.8	2.1	0.9	2.20	2.20	2.22	2.22	2.27	2.27	2.33	2.38	
71	60	12.1	2.1	1.5	2.22	2.26	2.28	2.40	2.40	2.40	2.49	2.58	
70	62.6	14.7	1.9	2.1	2.23	2.43	2.49	2.72	2.72	2.91	3.07	3.07	
69	66.3	18.4	2.0	1.8	2.36	2.74	2.84	3.20	3.20	3.47	3.67	3.67	
68	70	22.1	3.7	4.0	3.36	3.65	3.78	4.22	4.22	4.49	4.70	4.70	
67A	72.4	24.5	5.3	5.0	4.56	4.99	5.14	5.53	5.53	5.75	5.92	5.92	Kg. Pasir
66	77.2	29.3	6.0	6.1	6.37	6.92	7.06	7.22	7.22	7.30	7.38	7.38	
65Q	79.7	31.8	7.4	6.9	6.62	7.12	7.26	7.51	7.51	7.66	7.79	7.79	
65A	81.6	33.7	7.7	7.4	6.92	7.38	7.53	7.85	7.85	8.05	8.20	8.20	Kg. Gajah
64	86.5	38.6	9.5	8.4	7.79	8.16	8.31	8.76	8.76	9.03	9.23	9.23	
63	89.5	41.6	10.1	11.0	8.40	8.76	9.14	9.60	9.60	9.88	10.09	10.09	
62	95.5	47.6	11.6	11.3	10.41	10.76	11.35	11.77	11.77	12.04	12.24	12.24	
61	97.2	49.3	12.2	13.7	10.94	11.34	11.81	12.22	12.22	12.48	12.68	12.68	Kg. Pasir Sena
60	98	50.1	11.9	12.1	11.07	11.47	11.90	12.34	12.34	12.62	12.82	12.82	
59	98.6	50.7	12.6	14.2	11.18	11.58	12.00	12.46	12.46	12.75	12.98	12.98	
58	100.1	52.2	12.2	16.8	11.58	11.97	12.32	12.82	12.82	13.13	13.35	13.35	
57	101.1	53.2	12.8	14.0	11.88	12.27	12.57	13.10	13.10	13.43	13.68	13.68	
56	101.7	53.8	13.3	12.9	12.04	12.43	12.66	13.22	13.22	13.56	13.81	13.81	
54	103	55.1	13.7	16.2	12.51	12.86	13.02	13.56	13.56	13.90	14.15	14.15	
50	105.9	58.0	14.6	12.7	13.54	13.85	14.08	14.56	14.56	14.86	15.08	15.08	
46	109	61.1	12.8	14.1	14.17	14.49	14.68	15.19	15.19	15.49	15.70	15.70	
45	109.7	61.8	16.1	16.8	14.24	14.55	14.75	15.24	15.24	15.54	15.74	15.74	
44	111.4	63.5	14.6	17.8	14.62	14.96	15.17	15.71	15.71	16.04	16.29	16.29	
43	112.5	64.6	21.1	21.1	14.93	15.27	15.50	16.05	16.05	16.40	16.66	16.66	Idris Shah Bridge
42	114.3	66.4	17.3	16.2	15.63	15.71	15.94	16.52	16.52	16.88	17.16	17.16	
39	116.5	68.6	18.7	19.5	16.17	16.50	16.71	17.27	17.27	17.63	17.91	17.91	
36	119.4	71.5	19.9	20.1	17.28	17.62	17.78	18.35	18.35	18.74	19.03	19.03	
35	121.3	73.4	21.6	20.7	17.67	18.03	18.21	18.83	18.83	19.22	19.52	19.52	
34	123.1	75.2	29.3	21.6	18.25	18.60	18.72	19.35	19.35	19.72	20.01	20.01	
33	125.2	77.3	21.8	21.5	18.91	19.26	19.33	19.96	19.96	20.35	20.66	20.66	
31M	127.6	79.7	21.2	25.0	19.35	19.72	19.85	20.47	20.47	20.87	21.18	21.18	Kg. Kubang Haji
30M	129.5	81.6	23.5	23.0	19.75	20.12	20.29	20.91	20.91	21.32	21.63	21.63	
29	131.5	83.6	24.2	23.2	20.16	20.54	20.73	21.36	21.36	21.78	22.10	22.10	
28	133.1	85.2	21.4	21.6	20.53	20.92	21.12	21.76	21.76	22.18	22.50	22.50	Nordin Bridge

Source: Tumbok Block Integrated Rural Development Study Flood Investigation, May 1985



Table 7-7 POPULATION PROJECTION IN PERAK STATE

District	1991		2000		2010		2020		Growth Rate (1991/2020)
	Population	Percentage (%)	Population	Percentage (%)	Population	Percentage (%)	Population	Percentage (%)	
Kinta	628,303	33.4	741,145	34.2	888,744	35.0	1,105,917	35.7	1.97
Kuala Kangsar	146,684	7.8	167,079	7.7	197,778	7.8	240,400	7.8	1.72
Hulu Perak	81,524	4.3	88,331	4.1	93,488	3.7	111,911	3.6	1.10
Hilir Perak	202,227	10.8	219,666	10.1	235,069	9.2	289,341	9.3	1.24
Perak Tengah	75,676	4.0	82,500	3.8	95,600	3.8	108,200	3.5	1.24
Manjun	168,457	9.0	199,400	9.2	249,800	9.8	307,800	9.9	2.10
Kerian	148,575	7.9	162,950	7.5	185,650	7.3	208,800	6.7	1.18
Larut Matang & Selama	272,006	14.5	328,779	15.2	391,735	15.4	474,900	15.3	1.94
Batang Padang	156,514	8.3	178,877	8.2	203,940	8.0	252,732	8.2	1.67
Total	1,879,966	100.0	2,168,727	100.0	2,541,804	100.0	3,100,001	100.0	1.74

Source : Rancangan Struktur Sebahagian Daerah Kinta (Kinta District Structure Plan), 1996

Table 7-8(1/3) MAJOR DEVELOPMENT SCHEMES IN PERAK RIVER BASIN (1/3)

No.	Sector	Name	Owner	Location	Area (ha)	Cost (million RM)
1	Industry	Alor Bakong Integrated Development Project, Mk. Changkat Jong	MAJUPERAK Co., Ltd.	Langkap, Teluk Intan, Daerah Hilir Perak	77.3	50
2		Chemor Ceramic Park	PKNP	Jl. Jelapang, Chemor, Daerah Kinta	90.7	20.6
3		Fondari Park	PKNP	Estet Perindustrian Pengkalan II, Daerah Kinta	32.8	6.3
4		Tambun Industrial Estate	PYP Sdn., Ltd.	Tambun, Daerah Kinta	128.5	500
5		Bercham Industrial Estate	Sumitomi Sdn., Ltd.	Bercham, Daerah Kinta	4.1	6.4
6		Gopeng Industrial Park	Gopeng Land & Properties Sdn., Ltd.	Mk. Teja & Mk. Sg. Raya, Daerah Kinta	60.7	21.6
7		Tungxen Industrial Estate, Simpang Pulai, Ipoh	Tungxen Development Sdn., Ltd.	Batu 8, Mk. Sg. Raya, Daerah Kinta	40.5	7
8		IKS Industrial Estate, Kuala Kangsar	MIEL Sdn., Ltd.	Mk. Lubok Merbau/Kota Lama Kiri, Daerah Kuala Kangsar	40.9	111.9
9		Seri Iskandar Technology Park	Palmshine Development Sdn., Ltd. & Majlis Daerah Perak Tengah	Bandar Baru Seri Iskandar, Daerah Perak Tengah	61.1	200
10		Seri Iskandar Pharmaceutical Park	PKNP	Bandar Baru Seri Iskandar, Daerah Perak Tengah	114.3	29.5
11	Multi-Sector	Tapah New Town Development	Permodalan Perak, Ltd.	Tapah, Daerah Batang Padang	728.57	1,400
12		PKNP Complex, Meru Raya	PKNP	Taman Meru, Ipoh, Daerah Kinta	11.7	75.74
13		Greentown New Town Development	IZIN Development Sdn., Ltd.	Greentown, Bandaraya Ipoh	35.6	100
14		Tronoh Water Sports Complex	Lembayung Sukma Sdn., Ltd.	Tronoh, Daerah Kinta	477.6	1,000

Source : Perangkaan Utama Negeri Perak 1996 (Principal Statistics of Perak State 1996)

Table 7-8(2/3) MAJOR DEVELOPMENT SCHEMES IN PERAK RIVER BASIN (2/3)

No.	Sector	Name	Owner	Location	Area (ha)	Cost (million RM)
15	Multi-Sector	Kinta Highland Development Project	Rimba Raya Sdn., Ltd.	Dataran Tinggi Kinta	1,355.7	2,500
16		Tasek Perdana Town Center, Batu Gajah	Syarikat Maju Perak, Ltd.	Batu Gajah, Daerah Kinta	512.3	400
17		Lapangan Hill City Condominium	MORUBINA Sdn., Ltd.	Jl. Gopeng, Daerah Kinta	1.6	18
18		Seri Iskandar Town Development	SIDEC Sdn., Ltd.	Bandar Baru Seri Iskandar, Daerah Perak Tengah	4,047	20,000
19		Bagan Datoh Beach Development	Innovest Sdn., Ltd.	Bagan Datoh Daerah Hilir Perak	566.3	3,700
20	Trade	Medan Gopeng Business Complex, Ipoh (Megoplex Medan Gopeng)	PKNP	Jl. Gopeng, Ipoh, Daerah Kinta	0.6	15.2
21		Galaria Expo-Site, Ipoh (Silveritage Galleria)	PKNP	Jl. Gopeng, Ipoh, Daerah Kinta	4.5	12
22		Meru Raya Town	PKNP	Persimpangan Bertingkat Jelapang-Chemor, Daerah Kinta	461	1,478
23		Ipoh Metro Town	Intan Payung Sdn., Ltd.	Jl. Sultan Azlan Shah, Daerah Kinta	23.5	80
24		Ipoh Pulau Town	Desa Chandan Sdn., Ltd.	Simpang Pulau, Daerah Kinta	40.5	40
25		Ipoh Raya Town	KRIS Properties	Jl. Raja Muda Aziz, Ipoh, Daerah Kinta	8.1	10.4
26		Teluk Intan New Town	Bukit Mewah Development Sdn., Ltd.	Teluk Intan, Daerah Hilir Perak	11.5	180
27	Tourism	Sunway City	Kinta Valley Resort & Sunway Town	Tambun, Perak, Daerah Kinta	544.7	830.6
28		Gua Tempurung Development	Heritage Acres Sdn., Ltd.	Kg. Gunung Mesah, Daerah Kinta	2,428	500
29		Chenderoh Lake Golf Course Development, Lenggong, Perak	Land & General, Ltd.	Lenggong, Daerah Hulu Perak	428.1	141

Source : Perangkaan Utama Negeri Perak 1996 (Principal Statistics of Perak State 1996)

Table 7-8(3/3) MAJOR DEVELOPMENT SCHEMES IN PERAK RIVER BASIN (3/3)

No.	Sector	Name	Owner	Location	Area (ha)	Cost (million RM)
30	Special Project	Asean Medical College, Ipoh (Kolej Perubatan Antarabangsa)	Suci Teguh Holdings Sdn., Ltd.	Ipoh (Belakang Hospital Ipoh ), Daerah Kinta	2.4	40
31		Hospital Pantai Puteri	Paloh Medical Centre Sdn., Ltd.	Jl. Tambun, Ipoh, Daerah Kinta	1.1	24.8
32		University Commonwealth of Malaysia	Renong, Ltd	Bandar Baru Tapah, Daerah Batang Padang	1,249.7	1,000
33		Petronas Technology Institute	Petronas Property Management Service Sdn., Ltd.	Seri Iskandar, Daerah Perak Tengah	404.7	18
34		Office & Staff Housing Project of Perak Govt. Service	UDA Holdings Sdn., Ltd.	Mk. Sg. Terap, Daerah Kinta	242.3	160
35		Education Valley and Tourism Town	Gopeng, Ltd.	Bandar Gopeng, Daerah Kinta	3,657.3	2,652.5
36		New Privatised Complex of Perak	Konsortium Suvla Lines Sdn., Ltd.	Ipoh, Daerah Kinta	607.05	500
37		Perak Science Park of Education University		Kuala Kangsar	404.7	1,000

Source : Perangkaan Utama Negeri Perak 1996 (Principal Statistics of Perak State 1996)

Table 7-9 | RELATIONSHIP BETWEEN RIVER BASIN DIVIDE  
AND FOREST MANAGEMENT AREA

River Sub-Basin	Forest Management			
	Forest District	Forest Reserve	Number of Forest Compartment	Forest Area (km <sup>2</sup> )
Temengor	Hulu Peark	Belum	382	1,336.15
		Temengor	258	1,488.70
		Gerik	23	95.57
		Total	663	2,920.42
Chenderoh	Hulu Peark	Gerik	60	276.63
		Papulut	72	123.40
		Lepang Menering	18	38.04
		Padang Chong	10	12.04
		Bintang Hijau	232	585.07
		Air Cepam	51	230.92
		Gunung Lang	8	14.19
		Belukar Semang	40	90.74
		Sungai Kuak	15	14.99
		Kenderong	45	66.19
		Kuala Kangsar	Piah	237
	Bintang Hijau		23	55.06
	Total		811	2,053.85
	Pelus River	Kuala Kangsar	Piah	123
Korbu			311	890.97
Kledang Saiong			24	31.46
		Total	458	1,133.82
Upper Perak (Remaining Basin)	Kuala Kangsar	Piah	9	16.67
		Bintang Hijau	23	37.93
		Total	32	54.60
Kinta River	Kinta/Manjung	Bukit Kinta	360	691.84
		Kledang Saiong	72	100.43
		Parit	37	21.68
	Perak Selatan	Bujang Melaka	16	30.44
		Bukit Tapah	14	40.56
		Total	499	884.95
Bidor River	Perak Selatan	Bikam	4	4.01
		Bukit Slim	31	99.94
		Bukit Tapah	213	597.52
		Chikus	34	20.53
		Gunung Besout	9	15.91
		Total	291	737.91
Lower Perak	Kuala Kangsar	Kledang Saiong	140	165.17
		Bubu	121	180.29
		Bintang Hijau	6	19.25
	Kinta/Manjung	Kledang Saiong	22	22.28
		Parit	18	20.20
		Total	307	407.19
Grand Total			3,061	8,192.74

Source : Estimation was made using Forest Compartment Map and "Rancangan Tebangan" provided by Forestry Department, Perak State.

Table 7-10 NECESSARY WATERSHED INFORMATION FOR ESTABLISHMENT OF RIVER INFORMATION SYSTEM

Theme	Map (Scale)	Agency as Data Source	Renewal Interval	Components of Map Information			System Construction Program	Existence of Digital Data
				Component	Type	Attributes		
Topography	Topographic Map (1:50,000)	DSMM	More Than 10 Years	Contour	Polygon	Altitude	Operational	Under Preparation
				Geographic Features	Polygon/Line/Point	Name		
Geology	Geological Map (1:500,000)	DGSM	Unnecessary	Classification	Polygon	Class	Operational	Non
				Fault	Line	-		
Soil Cover	Soil Map (1:500,000)	DOA	Unnecessary	Classification	Polygon	Class	Operational	Existing
				Classification	Polygon	Class		
Land Use	Land Use Map (1:50,000)	DOA	5 Year	Classification	Polygon	Class	Operational	Existing
				Classification	Polygon	Class		
Regional Development	Future Land Use Plan (1:250,000)	TCPD	Target Year : 2020	Classification	Polygon	Class	Operational	Non
				Development	Point	Explanation		
				Population	-	Table		
Logging/Forest Conservation	Forest Reserve Map (1:50,000)	FD	1 Year (Only Data Base)	Forest Reserve	Polygon	Name	Operational	Non
				Logging Record	-	Table		
				Compartment	Polygon	Name		
Soil Conservation	Soil Erosion Map (1:25,000)	DOA (Under Studying)	Unnecessary	Classification	Polygon	Erosion Rate	Future	Planning in Future
				Classification	Polygon	Erosion Rate		
River Reserve	Cadastral Map (1:790)	DOLM	Occasion at Need	Land Parcel	Line	Lot No	Operational	Existing (Only Map)
				Land Parcel	Polygon	Parcel Data		

Table 7-11 DATA INPUT AND RENEWAL SYSTEM OF WATERSHED INFORMATION

Theme	Map (Scale)	Data Source	Data Form	Existence of Digital Data	Data Input Measures	Necessary Interval of Data Renewal	Data Volume (Approx. Sheet Size)
Topography	Topographic Map (1:50,000)	DSMM	Map & Attributes	Non	Digitizer Input	More Than 10 Years	28 Sheet (A2)
Geology	Geological Map (1:500,000)	DGSM	Map & Attributes	Non	Digitizer Input	Unnecessary	1 Sheet (A2)
Soil Cover	Soil Map (1:500,000)	DOA	Map & Attributes	Existing	Copy	Unnecessary	1 Sheet (A2)
Land Use	Land Use Map (1:50,000)	DOA	Map & Attributes	Existing	Copy	5 Years	28 Sheets (A2)
Regional Development	Future Land Use Plan (1:250,000)	TCPD	Map & Attributes, Table (Population Projection)	Non	Digitizer & Keyboard Input	Target Year : 2020	2 Sheets (A2)
Logging/Forest Conservation	Forest Reserve Map (1:50,000)	FD	Map & Attributes, Table (Logging Records)	Non	Digitizer & Keyboard Input	Unnecessary	1 Sheet (A1)
River Reserve	Cadastral Map (1:790)	PWB DOLM	Map & Attributes, Table (Land Registration)	Existing Non	Copy Keyboard Input	Table : 1 Year Occasion at Need	4,000 Compartments in Perak State 1,200 Sheets (A1) 55,000 Parcels

Table 7-12(1/5) OBJECTIVE INFORMATION TO BE DISSEMINATED (MAP INFORMATION)

Category	Name of Map and Scale of Original Map	Contents in the Map		Renewal Interval of Information	Agency as Data Source	Dissemination Level*	
		Name of Data	Type of Data				Attribute
General Information	1 Base Map (Scale: 1/500,000)	1.1.1 Basin Boundary	Polygon	Name of sub-basin	DSMM	Level 2	
		1.1.2 River Line	Line	Name of river			
		1.1.3 District Boundary	Polygon	Extent of sub-basin			
		1.1.4 Major Road	Line	Name of road			
		1.1.5 Major Town	Point	Name of town			
		1.1.6 Major Bridge	Point	Name of bridge			
Hydrological Information	2 Location Map of Gauging Point (Scale: 1/500,000)	2.1.1 Gauging Point	Point	Organization to maintain Structural features	DID and MMS	Level 2	
				Name of station			
				Type of station			
Information on Flood Mitigation	3 Location Map of Flood Mitigation Scheme (Scale: 1/500,000)	3.1.1 Stretch of channel works	Line	Current equipment	DID	Level 2	
				Catchment area (for water level St.)			
				Gauging data			
				Name of scheme			
				Type of work			
Information on Water Supply Management	3 Flood Inundation Area (Scale: 1/500,000)	3.1.2 Dam and Other Flood Mitigation Structure	Point	Design flood level	DID and TNB	Level	
				Competent agency			
				Completion year			
	4 Location Map of Intake Point (Scale: 1/500,000)	3.2.1 Flood Inundation Area	Polygon	Name of scheme	DID	Annually	Level 1
		3.2.2 Major Town Area	Polygon	Type of work			
		3.2.3 Mukim Boundary	Polygon	Design flood level			
		4.1.1 Intake Point	Point	Competent agency			
Information on Water Supply Management	4 Location Map of Intake Point (Scale: 1/500,000)			Flood Scale (recurrence probability)	PWB and DID	Level 2	
				Name of town			
				Name of Mukim			
				Name of intake facility			
				Purpose of intake			
				Structural type of intake			
				Intake capacity			
Information on Water Supply Management	4.1.2 Irrigation Scheme			Monthly average intake discharge	DID	Level 2	
				Name of supply area			
				Extent of supply area (ha)			
				Name of irrigation scheme			
				Name of intake point			
Information on Water Supply Management	4.1.3 Domestic and Industrial Supply Area			Intake capacity	PWB	Level 2	
				Clopping schedule			
				Monthly average intake discharge			
Information on Water Supply Management	4.1.3 Domestic and Industrial Supply Area			Name of service area	PWB	Level 2	
				Name of intake point			
Information on Water Supply Management	4.1.3 Domestic and Industrial Supply Area			Intake capacity	PWB	Level 2	
				Daily average water demand			

\*: Level 1 disseminates to the government agency only, while Level 2 opens to Public



Table 7-12(2/5) OBJECTIVE INFORMATION TO BE DISSEMINATED  
(MAP INFORMATION)

