

TABLES

Table 1 HYDROLOGICAL BALANCE BY STATE

Unit: $10^9 \text{ m}^3/\text{y}$

State	Rainfall	Surface Runoff	Groundwater Recharge	Evapo-transpiration
Perlis	2	1	0	1
Kedah	23	12	1	10
Pulau Pinang	3	2	0	1
Perak	50	22	4	24
Selangor	18	7	2	9
Negeri Sembilan	14	5	1	8
Melaka	3	1	0	2
Johor	45	19	3	23
Pahang	80	33	4	43
Trengganu	43	22	2	19
Kelantan	39	23	3	13
Peninsular Malaysia	320	147	20	153
Sabah	194	113	14	67
Sarawak	476	306	30	140
Malaysia	990	566	64	360

Table 2 CODING OF CITIES/TOWNS

No.	Name	No.	Name	No.	Name
<u>Perlis</u>		<u>Negeri Sembilan</u>		<u>Pahang (2/2)</u>	
C1	Kangar	C28	Port Dickson	C146	Pt 10
<u>Kedah</u>		C29	Seremban	C147	Pt 11
C2	Alor Setar	C30	Kuala Pilah	C148	Pt 12
C3	Sungai Petani	C118	Bahau	C149	Pt 13
C4	Kulim	C119	Tampin	C150	Pt 14
C101	Jitra	<u>Melaka</u>		C151	Pt 15
C102	Gura Chempedak	C31	Melaka	C152	Pt 16
C103	Yan	C120	Kelebang	C153	Pt 17
C104	Tikan Batu	C121	Bukit Baru	C154	Pt 18
<u>Pulau Pinang</u>		<u>Johor</u>		C155	Pt 19
C5	Butterworth	C32	Segamat	C156	Pt 20
C6	Bukit Mertajam	C33	Tangkak	<u>Trengganu</u>	
C8	Georgetown	C34	Muar	C51	Chukai
C105	Air Itam	C35	Batu Pahat	C52	Dungun
C106	Tg. Tokong	C37	Pontian Kechil	C53	Kuala Trengganu
C107	Gelugor	C38	Kulai	C132	Ulu Trengganu
C108	Tg. Bunga	C39	Johor Bahru	<u>Kelantan</u>	
C109	Kg. Pmtg Kuching	C40	Kota Tinggi	C54	Tanah Merah
C110	Perai	C41	Keluang	C55	Kota Bharu
<u>Perak</u>		C42	Mersing	C56	Peringat
C10	Taiping	C122	Labis	C57	Pengkak Kalong
C11	Kuala Kangsar	C123	Yong Peng	C58	Pasir Mas
C12	Sg. Siput Utara	C124	Pekan Nanas	C133	Kuala Krai
C13	Ipoh	C125	Jementah	C134	Kadok
C14	Batu Gajah	C126	Ulu Tiram	C135	Gua Musang
C15	Kampar	C127	Senai	C136	Rantau Panjang
C17	Telok Anson	C128	Kelapa Sawit	<u>Sabah</u>	
C18	Tapah	C129	Masai	C201	Tawau
C111	Baru Mambang	<u>Pahang (1/2)</u>		C202	Semporna
C112	Bagan Serai	C45	Temerloh	C203	Lahad Datu
C113	Jelapang	C46	Bentong	C204	Sandakan
<u>Selangor + Federal Territory</u>		C47	Kuantan	C205	Kudat
C21	Kuala Kubu Baru	C48	Jerantut	C206	Kota Belud
C22	Kelang	C49	Raub	C207	Ranau
C23	Shah Alam	C50	Kuala Lipis	C208	Kota Kinabalu
C24	Petaling Jaya	C130	Mentakab	C209	Papar
C25	W. Persekutuan:	C131	Teriang	C210	Keningau
	Kuala Lumpur	C137	Pt 1	C211	Labuan
C26	Kajang Chua	C138	Pt 2	<u>Sarawak</u>	
C114	S. Buloh	C139	Pt 3	C212	Limbang
C115	Semenyih	C140	Pt 4	C223	Marudi
C116	Ampang	C141	Pt 5	C214	Miri
C117	Serdang Baru	C142	Pt 6	C215	Bintulu
		C143	Pt 7	C216	Sibu
		C144	Pt 8	C217	Sarikei
		C145	Pt 9	C218	Serian
				C219	Kuching

Remarks; Pt 1-20: Pahang Tenggara new towns

Table 3 PROJECTED POPULATION BY STATE

	Area (10 ³ km ²)	Population (10 ³)			
		1980	1985	1990	2000
Perlis/Kedah	10.29	1,330	1,434	1,519	1,638
Pulau Pinang	1.04	970	1,066	1,133	1,171
Perak	20.95	1,875	1,978	2,050	2,110
Selangor	6.67	2,557	3,087	3,656	4,846
Negeri Sembilan	8.23	600	647	689	756
Melaka	1.65	482	509	526	538
Johor	19.14	1,704	1,911	2,113	2,487
Pahang	35.98	820	1,004	1,202	1,617
Trengganu	12.95	577	669	762	943
Kelantan	15.03	934	1,053	1,170	1,391
Peninsular Malaysia	131.93	11,849	13,358	14,820	17,497
Sabah	73.70	1,098	1,285	1,513	2,078
Sarawak	124.45	1,314	1,537	1,810	2,482
Malaysia	330.08	14,261	16,180	18,143	22,057
Annual growth rate (%)		2.6	2.3	2.0	

Remarks; Selangor: Including Federal Territory

Table 4 PROJECTED GDP AT 1970 CONSTANT PRICE BY STATE

	Unit: M\$10 ⁶			
	1980	1985	1990	2000
Perlis/Kedah	1,422	2,103	3,177	6,901
Pulau Pinang	2,220	3,011	4,364	7,208
Perak	2,882	3,891	5,528	10,224
Selangor	7,894	10,478	15,023	29,459
Negeri Sembilan	1,059	1,471	2,159	4,041
Melaka	688	930	1,347	2,554
Johor	2,857	4,162	6,245	12,673
Pahang	1,183	2,491	4,265	9,281
Trengganu	737	1,333	2,179	4,751
Kelantan	764	1,465	2,439	5,870
Peninsular Malaysia	21,706	31,335	46,726	92,962
Sabah	1,944	2,767	4,107	9,704
Sarawak	1,726	2,630	4,027	10,401
Malaysia	25,376	36,732	54,860	113,068
Annual growth rate (%)		7.7	8.4	7.5

Remarks; GDP : Gross domestic product at factor cost
Selangor: Including Federal Territory

Table 5 PROJECTED GROSS VALUE OF MANUFACTURING OUTPUT AT 1970 CONSTANT PRICE BY STATE

Unit: M\$10⁶

State	1980	1985	1990	2000
Perlis/Kedah	404	870	1,630	5,987
Pulau Pinang	2,595	3,914	6,324	10,560
Perak	1,664	3,059	5,473	12,106
Selangor	8,268	11,709	17,505	32,584
Negeri Sembilan	788	1,503	2,385	4,264
Melaka	297	531	946	2,351
Johor	2,389	4,244	7,140	15,433
Pahang	553	2,244	4,791	11,967
Trengganu	163	426	814	2,678
Kelantan	139	462	971	4,762
Peninsular Malaysia	17,260	28,962	47,979	102,692
Sabah	155	337	638	4,040
Sarawak	498	839	1,575	7,602
Malaysia	17,913	30,138	50,192	114,334
Annual growth rate (%)		11.0	10.7	8.6

Remarks; Selangor: Including Federal Territory

Table 6 PROJECTED GROSS VALUE OF MANUFACTURING OUTPUT AT 1970 CONSTANT PRICE BY COMMODITY GROUP

Unit: M\$10⁶

Commodity Group	1980	1985	1990	2000
Food	5,648	8,249	11,185	15,495
Textile	1,258	1,881	2,582	3,443
Wood	1,578	2,282	3,113	5,598
Paper	196	389	403	422
Publishing	696	1,350	2,775	9,265
Chemical	2,300	4,404	7,454	18,714
Rubber	1,492	2,679	4,905	12,427
Non-metal	631	1,090	1,861	4,262
Basic Metal	501	1,005	1,963	5,336
Machinery	3,433	6,377	13,146	37,187
Others	180	432	805	2,185
Total	17,913	30,138	50,192	114,334

Table 7 ASSUMED PER CAPITA DOMESTIC WATER USE

	Unit: lit			
	1980	1985	1990	2000
Population size of city/town				
More than 1,000,000	210	225	240	270
500,000 - 1,000,000	190	205	220	250
100,000 - 500,000	170	185	200	230
10,000 - 100,000	160	175	190	220
Rural area				
Treated supply	75	100	125	175
Untreated supply	40	45	55	70
Non-served area	40	40	40	40

Remarks; For the towns in Sabah and Sarawak in 1980, no figures showed here but actual figures were used.

Table 8 ASSUMED NET UNIT MANUFACTURING WATER USE

	Unit: m ³ /d/M\$106/y		
Commodity Group	1980	1985	1990 & 2000
Food	75	73	71
Textile	77	75	73
Wood Product	12	13	13
Paper Product	561	540	520
Publishing	10	10	10
Chemicals	137	133	130
Rubber Manufacturing	106	85	65
Non-metal	87	69	68
Basic Metal	52	50	49
Machinary	17	19	20
Miscellaneous	48	49	49

Remarks; At 1970 constant price.

Table 9 PROJECTED DOMESTIC AND INDUSTRIAL WATER DEMAND BY PURPOSE BY TYPE OF SUPPLY

Unit: 10⁶ m³/y

	1980	1985	1990	2000
Treated Public:				
Domestic	541	826	1,142	2,011
Industrial	325	530	713	1,415
Sub-total	866	1,356	1,855	3,426
Untreated: Domestic	19	41	60	100
Private: Industrial	315	495	665	1,314
Domestic	77	48	30	4
Sub-total	392	543	695	1,318
Malaysia	1,277	1,940	2,610	4,844
Raw Water to Singapore	198	250	316	414
Total	1,475	2,190	2,926	5,258

Remarks; All the figures are given in terms of source demand.

Table 10 PROJECTED DOMESTIC AND INDUSTRIAL WATER DEMAND BY STATE

Unit: 10⁶ m³/y

State	1980	1985	1990	2000
Perlis	7	9	16	37
Kedah	49	82	113	260
P. Pinang	124	169	236	343
Perak	145	216	327	596
Selangor	470	658	787	1,201
N. Sembilan	62	102	131	197
Melaka	30	43	61	112
Johor	159	258	338	578
Pahang	49	116	193	455
Trengganu	31	53	82	222
Kelantan	34	60	99	311
Peninsular Malaysia	1,160	1,766	2,383	4,312
Sabah	58	82	103	259
Sarawak	59	92	124	273
Malaysia	1,277	1,940	2,610	4,844
Raw Water to Singapore	198	250	316	414
Total	1,475	2,190	2,926	5,258

Remarks; Source demand comprising domestic and industrial demand.

Table 11 PROJECTED IRRIGATED PADDY DEVELOPMENT

Unit: 10³ ha

	1980	1985	1990	2000
Wet Paddy				
Irrigated				
Double cropping	238	277	314	367
Single cropping	91	116	141	178
Sub-total	329	393	455	545
Rainfed	217	147	95	5
Total	546	540	550	550
Dry & Hill Paddy	93	80	50	10
Total Paddy	639	620	600	560

Table 12 PROJECTED IRRIGATED PADDY AREA BY STATE

Unit: 10³ ha

	1980	1985	1990	2000
Perlis	7	9	12	13
Kedah	109	117	124	131
Pulau Pinang	17	17	17	17
Perak	49	54	59	60
Selangor	19	19	19	19
Negeri Sembilan	12	12	12	12
Melaka	9	9	10	10
Johor	4	8	11	13
Pahang	19	29	38	47
Trengganu	18	21	24	26
Kelantan	39	53	66	88
Peninsular Malaysia	302	348	392	436
Sabah	21	27	32	39
Sarawak	6	18	31	70
Malaysia	329	393	455	545

Remarks; Selangor: Including Federal Territory

Table 13 PROJECTED IRRIGATION WATER DEMAND BY STATE

Unit: 10⁶ m³/y

	1980	1985	1990	2000
Perlis	94	142	189	213
Kedah	2,263	2,299	2,334	2,497
Pulau Pinang	517	468	418	438
Perak	1,280	1,369	1,458	1,481
Selangor	624	596	567	567
Negeri Sembilan	290	298	306	315
Melaka	207	224	240	248
Johor	133	190	247	313
Pahang	342	568	793	1,026
Trengganu	397	433	468	520
Kelantan	859	1,056	1,252	1,635
Peninsular Malaysia	7,006	7,643	8,272	9,253
Sabah	372	471	569	639
Sarawak	14	105	196	482
Malaysia	7,392	8,219	9,037	10,374

Remarks; Selangor: Including Federal Territory

Table 14

BASIN AREA AND ASSUMED RIVER MAINTENANCE
FLOW IN PENINSULAR MALAYSIA

Basin No.	Name of Basin	Total Catchment Area (km ²)	Effective Catchment Area (km ²)	Balance Point (km)	River Maintenance Flow (m ³ /s)
1	Perlis	790	550	12	2.3
2	Pulau Langkawi	475	350	Unspecified	2.3
3	Kedah	3,695	2,510	15	14.3
4	Merbok	520	340	12	2.1
5	Muda	4,300	4,200	10	28.0
6	Perai+	895	600	15	4.5
7	Pulau Pinang	300	220	Unspecified	1.6
8	Kerian	1,420	1,360	7	10.2
9	Kurau+	3,255	1,155	45	7.8
10	Perak	14,700	13,555	70	52.3
11	Bernam	3,335	2,325	53	15.6
12	Tengi+	565	420	15	3.4
13	Selangor	1,820	1,685	32	19.6
14	Buloh+	560	295	15	2.2
15	Kelang	1,425	1,150	29	10.5
16	Langat	1,815	1,420	44	15.8
17	Sepang+	640	260	12	2.2
18	Linggi+	1,420	1,310	3	2.5
19	Melaka+	1,010	690	5	1.2
20	Kesang	705	675	4	0.8
21	Muar	6,595	6,170	20	8.2
22	Batu Pahat+	2,600	2,255	3	4.5
23	Pontian Kechil+	2,660	1,800	8	11.6
24	Johor+	3,250	2,490	42	14.1
25	Sedili Besar+	1,820	1,495	16	9.7
26	Mersing+	880	465	14	3.8
27	Endau	4,740	4,350	25	30.2
28	Rompin	4,285	3,730	40	20.0
29	Bebar+	1,895	570	49	4.2
30	Pahang+	29,300	27,650	44	143.0
31	Kuantan+	2,025	1,635	13	11.6
32	Kemaman+	2,570	2,245	5	23.1
33	Paka	850	815	2	7.4
34	Dungun	1,875	1,760	10	20.6
35	Marang+	760	650	6	8.1
36	Trengganu	4,650	4,600	1	61.5
37	Setiu+	1,035	875	6	10.0
38	Besut+	1,230	940	17	10.5
39	Kemasin+	1,020	310	35	4.8
40	Kelantan+	13,100	12,600	31	164.5
41	Golok	895	835	8	14.0
Total		131,680	113,310		

Remarks; The location of balance point is the river km measured upstream from the estuary.

Table 15 BASIN AREA AND ASSUMED RIVER MAINTENANCE FLOW IN SABAH AND SARAWAK

Basin No.	Basin	Total Catchment Area (km ²)	Effective Catchment Area (km ²)	Balance Point (km)	River Maintenance Flow (m ³ /s)
201	Pensiangan	5,971	5,971	0	75.9
202	Serudong	1,308	1,155	11	10.3
203	Kalabakan	1,371	1,288	13	12.4
204	Brantian	741	678	10	5.9
205	Umas Umas	553	408	5	3.3
206	Merutai Besar	558	473	5	4.2
207	Tawau	888	683	10	7.2
208	Kalumpang	2,792	2,284	5	23.5
209	Silibukan	2,714	2,154	5	30.4
210	Segama	5,558	4,787	35	63.2
211	Kinabatangan	16,755	15,752	52	74.7
212	Segaliud	2,335	1,632	8	22.5
213	Labuk	6,829	5,969	15	86.0
214	Sugut	3,094	2,826	35	40.4
215	Paitan	1,474	1,086	10	17.3
216	Bengkoka	1,866	1,463	4	6.8
217	Bongan	2,126	1,823	1	7.7
218	Kadamaian	1,336	1,171	5	7.3
219	Tuaran	1,247	1,139	6	7.8
220	Putatan	629	494	3	2.9
221	Papar	805	785	3	4.8
222	Kimanis	607	547	3	3.2
223	Membakut	736	338	12	1.9
224	Padas	9,180	8,475	27	57.2
225	Labuan	86	46	2	0.3
226	Lakutan	1,291	1,173	5	6.1
227	Lawas	1,080	977	5	7.8
228	Trusan	2,768	2,598	15	14.3
229	Limbang	3,920	3,865	6	71.1
230	Baram	22,325	21,822	63	388.0
231	Miri	788	263	20	1.8
232	Sibuti	935	790	15	4.5
233	Niah	1,345	1,117	12	6.1
234	Buai	1,440	1,242	31	8.5
235	Similajau	1,268	935	3	7.9
236	Kemena	6,000	5,745	21	62.0
237	Tatau	5,150	4,790	19	51.7
238	Balingian	2,518	1,548	46	16.3
239	Mukah	2,625	1,486	40	16.0
240	Oya	2,005	1,277	25	10.8
241	Rajang	51,053	46,035	15	1,409.0
242	Kerian	1,675	849	26	9.3
243	Saribas	1,900	799	39	8.4
244	Lupar	6,813	5,209	36	56.3
245	Sadong	3,645	2,935	81	33.2
246	Sarawak	3,358	2,152	35	36.4
247	Kayan	1,838	1,549	11	32.1
Total		197,299	172,583		

Remarks; The location of balance point is the river km measured upstream from the estuary.