Category	Name of Map and Scale of Original Map	Contents in the Map		Renewal Interval of Information	Agency as Data Source	Dissemination Level*	
		Name of Data	Type of Data				Attribute
Information on River Environmental Management	5.1 Location Map of River Water Quality Sampling Station (Scale: 1/500,000)	5.1.1 Sampling Station	Point	Name of sampling station	DOE	Level 2	
	5.2 Location Map of Major Pollutant Sources (Scale: 1/500,000)	5.2.1 Major Pollutant Sources	Point	Type of industry Code of pollutant sources	DOE	Level 1	
	6.1 Location Map of Protected Area (Scale: 1/500,000)	6.1.1 Protected Area	Polygon	Name of Protected Area Extent of protected area (ha)	DWNP	Level 2	
	7.1 Location Map of River Parks (Scale: 1/500,000)	7.1.1 River Parks	Point	Name of River Parks	LOCAL AUTHORITY	Level 2	
	7.2 Location Map of Camp Sites (Scale: 1/500,000)	7.2.1 Camp Sites	Point	Name of Camp Sites	Yayasan Perak	Level 2	
	7.3 Location Map of Royal Mausoleums (Scale: 1/500,000)	7.3.1 Royal Mausoleums	Point	Name of Royal Mausoleums	Yayasan Perak	Level 2	
	8.1 Geological Map (Scale: 1/500,000)	8.1.1 Geological Classification	Polygon Line	Name of class Fault	DGSM	Level 2	
	9.1 Reconnaissance Soil Map (Scale: 1/500,000)	9.1.1 Soil Classification	Polygon	Name of class	DOA	Level 2	
	10 Land Use Map (Scale: 1/500,000)	10.1.1 Land Use Classification	Raster Polygon	Name of Class Name of Class	DOA	Level 2 Level 1	
	11 Structure Plan (Scale : Variable)	11.1.1 Development Corridors	Raster	Name of Corridor	TCPD	Level 2 Level 1	
		11.1.2 Future Land Use	Polygon	Name of Class			
	12 Forest Reserve Map (Scale: 1/50,000)	12.1.1 Forest Reserve and Protection Forest	11.1.3 Major Projects	Point	Explanation Table	FD	Level 2 Level 1
			Raster	Name of Protection Forest			
13 Cadastral Map (Scale : 1/790)	13.1.1 Land Parcel Boundary 13.1.2 Land Parcel No.	Polygon	Name of Forest Reserve	Occasion at Need	DOLM, PWB	Level 2 Level 1	
		Point	Name of Protection Forest and Area				
		Line	Land Registration			Level 1	

\*: Level 1 disseminates to the government agency only, while Level 2 opens to Public

Table 7-12(3/5) OBJECTIVE INFORMATION TO BE DISSEMINATED  
(TABULAR INFORMATION)

Category	Name of Table	Renewal Interval of Information	Agency as Data Source	Dissemination Level*
Hydrological Information	1.1 Inventory of gauging station	Annually	DID	Level 2
	1.2 Hourly rainfall in northeast monsoon period (Oct. - Jan.)**	Annually & Real-time	DID	Level 2
	1.3 Daily and monthly rainfall	Annually	DID	Level 2
	1.4 Annual maximum rainfall	Annually	DID	Level 2
	1.5 Hourly river stage/discharge in northeast monsoon period(Oct. - Jan.)**	Annually & Real-time	DID	Level 2
	1.6 Daily and monthly river stage/discharge	Annually	DID	Level 2
	1.7 Annual maximum and minimum river stage/discharge	Annually	DID	Level 2
	1.8 Discharge rating table	Annually	DID	Level 2
	1.9 Monthly suspended sediment	Annually	DID	Level 2
	1.10 Annual maximum and minimum suspended sediment	Annually	DID	Level 2
	1.11 Sediment rating table	Annually	DID	Level 2
	1.12 Hourly and/or daily dam outflow/ discharge	Real-time	TNB	Level 2
	1.13 Monthly meteorological information	Annually	MMS (statistical book)	Level 2
	1.14 Tidal levels	Annually	Royal Malaysian Navy	Level 2
Information on Flood Mitigation	2.1 Inventory of Existing Flood Mitigation Scheme	As required	DID	Level 2
	2.2 Inventory of Projected Flood Mitigation Scheme	As required	DID	Level 2
	2.3 Probable Flood Peak Discharge	As required	DID	Level 2
	2.4 Longitudinal Profile of River Channel and Probable Flood Level	As required	DID	Level 2
	2.5 River Channel Flow Capacity	As required	DID	Level 2
	2.6 Flood Damage Record	Annually	DID	Level 2
Information on Water Supply Management	3.1 Inventory of Intake Facility		PWB and DID	Level 2
	3.2 Inventory of Irrigation Scheme		DID	Level 2
	3.3 Inventory of Domestic and Industrial Water Supply		PWB	Level 2
	3.4 Monthly Water Demand		PWB and DID	Level 2

\*: Level 1 disseminates to the government agency only, while Level 2 opens to Public

\*\* : Include the real-time information

Table 7-12(4/5) OBJECTIVE INFORMATION TO BE DISSEMINATED  
(TABULAR INFORMATION)

Category	Name of Table	Renewal Interval of Information	Agency as Data Source	Dissemination Level*
Information on River Environmental Management	4.1 Inventory of River Water Quality Sampling Station	Once a year	DOE	Level 2
	4.2 Inventory of Pollutant Sources	Once a year	DOE	Level 1
	4.3 River Water Quality Results on human life	3 times a year	DOE	Level 2
	4.4 River Water Quality Results on other items	3 times a year	DOE	Level 2
	4.5 Effluent Water Quality & Discharge survey data	3 times a year	DOE	Level 2
	4.6 General Rating Scale for WQI	Database	DOE	Level 2
	4.7 Effluent Water Quality Standards	Database	DOE	Level 2
Information on Watershed Management	5.1 Major Projects (Development Category, Name, Owner, Location, Area, Cost)	Target Year : 2020	TCPD	Level 1
	6.1 Forest Compartment Relational Table	Non	FD	Level 1
	6.2 Forest Management Record Table	Yearly		
	6.3 Logging Volume (Computation Result)	-		
	7.1 Land Registration Table	Occasion at Need	DOLM	Level 1

\*: Level 1 disseminates to the government agency only, while Level 2 opens to Public

Table 7-12(5/5) OBJECTIVE INFORMATION TO BE DISSEMINATED  
(GRAPHIC INFORMATION)

Category	Name of Graph	Renewal Interval of Information	Agency as Data Source	Dissemination Level*
Hydrological Information	1.1 Rainfall intensity curve at Ipoh	-	DID	Level 2
	1.2 Mean monthly rainfalls at sub-regions	-	DID	Level 2
Information on Flood Mitigation	2.1 Longitudinal channel profile and probable water level		DID	Level 2
	2.2 Profile of river channel flow capacity		DID	Level 2
Information on River Environmental Management	3.1 Water Quality Results of each sampling point	Once a year	DOE	Level 2
	3.2 Effluent Load of Major Pollutant Sources	Once a year	DOE	Level 1
	3.3 Longitudinal Variation of River Water Quality	Once a year	DOE	Level 2
	3.4 Annual Trend of Water Quality at Class 1 point (3 points)	Once a year	DOE	Level 2
Information on Watershed Management	4.1 Distribution of Aquatic Wildlife	Once per 3 years	DWNP	Level 2
	5.1 Historical Logging Volume	1 Year	FD	Level 1

\*: Level 1 disseminates to the government agency only, while Level 2 opens to Public

Table 7-13(1/2) INVENTORY OF ALL HARDWARE AND SOFTWARE IN OPERATIONAL SYSTEM

Hardware Name	Function	Specification	Location
HP C200 UNIX WORKSTATION	<ul style="list-style-type: none"> <li>• GIS Database Server</li> <li>• GIS Private Web Server</li> <li>• GIS Global Web Server</li> <li>• Internet Map Server</li> </ul>	<ul style="list-style-type: none"> <li>• RISC CPU: 200 MHz</li> <li>• Memory: 128 MB</li> <li>• Hard Disk: 9 GB</li> <li>• Two Network Cards</li> </ul>	DID HQ in KL
HP C200 UNIX WORKSTATION	<ul style="list-style-type: none"> <li>• TM Data Server</li> <li>• TM Private Web Server</li> <li>• TM Global Web Server</li> </ul>	<ul style="list-style-type: none"> <li>• RISC CPU: 200 MHz</li> <li>• Memory: 128 MB</li> <li>• Hard Disk: 8 GB</li> <li>• Two Network Cards</li> </ul>	DID HQ in KL
HP Kayak XA Pentium II Personal Computer	<ul style="list-style-type: none"> <li>• GIS Database Creation Machine</li> <li>• CD-R Backup Machine</li> </ul>	<ul style="list-style-type: none"> <li>• Intel Pentium II 233 MHz CPU</li> <li>• 64 MB Memory</li> <li>• 2.5 GB Hard disk</li> </ul>	DID HQ in KL
HP Vectra VL 6 Pentium II Personal Computer	<ul style="list-style-type: none"> <li>• Real-time Data Transmission Machine</li> </ul>	<ul style="list-style-type: none"> <li>• Intel Pentium II 233 MHz CPU</li> <li>• 64 MB Memory</li> <li>• 2.5 GB Hard disk</li> </ul>	DID PERAK in IPOH
Calcomp Drawing Board III Digitizer Model134480	<ul style="list-style-type: none"> <li>• GIS Graphic Data Input</li> </ul>	<ul style="list-style-type: none"> <li>• A0 Size Tablet</li> <li>• 16 Button Cordless Coursor</li> </ul>	DID HQ in KL
HP DesignJet 750C Plotter	<ul style="list-style-type: none"> <li>• Map Output Device</li> </ul>	<ul style="list-style-type: none"> <li>• A0 Size Paper</li> <li>• Color Ink Jet</li> </ul>	DID HQ in KL
HP LaserJet 6MP Printer	<ul style="list-style-type: none"> <li>• Document Output Device</li> </ul>	<ul style="list-style-type: none"> <li>• A4 Size Paper</li> <li>• Post Scrip</li> </ul>	DID HQ in KL
HP LaserJet 6MP Printer	<ul style="list-style-type: none"> <li>• Document Output Device</li> </ul>	<ul style="list-style-type: none"> <li>• A4 Size Paper</li> <li>• Post Scrip</li> </ul>	DID PERAK in IPOH
3COM Superstack II PS HUB 40 TP	<ul style="list-style-type: none"> <li>• Private Net Connect HUB in KL</li> </ul>	<ul style="list-style-type: none"> <li>• 12 Ports</li> <li>• 100 MB</li> <li>• Optical Fiber Transceiver</li> </ul>	DID HQ in KL
3COM Superstack II PS HUB 40 TP	<ul style="list-style-type: none"> <li>• Global Net Connect HUB in KL</li> </ul>	<ul style="list-style-type: none"> <li>• 12 Ports</li> <li>• 100 MB</li> </ul>	DID HQ in KL
3COM Office Connect HUB	<ul style="list-style-type: none"> <li>• Private Net Connect HUB in IPOH</li> </ul>	<ul style="list-style-type: none"> <li>• 8 Ports</li> <li>• 10 MB</li> </ul>	DID PERAK in IPOH
Cisco 2503 Router	<ul style="list-style-type: none"> <li>• ISDN Link in KL</li> </ul>	<ul style="list-style-type: none"> <li>• 128 kbps ISDN Line Modem</li> </ul>	Agrolink in KL
Cisco 2503 Router	<ul style="list-style-type: none"> <li>• ISDN Link in IPH</li> </ul>	<ul style="list-style-type: none"> <li>• 128 kbps ISDN Line Modem</li> </ul>	DID PERAK in IPOH

Table 7-13(2/2) INVENTORY OF ALL HARDWARE AND SOFTWARE IN OPERATIONAL SYSTEM

Hardware Name	Function	Specification	Location
HP SureStore DAT	• Server Backup Driver	• 4mm Tape	DID HQ in KL
Yamaha CDR400tx	• CD Recorder for Distributing Data	• 4X Write / 6X Read	DID HQ in KL
PK 600 AVR	• To save unstable power supply for Digitizer	• 600 VA	DID HQ in KL
PK 600 AVR	• To save unstable power supply for PC and Printer	• 600 VA	DID HQ in KL
PK 1052C/CX UPS	• Back up power for the GIS server computer	• 4 hours full load	DID HQ in KL
PK 1052C/CX UPS	• Back up power for the TM server computer	• 4 hours full load	DID HQ in KL
PK 1052C/CX UPS	• Back up power for the Real-time system in IPOH	• 4 hours full load	DID PERAK in IPOH
3COM Ethernet Card	• Upgrading exist TeleWin PC in IPOH	• 10/100 BaseT	DID PERAK in IPOH
Arc Info	• GIS Database Management	• Full Option	DID HQ in KL
	• GIS Analysis tools	• Version 7.1.2	
Arc View PC	• GIS Database Input Tool	• Version 3	DID HQ in KL
Arc View IMS	• GIS Information Distribution Tool	• Version 1	DID HQ in KL
Netscape Suitespot	• Web Server Software for GIS Server	• Version 3.1	DID HQ in KL
Netscape Suitespot	• Web Server Software for TM Server	• Version 3.1	DID HQ in KL
HP JetDirect Printer Server	• Unix Printer Utilities Software	• Full Version	DID HQ in KL

Table 7-14 PROCUREMENT COST OF HARDWARE AND SOFTWARE FOR THE OPERATIONAL SYSTEM

Item	Quantities	Unit Cost RM	Cost RM
<b>I. Hardware</b>			
(1) Workstation	2 units	111,490	222,980
(2) Personal Computer	2 units	10,980	21,960
(3) Digitizer	1 unit	15,480	15,480
(4) Plotter	1 unit	23,300	23,300
(5) Laser Jet Printer	2 units	3,760	7,520
(6) HUB(10Mb)	2 units	690	1,380
(7) HUB(100Mb)	1 unit	2,940	2,940
(8) Modular Router	2 units	11,700	23,400
(9) 4 mm Type Driver	1 unit	4,930	4,930
(10) CD-R Driver	1 unit	2,650	2,650
(11) AVR	2 units	260	520
(12) UPS	3 units	4,980	14,940
(13) Ethernet Cable	16 units	50	800
(14) Power Supply Cable	3 meters x 3	25	75
(15) Power Supply Cable	5 meters x 3	40	120
(16) Ethernet Card	1 unit	440	440
(17) Consumption	Plotter Ink x 5 sets	690	
(18) Consumption	Plotter Paper x 5 sets	245	
(19) Consumption	CD-R disc x 20 pices	20	
(20) Consumption	Printer toner x 2 set	380	
(21) Consumption	DAT/DDS Type x 1 set	340	
Sub-total			347,660
<b>2. Software</b>			
(1) Arc/Info	1	350,310	350,310
(2) Arc/View	1	36,110	36,110
(3) Web Server Soft	2	33,000	66,000
(4) Printer Server Soft	2	480	960
(5) Installation	1	15,000	15,000
Sub-total			468,380
<b>Grand Total</b>			<b>816,040</b>

Table 7-15 COST FOR DEVELOPMENT OF APPLICATION PROGRAM FOR  
TELEMETRY SYSTEM UNDER THE OPERATIONAL SYSTEM

Description	Unit Cost (RM)	Cost (RM)
1. Data Transmission Application: a. Reprogramming Telewin to enable: <ul style="list-style-type: none"> <li>• Manual key-in dam data.</li> <li>• Calculating all station's discharge data.</li> <li>• Alarm generation.</li> <li>• Data feeding.</li> </ul> b. Installation, Testing and Commissioning. c. Creation of manual.	42,000	42,000
2. Web Server Communication: a. To write data transfer scheduler program. b. Installation, Testing and Commissioning. c. Creation of manual.	25,200	25,200
3. Web Viewer Application: a. Web-page design with generation and web server data integration and application. b. Installation, Testing and Commissioning. c. Creation of manual.	66,920	66,920
Total		134,120



Table 7-16 COST FOR INITIAL DATA INPUT TO  
THE OPERATIONAL SYSTEM (1/2)

Description	Quantities	Unit Cost (RM)	Cost (RM)
1. Digitizing and Data Import of Map Information			
(1) Basin Boundary	28 sheets	2,400	66,900
(2) Contour	28 sheets	5,500	153,400
(3) River	28 sheets	5,500	153,400
(4) District Boundary	28 sheets	3,400	94,400
(5) Major Road and Railway	28 sheets	2,800	78,700
(6) Major Town	13 sheets	2,800	36,500
(7) Major Bridge	9 sheets	2,400	21,500
(8) Real-time Gauging Station	12 sheets	2,400	28,700
(9) Non-real time Gauging Station	23 sheets	2,400	54,900
(10) Mean Monthly Rainfall	5 sheets	2,800	14,100
(11) Location of Channel Stretch	10 sheets	2,800	28,100
(12) Flood Mitigation Scheme	10 sheets	2,400	23,900
(13) Flood Inundation Area	6 sheets	3,100	18,500
(14) Intake Point	2 sheets	2,400	4,800
(15) Domestic/Industrial Supply Area	2 sheets	3,100	6,200
(16) Water Quality Sampling Points	2 sheets	2,400	4,800
(17) Major Pollutant Sources	2 sheets	2,400	4,800
(18) Protected Area	2 sheets	2,400	4,800
(19) Distribution of Aquatic Wildlife	2 sheets	2,400	4,800
(20) River Parks	9 sheets	2,400	21,500
(21) Camp Sites	9 sheets	2,400	21,500
(22) Royal Mausoleums	9 sheets	2,400	21,500
(23) Geology	2 sheets	5,500	11,000
(24) Soil	2 sheets	3,200	6,500
(25) Land Use	2 sheets	3,200	6,500
(26) Structure Plan	1 sheets	3,200	3,200
(27) Future Land Use Plan	1 sheets	3,200	3,200
(28) Forest Reserve	2 sheets	3,200	6,500
Sub-total			904,600

Table 7-16 COST FOR INITIAL DATA INPUT TO  
THE OPERATIONAL SYSTEM (2/2)

Description	Quantities	Unit Cost (RM)	Cost (RM)
<b>2. Data Import and Input of Tabular Information</b>			
(1) Cadastral Map (data conversion)	1,200 files	10	12,000
(2) Hydrological Information	1,100 files	10	11,000
(3) Land Registration Table	500 records	6	3,000
(4) Miscellaneous			5,000
Sub-total			31,000
<b>3. Input of Graphic Information</b>			
(1) Rainfall Intensity Curve at IPOH	1 sheet	300	300
(2) Channel Profile 1	1 sheet	300	300
(3) Profile of River Channel Flow Capacity	1 sheet	300	300
(4) Annual Trend of Water Quality	3 sheets	300	800
(5) Historical Logging Volume	1 sheet	300	300
Sub-total			1,900
Grand Total			937,500

Table 7-17 CASH FLOW OF ECONOMIC COST AND BENEFIT OF THE OPERATIONAL SYSTEM  
ESTABLISHED IN THE STUDY PERIOD

(Unit: RM million)

Year	(1) Investment Cost	(2) Accumulated Investment Cost	(3) Maintenance Cost *	(4) Total Cost (1)+(3)	(5) Full Benefit	(6) Actual Benefit	(7) (1)-(6)
1998	2.92	2.92		2.92			2.92
1999			0.21	0.21	0.00	0.84	-0.63
2000			0.21	0.21	0.00	0.84	-0.63
2001			0.21	0.21	0.00	0.84	-0.63
2002			0.21	0.21	0.00	0.84	-0.63
2003			0.21	0.21	0.00	0.84	-0.63
2004			0.21	0.21	0.00	0.84	-0.63
2005			0.21	0.21	0.00	0.84	-0.63
2006			0.21	0.21	0.00	0.84	-0.63
2007			0.21	0.21	0.00	0.84	-0.63
2008			0.21	0.21	0.00	0.84	-0.63
Total	2.92	2.92	2.10	5.02	0.00	8.40	

EIRR= 17.1%

Table 9-1 FLOW REGIME AND NUMBER OF DAYS TO EXCEED CRITICAL MINIMUM DISCHARGE

(1) Item of Daily Discharge	(2) Critical Minimum Discharge	Year	Flow Regime			Number of Days			
			Ave.	95% Exceeding	Min.	(3) Days of (1)>(2)	(4) Days of (1)<(2)	(5) Days of Non- recording	(6) (3)/((3)+(4))
Outflow from Chenderoh Dam	84.9 m <sup>3</sup> /s* (3000 cusec)	1986	180	104	96	314	0	51	100%
		1987	211	119	97	324	0	41	100%
		1988	359	237	187	95	0	271	100%
		1989	190	118	100	278	0	87	100%
		1990	171	91	77	285	7	73	98%
		1991	170	103	82	339	1	25	100%
		1992	145	95	37	321	8	37	98%
		1993	153	72	33	205	17	143	92%
		Total	183	98	33	2,161	33	728	98%
Runoff Discharge from Pelus River Basin	28.3 m <sup>3</sup> /s** (1000 cusec)	1986	29	19	18	151	182	32	45%
		1987	45	19	18	145	190	30	43%
		1988	35	15	7	242	117	7	67%
		1989	41	22	21	255	51	59	83%
		1990	28	17	15	99	222	44	31%
		1991	31	12	5	127	213	25	37%
		1992	31	17	15	148	187	31	44%
		1993	42	23	22	173	68	124	72%
		Total	35	17	5	1,340	1,230	352	52%
Flow Discharge at Iskandar Bridge	113.2 m <sup>3</sup> /s*** (4000 cusec)	1986	205	128	122	346	0	19	100%
		1987	261	140	117	354	0	11	100%
		1988	395	251	228	95	0	271	100%
		1989	226	147	133	337	0	28	100%
		1990	193	108	93	300	30	35	91%
		1991	199	123	112	362	3	0	99%
		1992	175	116	78	350	10	6	97%
		1993	213	121	100	329	5	31	99%
		Total	217	123	78	2,473	48	401	98%

\* : Minimum outflow discharge from Chenderoh Dam

\*\* : Minimum runoff to guarantee the discharge at Iskandar bridge in case of dam out flow of 3000 cusec

\*\*\*: Minimum flow discharge to be guaranteed by outflow from Chenderoh Dam

Table 9-2 WATER DEFICIT OF PERAK RIVER AT ISKANDAR BRIDGE

Year	Deficit Period	Number of Deficit Days	Average Deficit (m <sup>3</sup> /s)	Maximum Deficit (m <sup>3</sup> /s)
1990	Aug. 04 - Aug. 05	2	1.25	1.44
	Aug. 12 - Aug. 12	1	7.65	7.65
	Aug. 14 - Aug. 14	1	0.53	0.53
	Aug. 16 - Aug. 22	7	8.91	17.76
	Aug. 24 - Aug. 27	4	9.09	20.12
	Sep. 02 - Sep. 16	15	5.80	11.03
1991	Jul. 14 - July 14	1	0.27	0.27
	Sep. 01 - Sep. 01	1	0.30	0.30
1992	Jan. 20 - Jan. 20	1	5.87	5.87
	Jan. 30 - Jan. 31	2	0.40	0.58
	Feb. 04 - Feb. 04	1	0.83	0.83
	Mar. 15 - Mar. 15	1	5.05	5.05
	Mar. 22 - Mar. 22	1	8.11	8.11
	Oct. 04 - Oct. 05	2	16.50	33.00
	Oct. 07 - Oct. 08	2	23.84	35.36
	Sep. 20 - Sep. 20	1	13.69	13.69
1993	Apr. 10 - Apr. 10	1	6.34	6.34
	Aug. 09 - Aug. 10	2	4.06	5.99
	Aug. 12 - Aug. 12	1	1.69	1.69
	Sep. 20 - Sep. 20	1	13.69	13.69
Total		48	7.12	35.36

Note: Deficit is counted when the daily average flow discharge at Iskandar Bridge is less than 4000cusec (113.2m<sup>3</sup>/s).

Table 9-3 DAM RESERVOIR VOLUME TO MAINTAIN THE GUARANTEED DISCHARGE  
AT ISKANDAR BRIDGE

Date			(1) Observed Outflow from Dam (m <sup>3</sup> /s)	(2) Observed Discharge at Iskandar Bridge (m <sup>3</sup> /s)	(3) Observed Deficit * at Iskandar Bridge (m <sup>3</sup> /s)	(4) Revised ** Outflow from Dam (m <sup>3</sup> /s)	(5) Reservoir Volume Used to Supply the Deficit ((4)-(1)) x 86,400 (10 <sup>3</sup> m <sup>3</sup> )
Year	Mon.	Day					
1990	Aug.	16	94.1	111.2	2.0	96.1	172.8
1990	Aug.	17	93.7	112.7	0.5	94.2	47.5
1990	Aug.	18	89.9	107.5	5.7	95.5	489.9
1990	Aug.	19	91.2	108.4	4.8	96.0	414.7
1990	Aug.	20	82.2	99.3	13.9	96.2	1203.6
1990	Aug.	21	78.5	95.5	17.7	96.2	1528.4
1990	Aug.	22	78.5	95.4	17.8	96.3	1534.5
1990	Aug.	23	120.8	137.5	0.0	96.5	-2095.2
1990	Aug.	24	84.0	100.7	12.5	96.5	1081.7
1990	Aug.	25	78.2	94.8	18.4	96.6	1588.9
1990	Aug.	26	76.5	93.1	20.1	96.7	1738.4
1990	Aug.	27	76.9	93.3	19.9	96.9	1720.2
1990	Aug.	28	117.1	133.5	0.0	96.9	-1749.6
1990	Aug.	29	140.0	156.4	0.0	96.8	-3735.1
1990	Aug.	30	132.6	150.6	0.0	95.2	-3231.4
1990	Aug.	31	95.2	115.0	0.0	93.4	-158.1
1990	Sep.	1	126.5	143.6	0.0	96.1	-2622.2
1990	Sep.	2	88.1	108.0	5.2	93.3	452.7
1990	Sep.	3	85.3	103.5	9.7	95.1	838.9
1990	Sep.	4	89.4	107.1	6.1	95.5	527.0
1990	Sep.	5	87.0	104.0	9.2	96.2	796.6
1990	Sep.	6	85.2	102.2	11.0	96.3	953.0
1990	Sep.	7	85.4	102.2	11.0	96.4	951.3
1990	Sep.	8	92.8	113.1	0.1	92.9	8.6
1990	Sep.	9	91.4	108.6	4.6	96.1	398.3
1990	Sep.	10	91.4	108.4	4.8	96.2	415.6
1990	Sep.	11	84.9	104.4	8.8	93.7	756.9
1990	Sep.	12	84.9	106.3	6.9	91.8	594.4
1990	Sep.	13	84.9	111.7	1.6	86.5	133.9
1990	Sep.	14	84.9	110.6	2.6	87.5	222.0
1990	Sep.	15	84.9	109.7	3.5	88.4	302.4
1990	Sep.	16	84.9	111.4	1.9	86.8	159.8
			Ave. 92.5	Ave. 111.2	Ave. 6.9	Ave. 94.5	Total 5440.6 ***

\* : Deficit to the guaranteed discharge of 4,000cusec (113.2 m<sup>3</sup>/s)

\*\* : Outflow discharge to guarantee the discharge of 4,000cusec (113.2m<sup>3</sup>/s) at Iskandar Bridge

\*\*\* : Corresponds to about 11cm in deference of reservoir water level of Temengor Dam

Table 9-4 PRODUCTION COST OF PADDY

Description	Cost (RM/ha)
1 . Land Preparation	312
2 . Field Leveling	401
3 . Planting	305
4 . Pest/Disease Control	167
5 . Harvesting	576
6 . Land Tax	9
7 . Irrigation Fee	34
. Total	1,805

Table 9-5 FLOOD DAMAGE FACTOR

Item	Flood Depth	Flood Duration	Damage Factor (%)	Remarks
Paddy (Production loss)	less than 0.5m	less than 2 days	30	
		3 to 4 days	37	
		5 to 6 days	40	
		more than 7 days	45	
	0.5 to 0.9 m	less than 2 days	33	
		3 to 4 days	40	
		5 to 6 days	43	
		more than 7 days	49	
	more than 1 m	less than 2 days	60	
		3 to 4 days	80	
		5 to 6 days	86	
		more than 7 days	96	
Rubber (Mortality of young tree)	more than 0.25 m	less than 7 days	5	Assume 9% of total planted area to be subject to mortality
		8 to 14 days	15	
		15 to 21 days	60	
		more than 22 days	100	
Oil Palm/Coconuts Palm (Mortality of young tree)	more than 0.25 m	less than 7 days	10	Assume 9% of total planted area to be subject to mortality
		8 to 14 days	20	
		15 to 21 days	70	
		more than 22 days	100	
Other Tree Crops (Mortality of young tree)	more than 0.25 m	less than 4 days	10	Assume 10% of total planted area to be subject to mortality
		5 to 8 days	25	
		9 to 12 days	60	
		more than 13 days	70	
House/Building	less than 0.5 m		3	
	0.5 to 1.0 m		5	
	1.0 to 2.0 m		7	
	2.0 to 3.0 m		11	
	more than 3 m		15	

Source: National Water Resources Study, Malaysia , Sectoral Report Vol. 5, Oct. 1982



Table 9-6 ESTIMATED PROBABLE FLOOD DAMAGE OF PERAK RIVER UNDER CONDITION OF PRESENT DAM OPERATION

Item of Damage	Area Inundated	Quantity Damaged	Unit Value	10-year Flood			20-year Flood			50-year Flood			100-year Flood			
				Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Damage Factor	Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Damage Factor	Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Damage Factor	Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Damage Factor	
				Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)	Flood Damage (10 <sup>3</sup> RM)		
<b>1. Direct Agricultural Damage</b>																
1.1 Paddy	1,200 ha	1,200 ha	1,500 RM/ha	0.40	720	0.40	720	0.80	1,440	0.86	1,548					
1.2 Rubber (Production Loss)	2,800 ha	2,800 ha	47 <sup>(3)</sup> RM/ha	1.19 <sup>(4)</sup>	156	1.31 <sup>(4)</sup>	173	1.92 <sup>(4)</sup>	252	2.71 <sup>(4)</sup>	356					
1.3 Rubber (Mortality Loss)	2,800 ha	252 ha	5,200 RM/ha	0.05	66	0.05	66	0.05	66	0.05	66					
1.4 Oil Palm (Mortality Loss)	2,500 ha	225 ha	3,500 RM/ha	0.10	79	0.10	79	0.10	79	0.10	79					
1.5 Coconut Palm (Mortality Loss)	1,000 ha	60 ha	6,200 RM/ha	0.10	37	0.10	37	0.25	93	0.25	93					
1.6 Other Tree Crop (Mortality Loss)	1,200 ha	120 ha	6,400 RM/ha	0.10	77	0.10	77	0.25	192	0.25	192					
1.7 Mix Horticulture	4,000 ha	4,000 ha	4,699 RM/ha	0.10	1,880	0.10	1,880	0.25	4,699	0.25	4,699					
Sub-Total (for 1.)					3,014		3,031		6,821		7,033					
<b>2. Direct Non-Agriculture Damage</b>																
2.1 Private House		5,000 houses	11,000 RM/house	0.05	2,750	0.05	2,750	0.07	3,850	0.11	6,050					
2.2 Shops & Commercial Sites		250 sites	13,000 RM/sites	0.05	163	0.05	163	0.07	228	0.11	358					
2.3 Industrial Facilities		60,000 m <sup>2</sup>	800 RM/m <sup>2</sup>	0.05	2,400	0.05	2,400	0.07	3,360	0.11	5,280					
2.4 Road		40 km	15,000 RM/km	1.00	600	1.00	600	1.00	600	1.00	600					
Sub-Total (for 2.)					5,913		5,913		8,038		12,288					
<b>3. Indirect Damage</b>																
3.1 Agricultural Damage <sup>(4)</sup>					603		606		1,364		1,407					
3.2 Private/Public Houses <sup>(5)</sup>					4,369		4,369		6,116		9,611					
3.3 Transportation <sup>(6)</sup>					600		600		600		600					
Sub-total (for 3.)					5,572		5,572		8,080		11,618					
<b>Damage Total</b>					14,498		14,518		22,938		30,938					

Note:

(1): Duration of flood discharge over 850m<sup>3</sup>/s

(2): Maximum flood inundation depth

(3): 9.4kg/ha/day x RM5/Ag

(4): Flood duration x 1/2

(5): 20% of "1. Direct Agricultural Damage"

(6): 150% of ("2.1 Direct Damage of Private House" + "2.2 Shops & Commercial Sites")

(7): 100% of "2.4 Direct Damage of Road"

Table 9-7 ESTIMATED PROBABLE FLOOD DAMAGE OF PERAK RIVER UNDER CONDITION OF PROPOSED DAM OPERATION

Item of Damage	Area Inundated	Quantity Damaged	Unit Value	10-year Flood		20-year Flood		50-year Flood		100-year Flood			
				Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Duration (days) <sup>(1)</sup>	Depth (m) <sup>(2)</sup>	Flood Damage (10 <sup>6</sup> RM)	Flood Damage (10 <sup>6</sup> RM)
				Damage Factor	Flood Damage (10 <sup>6</sup> RM)	Damage Factor	Flood Damage (10 <sup>6</sup> RM)	Damage Factor	Flood Damage (10 <sup>6</sup> RM)	Damage Factor	Flood Damage (10 <sup>6</sup> RM)	Damage Factor	Flood Damage (10 <sup>6</sup> RM)
1. Direct Agricultural Damage													
1.1 Paddy	1,200 ha	1,200 ha	1,500 RM/ha	0.37	666	0.37	666	0.80	1,440	0.86	1,548		
1.2 Rubber (Production Loss)	2,800 ha	2,800 ha	47 <sup>(3)</sup> RM/ha	1.13 <sup>(4)</sup>	148	1.21 <sup>(4)</sup>	159	1.92 <sup>(6)</sup>	252	2.71 <sup>(4)</sup>	356		
1.3 Rubber (Mortality Loss)	2,800 ha	252 ha	5,200 RM/ha	0.05	66	0.05	66	0.05	66	0.05	66		
1.4 Oil Palm (Mortality Loss)	2,500 ha	225 ha	3,500 RM/ha	0.10	79	0.10	79	0.10	79	0.10	79		
1.5 Coconut Palm (Mortality Loss)	1,000 ha	60 ha	6,200 RM/ha	0.10	37	0.10	37	0.25	93	0.25	93		
1.6 Other Tree Crop (Mortality Loss)	1,200 ha	120 ha	6,400 RM/ha	0.10	77	0.10	77	0.25	192	0.25	192		
1.7 Mix Horticulture	4,000 ha	4,000 ha	4,699 RM/ha	0.10	1,880	0.10	1,880	0.25	4,699	0.25	4,699		
Sub-Total (for 1.)					2,952		2,963				7,033		
2. Direct Non-Agriculture Damage													
2.1 Private House		5,000 houses	11,000 RM/house	0.03	1,650	0.03	1,650	0.07	3,850	0.11	6,050		
2.2 Shops & Commercial Sites		250 sites	13,000 RM/sites	0.03	98	0.03	98	0.07	228	0.11	358		
2.3 Industrial Facilities		60,000 m <sup>2</sup>	800 RM/m <sup>2</sup>	0.03	1,440	0.03	1,440	0.07	3,360	0.11	5,280		
2.4 Road		40 km	15,000 RM/km	1.00	600	1.00	600	1.00	600	1.00	600		
Sub-Total (for 2.)					3,788		3,788				12,288		
3. Indirect Damage													
3.1 Agricultural Damage <sup>(5)</sup>					590		593		1,364		1,407		
3.2 Private/Public Houses <sup>(5)</sup>					2,621		2,621		6,116		9,611		
3.3 Transportation <sup>(6)</sup>					600		600		600		600		
Sub-total (for 3.)					3,812		3,814		8,080		11,618		
Damage Total					10,551		10,564		22,938		30,938		

Note:

- (1): Duration of flood discharge over 850m<sup>3</sup>/s
- (2): Maximum flood inundation depth
- (3): 9.4kg/ha/day x RMS/kg
- (4): Flood duration x 1/2
- (5): 20% of "1. Direct Agricultural Damage"
- (6): 150% of ("2.1 Direct Damage of Private House" + "2.2 Shops & Commercial Sites")
- (7): 100% of "2.4 Direct Damage of Road"

Table 9-8 ESTIMATED ANNUAL AVERAGE FLOOD DAMAGE

Under Condition of Present Dam Operation

(1) Return Period	(2) Occurrence Probability  $1/(1)$	(3) Probable Damage  $(10^3 \text{ RM})$	(4) Occurrence Probability between $D_{(i-1)}$ and $D_{(i)}$ $(P_{(i-1)} - P_{(i)})$	(5) Average Damage between $D_{(i-1)}$ and $D_{(i)}$ $(D_{(i-1)} + D_{(i)})/2$ $(10^3 \text{ RM})$	(6) Probable Damage between $D_{(i-1)}$ and $D_{(i)}$ $(4) \times (5)$ $(10^3 \text{ RM})$
2 -year	$P_{(1)} = 0.50$	$D_{(1)} = 0$	-	-	-
10 -year	$P_{(2)} = 0.10$	$D_{(2)} = 14,498$	0.40	7,249	2,900
20 -year	$P_{(3)} = 0.05$	$D_{(3)} = 14,518$	0.05	14,508	725
50 -year	$P_{(4)} = 0.02$	$D_{(4)} = 22,938$	0.03	18,728	562
100 -year	$P_{(5)} = 0.01$	$D_{(5)} = 30,938$	0.01	26,938	269
Annual Average Flood Damage (Total of (6))					4,456

Under Condition of Proposed Dam Operation

(1) Return Period	(2) Occurrence Probability  $1/(1)$	(3) Probable Damage  $(10^3 \text{ RM})$	(4) Occurrence Probability between $D_{(i-1)}$ and $D_{(i)}$ $(P_{(i-1)} - P_{(i)})$	(5) Average Damage between $D_{(i-1)}$ and $D_{(i)}$ $(D_{(i-1)} + D_{(i)})/2$ $(10^3 \text{ RM})$	(6) Probable Damage between $D_{(i-1)}$ and $D_{(i)}$ $(4) \times (5)$ $(10^3 \text{ RM})$
2 -year	$P_{(1)} = 0.50$	$D_{(1)} = 0$	-	-	-
10 -year	$P_{(2)} = 0.10$	$D_{(2)} = 10,551$	0.40	5,276	2,110
20 -year	$P_{(3)} = 0.05$	$D_{(3)} = 10,564$	0.05	10,558	528
50 -year	$P_{(4)} = 0.02$	$D_{(4)} = 22,938$	0.03	16,751	503
100 -year	$P_{(5)} = 0.01$	$D_{(5)} = 30,938$	0.01	26,938	269
Annual Average Flood Damage (Total of (6))					3,410

**Table 9-9 C VALUES FOR PERMANENT PASTURE, RANGELAND,  
AND IDLE LAND**

Vegetal Canopy			Cover That Contacts the Surface					
Type and Height of Raised Canopy <sup>1)</sup>	Canopy Cover (%) <sup>2)</sup>	Type <sup>3)</sup>	Percent Ground Cover					
			0	20	40	60	80	95-100
No appreciable canopy		G	.45	.20	.10	.042	.013	.003
		W	.45	.24	.15	.090	.043	.011
Canopy of tall weeds or short brush (0.5 m fall ht.)	25	G	.36	.17	.090	.038	.012	.003
		W	.36	.20	.13	.082	.041	.011
	50	G	.26	.13	.070	.035	.012	.003
		W	.26	.16	.11	.075	.039	.011
	75	G	.17	.10	.060	.031	.011	.003
		W	.17	.12	.090	.067	.038	.011
Appreciable brush or bushes (2 m fall ht.)	25	G	.40	.18	.090	.040	.013	.003
		W	.40	.22	.14	.085	.042	.011
	50	G	.34	.16	.085	.038	.012	.003
		W	.34	.19	.13	.081	.041	.011
	75	G	.28	.14	.080	.036	.012	.003
		W	.28	.17	.12	.077	.040	.011
Trees but no appreciable low brush (4 m fall ht.)	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.087	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.085	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.083	.041	.011

Note 1) Average fall height of waterdrops from canopy to soil surface.

2) Portion of total-area surface that would be hidden from view by canopy in a vertical projection.

3) G: Cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 5 cm deep.

W: Cover at surface is mostly broadleaf herbaceous plants (as weeds) with little lateral-root network near the surface, and/or undecayed residue.

Source: Technical release No. 51, Geology: Procedure for computing sheet and rill erosion on project areas, Soil Conservation Service, U. S. Department Agriculture, 1972

**Table 9-10 C FACTOR FOR WOODLAND**

Stand Condition	Tree Canopy % of Area <sup>1)</sup>	Forest Litter % of Area <sup>2)</sup>	Undergrowth <sup>3)</sup>	C Factor
Well stocked	100-75	100-90	Managed <sup>4)</sup>	.001
			Unmanaged <sup>4)</sup>	.003-.011
Medium stocked	70-40	85-75	Managed	.002-.004
			Unmanaged	.01-.04
Poorly stocked	35-20	70-40	Managed	.003-.009
			Unmanaged	.02-.09

Note 1) When tree canopy is less than 20%, the area will be considered as grassland, or cropland for estimating soil loss.

2) Forest litter is assumed to be at least two inches deep over the percent ground surface area covered.

3) Undergrowth is defined as shrubs, weeds, grasses, vines, etc. on the surface area not protected by forest litter. Usually found under canopy openings.

4) Managed: grazing and fires are controlled.

Unmanaged: stands that are overgrazed or subjected to repeated burning.

Source: Technical release No. 51, Geology: Procedure for computing sheet and rill erosion on project areas, Soil Conservation Service, U. S. Department Agriculture, 1972

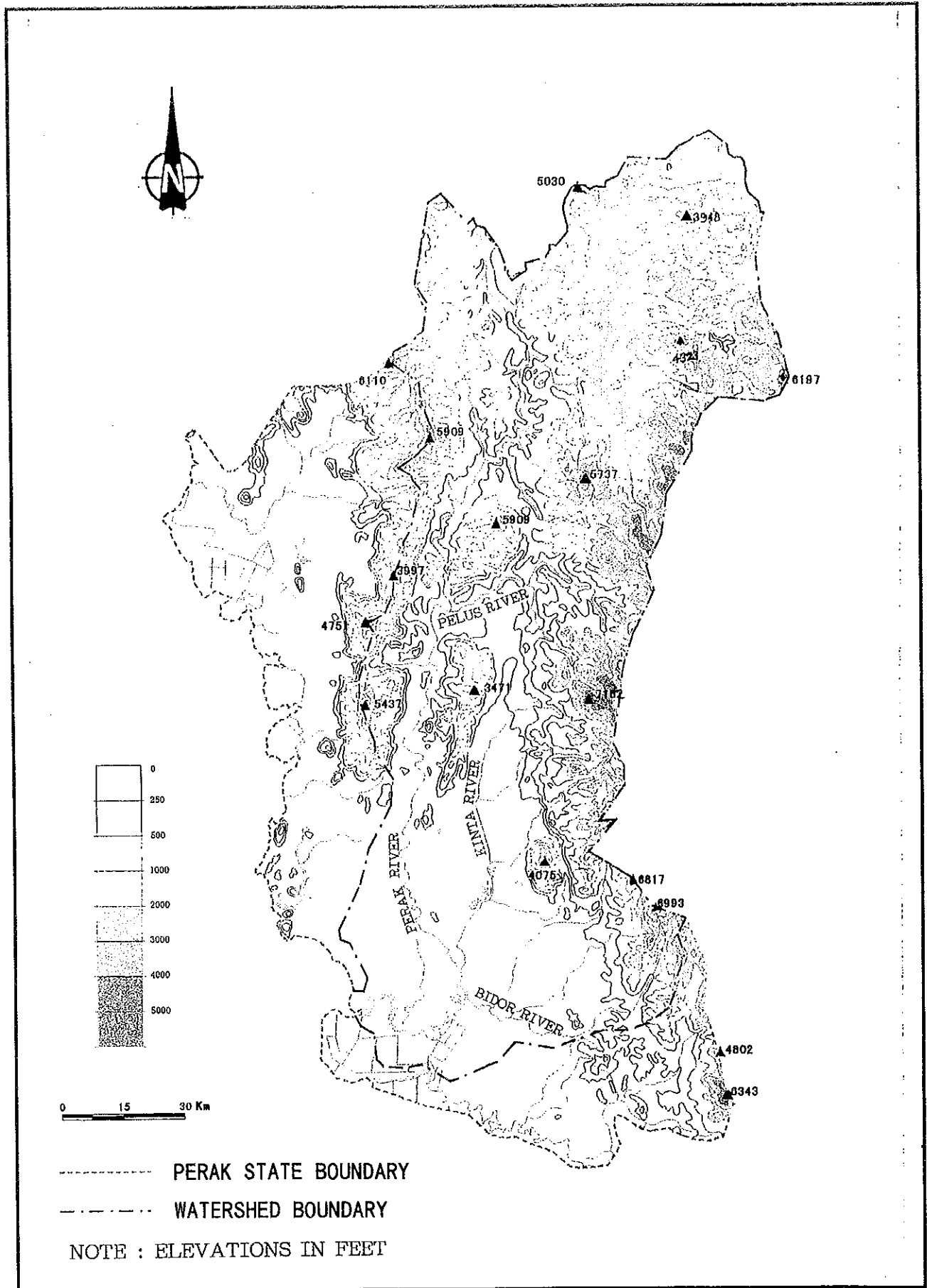
**Table 9-11 P FACTOR FOR CONTOURING, CONTOUR STRIPCROPPING  
AND TERRACING**

Land Slope (%)	P Value			
	Contouring	Contour Stripcropping	Terracing	
			a)	b)
2 - 7	0.50	0.25	0.50	0.10
8 - 12	0.60	0.30	0.60	0.12
13 - 18	0.80	0.40	0.80	0.16
19 - 24	0.90	0.45	0.90	0.18

Note Value of a) represents soil loss from the field, while value of b) represents effect on sediment yield. The difference is the sediment lost from the field, but it is trapped in the terrace channel.