Table 16 ESTIMATED ANNUAL NATURAL RUNOFF FROM EFFECTIVE AREA, TOTAL WATER DEMAND AND RIVER UTILIZATION RATIO BY BASIN IN PENINSULAR MALAYSIA

No.	Basin Name	Surface Runoff in Effective Area (1) (10 ⁶ m ³ /y)	1990				2000			
			Source Demand (10 ⁶ m ³ /y)		Ratio (2)/(1) (%)	Source Demand (10 ⁶ m ³ /y)		Ratio (3)/(1) (%)		
			D&I	Irrigation		Total (2)	D&I		Irrigation	Total (3)
1	Perlis	465	16	189	205	44	37	213	250	54
2	Pulau Langkawi	455	2	45	47	10	3	45	48	11
3	Kedah	2,837	52	1,878	1,930	68	132	1,972	2,104	74
4	Merbok	426	22	48	70	16	61	48	109	26
5	Muda	5,569	23	539	562	10	36	618	654	12
6	Perai	893	147	166	313	35	218	166	384	43
7	Pulau Pinang	311	95	30	125	40	136	31	167	54
8	Kerian	2,037	3	54	57	3	5	61	66	3
9	Kurau	1,560	108	518	626	40	206	518	724	46
10	Perak	12,848	208	932	1,140	9	375	957	1,332	10
11	Bernam	2,564	27	567	594	23	36	567	603	24
12	Tengi	347	3	0	3	1	3	0	3	1
13	Selangor	1,992	29	0	29	1	29	0	29	1
14	Buloh	222	8	0	8	4	11	0	11	5
15	Kelang	1,070	687	0	687	64	1,060	0	1,060	99
16	Langat	1,604	45	41	86	5	51	41	92	6
17	Sepang	224	71	3	74	33	111	3	114	51
18	Linggi	1,204	44	110	154	13	67	111	178	15
19	Melaka	583	56	169	225	39	104	177	281	48
20	Kesang	358	8	72	80	22	11	72	83	23
21	Muar	3,849	70	236	306	8	109	246	355	9
22	Batu Pahat	2,095	50	5	55	3	81	5	86	4
23	Pontian Kechil	1,940	158	6	164	8	280	6	286	15
24	Johor	2,362	350	1	351	15	457	1	458	19
25	Sedili Besar	1,632	5	0	5	0	5	0	5	0
26	Mersing	632	8	0	8	1	14	0	14	2
27	Endau	5,046	39	210	249	5	62	274	336	7
28	Rompin	3,340	30	126	156	5	58	126	184	6
29	Bebar	695	2	9	11	2	4	9	13	2
30	Pahang	24,238	108	585	693	3	235	818	1,053	4
31	Kuantan	1,691	55	13	68	4	155	13	168	9
32	Kemaman	3,369	10	18	28	1	30	18	48	1
33	Paka	1,082	0	3	3	0	0	3	3	0
34	Dungun	3,013	8	31	39	1	24	37	61	2
35	Marang	1,181	2	26	28	2	2	47	49	4
36	Trengganu	8,974	57	200	257	3	161	208	369	4
37	Setiu	1,466	2	42	44	3	2	59	61	4
38	Besut	1,544	3	148	151	9	3	148	151	9
39	Kemasin	532	18	0**	18	3	18*	0**	18	3
40	Kelantan	18,522	76	1,203**	1,279	7	293*	1,586**	1,879	10
41	Golok	1,580	5	49**	54	3	9	49**	58	4

Remarks; D&I: Domestic and Industrial Water Supply

*: Incremental demand after 1990 will be met by water from Basin 40.

** : All demand will be met by water from Basin 40.

Table 17 ESTIMATED EFFECTIVE AREA, ANNUAL NATURAL RUNOFF, TOTAL WATER DEMAND AND RIVER UTILIZATION RATIO IN WATER STRESS SUB-BASINS IN SABAH AND SARAWAK

Basin No.	Name of Sub-basin	Effective Area (km ²)	Surface Runoff in Effective Area (1) (10 ⁶ m ³ /y)	1990				2000			
				Source Demand (10 ⁶ m ³ /y)		Ratio (2)/(1) (%)	Source Demand (10 ⁶ m ³ /y)		Ratio (3)/(1) (%)		
				D&I	Irrigation		Total (2)	D&I		Irrigation	Total (3)
207	Tawau	83	103	8.0	0	8.0	8	25.8	0	25.8	25
212	Sandakan	36	82	14.8	0	14.8	18	50.1	0	50.1	61
217	Kudat	70	80	2.2	0	2.2	3	8.1	0	8.1	10
218	Kadamaian	813	1,378	0.9	126	126.9	9	3.7	135	138.7	10
219	Moyog	195	357	23.1	37	60.1	17	62.3	37	99.3	28
225	Labuan	46	96	12.4	0	12.4	13	23.8	0	23.8	25
231	Miri	150	247	13.4	0	13.4	5	51.4	0	51.4	21

Remarks; D&I: Domestic and Industrial Water Supply

Table 18 ESTIMATED WATER DEFICIT IN WATER STRESS BASINS/SUB-BASINS IN 1990 AND 2000

Unit: 10^6 m³/y

Basin No.	Name of Basin	1990				2000			
		1/N		4/N		1/N		4/N	
		Defi- cit	Year	Defi- cit	Year	Defi- cit	Year	Defi- cit	Year
<u>PENINSULAR MALAYSIA</u>									
1	Perlis	63.3	1968	33.3	1965	86.7	1968	49.7	1967
2	Pulau Langkawi	14.7	1968	7.4	1962	14.9	1968	7.5	1962
3	Kedah	963.4	1963	761.1	1965	1144.0	1963	903.6	1965
4	Merbok	13.9	1968	7.8	1962	18.5	1963	10.6	1965
5	Muda	221.5	1963	113.9	1979	280.4	1963	138.0	1979
6	Perai+	100.9	1963	55.7	1964	156.7	1963	91.3	1964
7	Pulau Pinang	56.8	1963	36.9	1965	81.8	1963	57.6	1965
8*	Kerian	10.4	1965	6.0	1979	10.8	1965	6.4	1979
9	Kurau+	260.6	1963	129.3	1962	280.9	1963	143.1	1962
11	Bernam	324.5	1978	76.3	1979	326.3	1978	76.9	1979
12*	Tengi+	0.5	1978	0		0.5	1978	0	
13*	Selangor	17.2	1978	0.1	1962	17.3	1978	0.1	1962
15	Kelang	101.7	1978	50.3	1965	168.0	1978	98.1	1965
16*	Langat	33.3	1978	4.6	1977	33.7	1978	4.8	1977
19	Melaka+	130.8	1979	72.8	1961	171.6	1979	96.7	1961
20	Kesang	25.6	1963	2.1	1968	26.3	1963	2.1	1968
21*	Muar+	139.0	1963	10.3	1962	161.3	1963	15.0	1962
23	Pontian Kechil+	215.2	1963	60.7	1968	276.3	1963	88.9	1971
24	Johor+	352.4	1963	112.1	1968	414.3	1963	152.8	1962
40	Kelantan+	636.8	1963	180.5	1977	798.7	1963	300.3	1977
<u>SABAH & SARAWAK (Sub-Basins)</u>									
207	Tawau	7.8	1973	0.8	1971	15.3	1973	5.5	1971
218	Wariu (Kadamaian)	51.1	1973	3.8	1970	54.5	1973	4.9	1975
220	Moyog	14.0	1973	4.8	1968	23.7	1973	11.2	1965
221*	Papar	12.1	1973	0.6	1968	12.4	1973	0.7	1968
231	Miri	3.3	1976	0.8	1974	13.2	1976	7.5	1974

Remarks; *: Basin interconnected or to be interconnected with a water stress Basin, though not water stress Basin in itself.

Table 19

ASSUMED DEVELOPMENT OF LAND DISPOSAL
OF EFFLUENT FROM OIL PALM MILLS AND
RUBBER FACTORIES

	1980	1990	2000
Palm oil mills	25	50	75
Rubber factories	0	10	20

Unit: %

Table 20

ASSUMED DISCHARGE RATIO, RUNOFF RATIO
AND BOD CONCENTRATION OF EFFLUENT

	Discharge Ratio	BOD Concentration (mg/lit)	Runoff Ratio
Domestic			
Urban sewerage	0.9	30	0.9
Urban non-sewerage	0.9	140 - 160	0.9
Rural	0.8	200	0.9
Manufacturing			
Urban sewerage	1.0	30	1.0
Urban non-sewerage	1.0	110 - 200	0.6
Rural	1.0	110 - 200	1.0
Palm Oil Mill			
Land disposal	0.1	50	0.6
Other treatment	0.3 - 0.55	50	0.6
Untreated	0.3 - 0.55	22,000	0.6
Rubber Factory			
Land disposal	0.1	50	0.6
Other treatment	0.3 - 0.55	50	0.6
Untreated	0.3 - 0.55	2,320	0.6
Animal Husbandry	1.0	200 ¹	0.1

Remarks; ¹: g/d/head

Infiltration ratio in sewerage system is assumed to be 0.2.

Table 21 WATER SOURCE DEVELOPMENT PLAN FOR PANINSULAR MALAYSIA FOR ALTERNATIVE B1 (1/2)

(1) DAMS			Catchment	Active	Net	Construc-	Construc-
Basin	Facilities	Purpose	Area	Storage	Supply	tion	tion
No.			(km ²)	Capacity	Capacity	Cost	Period
				(10 ⁶ m ³)	(10 ⁶ m ³ /y)	(M\$10 ⁶)	
1	Arau dam	IR	50	37	36	25	1983-1987
1	Timah-Tasoh dam	WS,IR,FM	150	6	20	14/1	1989-1993
2	Aver Tawar dam	IR	11	8	10	219	1985-1989
2	Ulu Melaka dam	IR	7	3	6	15	1985-1989
2	Nylor dam	IR	4	0.5	2	8	1985-1989
3	Ahning dam	WS,IR	120	116	100	70	1983-1987
3	Badak-Temin dam	IR	114	137	95	34	1983-1987
3	Sari dam	IR	61	73	51	31	1986-1990
3	Durian dam	IR	75	88	63	35	1989-1994
4	4-A dam	WS,IR	16	15	21	17	1985-1989
5	Naok-Reman dams	WS,IR	-	-	350	123	1983-1987
5	Beris dam	WS,IR	115	21	75	25	1983-1987
5	Tawar-Muda dam	WS,IR	135	21	75	37	1985-1989
5	Legong dam	WS,IR	44	44	45	32	1985-1989
5	Weng dam	WS,IR	37	37	38	27	1985-1989
5	Charock Teber dam	WS,IR	38	38	39	27	1985-1989
5	Chiak dam	WS,IR	23	23	24	17	1986-1990
6	Mengkuang Phase I & II	WS	4	24	24	55	U/C 1981-1985
8	Kerian dam	WS,IR	112	208	134	1,356	1985-1989
8	Sira dam	WS,IR	29	32	47	178	1985-1989
9	9-A(2) dam	WS,IR	-	-	15	18	1990-1994
10	Rui dam	WS,IR	215	313	163	796	1983-1987
10	Kinta (B) dam	WS	155	53	55	364	1985-1989
11	Geling dam	IR	56	30	32	89	1985-1989
11	Bil dam	IR	26	13	15	74	1985-1989
11	Sungkai dam	IR	193	161	100	530	1985-1989
11	(Hypothetical)	IR	-	-	153	811	1985-1989
13	Selangor dam	WS	201	270	186	541	1985-1989
13	Batan Kali dam	WS	49	72	45	76	1985-1989
15	Batu dam	WS	50	28	39	80	U/C 1982-1985
15	Gombak dam	WS	87	28	60	28	1986-1990
16	Semenyih dam	WS	54	15	44	89	U/C 1982-1985
18	Terip dam	WS,IR	23	43	41	21	1985-1989
21	Muar dam	WS,IR	209	36	37	20	1990-1994
21	Palong dam	WS,IR	316	140	107	27	1985-1989
24	Semangar dam	WS	160	137	123	54	1985-1989
24	Linggiu dam	WS	237	203	182	25	1985-1989
24	Pengeli dam	WS	143	65	84	30	1985-1989
25	Sedili dam	WS	227	124	164	18	1985-1989
27	Anak Endau dam	IR	36	38	33	76	U/C 1983-1987
27	Kemelai dam	IR	44	47	41	30	U/C 1983-1987
30	Kenaboi dam	WS	118	-	83	237	1988-1992
30	Perting dam	WS	88	119	59	214	1994-1998
30	Kongkoi dam	WS	54	69	33	224	1992-1996
30	Bera dam	WS	258	171	180	21	1985-1989
30	Teriang dam	WS	60	105	42	225	1985-1989
30	Gelami dam	WS	58	9	18	27	1990-1994
31	Kuantan Barrage	WS	-	-	-	20	U/C 1981-1985
40	Nenggiri dam	WS,IR	3,940	201	960	243	1995-1999

Remarks; Construction cost: At 1980 constant price
 IR: Irrigation, WS: Water supply, FM: Flood mitigation
 U/C: Under construction
 /1: Excluding flood mitigation cost

Table 22 WATER SOURCE DEVELOPMENT PLAN FOR PENINSULAR MALAYSIA FOR ALTERNATIVE B1 (2/2)

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
3	Jeniang diversion (barrage & canal)	Kedah 5 to 3	21.1	Included in Naok-Reman dams	1983 - 1987
10	Rui diversion (tunnel)	Perak Kedah 10 to 5	10.5	Included in Rui dam	1983 - 1987
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19&20	15	160	1985 - 1989
23	Teberau diversion (barrage)	Johor 23 to 23 & Singapore	35	9*	1985 - 1989
24	Semangar diversion (canal)	Johor 24 to 23	35	36	1985 - 1989
24	Johor diversion (barrage & canal)	Johor 24 to 24	27	25	1985 - 1989
25	Sedili diversion (canal & pipeline)	Johor 25 to 24	10	83	1985 - 1989
30	Kenaboi diversion (tunnel)	N. Sembilan, Selangor 30 to 16-15	5	11	1988 - 1992
30	Perting diversion (tunnel)	Pahang, Selangor 30 to 13-15	4	6	1994 - 1998
30	Kongkoi diversion	N. Sembilan, Selangor 30 to 16-15	2	2	1992 - 1996
30	Teriang diversion (pipeline)	N. Sembilan 30 to 17	Stage 1: 3 Stage 2: 1	525 300	1985 - 1989 1990 - 1994
30	Bera diversion (canal)	Pahang to N. Sembilan 30 to 21	13	32	1985 - 1989

Remarks; Construction cost: At 1980 constant price

*: Excluding the cost of distribution pipeline for water supply

Table 23 WATER SOURCE DEVELOPMENT PLAN FOR SABAH AND SARAWAK FOR ALTERNATIVE B1

(1) DAMS

Basin No.	Name of Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>							
207	Tawau dam	WS	38	7	21	89	1987-1991
213	Melilau dam	WS	58	17	48	150	1986-1990
217	Milau dam	WS	70	5	12	8	1987-1991
218	Wariu dam	IR,WS	123	25	65	269	1985-1989
221	Papar dam	IR,WS	353	25	58	71	1985-1989
<u>SARAWAK</u>							
231	Miri dam	WS	33	5	20	15	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Purpose	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>						
213	Melilau diversion	WS	213 to 212 (Sandakan)			
	- Pipeline-1	WS		0.3	133	1983-1987
	- Pipeline-2	WS		0.6	223	1986-1990
	- Pipeline-3	WS		0.6	223	1991-1995
217	Milau diversion	WS	217 to 217 (Kudat)	0.4	15	1983-1987
221	Papar diversion	WS	221 to 220 (Kota Kinabalu)	2	41	1985-1989
224	Padas diversion	WS	224 to 225 (Labuan)			
	- Pipeline-1	WS		0.3	153	1983-1987
	- Pipeline-2	WS		0.3	153	1988-1992

Remarks; Construction cost: At 1980 constant price
IR: Irrigation, WS: Water supply

Table 24 WATER SOURCE DEVELOPMENT PLAN FOR PENINSULAR MALAYSIA FOR ALTERNATIVE B2 (1/2)

(1) DAMS

Basin No.	Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
1	Timah-Tasoh dam	WS,IR,FM	150	6	20	14/1	1986-1990
2	Ayer Tawar dam	IR	11	8	10	219	1985-1989
2	Ulu Melaka dam	IR	7	3	6	15	1985-1989
3	Ahning dam	WS,IR	120	27	73	51	1983-1987
3	Badak-Temin dam	IR	114	137	95	34	1983-1987
3	Sari dam	IR	61	73	51	31	1986-1990
3	Durian dam	IR	75	88	63	35	1990-1994
5	Naok-Reman dams	WS,IR	-	-	350	123	1983-1987
5	Beris dam	WS,IR	115	21	75	25	1985-1989
5	Tawar-Muda dam	WS,IR	135	21	75	37	1985-1989
5	Legong dam	WS,IR	44	44	45	32	1986-1990
6	Mengkuang Phase I & II	WS	4	24	24	55	U/C 1981-1985
8	Kerian dam	WS,IR	112	92	120	970	1985-1989
10	Rui dam	WS,IR	215	313	168	796	1983-1987
10	Kinta (B) dam	WS	155	27	37	169	1985-1989
11	Geling dam	IR	56	12	13	36	1985-1989
13	Selangor dam	WS	201	270	190	575	1985-1989
13	Batang Kali dam	WS	49	72	45	76	1986-1990
15	Batu dam	WS	50	28	39	80	U/C 1982-1985
15	Combak dam	WS	87	28	60	28	1988-1992
16	Semenyih dam	WS	54	41	44	89	U/C 1982-1985
18	Terip dam	WS,IR	23	40	38	19	1985-1989
21	Palong dam	WS,IR	316	56	46	16	1985-1989
24	Semangar dam	WS	160	137	123	54	1985-1989
24	Linggiu dam	WS	237	203	182	25	1985-1989
25	Sedili dam	WS	227	124	164	18	1985-1989
27	Anak Endau dam	IR	36	28	12	45	U/C 1983-1987
27	Kemelai dam	IR	44	34	15	18	U/C 1983-1987
30	Teriang dam	WS	60	105	42	225	1985-1989
30	Gelami dam	WS	58	9	15	25	1990-1994
30	Keneboi dam	WS	118	136	83	237	1990-1994
30	Perring dam	WS	88	119	59	214	1994-1998
31	Kuantan barrage	WS	-	-	-	20	U/C 1981-1985
40	Nenggiri dam	WS,IR	3,940	49	490	195	1995-1979

Remarks; Construction cost: At 1980 constant price

IR: Irrigation, WS: Water supply, FM: Flood mitigation

/1: Excluding flood mitigation cost

Table 25

WATER SOURCE DEVELOPMENT PLAN FOR PENINSULAR
MALAYSIA FOR ALTERNATIVE B2 (2/2)

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
3	Jenjang diversion (barrage & canal)	Kedah 5 to 3	17.3	Included in Naok-Reman dams	1983 - 1987
10	Rui diversion (tunnel)	Perak Kedah 10 to 5	10.5	Included in Rui dam	1983 - 1987
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19 & 20	13	139	1985 - 1989
23	Teberau diversion (barrage)	Johor 23 to 23 & Singapore	30	9*	1985 - 1989
24	Semangar diversion (canal)	Johor 24 to 23	30	30	1985 - 1989
24	Johor diversion (barrage & canal)	Johor 24 to 24	22	21	1985 - 1989
25	Sedili diversion (canal & pipeline)	Johor 25 to 24	10	83	1985 - 1989
30	Kenaboi diversion (tunnel)	N. Sembilan, Selangor 30 to 16-15	5	11	1990 - 1994
30	Perting diversion (tunnel)	Pahang, Selangor 30 to 13-15	4	6	1994 - 1998
30	Teriang diversion (pipeline)	N. Sembilan 30 to 17	Stage 1: 3 Stage 2: 1	525 253	1985 - 1989 1990 - 1994

Remarks; Construction cost: At 1980 constant price

*: Excluding the cost of distribution pipeline for water supply

Table 26 WATER SOURCE DEVELOPMENT PLAN FOR SABAH AND SARAWAK FOR ALTERNATIVE B2

(1) DAMS

Basin No.	Name of Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>							
207	Tawau dam	WS	38	4	12	57	1987-1991
213	Melilau dam	WS	58	17	48	150	1986-1990
217	Milau dam	WS	70	5	12	8	1987-1991
218	Warlu dam	IR,WS	123	17	42	179	1985-1989
221	Papar dam	IR,WS	353	15	35	67	1985-1989
<u>SARAWAK</u>							
231	Miri dam	WS	33	4	15	13	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Purpose	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>						
213	Melilau diversion	WS	213 to 212 (Sandakan)			
	- Pipeline-1	WS		0.3	133	1983-1987
	- Pipeline-2	WS		0.6	223	1986-1990
	- Pipeline-3	WS		0.6	223	1991-1995
217	Milau diversion	WS	217 to 217 (Kudat)	0.4	15	1983-1987
221	Papar diversion	WS	221 to 220 (Kota Kinabalu)	2	41	1985-1989
224	Padas diversion	WS	224 to 225 (Labuan)			
	- Pipeline-1	WS		0.3	153	1983-1987
	- Pipeline-2	WS		0.3	153	1988-1992