Source: Technical release No. 51, Geology: Procedure for computing sheet and rill erosion on project areas, Soil Conservation Service, U. S. Department Agriculture, 1972

**FIGURE**



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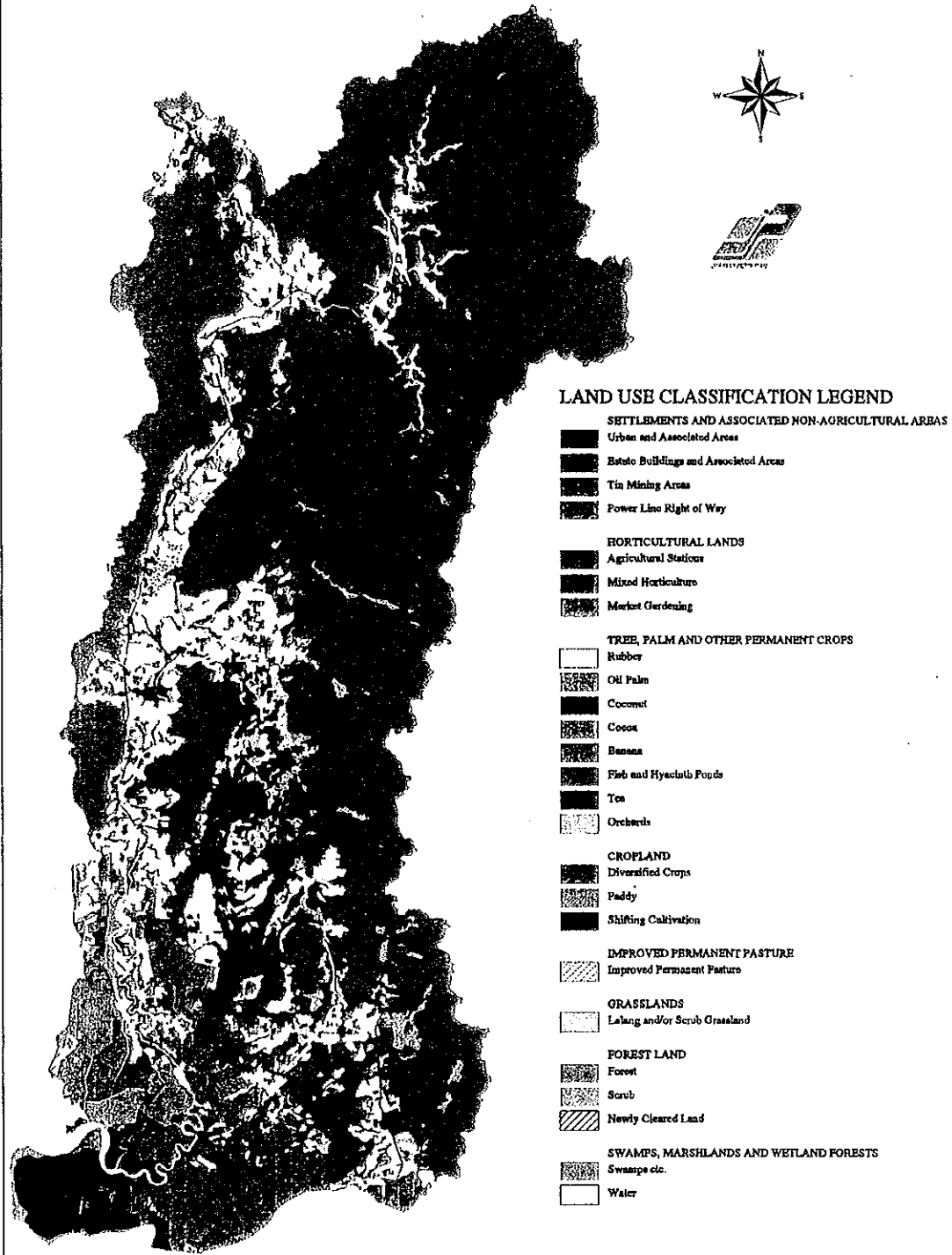
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Fig. 2-1 TOPOGRAPHIC MAP OF PERAK  
 RIVER BASIN

# LAND USE 1990 PERAK RIVER BASIN

Scale 1 : 700,000



Prepared by G.I.S. Section on 5th June 1997

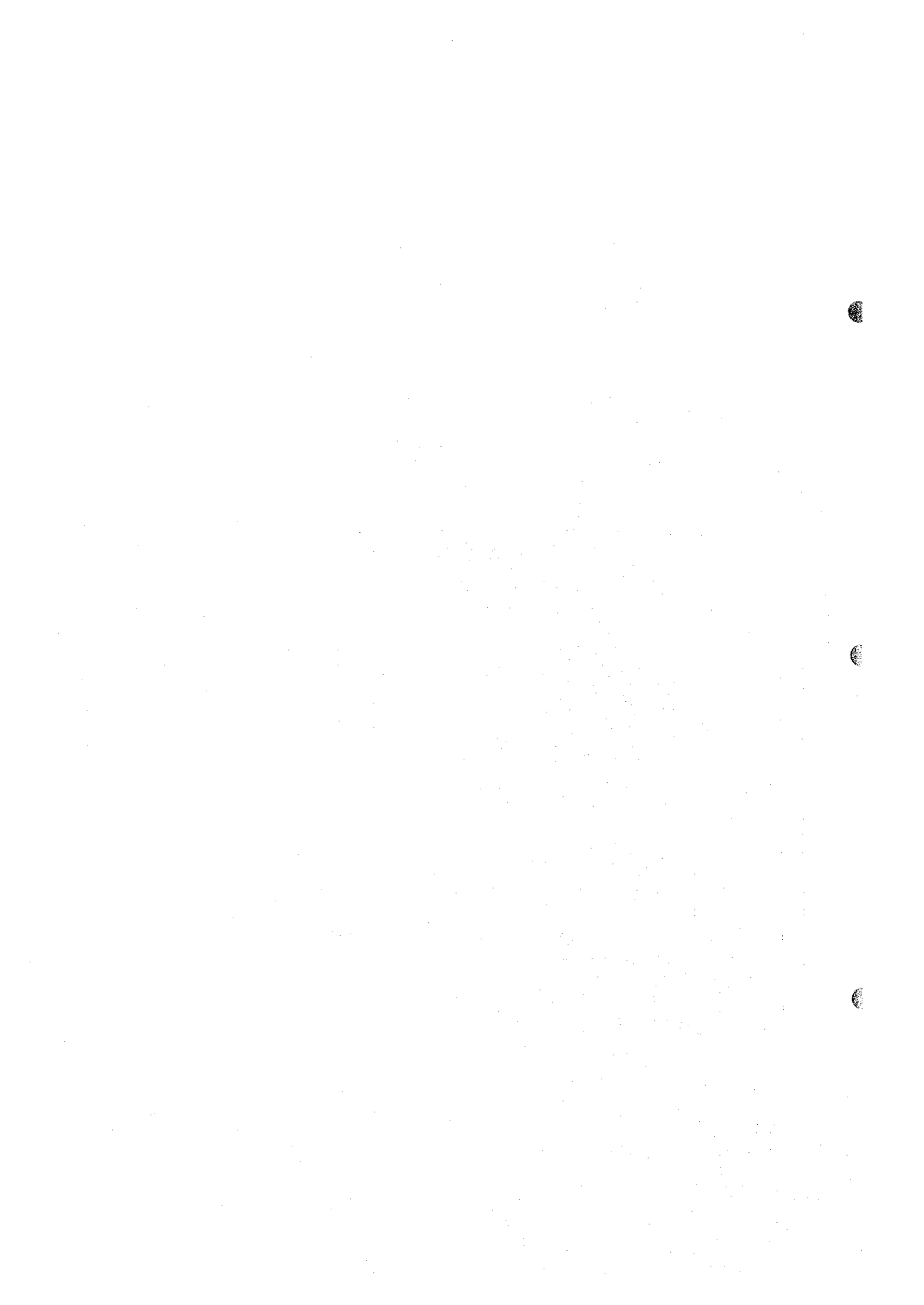
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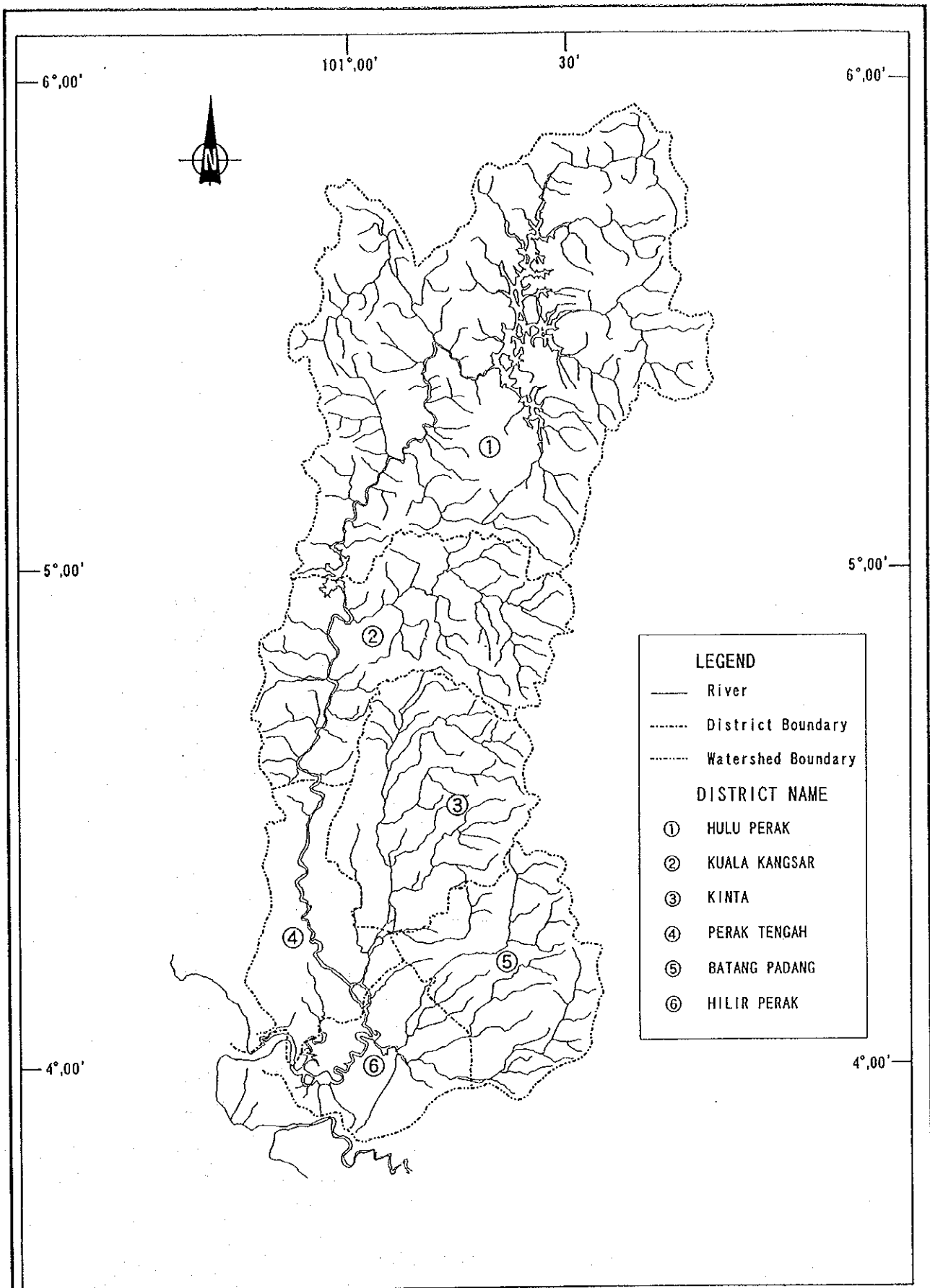
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Fig. 2-2

PRESENT LAND USE OF PERAK  
RIVER BASIN



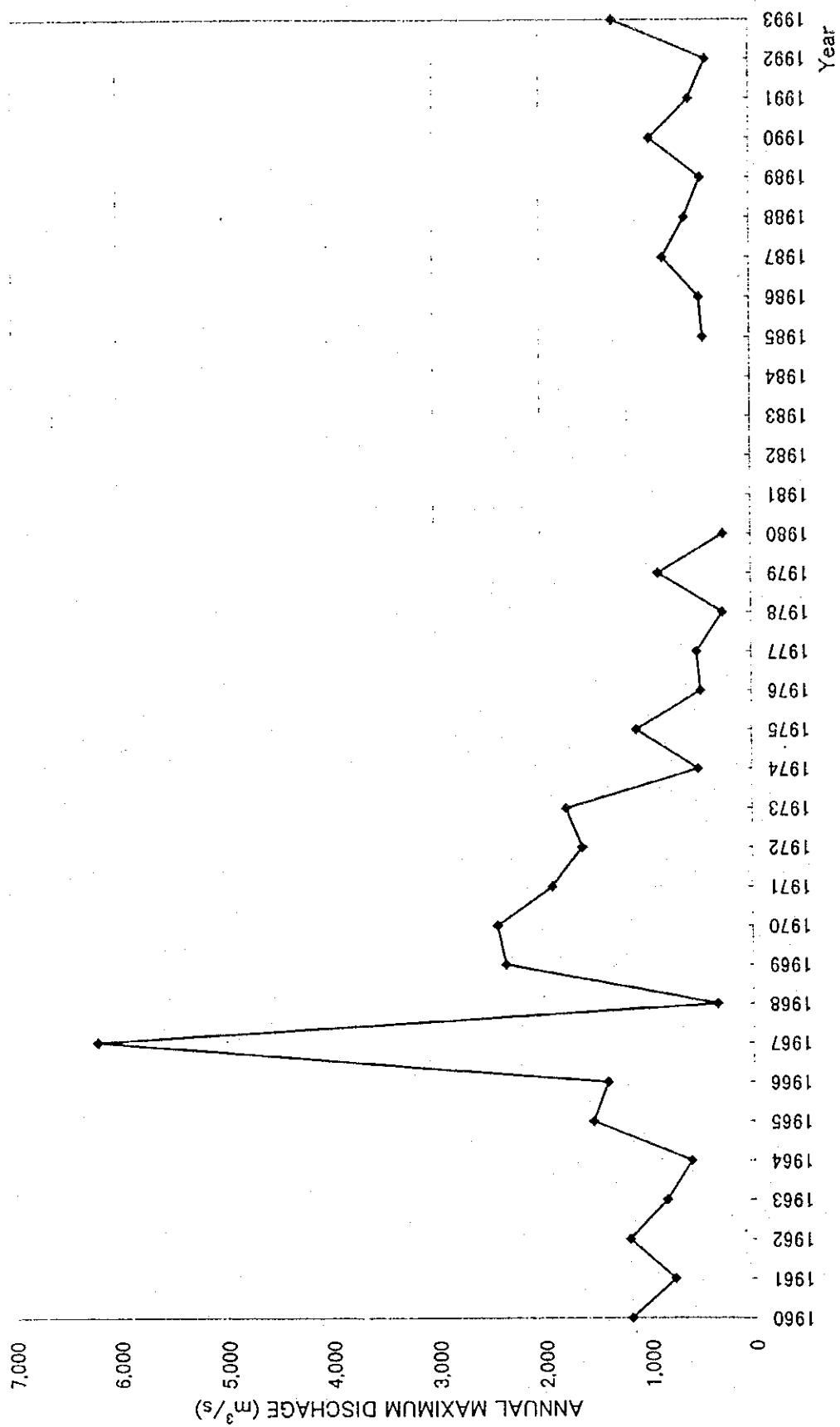




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Fig. 2-3 DISTRICT BOUNDARY IN PERAK  
RIVER BASIN

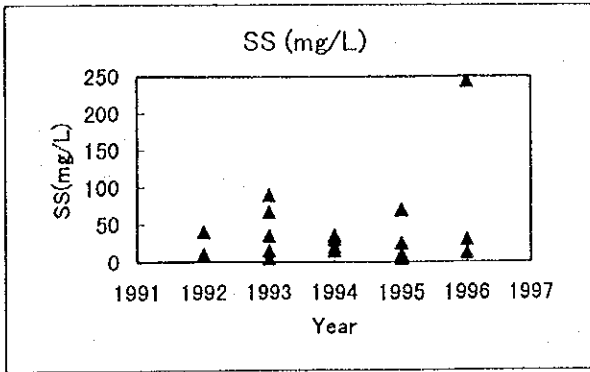
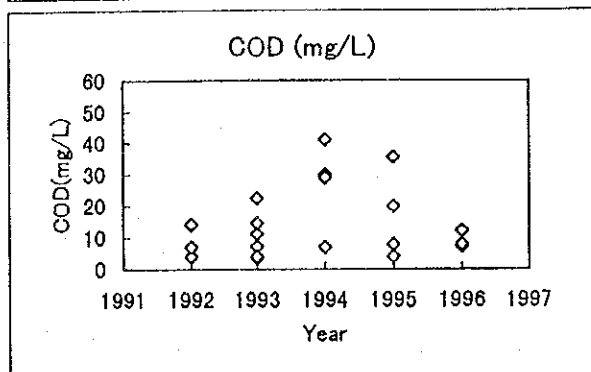
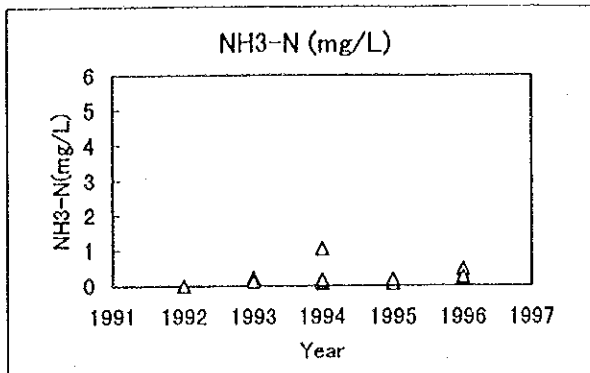
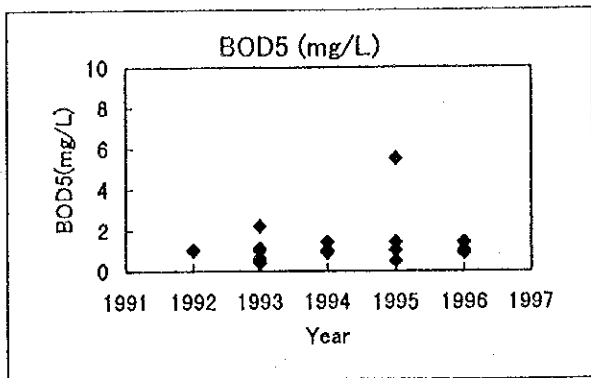


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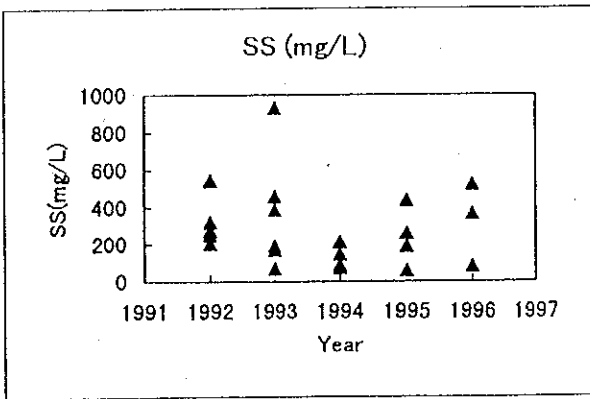
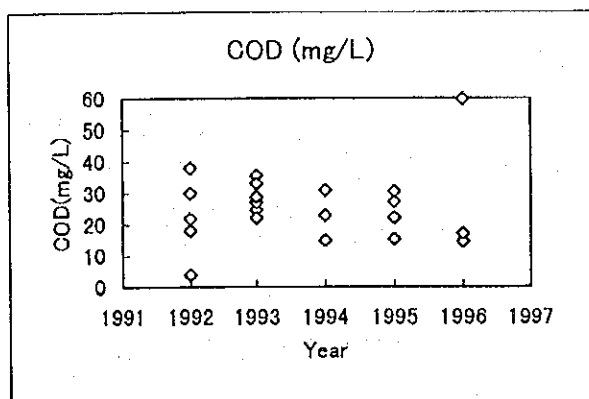
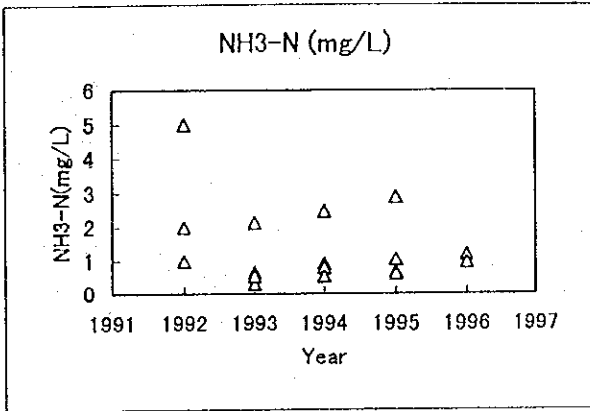
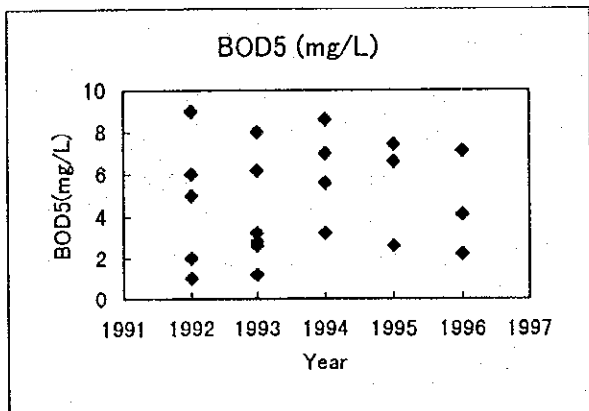
Fig. 3-1 ANNUAL PEAK DISCHARGE AT  
ISKANDAR BRIDGE

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RIVER NAME : SG.PERAK



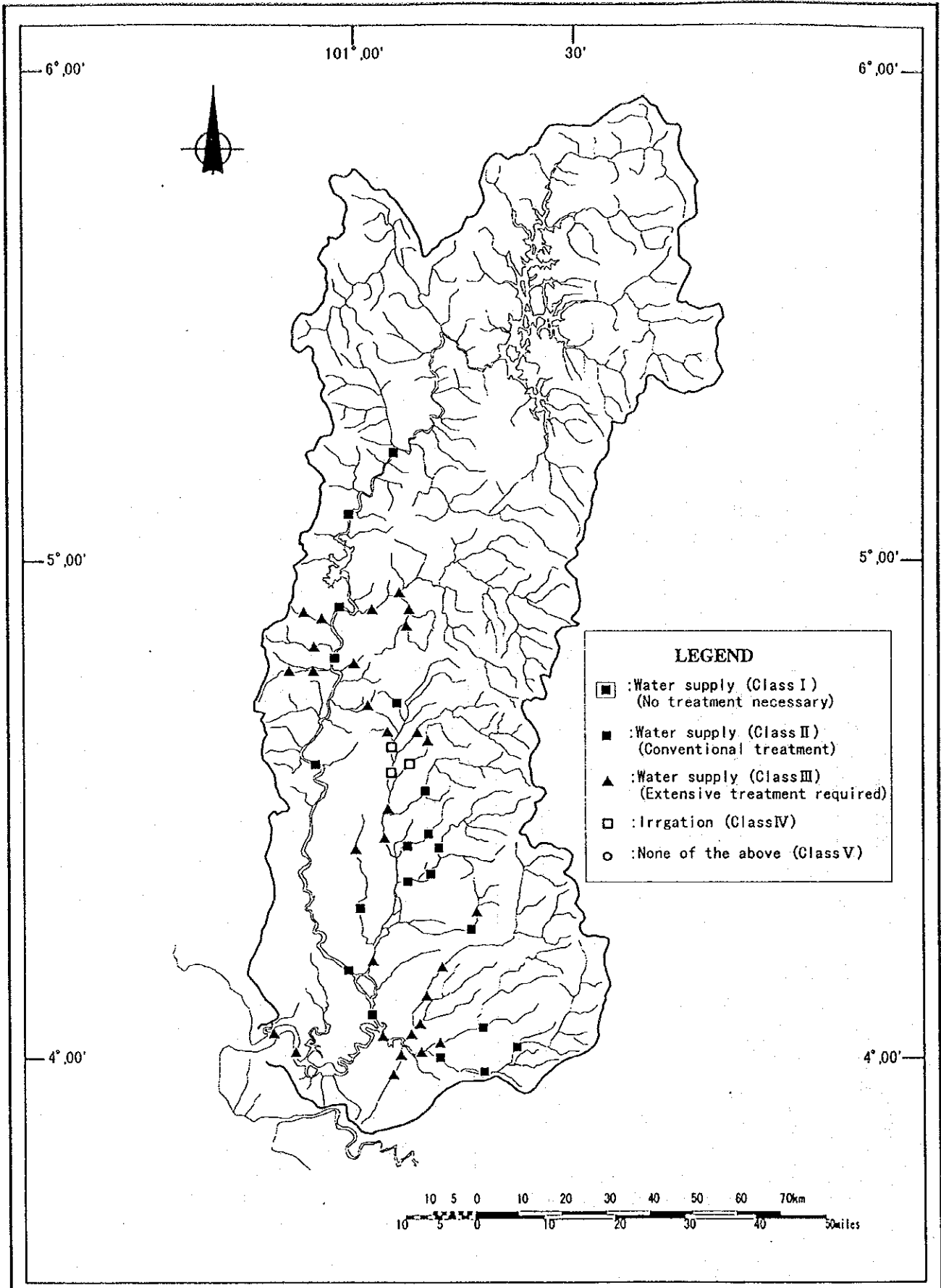
RIVER NAME : SG.KINTA



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Fig. 3-2 ANNUAL TREND OF WATER QUALITY IN SG. PERAK AND SG. KINTA

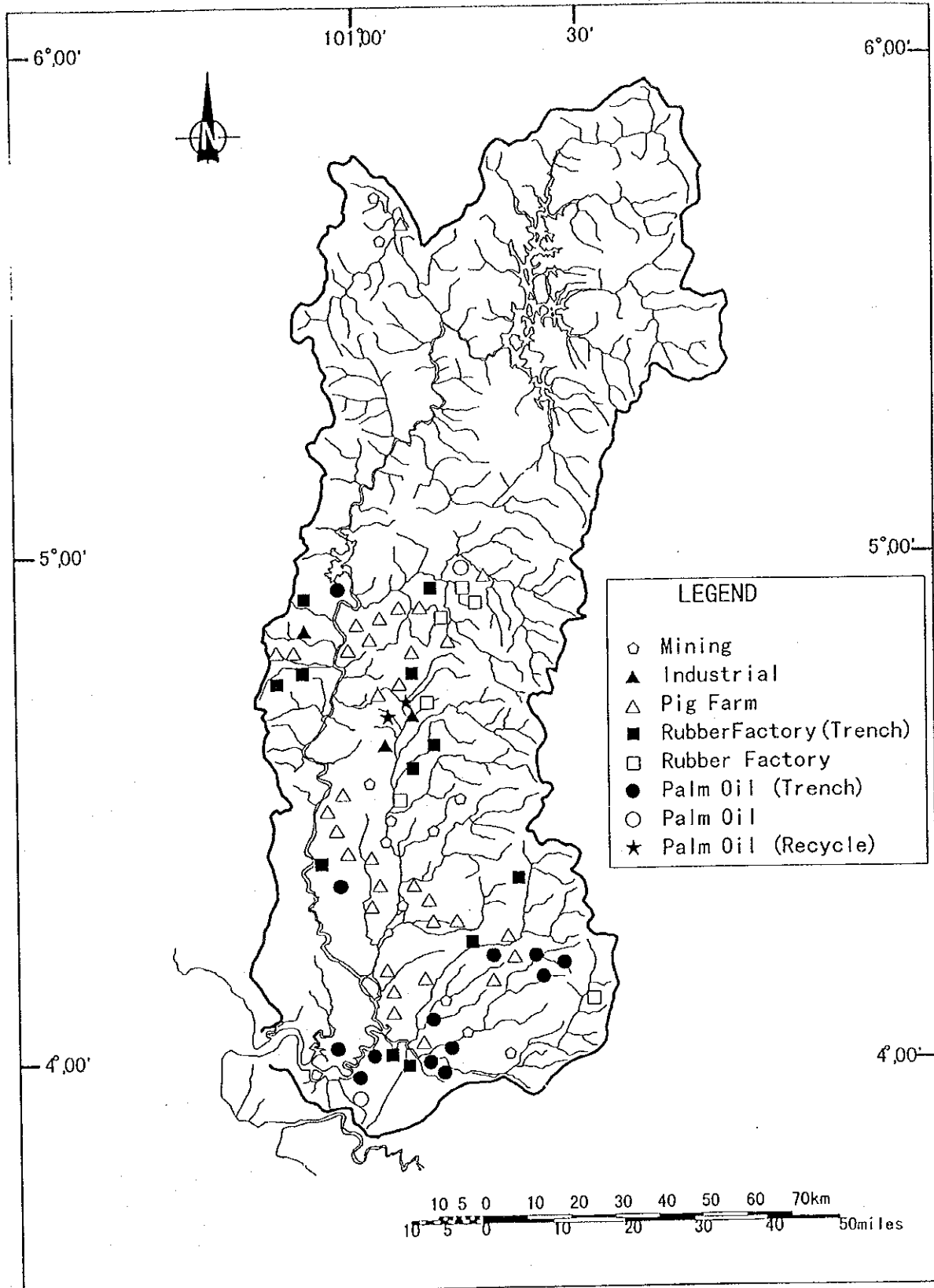


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Fig. 3-3

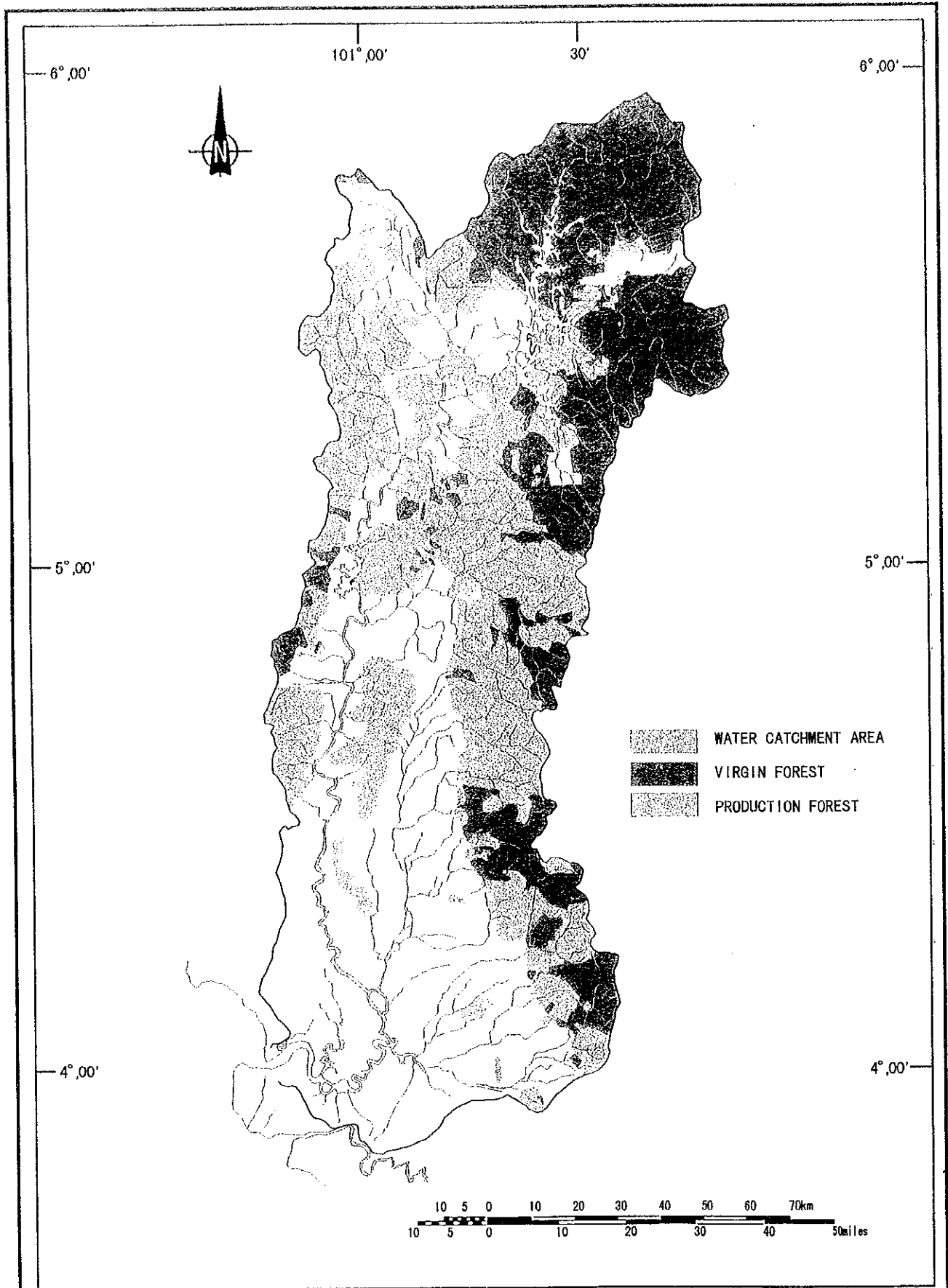
PRESENT RIVER WATER QUALITY  
BY WQI



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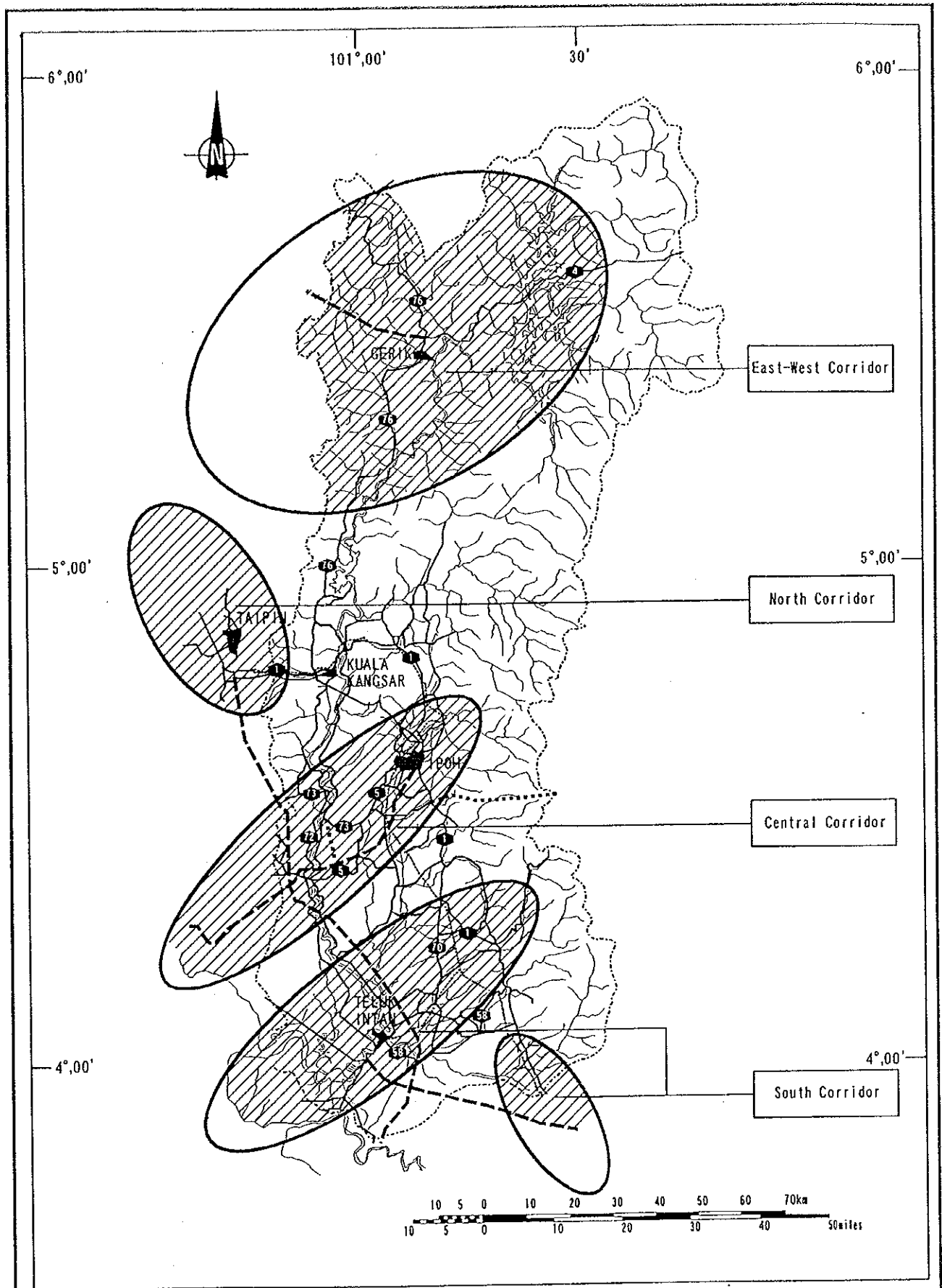
Fig. 3-4 LOCATION OF MAJOR POLLUTANT  
SOURCES FOR OPERATIONAL  
SYSTEM



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Fig. 3-5 PRESENT FOREST RESERVE AREA  
IN PERAK RIVER BASIN