Remarks; Construction cost: At 1980 constant price
IR: Irrigation, WS: Water supply

Table 27 WATER SOURCE DEVELOPMENT PLAN FOR PENINSULAR MALAYSIA FOR ALTERNATIVE B3

(1) DAMS							
Basin No.	Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
1	Timah-Tasoh dam	WS,IR,FR	150	6	20	14/1	1985-1989
2	Ulu Melaka dam	IR	7	2	5	12	1985-1989
2	Aver Tawar dam	IR	11	2	6	131	1985-1989
3	Ahning dam	WS,IR	120	27	73	51	1983-1987
3	Badak-Temin dam	IR	114	19	59	21	1983-1987
3	Sari dam	IR	61	14	38	23	1987-1991
3	Durian dam	IR	75	17	45	25	1991-1995
5	Naok-Reman dams	WS,IR	-	-	350	123	1983-1987
5	Beris dam	WS,IR	115	12	35	15	1986-1990
6	Mengkuang Phase I & II	WS	4	24	24	55	1981-1985
8	Kerian dam	WS,IR	112	9	40	54	1985-1989
10	Kinta (B) dam	WS	115	25	35	155	1985-1989
13	Selangor dam	WS	201	270	182	504	1985-1989
13	Batang Kali dam	WS	49	72	45	76	1992-1996
15	Batu dam	WS	50	28	39	80	U/C 1981-1985
15	Gombak dam	WS	87	28	28	7	1994-1998
18	Terip dam	WS,IR	23	26	25	13	1985-1989
21	Palong dam	WS,IR	316	30	20	13	1985-1989
24	Semangar dam	WS	160	137	123	54	1985-1989
24	Linggiu dam	WS	237	203	182	25	1985-1989
25	Sedili dam	WS	227	87	115	13	1986-1990
27	Anak Endau dam	IR	36	26	11	38	U/C 1983-1987
27	Kemelai dam	IR	44	31	13	15	U/C 1983-1987
30	Teriang dam	WS	60	70	36	166	1985-1989
31	Kuantan barrage	WS	-	-	-	20	U/C 1981-1985
40	Nenggiri dam	WS,IR	3,940	35	360	165	1995-1999

(2) DIVERSION FACILITIES					
Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
3	Jeniang diversion (barrage & canal)	Kedah 5 to 3	5	Included in Naok-Reman dams	1983-1987
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19 & 20	8	80	1985-1989
23	Teberau diversion (barrage)	Johor 23 to 23 & Singapore	27	9*	1985-1989
24	Semangar diversion (canal)	Johor 24 to 23	27	27	1985-1989
24	Johor diversion (barrage & canal)	Johor 24 to 24	19	18	1985-1989
25	Sedili diversion (canal & pipeline)	Johor 25 to 24	7	67	1986-1990
30	Teriang diversion (pipeline)	N. Sembilan 30 to 17	1	477	1985-1989

Remarks: Construction cost: At 1980 constant price
 IR: Irrigation, WS: Water supply, FM: Flood mitigation
 U/C: Under construction
 *: Excluding the cost of distribution pipeline for water supply
 /1: Excluding flood mitigation cost

Table 28 WATER SOURCE DEVELOPMENT PLAN FOR SABAH AND SARAWAK FOR ALTERNATIVE B3

(1) DAMS

Basin No.	Name of Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>							
213	Meliau dam	WS	58	17	48	150	1986-1990
217	Milau dam	WS	70	5	12	8	1987-1991
218	Wariu dam	IR,WS	123	8	10	64	1985-1989
221	Papar dam	IR,WS	353	15	35	67	1985-1989
<u>SARAWAK</u>							
231	Miri dam	WS	33	3	13	12	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Purpose	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>						
206	Melotai Kanan diversion (pipeline)	WS	206 to 207 (Tawau)	0.3	29	1987-1991
213	Meliau diversion	WS	213 to 212 (Sandakan)			
	- Pipeline-1	WS		0.3	133	1983-1987
	- Pipeline-2	WS		0.6	223	1986-1990
	- Pipeline-3	WS	0.6	223	1991-1995	
217	Milau diversion	WS	217 to 217 (Kudat)	0.4	15	1983-1987
221	Papar diversion	WS	221 to 220 (Kota Kinabalu)	2	41	1985-1989
224	Padas diversion	WS	224 to 225 (Labuan)			
	- Pipeline-1	WS		0.3	153	1983-1987
	- Pipeline-2	WS		0.3	153	1988-1992

Remarks; Construction cost: At 1980 constant price
IR: Irrigation, WS: Water supply

Table 29 ESTIMATED PUBLIC DEVELOPMENT
EXPENDITURE FOR WATER DEMAND
AND SUPPLY BALANCE ALTERNATIVES

Unit: M\$10⁶

Category	4MP	5MP	6MP	7MP	Total
<u>Alternative B1</u>					
Source Development	1,742	6,892	1,057	396	10,087
Irrigation	273	1,748	1,115	870	4,006
Public Water Supply	2,363	4,675	5,131	2,077	14,246
Inland Fishery	26	90	447	400	963
Total	4,404	13,405	7,750	3,743	29,302
<u>Alternative B2</u>					
Source Development	1,423	4,405	892	330	7,050
Irrigation	273	1,748	1,115	870	4,006
Public Water Supply	2,363	4,675	5,131	2,077	14,246
Inland Fishery	26	90	447	400	963
Total	4,085	10,918	7,585	3,677	26,265
<u>Alternative B3</u>					
Source Development	686	2,578	403	162	3,829
Irrigation	273	1,748	1,115	870	4,006
Public Water Supply	2,363	4,675	5,131	2,077	14,246
Inland Fishery	26	90	447	400	963
Total	3,348	9,091	7,096	3,509	23,044

Table 30 ESTIMATED MANPOWER REQUIREMENT FOR WATER DEMAND AND SUPPLY BALANCE ALTERNATIVES

Category	Unit: persons			
	4MP	5MP	6MP	7MP
<u>Alternative B1</u>				
Engineer	400	830	960	1,030
Technical Assistant	450	1,090	1,280	1,420
Technician	510	2,820	3,530	4,030
Others	650	16,020	20,350	22,910
Total Government Staff	2,010	20,760	26,120	29,390
<u>Alternative B2</u>				
Engineer	400	810	950	1,020
Technical Assistant	450	1,070	1,260	1,410
Technician	510	2,790	3,510	4,020
Others	650	15,960	20,300	22,860
Total Government Staff	2,010	20,630	26,020	29,310
<u>Alternative B3</u>				
Engineer	400	800	920	1,010
Technical Assistant	450	1,060	1,230	1,400
Technician	510	2,760	3,500	4,020
Others	650	15,920	20,250	22,830
Total Government Staff	2,010	20,540	25,900	29,260

Table 31

ESTIMATED ANNUAL EQUIVALENTS OF ECONOMIC
BENEFIT AND COST AND ECONOMIC IRR OF WATER
DEMAND AND SUPPLY BALANCE ALTERNATIVES

Alternative	Sector	Annual Equivalents (M\$10 ⁶)		Economic IRR (%)
		Benefit	Cost	
B1	Source development	-	312	
	Irrigation	259	133	
	Public water supply	1,167	988	
	Inland fishery	40	40	
	Reservoir recreation	38	-	
	Total	1,504	1,473	9.5
B2	Source development	-	219	
	Irrigation	253	133	
	Public water supply	1,143	988	
	Inland fishery	30	40	
	Reservoir recreation	28	-	
	Total	1,454	1,380	9.8
B3	Source development	-	118	
	Irrigation	242	133	
	Public water supply	1,089	988	
	Inland fishery	25	40	
	Reservoir recreation	23	-	
	Total	1,379	1,279	10.1

Table 32 SAFE SUPPLY PERIOD AND SAFE RIVER MAINTENANCE FLOW PERIOD IN 2000 WITH ALTERNATIVE PLANS IMPLEMENTED

Unit: days

Basin No.	Basin Name	Safe Supply Period				Safe Maintenance Flow Period			
		B1	B2	B3	Natural Flow	B1	B2	B3	Natural Flow
<u>PENINSULAR MALAYSIA</u>									
1	Perlis	365	350	305	195	365	330	284	174
2	P. Langkawi	365	365	351	285	365	350	316	265
3	Kedah	365	365	333	133	365	353	317	133
4	Merbok	365	365	344	275	365	360	295	200
5	Muda	365	365	346	225	365	343	279	195
6	Perai	365	311	340	179	365	294	284	169
7	Pulau Pinang	365	365	326	148	365	357	300	143
9	Kurau	365	357	294	169	365	330	267	164
10	Perak	365	365	365	332	365	365	337	307
11	Bernam	365	310	294	156	365	300	279	131
12	Tengi	365	310	294	280	365	300	279	270
13	Selangor	365	365	321	300	365	357	273	260
15	Kelang	365	365	321	159	365	357	273	143
16	Langat	365	365	321	299	365	357	273	245
17	Sepang	365	365	314	143	365	356	275	133
18	Linggi	365	365	342	239	365	355	246	187
19	Melaka	365	365	276	87	365	353	238	72
20	Kesang	365	302	252	212	365	271	220	207
21	Muar	365	302	252	132	365	271	220	132
23	Pontian Kechil	365	270	250	152	365	238	218	147
24	Johor	365	268	248	147	365	239	218	132
31	Kuantan	365	365	360	340	365	342	321	319
39	Kemasin	365	361	344	310	365	303	300	258
40	Kelantan	365	361	344	269	365	303	300	238
<u>SABAH</u>									
207	Tawau	365	295	268	254	365	282	255	244
218	Kadamaian	365	358	298	265	365	325	290	260
221	Papar	365	357	350	330	365	331	330	296
<u>SARAWAK</u>									
231	Miri	365	365	345	298	365	329	310	278

Remarks; Natural Flow: Natural flow only is depended upon, with neither existing nor proposed facilities.

Table 33 NUMBER OF PROPOSED DAMS/BARRAGES AND NUMBER OF PEOPLE TO BE REMOVED DUE TO CONSTRUCTION OF FACILITIES FOR WATER DEMAND AND SUPPLY BALANCE ALTERNATIVES

Alternatives	Number of Dams/Barrages	Number of People to be Removed
B1	53	3,200
B2	41	2,500
B3	32	2,100

Table 34 IDENTIFIED HYDROPOWER PROJECTS IN SABAH

Name	Dam Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Installed Capacity (MW)	Annual Energy Output (GWh)	Construction Cost (M\$10 ⁶)
Tenom Pangi Stage III	(Sook) 1,770	480	84	309	300
Papar Multipurpose	353	147	30	130	180 ^{/1}
Lower Halogilat	8,200	260	144	989	400 ^{/2}
Pangi No. 2	(8,000)	-	90 ^{/3}	547	290
Upper Padas	1,893	300	170	742	870
Pensiangan	5,106	4,342	370	1,639	1,070 ^{/4}
Sapulut	2,594	2,865	150	1,324	410

Remarks; ^{/1}: M\$67 x 10⁶ for D&I water supply deducted.
^{/2}: Cost for railway relocation not included.
^{/3}: After Tenom Pangi, Stage III completed.
^{/4}: Cost of transmission system to Tawau, Labuan & Sandakan included.

Table 35 OUTLINE OF PROPOSED PUBLIC SEWERAGE SYSTEM
FOR WATER POLLUTION ABATEMENT ALTERNATIVE P1

Basin No.	City/Town No.	City/Town Name	1990			2000		
			Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Population (10 ³)	Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Population (10 ³)
4	C3	Sg. Petani	35	90	56	128	100	79
6	C4	Kulim	6	50	20	27	100	54
15	C23	Shah Alam	41	100	66	89	100	141
15	C24	Petaling Jaya	614	100	484	949	100	927
15	C25	W. Persekutuan	685	100	1,419	1,030	100	2,039
16	C26	Kajang/Semenyih	16	60	26	35	100	58
18	C29	Seremban	73	100	210	115	100	290
21	C32	Segamat	19	80	51	47	100	104
23	C38	Kulai/Senai	67	100	47	121	100	78
27	C41	Kluang	42	70	47	84	80	67
39	C57	Pengkal Kalong	2	20	7	47	100	56
Total			1,600	-	2,433	2,672	-	3,893

Remarks; There is a sewerage system in C25, served 150,000 people with a treatment capacity of 56,000 m³/d in 1980.

Table 36 OUTLINE OF PROPOSED PUBLIC SEWERAGE SYSTEM
FOR WATER POLLUTION ABATEMENT ALTERNATIVE P2

Basin No.	City/Town No.	City/Town Name	1990			2000		
			Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Population (10 ³)	Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Population (10 ³)
4	C3	Sg. Petani	19	50	31	128	100	79
6	C4	Kulim	1	5	2	19	70	38
15	C23	Shah Alam	41	100	66	89	100	141
15	C24	Petaling Jaya	614	100	484	949	100	927
15	C25	W. Persekutuan	651	95	1,348	1,030	100	2,039
18	C29	Seremban	73	100	210	115	100	290
23	C38	Kulai/Senai	67	100	47	121	100	78
27	C41	Kluang	6	10	7	42	40	34
39	C57	Pengkal Kalong	0	0	0	37	80	45
Total			1,472	-	2,195	2,530	-	3,671

Remarks; There is a sewerage system in C25, served 150,000 people with a treatment capacity of 56,000 m³/d in 1980.

Table 37 ESTIMATED PUBLIC DEVELOPMENT EXPENDITURE
FOR WATER POLLUTION ABATEMENT ALTERNATIVES

Alternative	Unit: M\$10 ⁶				
	4MP	5MP	6MP	7MP	Total
P1	1,173	1,051	451	181	2,854
P2	1,066	992	469	188	2,712

Table 38 ESTIMATED MANPOWER REQUIREMENT FOR WATER
POLLUTION ABATEMENT ALTERNATIVES

Category	Unit: persons			
	4MP	5MP	6MP	7MP
<u>Alternative P1</u>				
Engineer	20	42	39	45
Technical Assistant	20	50	50	57
Technician	20	164	207	255
Others	20	210	268	332
Total Government Staff	80	466	564	689
<u>Alternative P2</u>				
Engineer	17	37	34	41
Technical Assistant	17	45	45	52
Technician	17	150	190	238
Others	17	192	249	312
Total Government Staff	68	424	518	643

Table 39

ESTIMATED ANNUAL EQUIVALENTS OF
ECONOMIC BENEFIT AND COST FOR WATER
POLLUTION ABATEMENT ALTERNATIVES

Unit: M\$10⁶

Alternative	Annual Equivalent (M\$10 ⁶)		
	Benefit	Cost	
P1	Sewerage	89	172
	Private purification facilities	-	8
	Pre-treatment for D&I water supply	-	22
	Saving in pre-treatment for D&I water supply	77	-
	Total	166	202
P2	Sewerage	83	161
	Private purification facilities	-	6
	Pre-treatment for D&I water supply	-	25
	Saving in pre-treatment for D&I water supply	77	-
	Total	160	192

Table 40 OUTLINE OF FLOOD MITIGATION MEASURES FOR ALTERNATIVE F1

Basin No.	Basin Name	River Improvement (km)	Dam (nos)	Flood-way (km)	Polder (nos)	Non-structural (10 ³ people)	Population Protected in 2000 (10 ³)	Flood Area Relieved (10 ³ ha)	Construction Cost (M\$10 ⁶)
PENINSULAR MALAYSIA									
1	Perlis	46	1	-	-	-	31	5	26.0
3	Kedah	31	-	-	-	-	16	1	31.9
5	Muda	139	-	-	-	-	78	16	127.3
6	Perai	4	-	-	-	-	3	1	3.6
7	Pinang	2	-	-	-	-	11	0	30.0
9	Kurau	23	-	-	-	-	14	4	22.4
10	Perak	38	-	50	1	-	340	75	583.5
11	Bernam	11	-	-	-	-	8	2	5.4
13	Selangor	18	-	-	-	-	9	8	23.6
14	Buloh	24	-	-	-	-	25	9	12.9
15	Kelang	73	2	-	-	-	268	14	142.6
16	Langat	128	-	-	-	-	121	56	91.1
18	Linggi	103	-	-	-	-	70	9	45.2
19	Melaka	32	-	5	-	-	66	8	30.3
20	Kesang	68	-	-	-	-	32	11	36.4
21	Muar	266	1	-	-	-	77	26	482.0
22	Batu Pahat	109	1	19	-	-	32	29	166.3
23	Pontian Kechil	30	-	-	-	-	21	1	18.0
24	Johor	58	-	-	-	-	34	6	61.5
26	Mersing	8	-	-	-	-	26	2	8.3
27	Endau	37	-	-	-	-	34	6	20.5
30	Pahang	547	3	-	-	-	328	268	1,931.6
31	Kuantan	56	-	-	-	-	50	17	105.5
32	Kemaman	36	-	-	-	-	24	7	72.3
33	Paka	12	-	-	-	-	-	2	20.4
34	Dungun	50	-	-	-	-	9	16	112.6
36	Trengganu	162	-	-	-	-	145	30	275.7
37	Setiu	24	-	-	-	-	3	4	16.5
38	Besut	66	-	-	-	-	62	24	97.6
39	Kemasin	-	-	16	-	-	266	60	102.3
40	Kelantan	65	2	-	1	-	408	78	377.5
41	Golok	73	-	-	-	-	50	27	73.3
	Total	2,339	10	90	2	-	2,661	822	5,154.1
SABAH									
207	Tawau	-	-	3	-	-	17.1	2	8.0
210	Segama	8	-	-	-	-	2.8	1	24.1
213	Labuk	15	-	-	-	-	2.0	3	27.1
217	Bongan	56	-	-	-	-	25.3	32	60.8
218	Kadamaian	15	-	-	-	-	13.0	6	33.3
219	Tuaran	13	-	-	-	-	4.8	4	27.3
220	Putatan	12	-	-	-	-	21.9	1	12.0
221	Papar	17	-	-	-	-	25.0	2	21.3
222	Kimanis	15	-	-	-	-	1.4	1	15.4
224	Padas	16	-	-	-	-	2.7	9	58.4
	Total	167	-	3	-	-	116.0	61	287.7
SARAWAK									
230	Baram	41	-	-	-	-	11.0	40	607.3
231	Miri	-	-	5	-	-	27.9	54	10.7
232	Sibuti	27	-	-	-	-	4.3	19	57.4
233	Niah	33	-	-	1	-	8.4	29	90.8
236	Kemena	103	-	-	-	-	31.1	88	493.7
237	Tatau	63	-	-	-	-	4.1	36	316.7
241	Rajang	221	-	-	-	-	103.9	124	2,620.7
246	Sarawak	142	1	-	-	-	63.8	43	328.1
247	Kayang	9	-	-	1	-	0.7	5	16.8
	Total	639	1	5	2	-	260.2	438	4,542.2