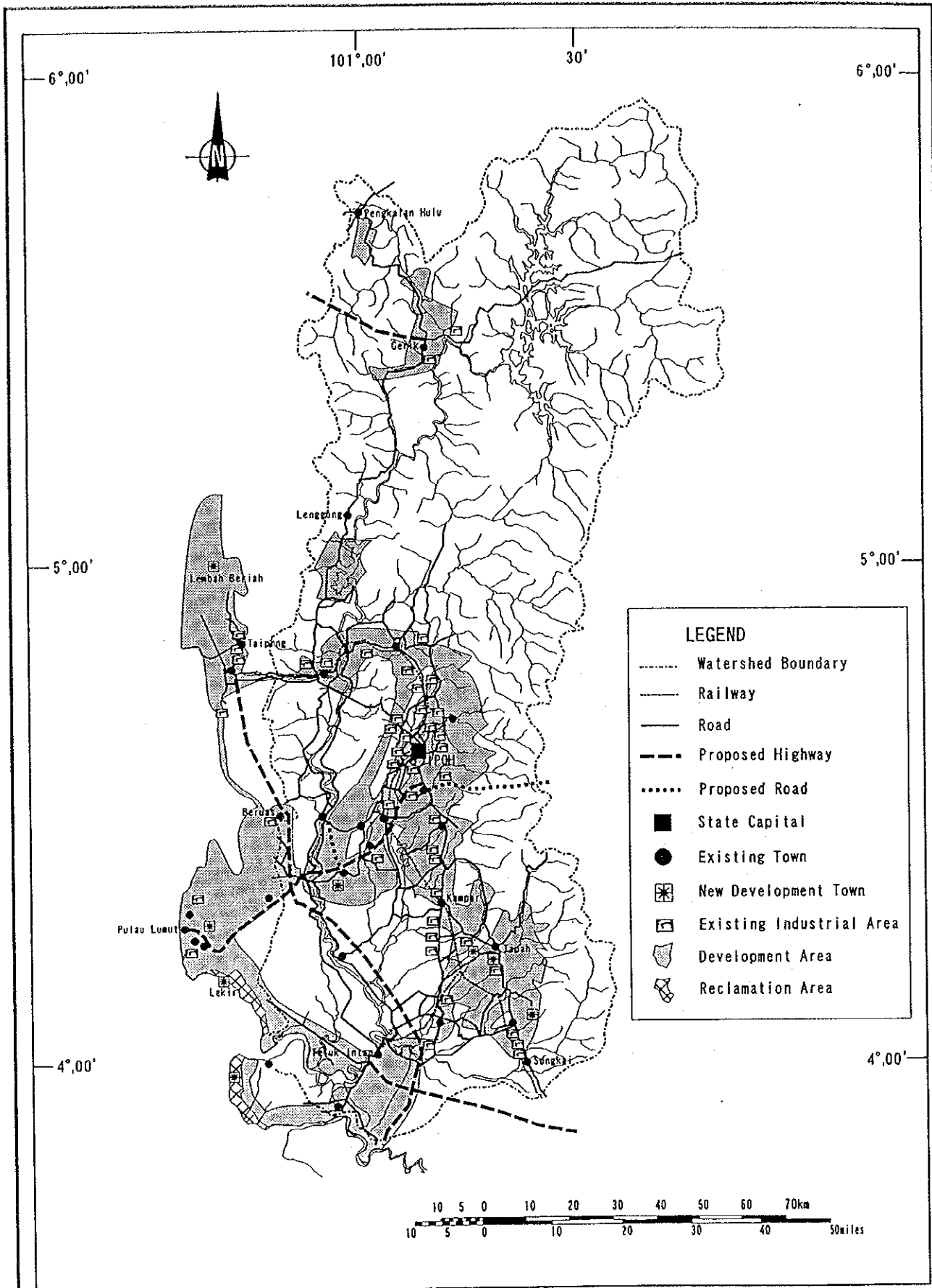


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Fig. 3-6 STRATEGIC DEVELOPMENT CORRI-  
DOR IN PERAK RIVER BASIN

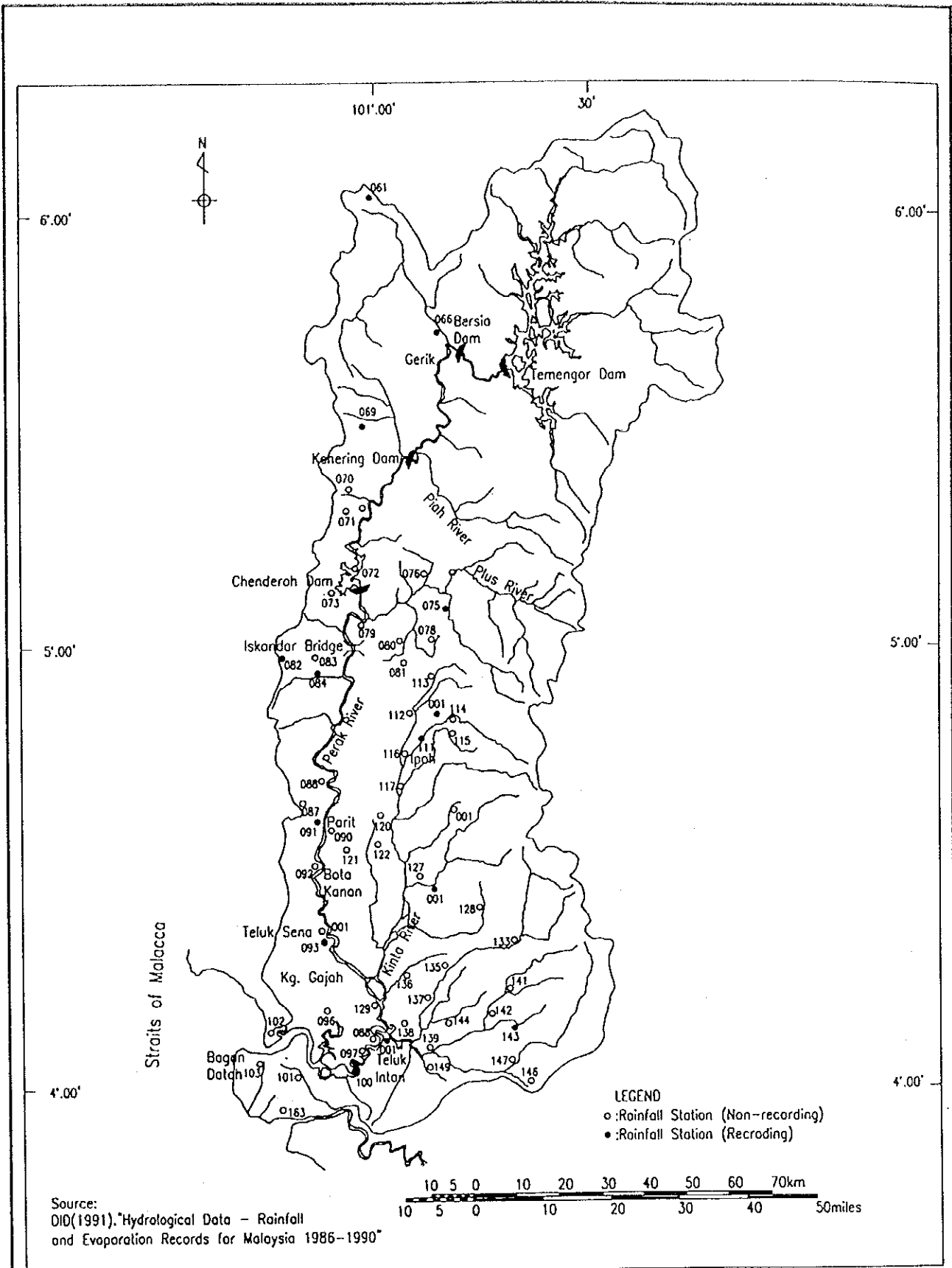




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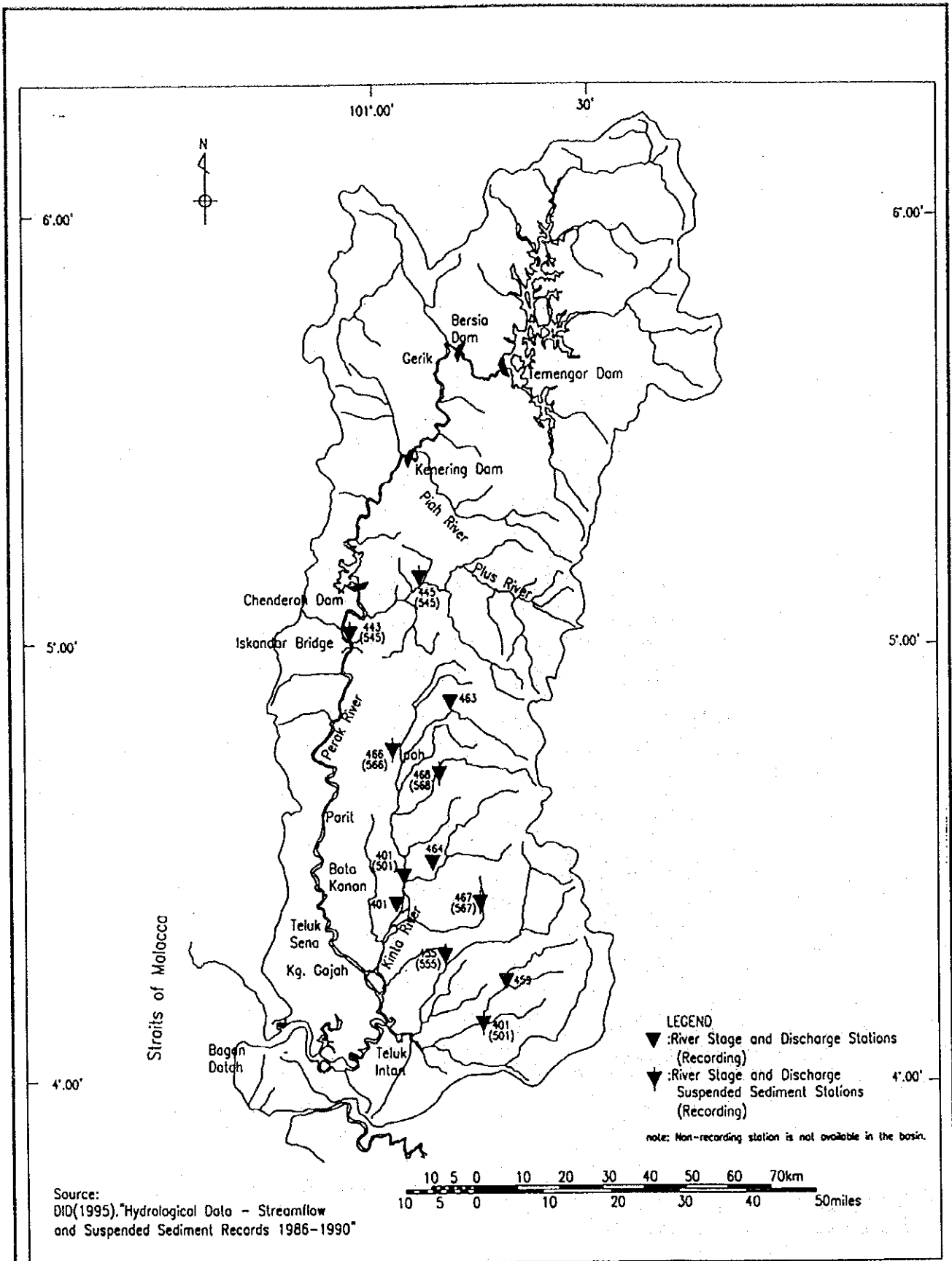
Fig. 3-7 URBAN AND INDUSTRIAL DEVELOPMENT AREA IN PERAK RIVER BASIN



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Fig. 4-1 LOCATION OF EXISTING DID RAIN-  
FALL STATIONS

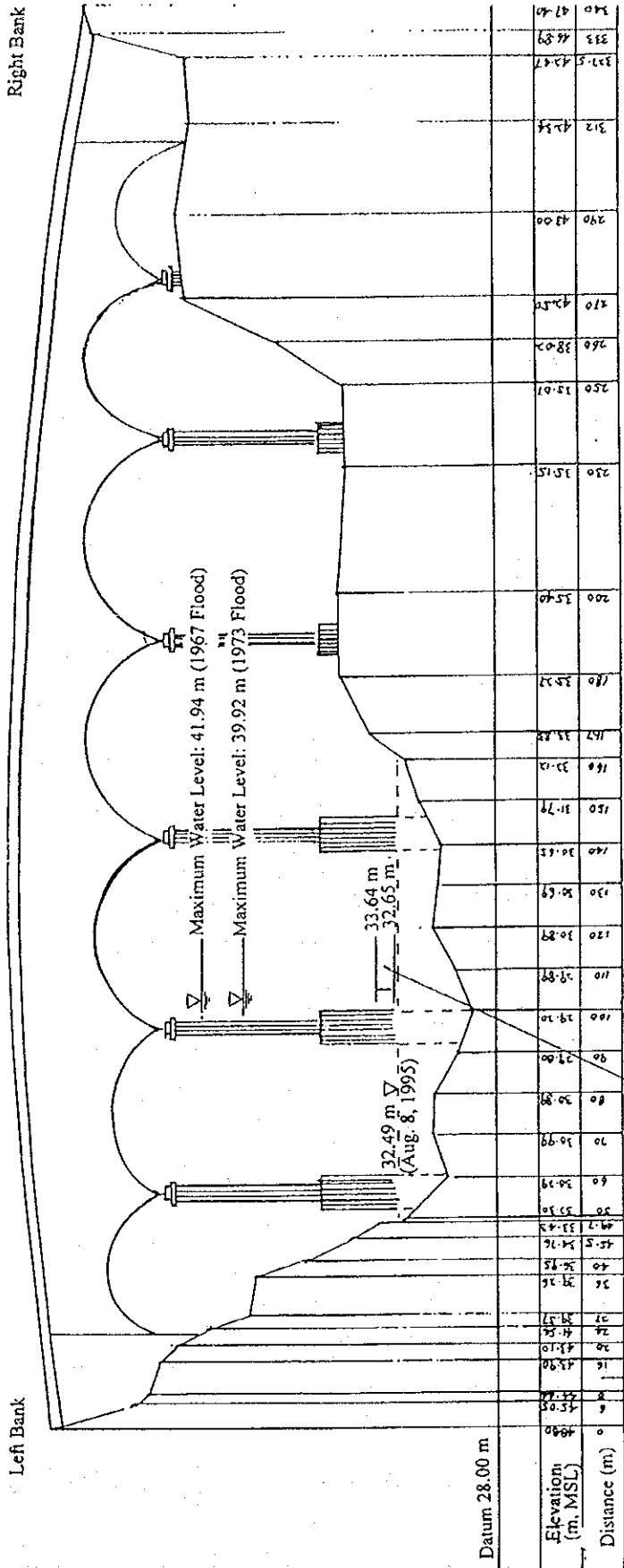


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Fig. 4-2

LOCATION OF EXISTING DID RIVER  
DISCHARGE AND SUSPENDED  
SEDIMENT GAUGING STATIONS



(Station Number: 4809443)

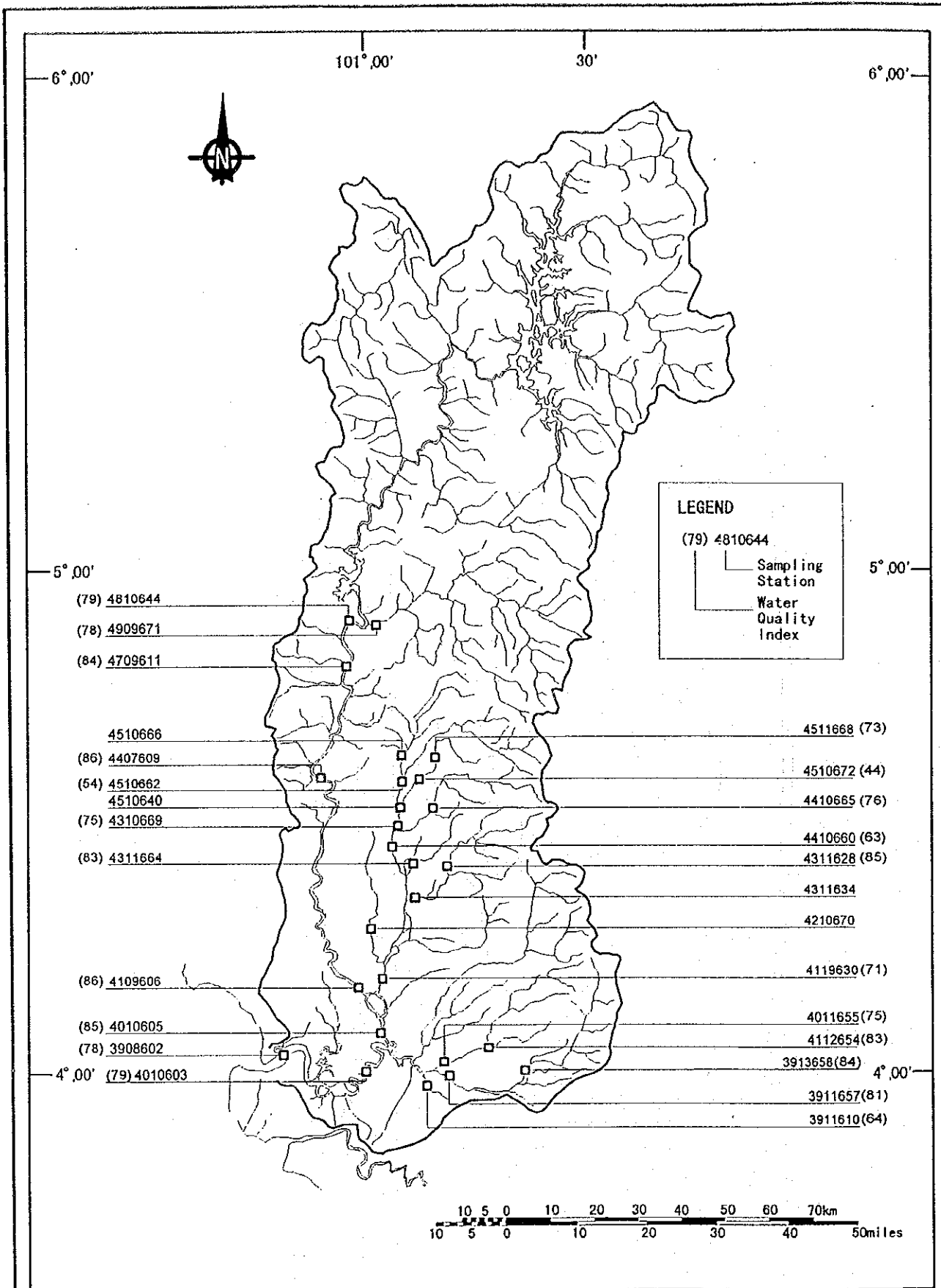
note: This cross-section is as of 1995.

Range of Discharge Measurement

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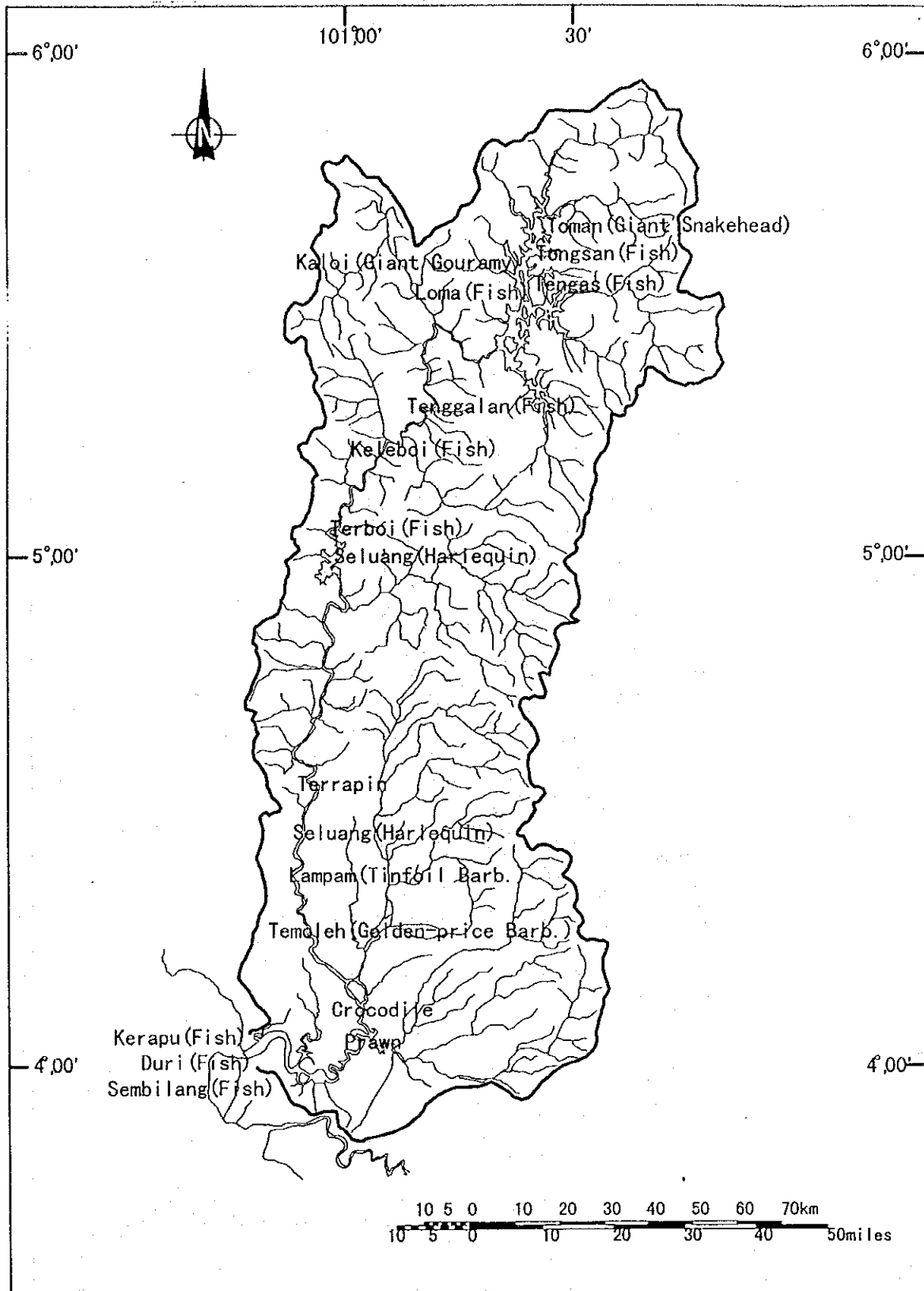
Fig. 4-3 CROSS-SECTION FOR DISCHARGE MEASUREMENT AT ISKANDAR BRIDGE



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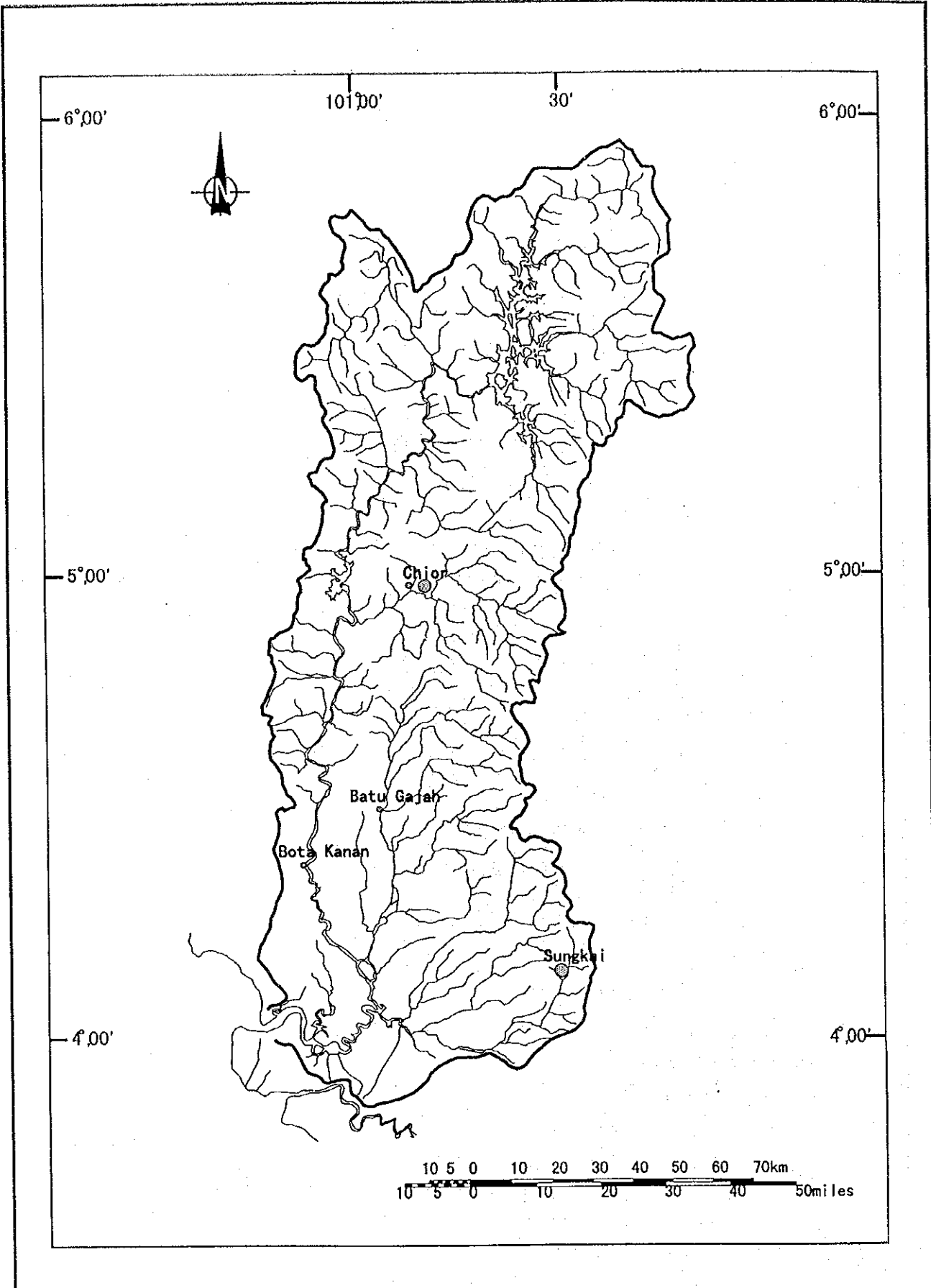
Fig. 4-4 EXISTING DOE WATER SAMPLING  
POINT AND WQI MONITORED AT  
THE SAMPLING POINTS