Table 41 OUTLINE OF FLOOD MITIGATION MEASURES FOR ALTERNATIVE F2

Basin No.	Basin Name	River Improvement (km)	Dam (nos)	Flood-way (km)	Polder (nos)	Non-structural (10 ³ people)	Population Protected in 2000 (10 ³)	Flood Area Relieved (10 ³ ha)	Construction Cost (M\$10 ⁶)
<u>PENINSULAR MALAYSIA</u>									
1	Perlis	34	1	-	-	-	25	4	22.0
3	Kedah	-	-	-	-	-	-	-	0.0
5	Muda	75	-	-	-	-	54	12	60.2
6	Perai	4	-	-	-	-	3	1	3.6
7	Pinang	2	-	-	-	-	11	0	30.0
9	Kurau	13	-	-	-	-	3	2	18.0
10	Perak	-	-	50	1	-	256	93	315.0
14	Buloh	-	-	-	-	-	-	-	0.0
15	Kelang	36	2	-	-	-	215	4	136.5
16	Langat	-	-	-	-	-	-	-	0.0
18	Linggi	41	-	-	-	-	53	4	10.3
19	Melaka	-	-	5	-	-	52	4	8.5
20	Kesang	38	-	-	-	-	20	9	26.3
21	Muar	53	1	-	1	-	45	4	30.4
22	Batu Pahat	93	1	19	-	-	28	26	155.9
23	Pontian Kechil	25	-	-	-	-	19	1	15.2
24	Johor	-	-	-	1	-	5	0	8.0
26	Mersing	6	-	-	-	-	23	1	6.6
27	Endau	11	-	-	-	-	18	1	5.6
30	Pahang	-	3	-	4	10	63	3	412.1
31	Kuantan	6	-	-	1	-	27	2	34.1
32	Kemena	-	-	-	1	-	14	2	9.8
36	Trengganu	29	-	-	1	-	77	10	78.9
37	Setiu	9	-	-	-	-	2	1	7.7
38	Besut	33	-	-	-	-	55	19	57.7
39	Kemasin	-	-	-	-	-	116	14	-
40	Kelantan	65	2	-	1	-	406	78	377.5
Total		573	10	74	11	10	1,590	295	1,829.9
<u>SABAH</u>									
207	Tawau	-	-	3	-	-	17.1	2	8.0
217	Bongan	56	-	-	-	-	25.3	32	60.8
218	Kadamaian	16	-	-	-	-	13.0	6	33.3
220	Putatan	12	-	-	-	-	21.5	1	12.0
Total		84	-	3	-	-	76.9	41	114.1
<u>SARAWAK</u>									
231	Miri	-	-	5	-	-	27.9	54	10.7
233	Niah	-	-	-	1	-	0.9	0	0.8
236	Kemena	30	-	-	-	-	16.6	18	156.1
241	Rajang	21	-	-	-	-	9.3	27	23.1
246	Sarawak	142	1	-	-	-	62.1	43	328.1
Total		193	1	5	1	-	116.8	142	518.8

Table 42 OUTLINE OF FLOOD MITIGATION MEASURES FOR ALTERNATIVE F3

Basin No.	Basin Name	River Improvement (km)	Dam (nos)	Flood-way (km)	Polder (nos)	Non-structural (10 ³ people)	Population Protected in 2000 (10 ³)	Flood Area Relieved (10 ³ ha)	Construction Cost (M\$106)
PENINSULAR MALAYSIA									
1	Perlis	46	1	-	-	-	31	5	26.0
3	Kedah	16	-	-	-	4	12	1	10.1
5	Muda	75	-	-	-	-	54	12	60.2
6	Perai	4	-	-	-	-	3	1	3.6
7	Pinang	2	-	-	-	-	11	0	30.0
9	Kurau	13	-	-	-	-	3	2	18.0
10	Perak	-	-	50	1	-	256	93	315.0
11	Bernam	11	-	-	-	-	8	2	5.4
14	Buloh	24	-	-	-	-	25	9	12.9
15	Kelang	73	2	-	-	-	268	14	142.6
16	Langat	128	-	-	-	-	121	56	91.1
18	Linggi	103	-	-	-	-	70	10	45.2
19	Melaka	32	-	5	-	-	66	8	30.3
20	Kesang	68	-	-	-	-	32	11	36.4
21	Muar	53	1	-	1	-	45	4	30.4
22	Batu Pahat	109	1	19	-	-	32	29	166.3
23	Pontian Kechil	30	-	-	-	-	21	1	18.0
24	Johor	-	-	-	1	-	5	0	8.0
26	Mersing	9	-	-	-	-	26	2	8.3
27	Endau	37	-	-	-	-	33	6	20.5
30	Pahang	-	3	-	4	10	63	3	412.1
31	Kuantan	6	-	-	1	-	27	2	34.1
32	Kemaman	-	-	-	1	-	14	2	9.8
36	Trengganu	5	-	-	1	34	35	3	33.3
38	Besut	66	-	-	-	-	62	24	97.6
39	Kemasin	-	-	16	-	-	266	60	102.3
40	Kelantan	65	2	-	1	-	408	78	377.5
41	Golok	10	-	-	-	-	20	6	16.6
Total		985	10	90	11	48	2,017	444	2,161.6
SABAH									
207	Tawau	-	-	3	-	-	17.1	2	8.0
217	Bongan	5	-	-	-	-	3.1	6	1.1
220	Putatan	12	-	-	-	-	21.9	1	12.0
Total		17	-	3	-	-	42.1	9	21.1
SARAWAK									
230	Baram	-	-	-	1	-	2.8	2	3.5
231	Miri	-	-	5	-	-	27.9	54	10.7
233	Niah	-	-	-	1	-	0.9	0	0.7
247	Kayang	-	-	-	1	-	0.7	2	6.2
Total		-	-	5	3	-	32.3	58	21.1

Table 43 ESTIMATED PUBLIC DEVELOPMENT EXPENDITURE
FOR FLOOD MITIGATION ALTERNATIVES

Unit: M\$10⁶

Alternative	4MP	5MP	6MP	7MP	Total
F1	115	1,966	3,176	4,818	10,075
F2	131	487	856	1,077	2,551
F3	114	609	738	835	2,296

Table 44 ESTIMATED MANPOWER REQUIREMENT FOR
FLOOD MITIGATION ALTERNATIVES

Unit: persons

Category	4MP	5MP	6MP	7MP
<u>Alternative F1</u>				
Engineer	30	200	290	390
Technical Assistant	50	290	430	590
Technician	70	480	670	900
Others	120	460	610	810
Total Government Staff	270	1,430	2,000	2,690
<u>Alternative F2</u>				
Engineer	30	80	150	180
Technical Assistant	60	130	230	290
Technician	80	200	330	390
Others	130	230	340	400
Total Government Staff	300	640	1,050	1,260
<u>Alternative F3</u>				
Engineer	30	100	130	160
Technical Assistant	50	170	220	270
Technician	70	260	310	360
Others	110	310	320	400
Total Government Staff	260	840	980	1,190

Table 45 ESTIMATED ANNUAL EQUIVALENTS OF ECONOMIC BENEFIT AND COST AND ECONOMIC IRR FOR FLOOD MITIGATION ALTERNATIVES

Alternative	Annual Equivalents (M\$10 ⁶)		Economic IRR (%)
	Benefit	Cost	
F1	100.5	272.7	2.7
F2	75.1	71.1	8.4
F3	76.9	67.5	8.9

Table 46 NUMBER OF PEOPLE PROTECTED AND THOSE TO BE REMOVED DUE TO CONSTRUCTION OF PROPOSED FACILITIES FOR FLOOD MITIGATION ALTERNATIVES

Unit: 10³ persons

Alternative	People Protected	People Removed
F1	3,037	210
F2	1,784	63
F3	2,091	66

Table 47 RECOMMENDED URBAN WATER SUPPLY DEVELOPMENT PLAN BY STATE

State	1985			1990			2000		
	TC	SF	SP	TC	SF	SP	TC	SF	SP
Perlis	5	85	14	13	90	17	41	100	26
Kedah	75	85	181	111	90	219	313	100	316
P. Pinang	241	93	464	346	97	516	517	100	616
Perak	311	96	700	418	98	791	737	100	973
Selangor	1,115	99	1,908	1,409	99	2,423	2,402	100	3,864
N. Sembilan	149	96	235	197	97	284	314	100	400
Melaka	46	85	105	69	90	118	141	100	151
Johor	377	91	731	512	94	925	941	100	1,450
Pahang	198	91	499	350	94	734	824	100	1,167
Trengganu	104	97	337	165	98	453	443	100	740
Kelantan	97	75	283	167	84	413	556	100	784
P. Malaysia	2,718	94	5,457	3,757	96	6,893	7,229	100	10,487
Sabah	156	(90)	397	192	(93)	542	502	(100)	1,068
Sarawak	157	(95)	481	227	(97)	648	527	(100)	1,225
Malaysia	3,031	(94)	6,335	4,176	(96)	8,083	8,258	(100)	12,780

- Remarks; (1) TC: Treatment capacity required in the corresponding year in $10^3 \text{ m}^3/\text{d}$
SF: Service factor in %
SP: Served population in 10^3
- (2) SP for Sabah and Sarawak includes that for suburban rural areas.
- (3) SF for Sabah and Sarawak is calculated by dividing SP, which includes served population in suburban rural areas, by total urban and suburban rural population.

Table 48 RECOMMENDED RURAL TREATED WATER SUPPLY DEVELOPMENT PLAN BY STATE

State	1985			1990			2000		
	TC	SF	SP	TC	SF	SP	TC	SF	SP
Perlis	18	75	116	23	75	123	33	75	128
Kedah	90	54	567	127	61	665	191	64	727
P. Pinang	122	84	477	148	89	537	179	95	529
Perak	163	70	877	303	76	947	510	79	895
Selangor	256	75	869	279	84	1,025	331	99	971
N. Sembilan	52	74	298	61	79	314	64	81	288
Melaka	49	83	317	66	88	346	90	88	342
Johor	122	54	602	178	74	842	298	100	1,037
Pahang	49	67	305	61	73	307	93	76	344
Trengganu	23	43	137	28	44	134	27	45	91
Kelantan	33	33	223	46	37	252	59	39	237
P. Malaysia	977	64	4,788	1,320	72	5,492	1,875	80	5,589
Sabah	31	16	132	52	23	218	104	35	353
Sarawak	39	18	187	56	21	241	108	24	339
Malaysia	1,047	54	5,107	1,428	61	5,951	2,087	68	6,281

Remarks; TC: Treatment capacity in 10^3 m³/d
SF: Service factor in %
SP: Served population in 10^3 persons

Table 49 RECOMMENDED RURAL UNTREATED WATER SUPPLY DEVELOPMENT PLAN BY STATE

State	1985			1990			2000		
	SD	SF	SP	SD	SF	SP	SD	SF	SP
Perlis	0	13	19	1	18	29	1	25	43
Kedah	6	31	322	9	34	374	13	36	402
P. Pinang	0	2	9	1	3	15	1	5	27
Perak	5	19	237	6	21	256	8	21	242
Selangor	0	2	23	0	2	21	0	1	10
N. Sembilan	1	9	35	1	12	48	7	19	67
Melaka	1	6	22	1	8	31	1	12	46
Johor	1	5	54	1	4	44	0	0	0
Pahang	2	21	96	2	23	97	4	24	108
Trengganu	4	52	168	4	55	166	3	55	112
Kelantan	6	52	350	10	58	395	13	61	371
P. Malaysia	26	18	1,335	36	19	1,476	51	20	1,428
Sabah	6	23	190	10	35	325	22	53	537
Sarawak	9	37	386	14	43	503	27	54	773
Malaysia	41	20	1,911	60	24	2,304	100	30	2,738

Remarks; SD: Source demand in 10^6 m³/y
 SF: Service factor in %
 SP: Served population in 10^3 persons

Table 50 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN FOR PENINSULAR MALAYSIA (1/2)

(1) DAM

Basin No.	Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Reservoir Surface Area (km ²)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
1	Timah-Tasoh dam	WS,IR,FM	150	6	11	20	14 ^{/1}	1983-1987
2	Aver Tawar dam	IR	11	2	0.3	6	131	1985-1989
2	Ulu Melaka dam	IR	7	2	0.3	5	12	1985-1989
3	Ahning dam	WS,IR	120	27	10	73	51	1983-1987
3	Badak-Temin dam	IR	114	19	4	59	21	1985-1989
3	Sari dam	IR	61	14	3	38	23	1987-1991
3	Durian dam	IR	75	17	3	45	25	1991-1995
5	Naok-Reman dam	WS,IR	-	-	20	350	123	1983-1987
5	Beria dam	WS,IR	115	15	4	55	19	1988-1992
6	Mengkuang Phase I&II	WS	4	24	2	24	55	U/C 1981-1985
8	Kerian dam	WS,IR	112	9	1	40	54	1985-1989
10	Rui dam	WS,IR	215	145	6	140	447	1985-1989
10	Kinta (B) dam	WS	155	53	2	55	364	1985-1989
13	Selangor dam	WS	201	270	6	186	541	1985-1989
13	Batang Kali dam	WS	49	72	1	45	76	1985-1989
15	Batu dam	WS	50	28	2	39	80	U/C 1981-1985
15	Gombak dam	WS	87	28	3	60	28	1986-1990
16	Semenyih dam	WS	54	42	15	44	89	U/C 1981-1985
18	Terip dam	WS,IR	23	43	4	41	21	1985-1989
21	Muar dam	WS,IR	209	36	1	37	20	1990-1994
21	Palong dam	WS,IR	316	140	6	107	27	1985-1989
24	Semangor dam	WS	160	137	22	123	54	1985-1989
24	Linggü dam	WS	237	203	30	182	25	1985-1989
24	Pengeli dam	WS	143	65	11	84	30	1989-1993
25	Sedili dam	WS	227	124	30	164	18	1985-1989
27	Anak Endau dam	IR	36	26	1	11	38	U/C 1983-1987
27	Kemelai dam	IR	44	31	3	13	15	U/C 1983-1987
30	Kenaboi dam	WS	118	136	3	83	237	1988-1992
30	Perting dam	WS	88	119	1	59	214	1994-1998
30	Kongkoi dam	WS	54	69	2	33	224	1992-1996
30	Teriang dam	WS	60	105	7	42	225	1985-1989
30	Gelami dam	WS	58	9	2	18	27	1990-1994
31	Kuantan barrage	WS	-	-	-	-	20	U/C 1981-1985
40	Nenggiri dam	HY,WS,IR	3,940	35	200	360	165**	1983-1987
40	Nal dam*	IR	-	-	-	-	-	1985-1989
41	Golok dam	IR	64	5	3	32	39	1985-1989

Remarks; Construction cost: At 1980 constant price
 IR: Irrigation, WS: Water supply, FM: Flood mitigation,
 HY: Hydropower, U/C: Under construction
 * : Planned by DID but not finalized.
 **; Cost for hydropower development is deducted.
 /1: Excluding flood mitigation cost

Table 51 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR PENINSULAR MALAYSIA (2/2)

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
5	Jeniang diversion (barrage & canal)	Kedah 5 to 3	8.4	Included in Naok-Reman dama	1983 - 1987
10	Rui diversion (tunnel)	Perak Kedah 10 to 5	8.9	Included in Rui dam	1985 - 1989
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19 & 20	15	160	1985 - 1989
23	Teberau diversion (barrage)	Johor 23 to 23 & Singapore	35	9*	1985 - 1989
24	Semangor diversion (canal)	Johor 24 to 23	35	36	1985 - 1989
24	Johor diversion (barrage & canal)	Johor 24 to 24	27	25	1985 - 1989
25	Sedili diversion (canal & pipeline)	Johor 25 to 24	10	83	1985 - 1989
30	Kenaboi diversion (tunnel)	N. Sembilan, Selangor 30 to 16-15	5	11	1988 - 1992
30	Perting diversion (tunnel)	Pahang Selangor 30 to 13-15	4	6	1994 - 1998
30	Kongkoi diversion	N. Sembilan, Selangor 30 to 16-15	2	2	1992 - 1996
30	Teriang diversion (pipeline)	N. Sembilan 30 to 17	Stage 1: 3 Stage 2: 1	525 300	1985 - 1989 1990 - 1994

Remarks: Construction cost: At 1980 constant price

*: Excluding the cost of distribution pipeline for water supply

Table 52 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR SABAH AND SARAWAK

(1) DAMS

Basin No.	Name of Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Reservoir Surface Area (km ²)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>								
207	Tawau dam	WS	38	7	0.5	21	89	1987-1991
213	Meliau dam	WS	58	17	0.9	48	150	1986-1990
217	Milau dam	WS	70	5	6	12	8	1987-1991
218	Wariu dam	IR, WS	123	8	0.3	10	64	1985-1989
221	Papar dam	HY, IR, WS	353	15	3	35	67*	1985-1989
<u>SARAWAK</u>								
231	Miri dam	WS	33	5	3	20	15	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Purpose	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>						
213	Meliau diversion	WS	213 to 212 (Sandakan)			
	- Pipeline-1	WS		0.3	133	1983-1987
	- Pipeline-2	WS		0.6	223	1986-1990
	- Pipeline-3	WS		0.6	223	1991-1995
217	Milau diversion	WS	217 to 217 (Kudat)	0.4	15	1983-1987
221	Papar diversion	WS	221 to 220 (Kota Kinabalu)	2	41	1985-1989
224	Padas diversion	WS	224 to 225 (Labuan)			
	- Pipeline-1	WS		0.3	153	1983-1987
	- Pipeline-2	WS		0.3	153	1988-1992

Remarks; Construction cost: At 1980 constant price
IR: Irrigation, WS: Water supply, HY: Hydropower
*: Cost for hydropower development is deducted.

Table 53 RECOMMENDED HYDROPOWER DEVELOPMENT PLAN

Basin No.	Project	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Surface Area (km ²)	Installed Capacity (MW)	Annual Energy Output (GWh)	Purpose	Construction Cost (M\$10 ⁶)	Date of Commission
<u>Peninsular Malaysia</u>									
36	Ulu Trengganu	420	600	46	100	360	HY	221	1988
40	Pergau	227	68	4	100	540	HY	190	1988
40	Nenggiri	3,940	200	49	82	430	HY, IR, WS	196/1	1988
30	Tembeling (Upper)	2,850	1,730	250	110	440	HY (IR, WS)	310	1988
30	Tekai & Penut	1,390	1,070	68	74	370	HY, FM (IR, WS)	258	1990
30	Telom Hilir	1,200	500	28	98	480	HY, FM	191	1991
40	Lebir	2,474	2,834	247	120	410	HY, FM (IR, WS)	568	1991
30	Jelai Kechil	890	560	70	60	300	HY, FM	250	1992
30	Maran	25,000	-	197	130	680	HY, (IR)	431	1993
40	Galas (Dabong)	7,480	580	105	97	530	HY, FM	368	1994
40	Kelantan barrage	12,130	-	-	40	275	HY	300	1995
30	Jelai	3,060	138	88	10	34	HY	69	1996
30	Tenum 1	730	140	18	5	14	HY	59	1997
Total		61,761	8,420	1,170	1,026	4,863		3,576	
<u>Sabah</u>									
224	Tenom Pangi Stage III								
	- Sook dam & power	1,770	480	27	40	172	HY	150	1990
	- Pangi extension	(7,815)	-	-	44	137	HY	150	1990
221	Papar multi-purpose	353	147	5	30	130	HY, IR, WS	180/2	1990
224	Pangi No.2	(8,000)	-	2	90/4	547	HY	290/3	1994
224	Upper Padas	1,893	300	9	170	742	HY	870	1996
Total		(19,831)	927	43	374	1,728		1,640	
<u>Sarawak</u>									
241	Konowit	1,250	1,180	71	110	485	HY	510	1990
244	Batang Sekrang	440	450	15	46	210	HY	310	1996
244	Upper Batang Ai	360	340	8	48	225	HY	460	1998
Total		2,050	1,970	94	204	920		1,280	

Remarks; Construction cost: Financial cost at 1980 constant price excluding flood mitigation cost

IR: Irrigation, WS: Water supply, HY: Hydropower
(): Incidental function

/1: M\$165 x 10⁶ for irrigation and D&I water supply deducted

/2: M\$67 x 10⁶ for irrigation and D&I water supply deducted

/3: Cost for railway relocation not included

/4: After Tenom Pangi, Stage III

Table 54 RECOMMENDED PLAN FOR IMPROVEMENT
OF PURIFICATION SYSTEM IN PALM
OIL MILLS AND RUBBER FACTORIES
IN TREATMENT CAPACITY

Unit: m³/d

No.	Basin Name	1981 - 1990			1991 - 2000		
		Palm Oil	Rubber	Total	Palm Oil	Rubber	Total
<u>Peninsular Malaysia</u>							
4	Merbok	0	2,500	2,500	0	2,332	2,332
6	Perai	0	936	936	0	5,852	5,852
9	Kurau	0	0	0	0	520	520
10	Perak	1,520	6,840	8,360	1,476	4,200	5,676
11	Bernam	1,996	96	2,092	208	220	428
14	Buloh	592	292	884	1,008	160	1,168
15	Kelang	960	4,520	5,480	160	1,134	1,294
16	Langat	676	1,300	1,976	904	4	908
17	Sepang	80	72	152	240	76	316
18	Linggi	1,072	5,888	6,960	40	900	940
19	Melaka	0	5,732	5,732	0	1,152	1,152
20	Kesang	192	1,060	1,252	0	144	144
21	Muar	1,292	7,076	8,368	1,332	1,224	2,556
22	Batu Pahat	688	764	1,452	1,812	220	2,032
23	Sekudai	292	704	996	704	388	1,092
24	Johor	2,876	1,900	4,776	2,572	256	2,828
27	Endau	1,852	244	2,096	1,684	188	1,872
28	Rompin	1,308	0	1,308	4	0	4
32	Kemaman	1,904	0	1,904	176	0	176
	Peninsular Malaysia	17,300	39,924	57,224	12,320	18,970	31,290
<u>Sabah and Sarawak</u>							
209	Silibukan	0	360	360	0	0	0
217	Bongan	360	0	360	0	0	0
234	Suai	440	0	440	40	0	40
	Malaysia	18,100	40,284	58,384	12,360	18,970	31,330

Table 55 RECOMMENDED PUBLIC SEWERAGE DEVELOPMENT
PLAN FOR WATER POLLUTION ABATEMENT

Basin No.	City/Town No.	City/Town Name	1990			2000		
			Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Popu- lation (10 ³)	Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Popu- lation (10 ³)
4	C3	Sg. Petani	31	80	50	128	100	79
6	C4	Kulim	7	65	26	27	100	54
15	C23	Shah Alam	25	60	40	89	100	141
15	C24	Petaling Jaya	276	45	218	949	100	927
15	C25	W. Persekutuan	343	50	710	1,030	100	2,039
16	C26	Kajang/Semenyih	9	35	15	35	100	58
18	C29	Seremban	33	45	95	115	100	290
21	C32	Segamat	12	50	32	47	100	104
23	C38	Kulai/Senai	34	50	24	121	100	78
27	C41	Kluang	24	40	27	84	80	67
39	C57	Pengkajene	10	85	32	47	100	56
Total			804	-	1,269	2,672	-	3,893

Remarks; There is a sewerage system in C25, served 150,000 people with a treatment capacity of 56,000 m³/d in 1980.

Table 56 POLLUTION LOAD IN 2000 BY BASIN UNDER WITH AND WITHOUT IMPLEMENTATION OF RECOMMENDED PLAN

No.	Basin Name	Without Project				Max. BOD in River (mg/lit)	With Project				Max. BOD in River (mg/lit)
		BOD Load into River (ton/d)			Total		BOD Load into River (ton/d)			Total	
		PR	UI	RA			PR	UI	RA		
<u>Peninsular Malaysia</u>											
1	Perlis	0	4	0	4	14	0	4	0	4	14
2	P. Langkawi	-----				not studied	-----				
3	Kedah	1	13	1	15	11	1	8	1	10	7
4	Merbok	8	6	0	14	54	0	2	0	2	9
5	Muda	9	1	1	11	3	9	1	1	11	3
6	Peral	7	2	2	11	32	0	0	2	2	5
7	P. Pinang	-----				not studied	-----				
8	Kerian	5	0	0	5	3	5	0	0	5	3
9	Kurau	3	2	1	6	6	0	2	1	3	0
10	Perak	24	42	12	78	9	24	12	60	3	3
11	Bernam	9	0	2	11	6	0	0	1	1	0
12	Tengi	0	0	0	0	0	0	0	0	0	0
13	Selangor	3	1	1	5	3	3	1	1	5	3
14	Buloh	7	1	2	10	46	0	1	2	3	40
15	Kelang	11	126	2	139	105	0	36	2	38	14
16	Langat	8	3	2	13	9	8	1	2	11	6
17	Sepang	1	0	1	2	20	0	0	1	1	6
18	Linggi	12	9	2	23	292	0	2	2	4	23
19	Melaka	8	3	1	12	85	0	3	1	4	14
20	Kesang	2	0	0	2	37	1	0	0	1	9
21	Muar	20	7	1	28	30	0	5	1	76	7
22	Batu Pahat	11	9	2	22	85	0	3	2	5	16
23	Sekudai	5	10	0	15	117	0	3	1	4	13
24	Johor	24	6	1	31	52	0	6	0	6	1
25	Sedili Basar	3	0	0	3	3	3	0	0	3	3
26	Mersing	0	0	0	0	0	0	2	0	2	0
27	Endau	15	9	0	24	29	0	4	0	4	7
28	Rompin	5	9	0	14	9	2	4	0	6	5
29	Bebar	0	1	0	1	7	0	1	0	1	7
30	Pahang	41	37	1	79	4	41	37	1	79	4
31	Kuantan	6	0	0	6	4	6	27	0	33	1
32	Kemaman	8	5	0	13	10	0	5	0	5	0
33	Paka	0	0	0	0	0	0	0	0	0	0
34	Dungun	3	0	0	3	2	3	4	0	7	2
35	Marang	0	0	0	0	0	0	0	0	0	0
36	Trengganu	3	1	0	4	1	3	26	0	29	1
37	Setiu	0	0	0	0	0	0	0	0	0	0
38	Besut	0	0	0	0	0	0	0	0	0	0
39	Kemasin	0	5	0	5	23	0	2	0	2	9
40	Kelantan	5	12	1	18	1	3	3	2	8	1
41	Colok	-----				not studied	-----				
<u>Peninsular Malaysia</u>		267	324	36	627	-	112	217	36	365	-
<u>Sabah and Sarawak</u>											
209	Silibukan	5	0	0	5	7	0	0	0	0	0
217	Bongan	2	0	0	2	5	0	0	0	0	0
234	Suai	2	0	0	2	6	0	0	0	0	0
<u>Other Basins</u>		14	24	6	44	-	14	24	6	44	-
<u>Malaysia</u>		290	348	42	680	-	126	241	42	409	-

Remarks; PR: Palm oil mill and rubber factory effluent
 UI: Urban sewer and industrial effluent
 RA: Rural sewer and animal husbandry
 Other Basins: No problem Basins

Table 57 ASSUMED PUBLIC SEWERAGE DEVELOPMENT
NOT AFFECTING RIVER WATER QUALITY

Basin No.	City/Town No. Name	1990			2000			
		Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Popu- lation (10 ³)	Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Popu- lation (10 ³)	
<u>Peninsular Malaysia</u>								
3	C2	Alor Setar	30	50	43	119	60	60
6	C5	Butterworth	42	35	36	148	80	97
6	C6	Bukit Mertajam	15	35	12	54	80	30
7	C8	Georgetown	79	70	183	128	80	235
9	C10	Taiping	71	45	111	246	80	250
10	C13	Ipoh	90	45	111	297	80	357
10	C17	Telok Anson	21	45	27	76	80	55
15	C22	Klang	49	20	72	180	50	307
17	C28	Port Dickson	65	40	26	206	80	51
19	C31	Melaka	32	50	49	112	80	90
23	C39	Johor Bahru	89	40	176	330	80	549
31	C47	Kuantan	75	60	200	288	80	522
36	C53	Kuala Trengganu	60	50	189	218	60	367
40	C55	Kota Bahru	79	70	241	333	80	454
Peninsular Malaysia			797	-	1,476	2,735	-	3,424
<u>Sabah and Sarawak</u>								
207	C201	Tawau	13	70	57	48	80	120
209	C203	Lahad Datu	6	70	27	26	80	67
212	C204	Sandakan	26	75	95	93	80	178
220	C208	Kota Kinabalu	39	75	101	117	80	217
236	C215	Bintulu	120	75	26	577	80	41
246	C219	Kuching	39	55	155	128	80	398
Sabah & Sarawak			243	-	461	989	-	1,021
Malaysia			1,040	-	1,937	3,724	-	4,445

Remarks; There is a sewerage system in C8, served 174,000 people with treatment capacity of 46,000 m³/d in 1980. There are untreated sewerage systems in C201, C203, C204 and C208.

Table 58 RECOMMENDED FLOOD MITIGATION PROGRAM BY 1990

Basin No.	Basin Name	R.I. (km)	Dam (nos)	F.W. (km)	Pold. (nos)	N.S. (10 ³)	P.P. (10 ³)	F.A. (km ²)
<u>Peninsular Malaysia</u>								
1	Perlis	34	1	-	-	-	25	37
3	Kedah	-	-	-	-	-	-	-
5	Muda	48	-	-	-	-	43	88
6	Perai	-	-	-	-	-	-	-
7	Pinang	1	-	-	-	-	6	1
9	Kurau	13	-	-	-	-	3	25
10	Perak	-	-	-	-	-	23	5
14	Buloh	-	-	-	-	-	-	-
15	Kelang	20	2	-	-	-	126	29
16	Langat	-	-	-	-	-	-	-
18	Linggi	27	-	-	-	-	31	30
20	Kesang	8	-	-	-	-	2	10
22	Batu Pahat	24	-	-	-	-	5	42
23	Pontian Kechil	25	-	-	-	-	19	8
30	Pahang	-	2	-	1	10	35	20
31	Kuantan	-	-	-	-	-	-	-
32	Kemena	-	-	-	1	-	14	20
37	Setiu	9	-	-	-	-	2	6
39	Kemasin	-	-	-	-	-	50	62
40	Kelantan	5	1	-	1	-	40	50
Total		214	7	-	3	10	434	433
<u>Sabah</u>								
217	Bongan	47	-	-	-	-	21	269
<u>Sarawak</u>								
229	Limbang	-	1	-	-	-	5	262
231	Miri	-	-	5	-	-	28	542
Total		-	1	5	-	-	33	804

Remarks; R.I. : River improvement, N.S.: Resettlement in person (2000)
 F.W. : Floodway, P.P.: Population protected(2000)
 Pold.: Polder, F.A.: Flood area relieved

Table 59 RECOMMENDED FLOOD MITIGATION PROGRAM BY 2000

Basin No.	Basin Name	R.I. (km)	Dam (nos)	F.W. (km)	Pold. (nos)	N.S. (10 ³)	P.P. (10 ³)	F.A. (km ²)
<u>Peninsular Malaysia</u>								
1	Perlis	34	1	-	-	-	25	37
3	Kedah	-	-	-	-	-	-	-
5	Muda	75	-	-	-	-	54	121
6	Perai	4	-	-	-	-	3	5
7	Pinang	2	-	-	-	-	11	2
9	Kurau	13	-	-	-	-	3	25
10	Perak	-	-	50	1	-	256	925
14	Buloh	-	-	-	-	-	-	-
15	Kelang	36	2	-	-	-	215	36
16	Langat	-	-	-	-	-	-	-
18	Linggi	41	-	-	-	-	53	43
19	Melaka	-	-	5	-	-	52	37
20	Kesang	38	-	-	-	-	20	91
21	Muar	53	1	-	1	-	45	38
22	Batu Pahat	93	1	19	-	-	28	260
23	Pontian Kechil	25	-	-	-	-	19	8
24	Johor	-	-	-	1	-	5	1
26	Mersing	6	-	-	-	-	23	9
27	Endau	11	-	-	-	-	18	8
30	Pahang	-	3	-	4	10	63	29
31	Kuantan	6	-	-	1	-	27	22
32	Kemena	-	-	-	1	-	14	20
36	Trengganu	29	-	-	1	-	77	97
37	Setiu	9	-	-	-	-	2	6
38	Besut	33	-	-	-	-	55	185
39	Kemasin	-	-	-	-	-	116	144
40	Kelantan	65	2	-	1	-	406	777
	Total	573	10	74	11	10	1,590	2,926
<u>Sabah</u>								
207	Tawau	-	-	3	-	-	17	18
217	Bongan	56	-	-	-	-	25	315
218	Kadamaian	16	-	-	-	-	13	63
220	Putatan	12	-	-	-	-	22	7
	Total	84	-	3	-	-	77	403
<u>Sarawak</u>								
229	Limbang	-	1	-	-	-	5	262
231	Miri	-	-	5	-	-	28	542
233	Niah	-	-	-	1	-	1	3
236	Kemena	30	-	-	-	-	17	178
241	Rajang	21	-	-	-	-	9	266
246	Sarawak	142	1	-	-	-	62	425
	Total	193	2	5	1	-	122	1,676

Remarks; R.I. : River improvement, N.S. : Resettlement in person(2000)
 F.W. : Floodway, P.P.: Population protected (2000)
 Pold.: Polder, F.A.: Flood area relieved

Table 60 RECOMMENDED PLAN FOR FLOOD FORECASTING AND WARNING SYSTEM

Basin No.	River Basin	People Rel'ved by F/F (10 ³)	Construction Cost (M\$10 ⁶)	Construction Period
1	Perlis	9.0	0.9	5MP
5	Muda	10.2	1.2	5MP
7	Pinang	5.5	0.8	5MP
10	Perak/ <u>1</u>	162.9	0.7	4MP
13	Selangor	4.4	0.5	5MP
15	Kelang	113.2	1.5	4MP
16	Langat	20.6	0.5	5MP
18	Linggi	14.6	0.9	5MP
19	Melaka	25.2	1.1	5MP
21	Muar	14.2	1.8	5MP
23	Sekudai	9.2	1.0	4MP
	Tebrau	5.8	0.5	4MP
24	Johor	4.4	0.8	4MP
30	Pahang/ <u>1</u>	99.1	1.0	5MP
31	Kuantan	8.5	0.5	5MP
32	Kemaman	6.7	0.5	4MP
34	Dungun	2.6	0.6	4MP
36	Trengganu/ <u>1</u>	20.5	0.4	4MP
38	Besut/ <u>1</u>	15.1	0.2	4MP
39	Kemasin/Semarak	7.1	0.3	4MP
40	Kelantan/ <u>1</u>	213.5	0.7	4MP
41	Golok	12.7	0.2	4MP
Total		785.0	16.6	
207	Tawau	8.5	2.4	6MP
210	Segama	3.5	4.1	7MP
211	Kinabatangan	4.3	4.2	4MP
217	Bongan	12.7	3.0	5MP
218	Kadamaian	6.5	2.2	6MP
221	Papar	14.2	2.1	5MP
224	Padas	3.0	5.4	7MP
Total		52.7	23.4	
229	Limbang	2.6	3.6	7MP
230	Baram	6.0	9.8	5MP
231	Miri	14.0	2.3	6MP
233	Niah	5.0	2.6	7MP
236	Kemena	11.1	4.1	6MP
237	Tatau	2.7	3.8	7MP
241	Rajang	16.6	19.9	6MP
245	Sadong	5.0	2.7	4MP
246	Sarawak	22.9	3.4	5MP
Total		85.9	52.2	

Remarks; 1: Additional flood forecasting stations be recommended.

Table 61 ASSUMED UNIT CONSTRUCTION COST
FOR PENINSULAR MALAYSIA (1/2)

1. Compensation on Land (M\$10⁶/km²)

Irrigated paddy	2.5	Urban area class S	100
Rainfed paddy	1.5	Urban area class A	10
Tree crop field classes A & B	1.5	Urban area class B	5
Tree crop field class C	0.5	Village area class A	5
Forest class A	0.5	Village area class B	1
Forest class B	0.1		

2. Resettlement (M\$10³/household)

Urban	30	Rural	10
-------	----	-------	----

3. Civilwork

Dam	M\$48-66 per m ³ of embankment volume
Canal	M\$50-94/m per m ³ /s of discharge capacity
Tunnel	M\$160-182/m per m ³ /s of discharge capacity
Pipeline	M\$990-1,980/m per m ³ /s of discharge capacity
Barrage/Weir	M\$1,320/m per m ³ /s of 100-y maximum capacity
Pumping station	M\$7,700-14,300 m ³ /s of discharge capacity

4. River Facilities

<u>Channel improvement (M\$10⁶/km)</u>		<u>Floodway (M\$10⁶/km)</u>	
200 m ³ /s	0.2 - 0.4	200 m ³ /s	0.2 - 0.5
500 m ³ /s	0.3 - 0.6	500 m ³ /s	0.4 - 0.9
1,000 m ³ /s	0.4 - 0.8	1,000 m ³ /s	0.5 - 1.2
10,000 m ³ /s	1.2 - 2.9	2,000 m ³ /s	0.7 - 1.8

Polder

Protection bund	M\$150-700 x 10 ³ /km
Drainage system	M\$540 x 10 ³ /km
Drainage pump	M\$150-380 x 10 ³ per m ³ /s

Remarks; Unit construction costs include the engineering and administration cost, but the physical contingency is not included.
S: Very good access, A: Good access, B: Poor access, C: Very poor access

Table 62 ASSUMED UNIT CONSTRUCTION COST
FOR PENINSULAR MALAYSIA (2/2)

5. <u>D&I Water Supply System</u>	
Pipeline	M\$430/m per m ³ /s of discharge capacity
Treatment plant	M\$710 per m ³ /d of capacity
Distribution system	M\$1,300 per m ³ /d of capacity
6. <u>Sewerage System</u>	
	M\$157 x 10 ⁶ per 100 x 10 ³ m ³ /d
7. <u>D&I Pre-treatment System</u>	
Aerated lagoon	M\$38 x 10 ⁶ per 100 x 10 ³ m ³ /d
Rapid sandfilter bed	M\$112 x 10 ⁶ per 100 x 10 ³ m ³ /d
8. <u>Power Facilities</u>	
<u>Generating equipment</u>	
Rated head more than 140 m	M\$275-440 per kW
Rated head 20 - 80 mm	M\$550-880 per kW
Rated less than 30 m	M\$1,320-1,540 per kW
<u>Transmission line</u>	M\$162-194 x 10 ³ per km
9. <u>Irrigation Facilities</u>	
From rainfed paddy to irrigated paddy	M\$11,370 per ha
From new reclaimed land to irrigated paddy	M\$12,300 per ha
From irrigated single cropped paddy to double	M\$6,150 per ha
Tertiary development and rehabilitation	M\$5,470 per ha

Remarks; Unit construction costs include the engineering and administration cost, but the physical contingency is not included.