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Fig. 4-5 AQUATIC WILDLIFE OF PERAK  
RIVER

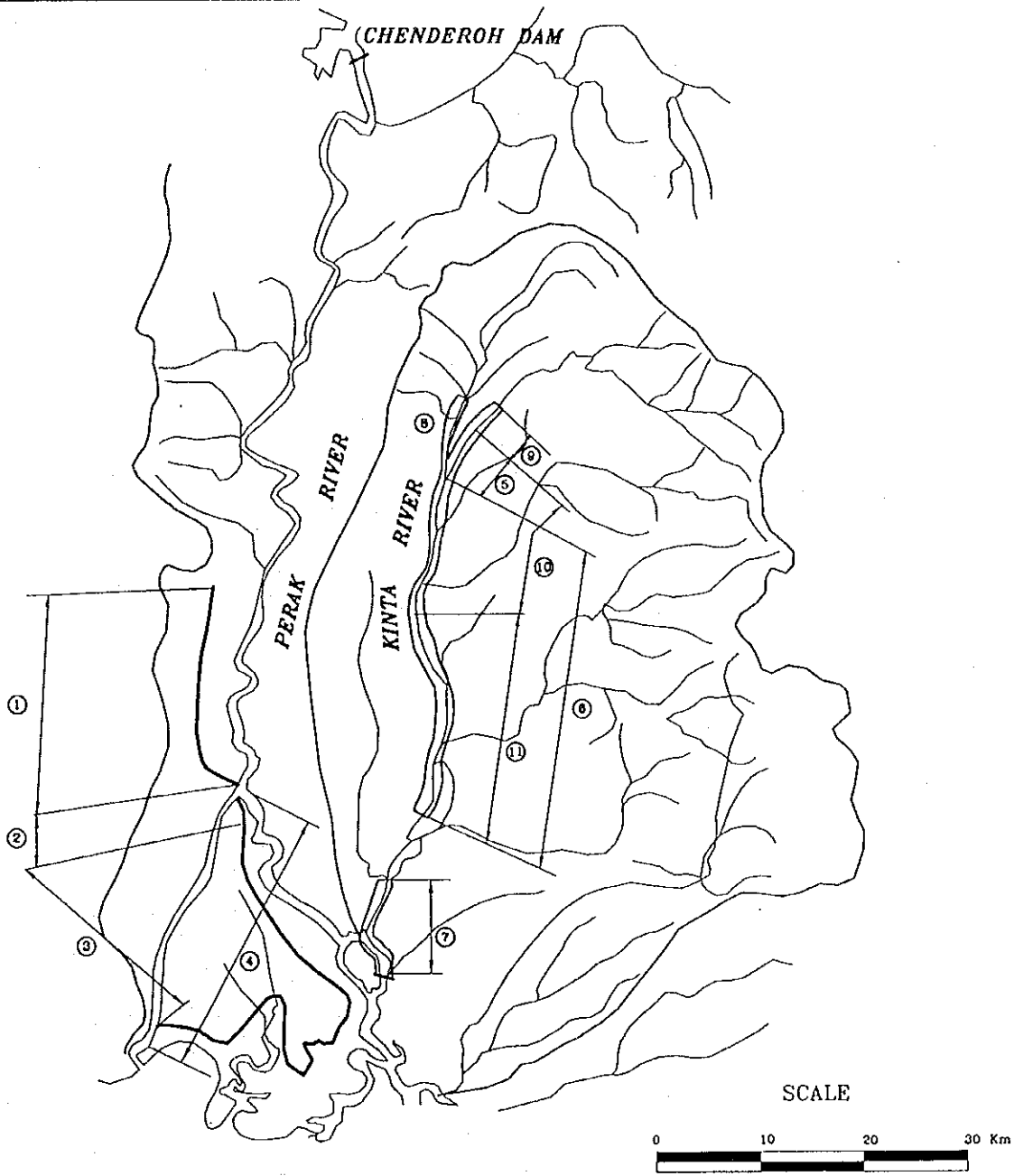


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Fig. 4-6 LOCATION OF PROTECTED AREA IN  
PERAK RIVER BASIN

River	No.	Name of Scheme	Existing/ Proposed
Perak	①	Tran-Perak Stage IV Embankment	Existing
	②	Lambor Kiri Embankment	Existing
	③	Stage I Drain Embankment	Existing
	④	Perak Flood Bypass	Proposed
Kinta	⑤	Ipoh Flood Mitigation Scheme	Existing
	⑥	Kinta Conservancy Scheme	Existing
	⑦	Malaysia Mining Company Diversion Pari Scheme	Existing
	⑧	Dg. Kinta Upgrading Scheme	Proposed
	⑩	Bund Upgrading (1)	Proposed
	⑪	Bund Upgrading (2)	Proposed



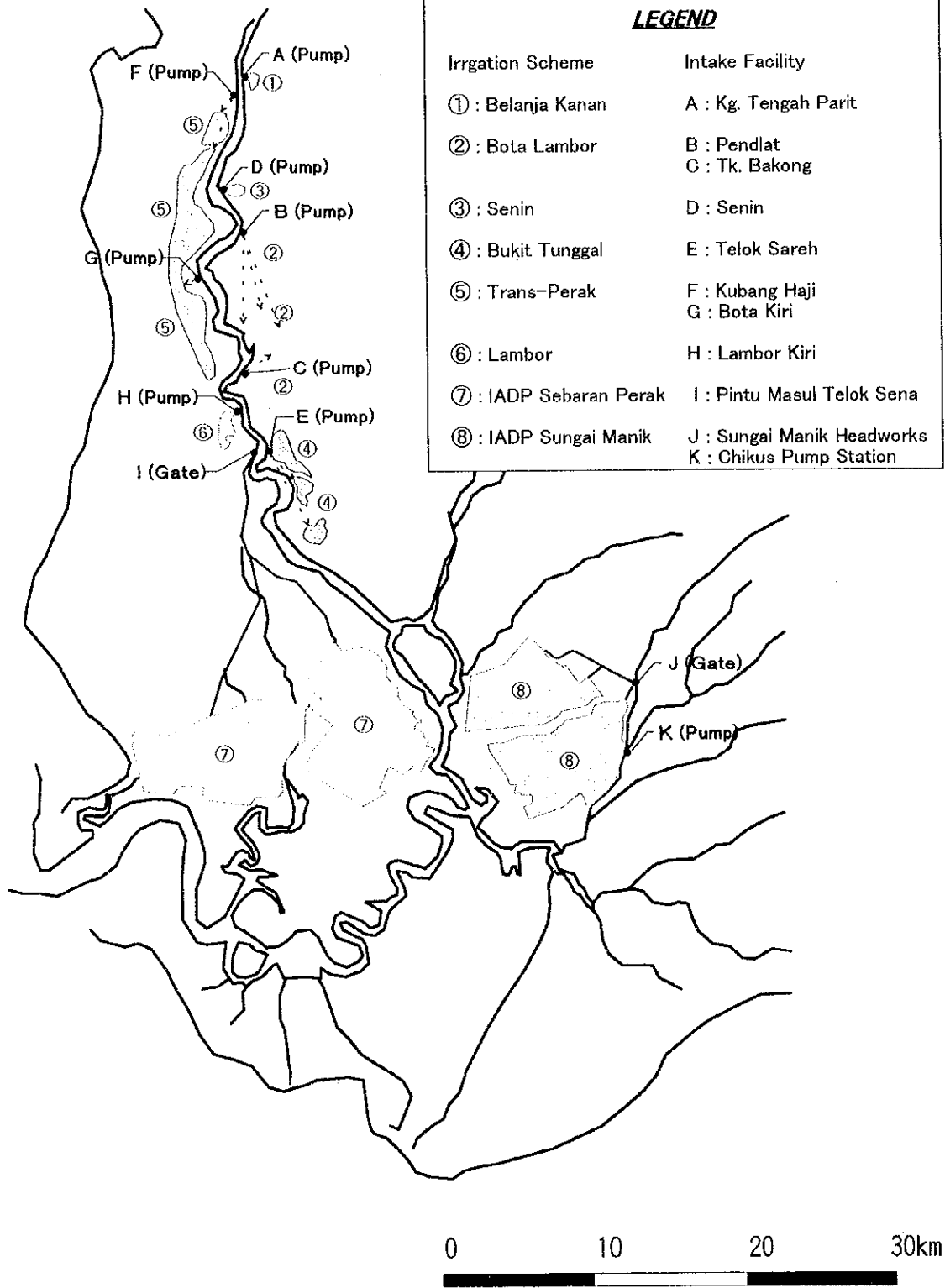
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BASIN INFORMATION SYSTEM IN MALAYSIA

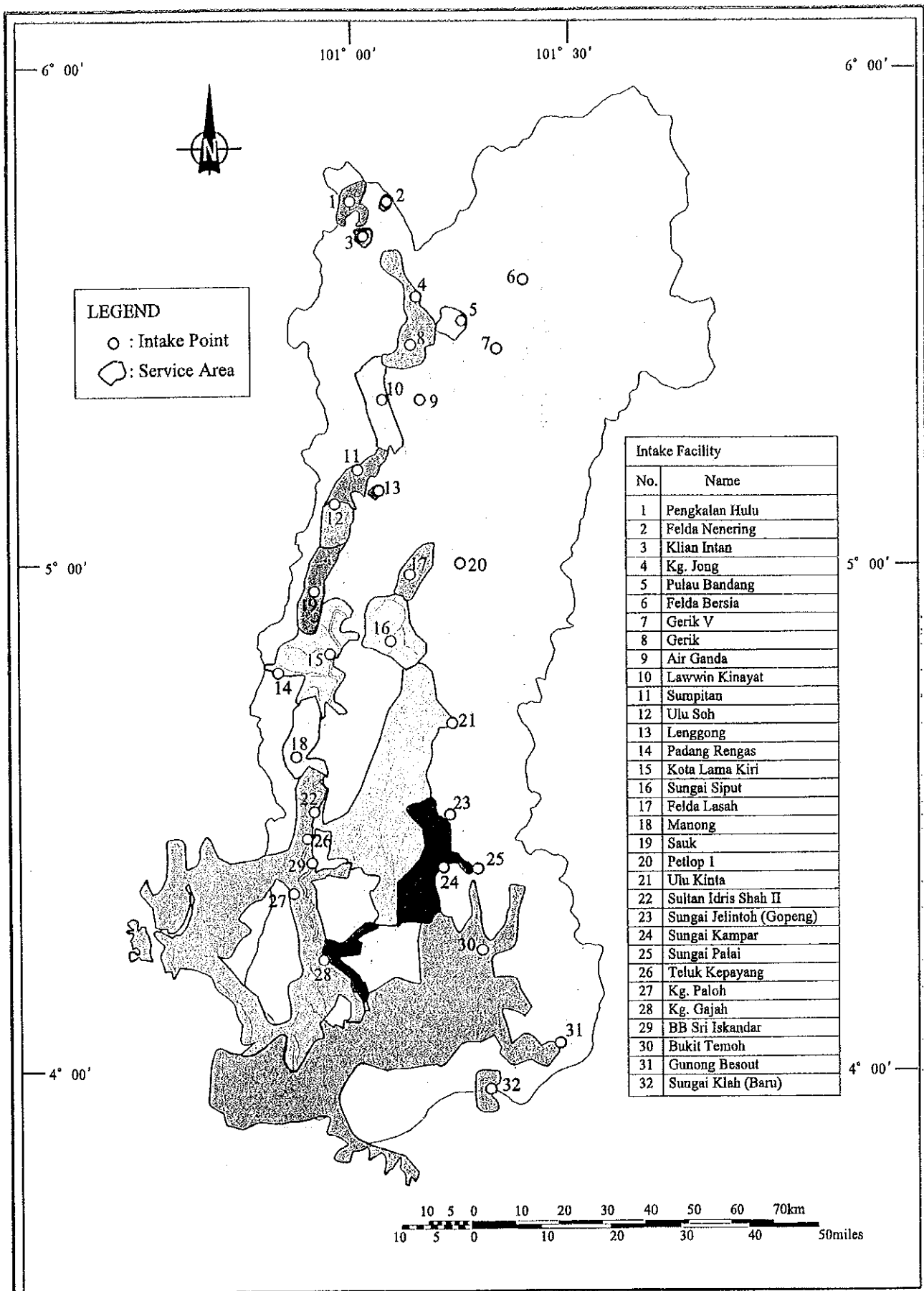
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Fig. 4-7

LOCATION MAP OF EXISTING AND  
PROPOSED FLOOD MITIGATION  
WORKS





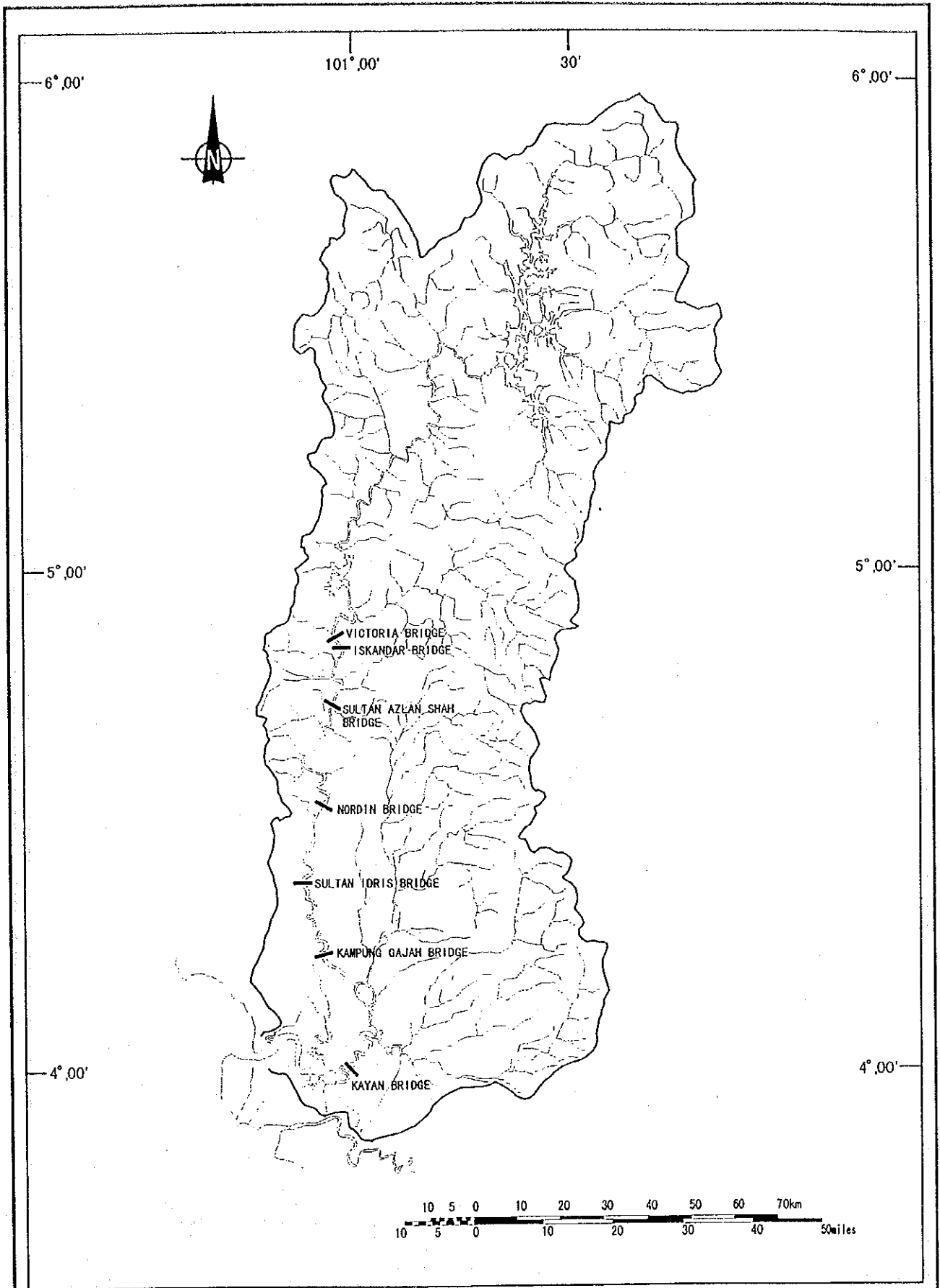


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Fig. 4-9 LOCATION MAP OF INTAKE POINTS  
AND SERVICE AREA FOR DOMESTIC  
AND INDUSTRIAL WATER SUPPLY

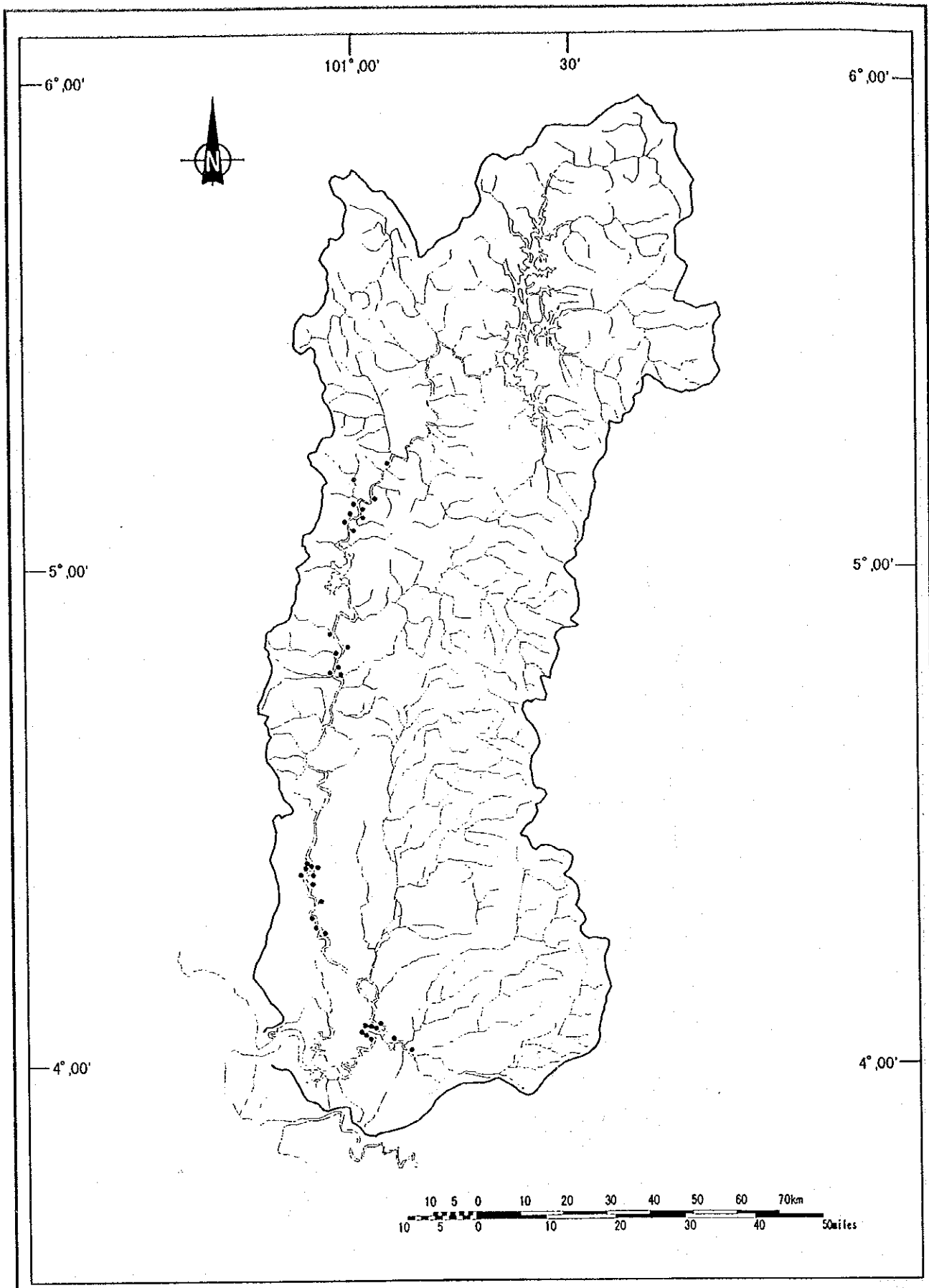




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Fig. 4-10 LOCATION MAP OF EXISTING MAJOR BRIDGES OVER PERAK RIVER

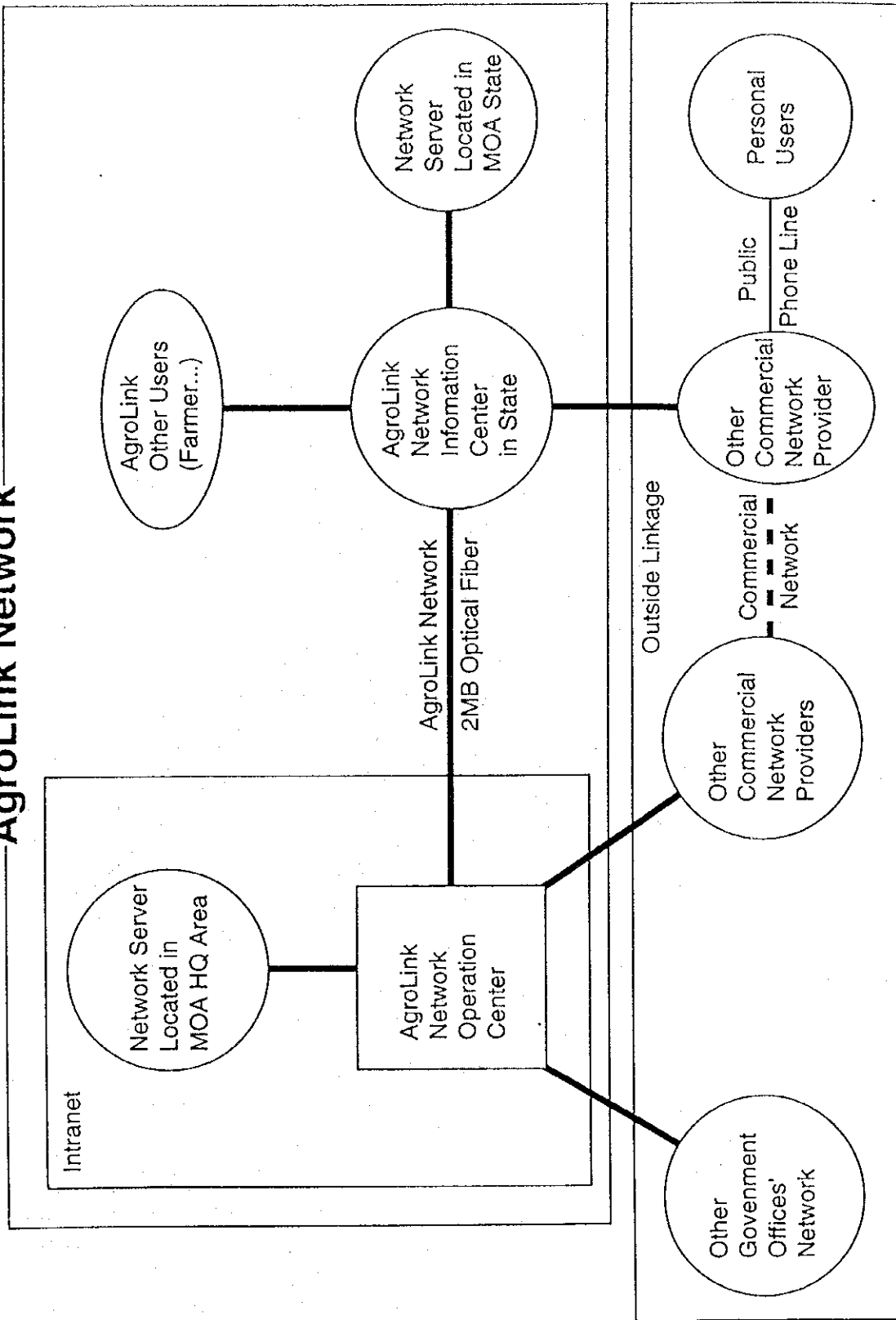


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Fig. 4-11 LOCATION OF SAND MINING SITES