Table 63 ASSUMED UNIT CONSTRUCTION COST
FOR SABAH AND SARAWAK (1/2)

1. Compensation on Land (M\$10⁶/km²)

Irrigated paddy	2.5	Urban area class S	100
Rainfed paddy	1.5	Urban area class A	10
Tree crop field class A	1.5	Urban area class B	5
Tree crop field class B	1.0	Village area class A	5
Tree crop field class C	0.5	Village area class B	1
Forest class A	0.5		
Forest class B	0.1		

2. Resettlement (M\$10³/household)

Urban	30	Rural	10
-------	----	-------	----

3. Civilwork

Dam	M\$50-70 per m ³ of embankment volume
Canal	M\$60-100 m per m ³ /s of discharge capacity
Tunnel	M\$180-200/m per m ³ /s of discharge capacity
Pipeline	M\$1,090-2,180/m per m ³ /s of discharge capacity
Barrage/Weir	M\$1,450/m per m ³ /s 100-y maximum capacity
Pumping station	M\$8,500-15,700 m ³ /s of discharge capacity

4. River Facilities

<u>Channel improvement (M\$10⁶/km)</u>		<u>Floodway (M\$10⁶/km)</u>	
200 m ³ /s	0.2 - 0.4	200 m ³ /s	0.2 - 0.6
500 m ³ /s	0.3 - 0.7	500 m ³ /s	0.4 - 1.0
1,000 m ³ /s	0.4 - 0.9	1,000 m ³ /s	0.6 - 1.3
10,000 m ³ /s	1.3 - 3.2	2,000 m ³ /s	0.8 - 2.0

Polder

Protection bund	M\$170-770 x 10 ³ /km
Drainage system	M\$590 x 10 ³ /km
Drainage pump	M\$170-420 x 10 ³ per m ³ /s

Remarks; Unit construction costs include the engineering and administration cost, but the physical contingency is not included.
S: Very good access, A: Good access, B: Poor access,
C: Very poor access.

Table 64 ASSUMED UNIT CONSTRUCTION COST
FOR SABAH AND SARAWAK (2/2)

5. D&I Water Supply System

Pipeline	M\$470/m per m ³ /s of discharge capacity
Treatment plant	M\$780 per m ³ /d of capacity
Distribution system	M\$1,430 per m ³ /d of capacity

6. Sewerage System M\$173 x 10⁶ per 100 x 10³ m³/d

7. D&I Pre-treatment System

Aerated lagoon	M\$42 x 10 ⁶ per 100 x 10 ³ m ³ /d
Rapid sandfilter bed	M\$123 x 10 ⁶ per 100 x 10 ³ m ³ /d

8. Power Facilities

Generating equipment

Rated head more than 140 m	M\$300-480 per kW
Rated head 20 - 80 m	M\$600-970 per kW
Rated less than 30 m	M\$1,450-1,690 per kW

Transmission line M\$180-210 x 10³ per km

9. Irrigation Facilities

From rainfed paddy to irrigated paddy	M\$11,370 per ha
From new reclaimed land to irrigated paddy	M\$12,300 per ha
From irrigated single cropped paddy to double	M\$6,150 per ha
Tertiary development and rehabilitation	M\$5,470 per ha
From rainfed to control drainage scheme	M\$3,000

Remarks; Unit construction costs include the engineering and administration cost, but the physical contingency is not included.

Table 65 ESTIMATED PUBLIC DEVELOPMENT
EXPENDITURE FOR RECOMMENDED PLAN

Sector	Unit: M\$10 ⁶				
	4MP	5MP	6MP	7MP	Total
Source Development	976	3,859	1,031	177	6,043
Irrigation	273	1,748	1,115	870	4,006
Inland Fishery	26	90	447	400	963
Public Water Supply	2,363	4,675	5,131	2,077	14,246
Public Water Supply; Pre-treatment facilities	182	197	122	47	548
Public Sewerage (Effective for river water pollution abatement)	573	953	952	382	2,860
Public Sewerage (Others)	672	1,188	1,226	490	3,576
Flood Mitigation	131	487	856	1,077	2,551
Hydropower	774	3,026	2,506	190	6,496
Total	5,970	16,223	13,386	5,710	41,289

Remarks; (1): At 1980 constant price
(2): The amount shown for water supply and irrigation in 4MP does not include that for providing the capacity necessary by 1985.

Table 66 ESTIMATED PRIVATE DEVELOPMENT
EXPENDITURE FOR RECOMMENDED PLAN

	Unit: M\$10 ⁶				
	4MP	5MP	6MP	7MP	Total
Private Water Supply	448	2,626	4,166	3,333	10,573
Sewerage: Affecting river water quality	203	498	604	242	1,547
Sewerage: Not affecting river water quality	289	768	958	383	2,398
Palm & Rubber Purification Facilities	62	58	28	11	159
Total	1,002	3,950	5,756	3,969	14,677

Remarks; same as Remarks in Table 65.

Table 67

ESTIMATED PUBLIC RECURRENT
EXPENDITURE FOR RECOMMENDED PLAN

Sector	Unit: M\$10 ⁶				Total
	4MP	5MP	6MP	7MP	
Source Development	0	32	102	145	297
Irrigation	0	20	152	235	407
Inland Fishery	0	3	26	65	94
Public Water Supply	0	415	909	1,342	2,666
Public Water Supply; Pre-treatment facilities	0	128	160	168	456
Public Sewerage (Effective for river water pollution abatement)	0	191	382	542	1,115
Public Sewerage (Others)	0	230	469	675	1,374
Flood Mitigation	0	101	274	556	931
Hydropower	0	23	97	157	277
Total	0	1,143	2,589	3,885	7,617

Remarks; (1): At 1980 constant price
(2): Expenditure for recommended facilities only.

Table 68 ESTIMATED MANPOWER REQUIREMENT
FOR RECOMMENDED PLAN

Category	Unit: persons			
	4MP	5MP	6MP	7MP
<u>Construction</u>				
Engineer	400	500	520	520
Technical Assistant	450	600	610	610
Technician	510	810	810	790
Others	650	1,060	970	930
Total Government Staff	2,010	2,970	2,910	2,850
<u>O & M</u>				
Engineer	0	310	430	500
Technical Assistant	0	470	660	800
Technician	0	1,980	2,710	3,230
Others	0	14,910	19,340	21,940
Total Government Staff	0	17,670	23,140	26,470

Remarks; Requirements for the recommended facilities only.

Table 69 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED WATER DEMAND AND SUPPLY BALANCE PLAN

		Amount
1. National Economic Development		
1.1 Economic Benefit		
Irrigation	(M\$10 ⁶)	256
D&I water supply	(M\$10 ⁶)	1,146
Inland fishery	(M\$10 ⁶)	40
Reservoir recreation	(M\$10 ⁶)	33
<u>Total</u>	<u>(M\$10⁶)</u>	<u>1,475</u>
1.2 Economic Cost		
Dam/diversion facilities	(M\$10 ⁶)	183
Irrigation	(M\$10 ⁶)	133
D&I water supply	(M\$10 ⁶)	988
Inland fishery	(M\$10 ⁶)	40
<u>Total</u>	<u>(M\$10⁶)</u>	<u>1,344</u>
1.3 EIRR	(%)	11
2. Environmental Quality		
2.1 Beneficial Effect		
Safe maintenance flow period		See Table 70
Surface area of reservoir created	(km ²)	409
2.2 Adverse Effect		
Number of sites where kind of fish might be reduced being located immediately downstream of dam and barrages	(no. of sites)	41
3. Social Well-Being		
3.1 Beneficial Effect		
Number of farm households benefited by proposed irrigation in 2000	(10 ³)	290
Number of people served by proposed public water supply in 2000	(10 ⁶)	21.8
Safe supply period		See Table 70
3.2 Adverse Effect		
Number of people to be removed for construction of facilities	(10 ³)	2

Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and lake recreation benefits.

Table 70 SAFE SUPPLY PERIOD AND SAFE RIVER MAINTENANCE FLOW PERIOD IN 2000 WITH RECOMMENDED PLAN IMPLEMENTED

Unit: days

Basin No.	Basin Name	Safe Supply Period		Safe Maintenance Flow Period	
		Plan Implemented	Natural Flow	Plan Implemented	Natural Flow
<u>PENINSULAR MALAYSIA</u>					
1	Perlis	305	195	284	174
2	P. Langkawi	351	285	316	265
3	Kedah	333	133	317	133
4	Merbok	365	275	365	200
5	Muda	346	225	279	195
6	Perai	365	179	365	169
7	Pulau Pinang	365	148	365	143
9	Kurau	294	169	267	164
10	Perak (Kinta)	365	332	365	307
11	Bernam	365	156	279	131
12	Tengi	365	280	365	270
13	Selangor	365	300	365	260
15	Kelang	365	159	365	143
16	Langat	365	299	365	245
17	Sepang	365	143	365	133
18	Linggi	365	239	365	187
19	Melaka	365	87	365	72
20	Kesang	365	212	365	207
21	Muar	365	132	365	132
23	Pontian Kechil	365	152	365	147
24	Johor	365	147	365	132
31	Kuantan	365	340	365	319
39	Kemasin	344	310	300	258
40	Kelantan	344	269	300	238
<u>SABAH</u>					
207	Tawau	365	254	365	244
218	Kadamaian	298	265	290	260
221	Papar	350	330	330	296
<u>SARAWAK</u>					
231	Miri	365	298	365	278

Remarks; Natural Flow: Natural flow only is depended upon, with neither existing nor proposed facilities.

Table 71 BENEFICIAL AND ADVERSE EFFECTS OF
RECOMMENDED PLAN FOR HYDROPOWER
DEVELOPMENT

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Power generation	(M\$10 ⁶) 502
1.2 Economic Cost	
Dam & power facilities	(M\$10 ⁶) 177
1.3 EIRR	(%) 20
2. Environmental Quality	
2.1 Beneficial Effect	
Surface area of reservoir created	(km ²) 1,307
2.2 Adverse Effect	
Number of sites where kind of fish might be reduced being located immediately downstream of dam	(nos. of site) 20
3. Social Well-Being	
3.1 Adverse Effect	
Number of people to be removed for construction of facilities	(10 ³) 30

Remarks; Economic benefit other than power generation benefit is not shown here, but included in the water demand and supply account.

Table 72 BENEFICIAL AND ADVERSE EFFECTS
OF RECOMMENDED WATER POLLUTION
ABATEMENT PLAN

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 ⁶) 64
Saving in pre-treatment for D&I water supply	(M\$10 ⁶) 77
Total	(M\$10 ⁶) 141
1.2 Economic Cost	
Sewerage	(M\$10 ⁶) 131
Purification facilities in rubber factories and palm oil mills	(M\$10 ⁶) 8
Pre-treatment for D&I water supply	(M\$10 ⁶) 21
Total	(M\$10 ⁶) 160
1.3 EIRR	(%) -
2. Environmental Quality	
2.1 Beneficial Effects	
Reduction in length of river stretch where BOD concentration is more than 5 mg/lit in 2000 (see Table 73)	(km) 794
3. Social Well-being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 ³) 3,893
3.2 Adverse Effect	-

Table 73 LENGTH OF RIVER STRETCHES WHERE BOD CONCENTRATION IS MORE THAN 5 MG/LIT WITH AND WITHOUT RECOMMENDED PLAN IMPLEMENTED

Unit: km

No.	Basin Name	Studied Length	Length of Stretch where BOD Concentration is more than 5 mg/lit			
			1990		2000	
			Without	With	Without	With
<u>Peninsular Malaysia</u>						
3	Kedah	55	0	0	10	10
4	Merbok	24	24	14	24	14
6	Perai	33	24	6	29	0
9	Kurau	65	20	0	21	16
10	Perak	270	7	0	70	0
11	Bernam	135	105	0	8	0
14	Buloh	33	33	33	33	33
15	Kelang	85	80	75	80	75
16	Langat	130	51	3	54	0
17	Sepang	15	15	1	15	11
18	Linggi	45	45	45	45	45
19	Melaka	40	40	31	40	31
20	Kesang	33	33	19	33	30
21	Muar	190	150	47	190	72
22	Batu Pahat	85	85	85	85	40
23	Sekudai	38	38	28	38	26
24	Johor	103	87	0	89	0
27	Endau	128	92	15	115	7
28	Rompin	185	182	0	155	0
32	Kemaman	35	35	0	18	0
39	Kemasin	40	32	0	40	17
Peninsular Malaysia		1,767	1,178	402	1,192	427
<u>Sabah & Sarawak</u>						
209	Silibukan	18	0	0	10	0
217	Bongan	15	15	0	0	0
234	Suai	91	37	0	19	0
Sabah & Sarawak		124	52	0	29	0
Malaysia		1,891	1,230	402	1,221	427

Remarks; Herein shown are only the Basins where some measures are recommended.

Table 74

BENEFICIAL AND ADVERSE EFFECTS OF
ASSUMED SEWERAGE DEVELOPMENT PLAN
NOT AFFECTING RIVER WATER QUALITY

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 ⁶) 68
Saving in pre-treatment for D&I water supply	(M\$10 ⁶) -
Total	(M\$10 ⁶) 68
1.2 Economic Cost	
Sewerage	(M\$10 ⁶) 191
Private purification facilities	(M\$10 ⁶) -
Pre-treatment for D&I water supply	(M\$10 ⁶) -
Total	(M\$10 ⁶) 191
1.3 EIRR	(%) -
2. Environmental Quality	
2.1 Beneficial Effects	
Improvement in water quality in estuary and sea	Unquantified
3. Social Well-being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 ³) 4,445
3.2 Adverse Effect	

Table 75

BENEFICIAL AND ADVERSE EFFECTS OF
RECOMMENDED FLOOD MITIGATION PLAN

Item		Amount
1. National Economic Development		
1.1 Economic Benefit		
Damage reduction	(M\$10 ⁶)	75
1.2 Economic Cost		
Flood mitigation work	(M\$10 ⁶)	71
1.3 EIRR	(%)	8.4
2. Environmental Quality		
2.1 Beneficial Effect		
Length of improved river stretch	(km)	932
2.2 Adverse Effect		-
3. Social Well-Being		
3.1 Beneficial Effect		
Number of protected people by proposed facilities in 2000	(10 ³)	1,789
Population served by proposed flood warning system in 2000	(10 ³)	924
Area relieved from flood hazard	(10 ³ ha)	503
3.2 Adverse Effect		
Number of people to be removed for construction of facilities	(10 ³)	63

Table 76

PROJECTED GDP BY STATE UNDER
THE CONDITION OF LOWER
ECONOMIC GROWTH

State	Unit: M\$10 ⁶			
	1980	1985	1990	2000
Perlis/Kedah	1,422	2,025	2,646	4,175
Pulau Pinang	2,220	2,905	3,751	5,200
Perak	2,882	3,759	4,710	6,720
Selangor	7,894	10,281	13,580	22,127
Negeri Sembilan	1,059	1,418	1,842	2,768
Melaka	688	897	1,135	1,646
Johor	2,857	4,019	5,362	8,580
Pahang	1,183	2,364	3,633	6,630
Trengganu	737	1,271	1,837	3,182
Kelantan	764	1,392	2,004	3,550
Peninsular Malaysia	21,706	30,331	40,500	64,578
Sabah	1,944	2,702	3,630	6,492
Sarawak	1,726	2,558	3,498	6,515
Malaysia	25,376	35,591	47,628	77,585
Annual growth rate	7%	6%	5%	

Table 77

PROJECTED DOMESTIC AND INDUSTRIAL WATER
DEMAND BY PURPOSE BY TYPE OF SUPPLY UNDER
THE CONDITION OF LOWER ECONOMIC GROWTH

		Unit: 10 ⁶ m ³ /y			
		1980	1985	1990	2000
Treated Public:					
	Domestic	541	791	1,063	1,708
	Industrial	325	513	613	955
	Sub-total	866	1,304	1,676	2,663
Untreated:	Domestic	19	42	57	94
Private:	Industrial	315	465	549	872
	Domestic	77	46	34	14
	Sub-total	392	511	583	886
Malaysia		1,277	1,857	2,316	3,643
Raw Water to Singapore		198	240	274	379
Total		1,475	2,097	2,590	4,022

Remarks; All the figures are given in terms of source demand.

Table 78

PROJECTED DOMESTIC AND INDUSTRIAL
WATER DEMAND BY STATE UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

		Unit: 10 ⁶ m ³ /y			
State		1980	1985	1990	2000
	Perlis	7	10	13	23
	Kedah	49	78	98	160
	P. Pinang	124	161	207	284
	Perak	145	203	271	425
	Selangor	470	635	741	1,043
	N. Sembilan	62	97	115	152
	Melaka	30	41	52	79
	Johor	159	246	302	459
	Pahang	49	107	154	333
	Trengganu	31	50	72	138
	Kelantan	34	60	85	169
Peninsular Malaysia		1,160	1,688	2,110	3,265
Sabah		58	79	94	178
Sarawak		59	90	112	200
Malaysia		1,277	1,857	2,316	3,643
Raw Water to Singapore		198	240	274	379
Total		1,475	2,097	2,590	4,022

Remarks; Source demand comprising domestic and industrial demand.

Table 79

RECOMMENDED URBAN WATER SUPPLY DEVELOPMENT
PLAN BY STATE UNDER THE CONDITION OF
LOWER ECONOMIC GROWTH

State	1985			1990			2000		
	TC	SF	SP	TC	SF	SP	TC	SF	SP
Perlis	7	85	14	10	90	16	20	95	21
Kedah	72	85	179	92	90	208	162	95	247
P. Pinang	229	93	458	296	95	478	401	98	503
Perak	272	97	685	347	98	739	507	99	789
Selangor	1,043	99	1,889	1,284	99	2,292	1,906	100	3,198
N. Sembilan	142	96	232	171	97	267	231	99	327
Melaka	45	85	105	58	90	112	89	95	120
Johor	357	92	714	451	95	868	687	97	1,159
Pahang	183	92	479	282	94	684	586	98	973
Trengganu	99	97	334	143	98	428	282	99	608
Kelantan	95	79	288	143	86	393	294	94	599
P. Malaysia	2,544	94	5,377	3,277	96	6,485	5,165	98	8,544
Sabah	151	(89)	389	178	(93)	522	348	(96)	899
Sarawak	153	(94)	476	199	(96)	615	381	(99)	1,027
Malaysia	2,848	(94)	6,242	3,654	(96)	7,622	5,894	(98)	10,470

Remarks; (1) TC: Treatment capacity required in the corresponding year in $10^3 \text{ m}^3/\text{d}$

SF: Service factor in %

SP: Served population in 10^3

(2) SP for Sabah and Sarawak includes that for suburban rural areas.

(3) SF for Sabah and Sarawak is calculated by dividing SP, which includes served population in suburban rural areas, by total urban and suburban rural population.

Table 80

RECOMMENDED RURAL TREATED WATER SUPPLY
DEVELOPMENT PLAN BY STATE UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

State	1985			1990			2000		
	TC	SF	SP	TC	SF	SP	TC	SF	SP
Perlis	17	75	117	21	74	123	30	73	133
Kedah	86	54	569	116	60	666	172	63	746
P. Pinang	117	84	480	141	87	549	190	92	610
Perak	184	70	888	261	75	966	420	78	1,023
Selangor	297	75	884	329	83	1,121	454	95	1,561
N. Sembilan	49	74	300	59	78	322	80	79	337
Melaka	47	83	318	61	87	351	84	87	362
Johor	118	54	610	183	74	881	322	97	1,264
Pahang	48	67	322	61	72	346	111	75	469
Trengganu	21	42	138	27	45	145	36	45	148
Kelantan	31	33	226	44	36	258	65	38	288
P. Malaysia	1,015	64	4,852	1,303	71	5,728	1,964	79	6,941
Sabah	30	16	135	41	19	185	86	29	327
Sarawak	38	17	172	50	18	210	95	24	344
Malaysia	1,083	54	5,159	1,394	60	6,123	2,145	67	7,612

Remarks; TC: Treatment capacity in 10^3 m³/d
 SF: Service factor in %
 SP: Served population in 10^3 persons

Table 81: RECOMMENDED RURAL UNTREATED WATER SUPPLY DEVELOPMENT PLAN BY STATE UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

State	1985			1990			2000		
	SD	SF	SP	SD	SF	SP	SD	SF	SP
Perlis	0	13	20	1	17	29	1	24	44
Kedah	6	31	322	9	34	375	13	35	412
P. Pinang	0	2	9	1	3	16	1	5	31
Perak	5	19	240	7	20	262	8	21	277
Selangor	0	2	23	0	2	23	0	1	16
N. Sembilan	1	9	35	1	12	49	2	18	78
Melaka	1	6	22	1	8	31	2	12	48
Johor	1	5	54	1	4	47	0	0	0
Pahang	2	21	101	3	23	109	4	24	147
Trengganu	3	52	170	5	55	178	5	55	182
Kelantan	7	52	355	10	57	406	13	60	452
P. Malaysia	26	18	1,351	39	19	1,525	49	19	1,687
Sabah	6	20	207	8	31	291	19	47	533
Sarawak	9	38	397	12	42	491	25	56	809
Malaysia	41	21	1,955	59	23	2,307	93	27	3,029

Remarks; SD: Source demand in 10^6 m³/y
 SF: Service factor in %
 SP: Served population in 10^3 persons

Table 82

RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR PENINSULAR MALAYSIA UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH (1/2)

(1) DAMS

Basin No.	Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁹ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
1	Timah-Tasoh dam	WS,IR,FM	150	6	20	14/1	1986-1990
2	Ulu Melaka dam	IR	7	2	5	12	1985-1989
2	Aver Tawar dam	IR	11	2	6	131	1985-1989
3	Ahning dam	WS,IR	120	27	73	51	1983-1987
3	Badak-Temin dam	IR	114	19	59	21	1983-1987
3	Sari dam	IR	61	14	38	23	1989-1993
5	Naok-Reman dams	WS,IR	-	-	350	123	1983-1987
6	Mengkuang Phase I & II	WS	4	24	24	55	U/C 1981-1985
8	Kerian dam	WS,IR	112	7	22	30	1985-1989
10	Rui dam	WS,IR	215	145	140	447	1985-1989
10	Kinta dam	WS	155	20	28	133	1985-1989
13	Selangor dam	WS	201	270	182	504	1985-1989
13	Batang Kali dam	WS	49	72	45	76	1985-1989
15	Batu dam	WS	50	28	39	80	U/C 1982-1985
15	Gombak dam	WS	87	28	60	28	1988-1992
16	Semenyih dam	WS	54	41	44	89	U/C 1982-1985
18	Terip dam	WS,IR	23	27	26	13	1985-1989
21	Palong dam	WS,IR	316	140	107	27	1985-1989
24	Semangar dam	WS	160	137	123	54	1985-1989
24	Linggiu dam	WS	237	203	182	25	1985-1989
24	Pengeli dam	WS	143	65	84	30	1985-1989
25	Sedili dam	WS	227	84	110	12	1986-1990
27	Anak Endau dam	IR	36	26	11	38	U/C 1983-1987
27	Kemelai dam	IR	44	31	30	15	U/C 1983-1987
30	Kenaboi dam	WS	118	136	83	237	1991-1995
30	Teriang dam	WS	60	70	36	166	1985-1989
31	Kuantan barrage	WS	-	-	-	20	U/C 1981-1985
40	Nenggiri dam	HY,WS,IR	3,940	35	360	165**	1995-1999
40	Nal dam*	IR	-	-	-	-	1985-1989
41	Golok dam	IR	64	5	32	39	1985-1989

Remarks; Construction cost: At 1980 constant price

IR: Irrigation, WS: Water supply, FM: Flood mitigation, HY: Hydropower

U/C: Under construction

* : Planned by DID but not finalized.

** : Cost for hydropower development is deducted.

/1: Excluding flood mitigation cost

Table 83 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR PENINSULAR MALAYSIA UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH (2/2)

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
3	Jeniang diversion (barrage & canal)	Kedah 5 to 3	8.6	Included in Naok-Reman dams	1983 - 1987
10	Rui diversion (tunnel)	Perak Kedah 10 to 5	8.9	Included in Rui dam	1985 - 1989
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19 & 20	15	160	1985 - 1989
24	Teberau diversion (barrage)	Johor 23 to 23 & Singapore	32	9*	1985 - 1989
24	Semangar diversion (canal)	Johor 24 to 23	32	32	1985 - 1989
24	Johor diversion (barrage & canal)	Johor 24 to 24	24	22	1985 - 1989
25	Sedili diversion (canal & pipeline)	Johor 25 to 24	7	67	1986 - 1990
30	Kenaboi diversion (tunnel)	N. Sembilan, Selangor 30 to 15	5	11	1991 - 1995
30	Teriang diversion (pipeline)	N. Sembilan 30 to 17	1	477	1985 - 1989

Remarks; Construction cost: At 1980 constant price

*: Excluding the cost of distribution pipeline for water supply

Table 84

RECOMMENDED WATER SOURCE DEVELOPMENT
PLANS FOR SABAH AND SARAWAK UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

(1) DAMS

Basin No.	Name of Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>							
207	Tawau dam	WS	38	3.7	13.2	59	1987-1991
213	Melilau dam	WS	58	7	28	87	1988-1992
218	Wariu dam	IR,WS	123	8	10	64	1985-1989
221	Papar dam	IR,WS	353	20	33	61*	1985-1989
<u>SARAWAK</u>							
231	Miri dam	WS	33	1.2	7.6	10	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Purpose	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
<u>SABAH</u>						
213	Melilau diversion	WS	213 to 212 (Sandakan)			
	- Pipeline-1	WS		0.3	133	1983-1987
	- Pipeline-2	WS		0.6	223	1988-1992
217	Melilau diversion	WS	217 to 217 (Kudat)	0.1	15	1983-1987
221	Papar diversion	WS	221 to 220 (Kota Kinabalu)	1	25	1985-1989
224	Padas diversion	WS	224 to 225 (Labuan)			
	- Pipeline-1	WS		0.4	214	1983-1987

Remarks; Construction cost: At 1980 constant price

IR: Irrigation, WS: Water supply.

*: Cost for water demand and supply balance only

Table 85

RECOMMENDED HYDROPOWER DEVELOPMENT PLAN UNDER
THE CONDITION OF LOWER ECONOMIC GROWTH

Basin No.	Project	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Surface Area (km ²)	Installed Capacity (MW)	Annual Energy Output (GWh)	Purpose	Construction Cost (M\$10 ⁶)	Date of Commission
<u>Peninsular Malaysia</u>									
36	Ulu Trengganu	420	600	46	100	360	HY	221	1988
40	Pergau	227	68	4	100	540	HY	190	1989
40	Nenggiri	3,940	200	49	82	430	HY, IR, WS	196 ^{/1}	1990
30	Tembeling (Upper)	2,850	1,730	250	110	440	HY (IR, WS)	310	1990
30	Tekai & Penut	1,390	1,070	68	74	370	HY, FM (IR, WS)	258	1994
30	Telom Hilir	1,200	500	28	98	480	HY, FM	191	1995
40	Lebir	2,474	2,834	247	120	410	HY, FM (IR, WS)	568	1996
30	Jelai Kechil	890	560	70	60	300	HY, FM	250	1997
30	Maran	25,000	-	197	130	680	HY, (IR)	431	1998
40	Galas (Dabong)	7,480	580	105	97	530	HY, FM	368	1999
40	Kelantan barrage	12,100	-	-	40	275	HY	300	2000
Total		57,971	8,142	1,064	1,011	4,815		3,448	
<u>Sabah</u>									
224	Tenom Pangi Stage III								
	- Sook dam & power	1,770	480	27	40	172	HY	150	1990
	- Pangi extension	(7,815)	-	-	44	137	HY	150	1990
221	Papar multi-purpose	353	147	5	30	130	HY, IR, WS	180 ^{/2}	1990
224	Pangi No.2	(8,000)	-	2	90 ^{/4}	547	HY	290 ^{/3}	1994
Total		(17,938)	627	34	204	986		770	
<u>Sarawak</u>									
244	Batang Sekrang	440	420	15	46	210	HY	310	1996

Remarks; Construction cost: Financial cost at 1980 constant price excluding flood mitigation cost

IR: Irrigation, WS: Water supply, HY: Hydropower

(): Incidental function

^{/1}: M\$165 x 10⁶ for irrigation and D&I water supply deducted

^{/2}: M\$61 x 10⁶ for irrigation and D&I water supply deducted

^{/3}: Cost for railway relocation not included

^{/4}: After Tenom Pangi, Stage III

Table 86

PLAN FOR IMPROVEMENT OF PURIFICATION
SYSTEM IN PALM OIL MILLS AND RUBBER
FACTORIES UNDER THE CONDITION OF
LOWER ECONOMIC GROWTH

Unit: m³/d

No.	Basin Name	1981 - 1990			1991 - 2000		
		Palm Oil	Rubber	Total	Palm Oil	Rubber	Total
<u>Peninsular Malaysia</u>							
4	Merbok	0	2,500	2,500	0	2,332	2,332
6	Perai	0	936	936	0	5,852	5,852
9	Kurau	0	0	0	0	520	520
10	Perak	1,520	6,840	8,360	1,476	4,200	5,676
11	Bernam	1,996	96	2,092	208	220	428
14	Buloh	592	292	884	1,008	160	1,168
15	Kelang	960	4,520	5,480	160	1,134	1,294
16	Langat	676	1,300	1,976	904	4	908
17	Sepang	80	72	152	240	76	316
18	Linggi	1,072	5,888	6,960	40	900	940
19	Melaka	0	5,732	5,732	0	1,152	1,152
20	Kesang	192	1,060	1,252	0	144	144
21	Muar	1,292	7,076	8,368	1,332	1,224	2,556
22	Batu Pahat	688	764	1,452	1,812	220	2,032
23	Sekudai	292	704	996	704	388	1,092
24	Johor	2,876	1,900	4,776	2,572	256	2,828
27	Endau	1,852	244	2,096	1,684	188	1,872
28	Rompin	1,308	0	1,308	4	0	4
32	Kemaman	1,904	0	1,904	176	0	176
Peninsular Malaysia		17,300	39,924	57,224	12,320	18,970	31,290
<u>Sabah and Sarawak</u>							
209	Silibukan	0	360	360	0	0	0
217	Bongan	360	0	360	0	0	0
234	Suai	440	0	440	40	0	40
Malaysia		18,100	40,284	58,384	12,360	18,970	31,330

Table 87 PUBLIC SEWERAGE DEVELOPMENT PLAN FOR WATER POLLUTION ABATEMENT UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Basin No.	City/Town No. Name	1990			2000			
		Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Population (10 ³)	Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Population (10 ³)	
4	C3	SG. Petani	18	60	35	59	100	66
6	C4	Kulim	4	40	15	15	100	44
15	C23	Shah Alam	20	55	34	73	100	117
15	C24	Petaling Jaya	221	40	183	810	100	768
15	C25	W. Persekutuan	282	45	604	856	100	1,691
16	C26	Kajang/Semenyih	7	30	12	26	90	43
18	C29	Seremban	26	40	79	87	100	240
21	C32	Segamat	10	45	28	35	100	87
23	C38	Kulai/Senai	26	45	20	89	100	65
27	C41	Kluang	16	30	19	54	70	48
39	C57	Pengkal Kalong	6	60	21	22	100	46
Total			636	-	1,050	2,126	-	3,215

Remarks; There is a sewerage system in C25, served 150,000 people with a treatment capacity of 56,000 m³/d in 1980.

Table 88 POLLUTION LOAD IN 2000 BY BASIN WITH AND WITHOUT IMPLEMENTATION OF RECOMMENDED PLAN UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

No.	Basin Name	Without Project				Max. BOD in River (mg/lit)	With Project				Max. BOD in River (mg/lit)
		BOD Load into River (ton/d)					BOD Load into River (ton/d)				
		PR	UI	RA	Total		PR	UI	RA	Total	
Peninsular Malaysia											
1	Perlis	0	2	0	2	8	0	2	0	2	8
2	P. Langkawi	-----				not studied	-----				
3	Kedah	0	7	1	8	6	0	4	1	5	4
4	Merbok	6	4	0	10	52	0	1	0	1	6
5	Muda	9	1	1	11	3	9	1	1	11	3
6	Perai	7	1	2	10	30	0	1	2	3	8
7	P. Pinang	-----				not studied	-----				
8	Kerian	5	0	0	5	3	5	0	0	5	3
9	Kurau	3	2	1	6	6	0	2	1	3	5
10	Perak	24	28	11	63	7	1	18	11	30	5
11	Bernam	9	0	1	10	6	0	0	1	1	1
12	Tengi	0	0	0	0	0	0	0	0	0	0
13	Selangor	3	1	1	5	3	3	1	1	5	3
14	Buloh	7	0	3	10	45	0	0	3	3	39
15	Kelang	11	112	3	126	92	0	50	3	53	13
16	Langat	8	3	3	14	9	0	2	3	5	5
17	Sepang	1	0	1	2	101	0	0	1	1	23
18	Linggi	12	6	2	20	245	0	1	2	3	28
19	Melaka	8	1	1	10	83	0	8	1	9	20
20	Kesang	2	0	0	2	42	0	0	0	0	8
21	Muar	20	3	2	25	24	0	8	2	10	6
22	Batu Pahat	11	7	2	20	85	0	7	2	9	14
23	Sekudai	5	7	1	13	103	0	2	1	3	12
24	Johor	22	5	0	27	48	0	4	1	5	3
25	Sedili Basar	3	0	0	3	3	3	0	0	3	3
26	Mersing	0	2	0	2	6	0	2	0	2	6
27	Endau	15	7	0	22	26	0	4	0	4	5
28	Rompin	5	7	0	12	9	0	6	0	6	3
29	Bebar	0	1	0	1	5	0	1	0	1	5
30	Pahang	41	25	1	67	4	41	25	1	67	4
31	Kuantan	6	0	0	6	4	6	0	0	6	4
32	Kemaman	8	2	0	10	10	0	2	0	2	0
33	Paka	0	0	0	0	0	0	0	0	0	0
34	Dungan	3	0	0	3	2	3	0	0	3	0
35	Marang	0	0	0	0	0	0	0	0	0	0
36	Trengganu	3	0	0	3	2	3	0	0	3	2
37	Setiu	0	0	0	0	0	0	0	0	0	0
38	Besut	0	0	0	0	0	0	0	0	0	0
39	Kemasin	0	3	0	3	11	0	1	0	1	5
40	Kelantan	5	5	1	11	1	5	5	1	11	1
41	Golok	-----				not studied	-----				
Peninsular Malaysia		262	242	38	542	-	79	158	39	276	-
Sabah and Sarawak											
209	Silibukan	5	0	0	5	4	0	0	0	0	0
217	Bongan	2	0	0	2	9	0	0	0	0	0
234	Suai	2	0	0	2	9	0	0	0	0	0
Other Basins		14	18	5	37	-	14	18	5	37	-
Malaysia		285	260	43	588	-	93	176	44	313	-

Remarks; PR: Palm oil mill and rubber factory effluent
 UI: Urban domestic and urban industry effluent
 RA: Rural and animal husbandry
 Other Basins: No problem Basins

Table 89

ASSUMED PUBLIC SEWERAGE DEVELOPMENT NOT
AFFECTING RIVER WATER QUALITY UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

Basin No.	City/Town No.	Name	1990			2000		
			Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Popu- lation (10 ³)	Treatment Capacity (10 ³ m ³ /d)	Service Factor (%)	Served Popu- lation (10 ³)
<u>Peninsular Malaysia</u>								
3	C2	Alor Setar	16	35	28	56	60	50
6	C5	Butterworth	30	30	29	93	65	66
6	C6	Bukit Mertajam	11	30	9	34	65	20
7	C8	Georgetown	64	65	174	81	65	174
9	C10	Taiping	39	30	70	135	65	168
10	C13	Ipoh	50	30	107	164	65	241
10	C17	Telok Anson	12	20	11	41	65	37
15	C22	Klang	40	20	68	151	50	254
17	C28	Port Dickson	35	25	10	116	65	34
19	C31	Melaka	18	35	33	55	65	61
23	C39	Johor Bahru	59	30	125	202	65	370
31	C47	Kuantan	49	45	142	166	65	352
36	C53	Kuala Trengganu	41	40	143	139	65	329
40	C55	Kota Bahru	38	40	130	134	65	306
Peninsular Malaysia			502	-	1,079	1,567	-	2,462
<u>Sabah & Sarawak</u>								
207	C201	Tawau	7	45	35	22	65	81
209	C203	Lahad Datu	3	35	13	12	65	45
212	C204	Sandakan	14	45	54	39	65	120
220	C208	Kota Kinabalu	25	50	64	64	65	146
236	C215	Bintulu	85	75	25	238	75	32
246	C219	Kuching	26	40	106	75	65	268
Sabah & Sarawak			160	-	297	450	-	692
Malaysia			662	-	1,376	2,017	-	3,154

Remarks; There is a sewerage system in C8, served 174,000 people with a treatment capacity of 46,000 m³/d.
There are untreated sewerage systems in C201, C203, C204 and C208.

Table 90

ESTIMATED PUBLIC DEVELOPMENT
EXPENDITURE UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH

Sector	Unit: M\$10 ⁶				
	4MP	5MP	6MP	7MP	Total
Source Development	805	2,858	423	149	4,235
Irrigation	273	1,748	1,115	870	4,006
Inland Fishery	25	89	380	332	826
Public Water Supply	1,907	3,493	3,684	1,499	10,583
Public Water Supply; Pre-treatment facilities	129	153	104	41	427
Public Sewerage (Effective for river water pollution abatement)	459	801	830	333	2,423
Public Sewerage (Others)	409	688	695	278	2,070
Flood Mitigation	110	477	848	1,082	2,517
Hydropower	305	1,383	2,116	725	4,529
Total	4,422	11,690	10,195	5,309	31,616

Remarks; (1): At 1980 constant price.
(2): The amount shown for water supply and irrigation in 4MP does not include that for providing the capacity necessary by 1985.

Table 91

ESTIMATED PRIVATE DEVELOPMENT
EXPENDITURE UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH

	Unit: M\$10 ⁶				
	4MP	5MP	6MP	7MP	Total
Private Water Supply	300	1,619	2,091	1,673	5,683
Sewerage: Affecting river water quality	154	366	440	176	1,136
Sewerage: Not affecting river water quality	183	373	417	167	1,140
Palm & Rubber Purification Facilities	62	57	26	10	155
Total	699	2,415	2,974	2,026	8,114

Remarks; Same as Remarks in Table 90.

Table 92 ESTIMATED PUBLIC RECURRENT
EXPENDITURE UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH

Sector	Unit: M\$10 ⁶				
	4MP	5MP	6MP	7MP	Total
Source Development	0	26	72	102	200
Irrigation	0	20	152	235	407
Inland Fishery	0	4	36	78	118
Public Water Supply	0	325	684	993	2,002
Public Water Supply; Pre-treatment facilities	0	113	140	147	400
Public Sewerage (Effective for river water pollution abatement)	0	156	318	457	931
Public Sewerage (Others)	0	137	275	391	803
Flood Mitigation	0	99	271	553	923
Hydropower	0	11	49	96	156
Total	0	891	1,997	3,052	5,940

Remarks: (1): At 1980 constant price
(2): Expenditure for the recommended facilities only.