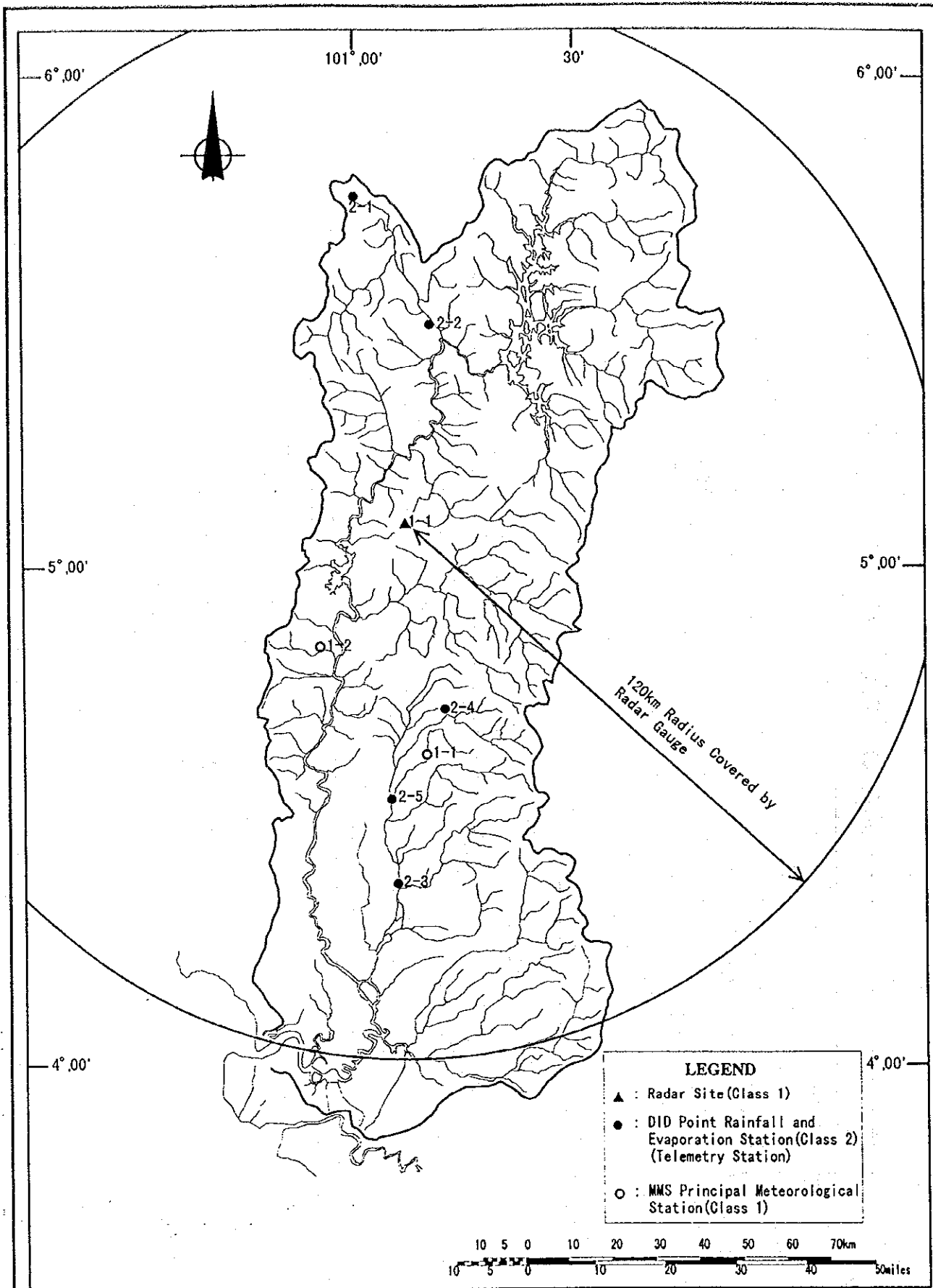
# AgroLink Network



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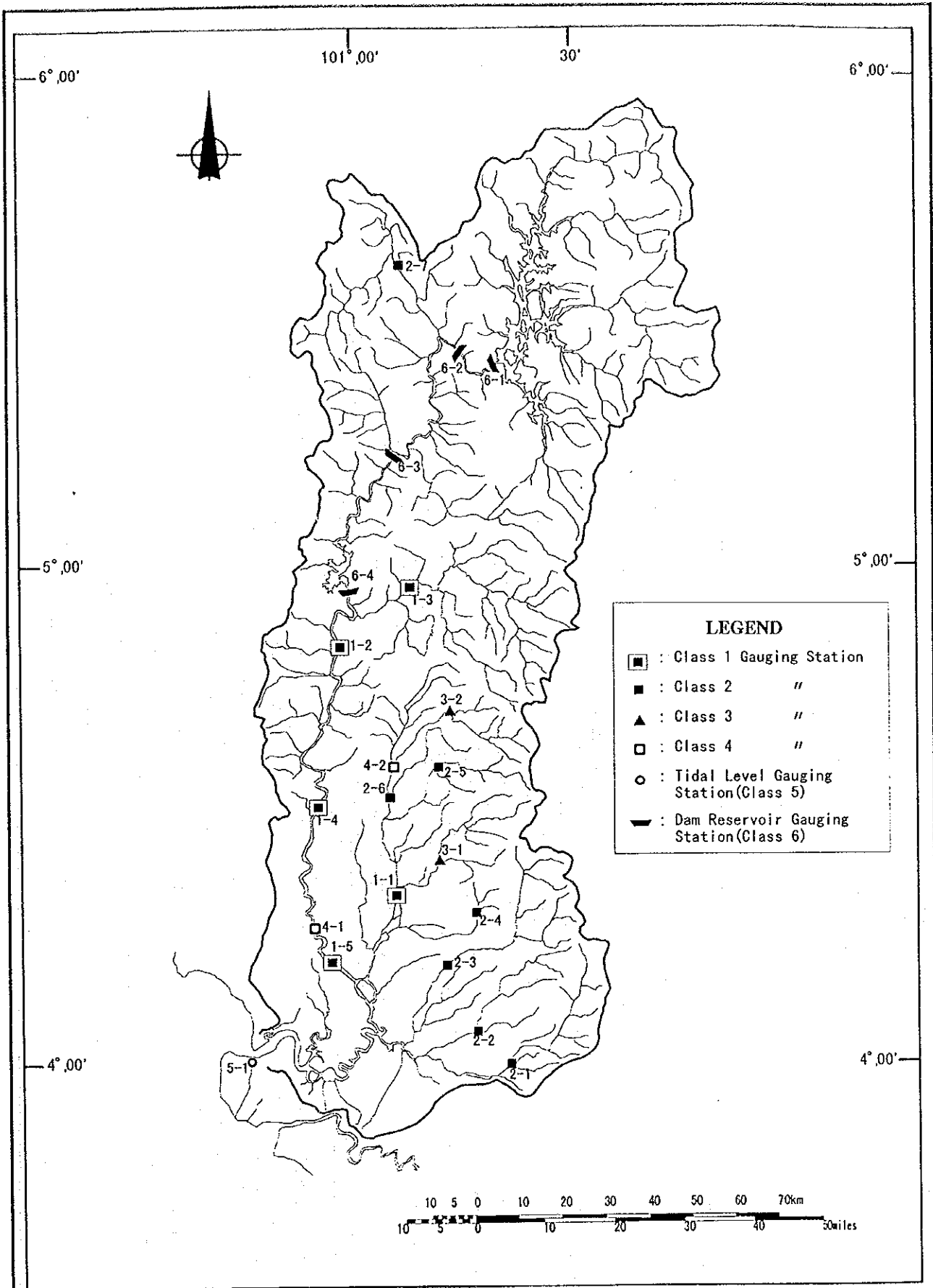
Fig. 5-1 AGROLINK NETWORK CONFIGURATION



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Fig. 6-1 LOCATION OF RAINFALL STATIONS  
PROPOSED FOR MASTER PLAN

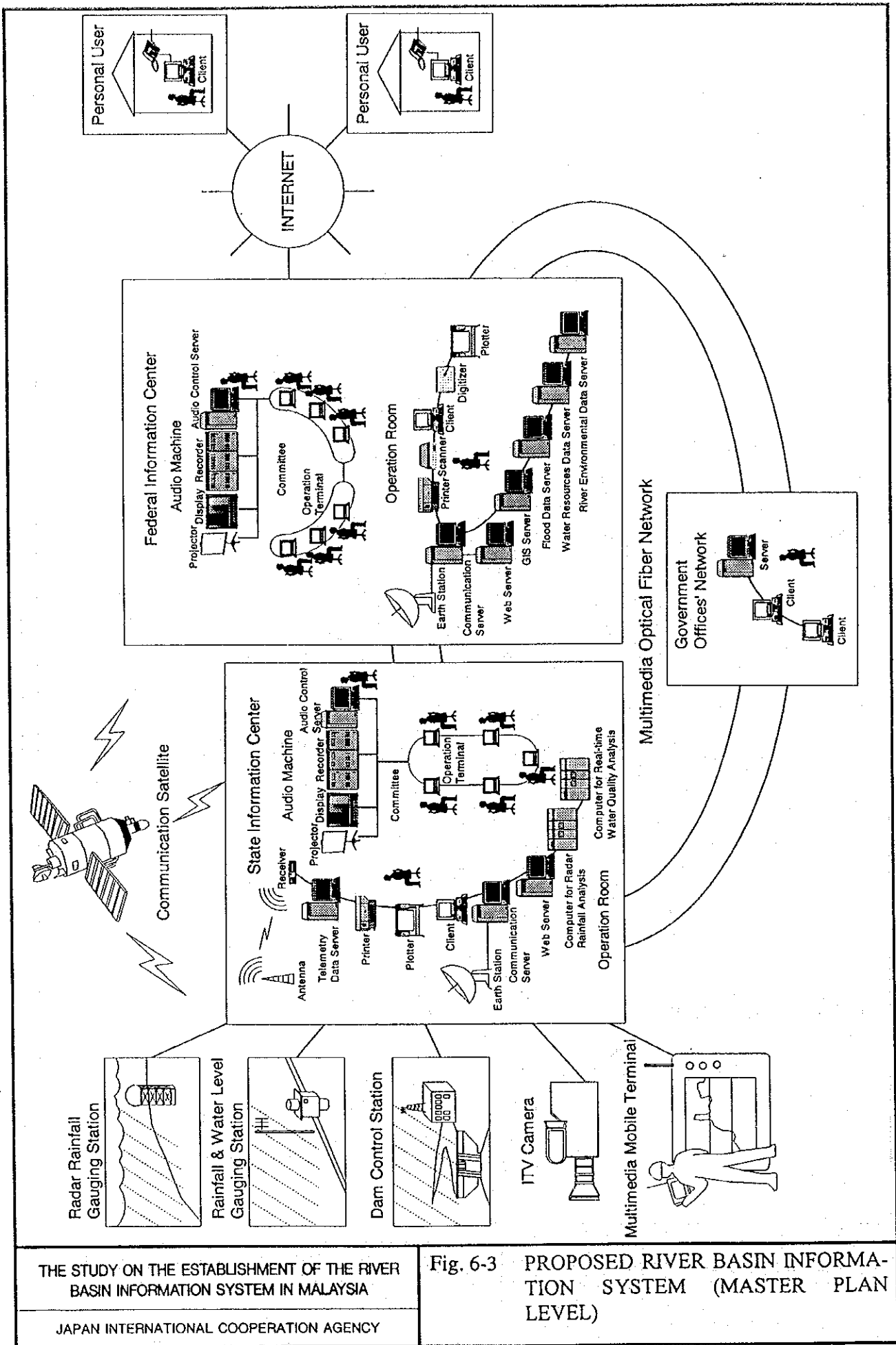


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Fig. 6-2 LOCATION OF STREAM GAUGING  
STATIONS PROPOSED FOR MASTER  
PLAN





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Fig. 6-3

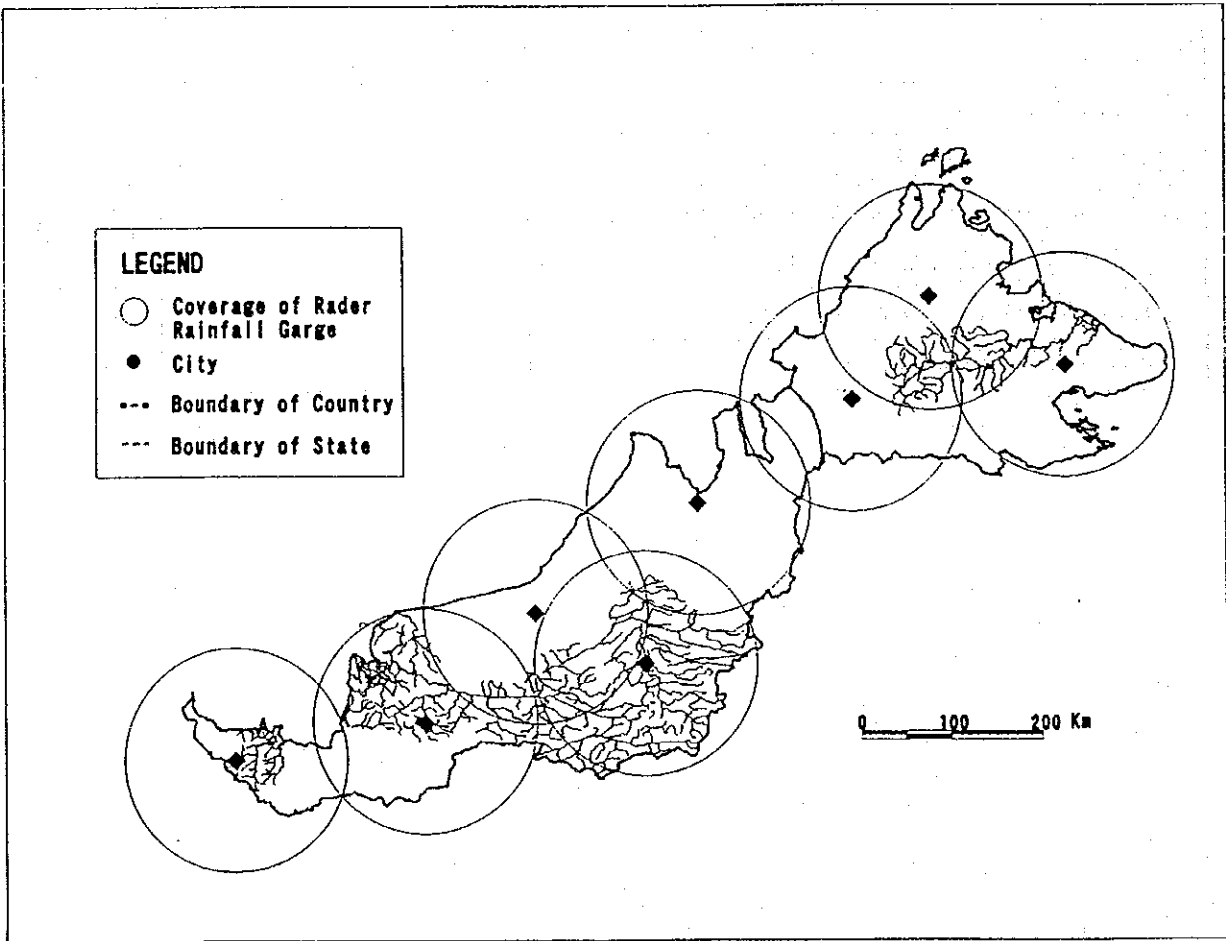
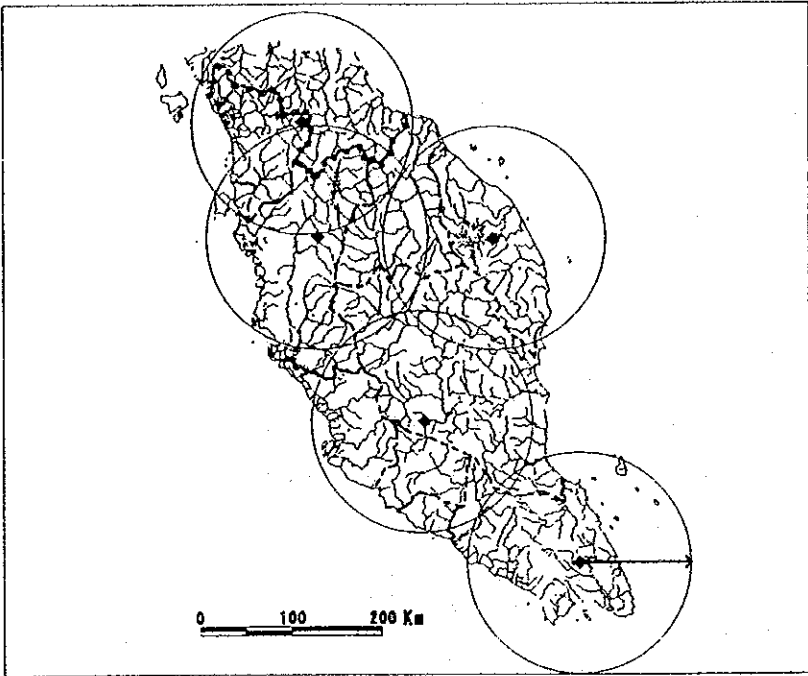
PROPOSED RIVER BASIN INFORMATION  
SYSTEM (MASTER PLAN  
LEVEL)

Items to be Established	8th MP	9th MP	10th MP	11th MP
	(2001-2005)	(2006-2010)	(2011-2015)	(2016-2020)
<b>1. Gauging/Monitoring System</b>				
(1) Water stage gauging (expansion of the existing network)	●			
(2) Portable information terminal (PIT)	●			
(3) Automatic water quality gauge		●		
(4) Radar rainfall gauge			●	
(5) Industrial television (ITV)				●
<b>2. Processing System</b>				
(1) Data base server	●			
(2) Input/output devices	●			
(3) Computer for analysis of real-time water quality data		●		
(4) Computer for analysis of radar rainfall gauge data			●	
(5) Audio Control Server				●
<b>3. Data Transmission System</b>				
(1) Telemetry system (expansion of the existing system)	●			
(2) Optical fiber network (between KL - Ipoh and within the area of KL)	●			
(2) Telemetry system (for real-time water quality)		●		
(3) Multiplex radio wave system (for radar rainfall gauge)			●	
(4) Optical fiber network (within Perak river basin)				●

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Fig. 6-4 PROJECT IMPLEMENTATION  
SCHEDULE



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Fig. 6-5 PROPOSED NATION-WIDE RADAR  
RAINFALL SITES IN MALAYSIA

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