Table 93 ESTIMATED MANPOWER REQUIREMENT UNDER
THE CONDITION OF LOWER ECONOMIC GROWTH

Category	Unit: persons			
	4MP	5MP	6MP	7MP
<u>Construction</u>				
Engineer	400	500	500	510
Technical Assistant	450	590	610	610
Technician	510	710	680	670
Others	650	1,040	950	920
Total Government Staff	2,010	2,840	2,740	2,710
<u>O & M</u>				
Engineer	0	270	330	410
Technical Assistant	0	390	500	650
Technician	0	1,620	2,080	2,510
Others	0	12,410	15,410	17,820
Total Government Staff	0	14,690	18,320	21,390

Remarks; Requirements for recommended facilities only.

Table 94 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED WATER DEMAND AND SUPPLY BALANCE PLAN UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

		Amount
1. National Economic Development		
1.1 Economic Benefit		
Irrigation	(M\$10 ⁶)	256
D&I water supply	(M\$10 ⁶)	793
Inland fishery	(M\$10 ⁶)	35
Reservoir recreation	(M\$10 ⁶)	30
Total	(M\$10 ⁶)	1,114
1.2 Economic Cost		
Dam/diversion facilities	(M\$10 ⁶)	132
Irrigation	(M\$10 ⁶)	133
D&I water supply	(M\$10 ⁶)	657
Inland fishery	(M\$10 ⁶)	35
Total	(M\$10 ⁶)	957
1.3 EIRR	(%)	12
2. Environmental Quality		
2.1 Benefit Effect		
Safe maintenance flow period		See Table 95
Surface area of reservoir created	(km ²)	377
2.2 Adverse Effect		
Number of sites where kind of fish might be reduced being located immediately downstream of dam and barrages	(no. of sites)	31
3. Social Well-Being		
3.1 Beneficial Effect		
Number of farm households benefited by proposed irrigation in 2000	(10 ³)	290
Number of people served by proposed public water supply in 2000	(10 ⁶)	21.1
Safe supply period		See Table 95
3.2 Adverse Effect		
Number of people to be removed for construction of facilities	(10 ³)	2

Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and lake recreation benefits.

Table 95

SAFE SUPPLY PERIOD AND SAFE RIVER MAINTENANCE
FLOW PERIOD IN 2000 WITH RECOMMENDED PLAN
IMPLEMENTED UNDER THE CONDITION OF LOWER
ECONOMIC GROWTH

Unit: days

Basin No.	Basin Name	Safe Supply Period		Safe Maintenance Flow Period	
		With Structure	Without Structure	With Structure	Without Structure
<u>PENINSULAR MALAYSIA</u>					
1	Perlis	309	200	290	190
2	Langkawi	351	285	316	265
3	Kedah	333	133	317	133
4	Merbok	365	285	365	275
5	Muda	347	225	279	195
6	Perai	365	184	365	174
7	Pinang	365	154	365	148
9	Kurau	294	184	268	169
10	Perak (Kinta)	365	332	365	307
11	Bernam	365	156	280	136
12	Tengi	365	365	365	339
13	Selangor	365	334	365	280
15	Kelang	365	189	365	143
16	Langat	365	300	365	251
17	Sepang	365	189	365	174
18	Linggi	365	245	365	187
19	Melaka	365	92	365	87
20	Kesang	365	212	365	207
21	Muar	365	132	365	132
23	Pontian Kechil	365	152	365	152
24	Johor	365	152	365	137
31	Kuantan	365	359	365	334
39	Kemasin	344	311	304	261
40	Kelantan	344	269	304	243
<u>SABAH</u>					
207	Tawau	365	260	365	252
218	Kadamaian	298	265	292	261
221	Papar	351	330	331	296
<u>SARAWAK</u>					
231	Miri	365	303	365	288

Table 96 BENEFICIAL AND ADVERSE EFFECTS OF
RECOMMENDED PLAN FOR HYDROPOWER
DEVELOPMENT UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Power generation	(M\$10 ⁶) 350
1.2 Economic Cost	
Dam & power facilities	(M\$10 ⁶) 110
1.3 EIRR	(%) 22
2. Environmental Quality	
2.1 Beneficial Effect	
Surface area of reservoir created	(km ²) 1,113
2.2 Adverse Effect	
Number of sites where kind of fish might be reduced being located immediately downstream of dam	(nos. of site) 15
3. Social Well-Being	
3.1 Adverse Effect	
Number of people to be removed for construction of facilities	(10 ³) 27

Remarks; Economic benefit other than power generation benefit is not shown here, but included in the water demand and supply account.

Table 97

BENEFICIAL AND ADVERSE EFFECTS OF WATER
POLLUTION ABATEMENT PLAN UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 ⁶) 46
Saving in pre-treatment for D&I water supply	(M\$10 ⁶) 61
Total	(M\$10 ⁶) 107
1.2 Economic Cost	
Sewerage	(M\$10 ⁶) 113
Private purification facilities	(M\$10 ⁶) 8
Pre-treatment for D&I water supply	(M\$10 ⁶) 16
Total	(M\$10 ⁶) 137
1.3 EIRR	(%) -
2. Environmental Quality	
2.1 Beneficial Effects	
Reduction in length of river stretch where BOD concentration is more than 5 mg/lit in 2000 (see Table 98)	(km) 875
3. Social Well-being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 ³) 3,215
3.2 Adverse Effect	-

Table 98 LENGTH OF RIVER STRETCHES WHERE BOD CONCENTRATION IS MORE THAN 5 MG/LIT WITH AND WITHOUT RECOMMENDED PLAN IMPLEMENTED UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Unit: km

No.	Basin Name	Studied Length	Length of Stretch where BOD Concentration is more than 5 mg/lit			
			1990		2000	
			Without	With	Without	With
<u>Peninsular Malaysia</u>						
3	Kedah	55	0	0	0	0
4	Merbok	24	24	14	14	1
6	Perai	33	23	7	29	11
9	Kurau	65	20	0	20	0
10	Perak	270	60	0	70	0
11	Bernam	135	105	0	35	0
14	Buloh	33	33	33	33	33
15	Kelang	85	80	75	80	76
16	Langat	130	42	3	103	0
17	Sepang	15	12	1	15	11
18	Linggi	45	45	45	45	45
19	Melaka	40	40	31	40	30
20	Kesang	33	33	16	33	28
21	Muar	190	190	0	190	3
22	Batu Pahat	85	85	44	85	37
23	Sekudai	38	38	28	38	25
24	Johor	103	89	0	86	0
27	Endau	128	90	11	112	0
28	Rompin	185	136	0	88	0
32	Kemaman	35	35	0	17	0
39	Kemasin	40	0	0	23	0
Peninsular Malaysia		1,767	1,180	308	1,156	300
<u>Sabah & Sarawak</u>						
217	Bongan	15	15	0	0	0
234	Suai	91	37	0	19	0
Sabah & Sarawak		106	52	0	19	0
Malaysia		1,873	1,232	308	1,175	300

Remarks; Herein shown are only the Basins where some measures are recommended.

Table 99 BENEFICIAL AND ADVERSE EFFECTS OF ASSUMED SEWERAGE DEVELOPMENT PLAN NOT AFFECTING RIVER WATER QUALITY UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 ⁶) 37
Saving in pre-treatment for D&I water supply	(M\$10 ⁶) -
Total	(M\$10 ⁶) 37
1.2 Economic Cost	
Sewerage	(M\$10 ⁶) 112
Private purification facilities	(M\$10 ⁶) -
Pre-treatment for D&I water supply	(M\$10 ⁶) -
Total	(M\$10 ⁶) 112
1.3 EIRR	(%)
2. Environmental Quality	
2.1 Beneficial Effects	
Improvement in water quality in estuary and sea	Unquantified
3. Social Well-being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(103) 3,154
3.2 Adverse Effect	-

Table 100

BENEFICIAL AND ADVERSE EFFECTS OF
FLOOD MITIGATION PLAN UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 ⁶) 49
1.2 Economic Cost	
Flood mitigation work	(M\$10 ⁶) 69
1.3 EIRR	(%) 5.7
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km) 916
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 ³) 1,783
Population served by proposed flood warning system in 2000	(10 ³) 920
Area relieved from flood hazard	(10 ³ ha) 497
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 ³) 62

FIGURES

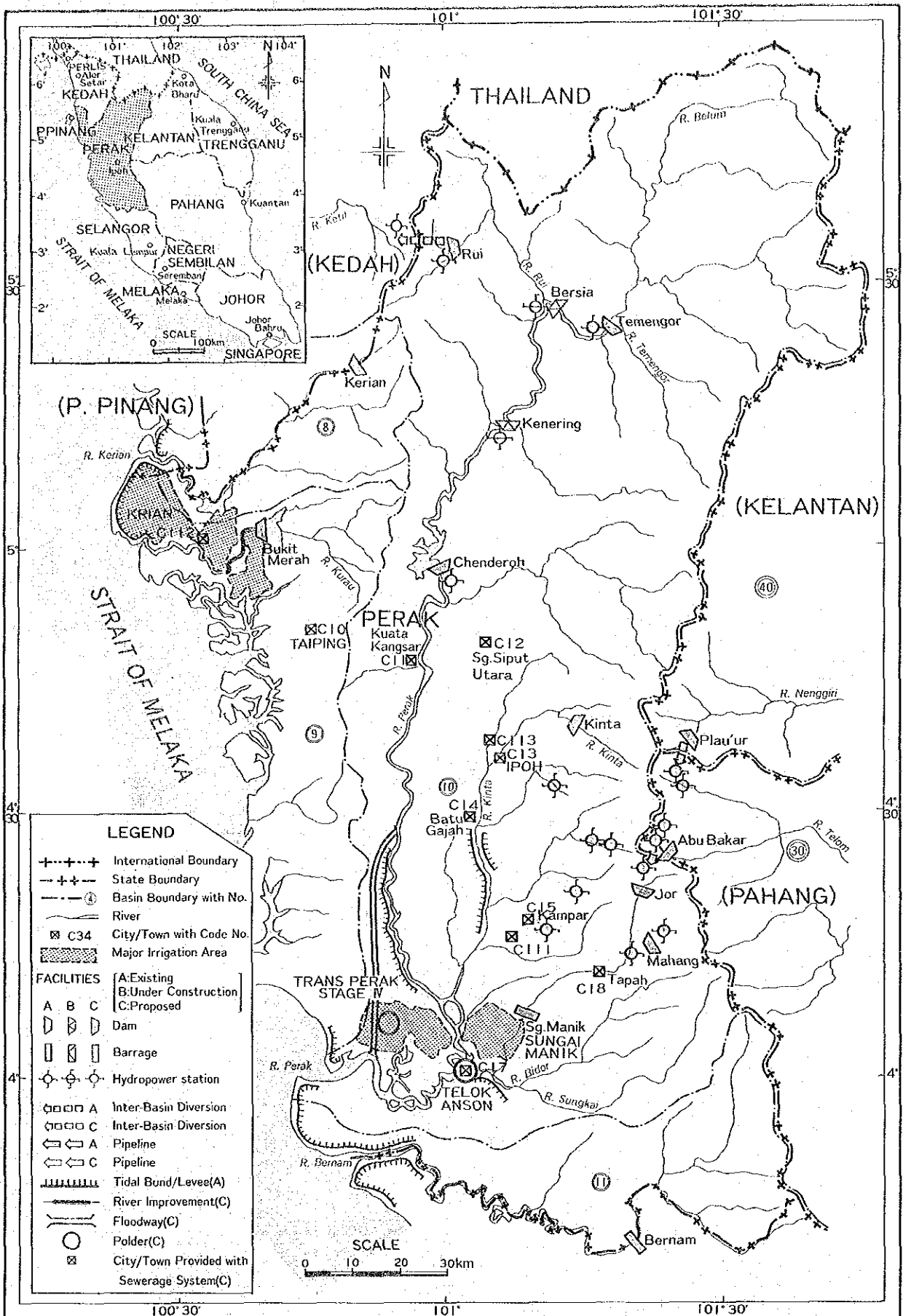


Fig.2 Recommended Plan for the State of Perak

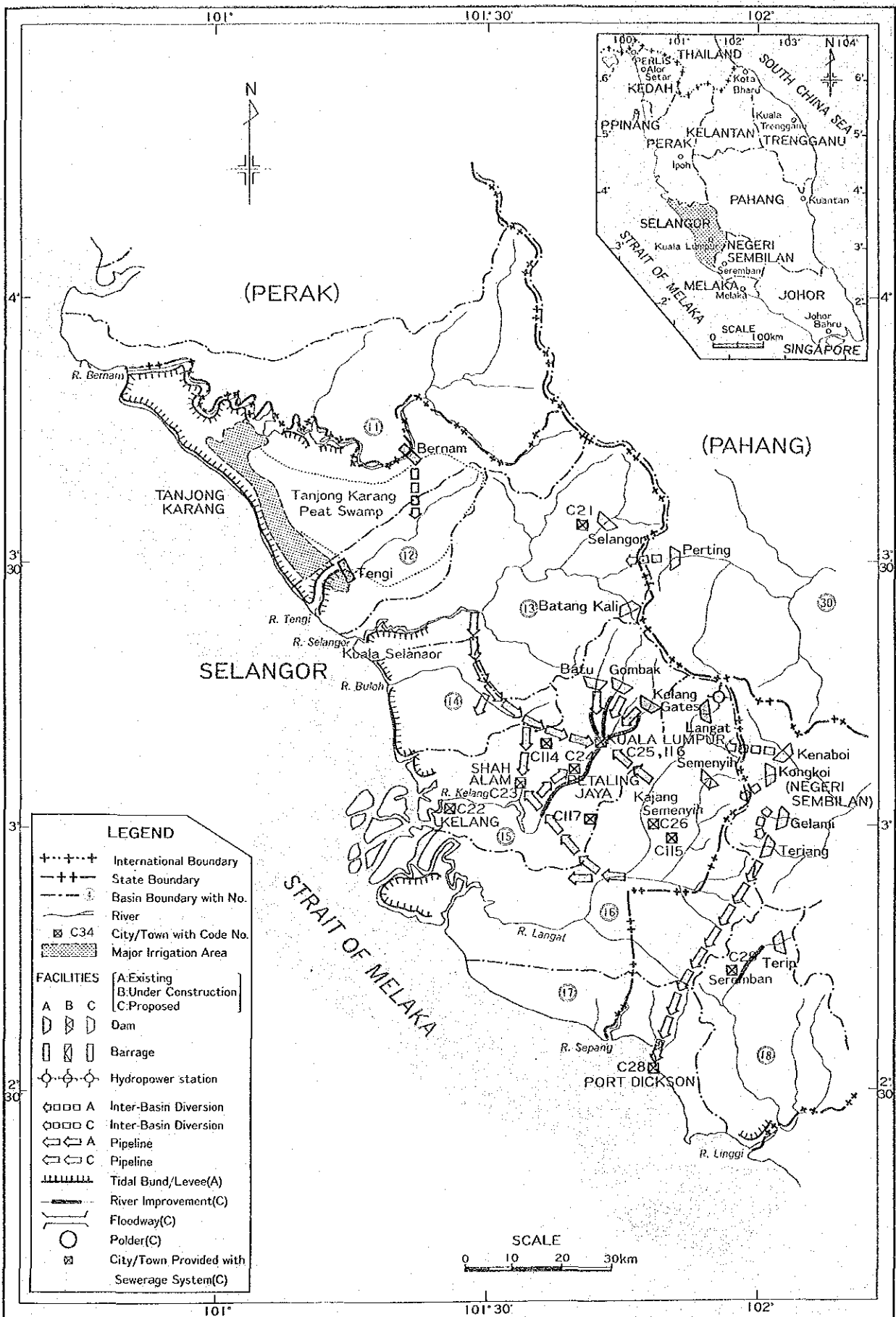


Fig.3 Recommended Plan for the State of Selangor

GOVERNMENT OF MALAYSIA
 NATIONAL WATER RESOURCES STUDY MALAYSIA
 JAPAN INTERNATIONAL COOPERATION AGENCY

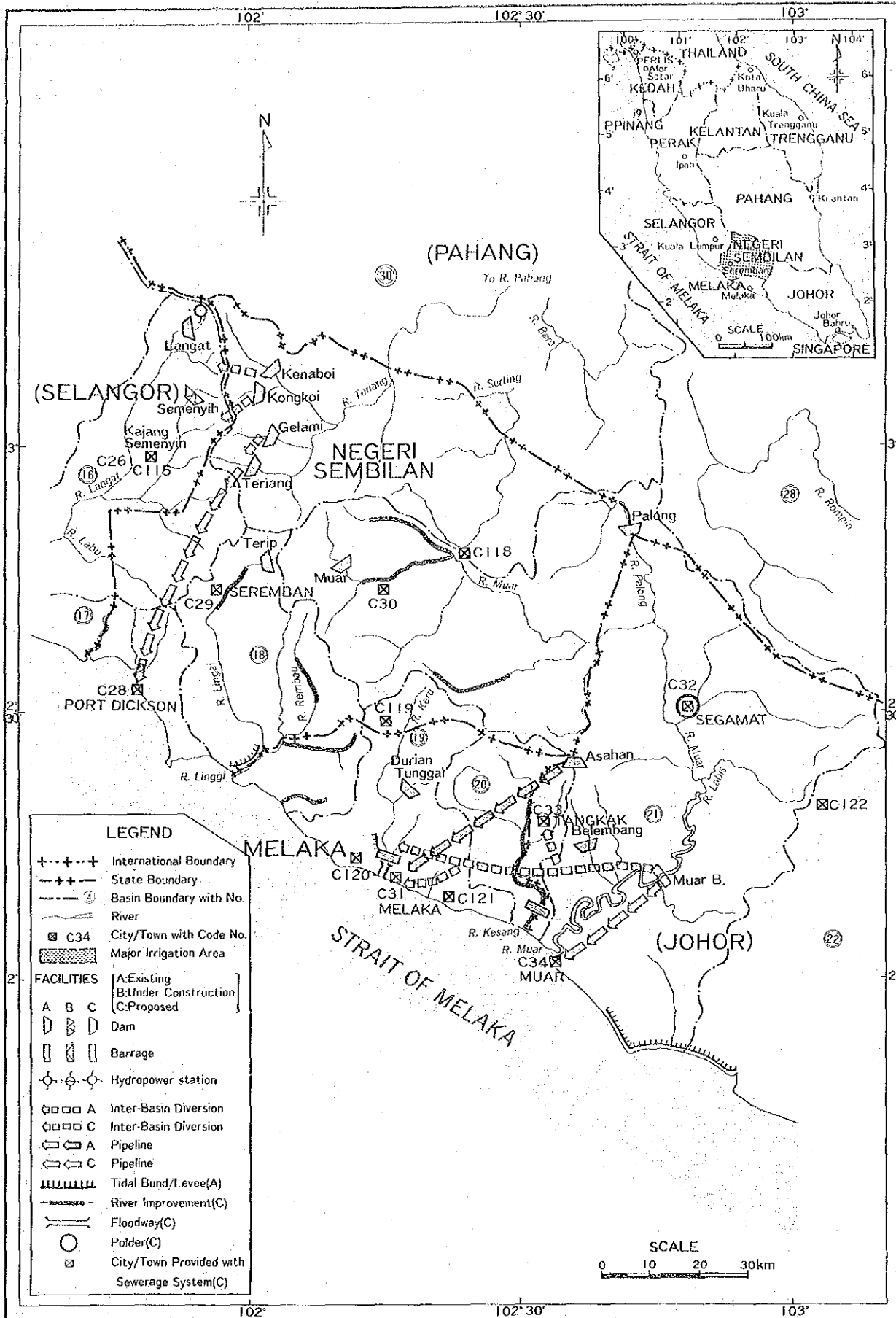


Fig.4 Recommended Plan for the States of N. Sembilan and Melaka

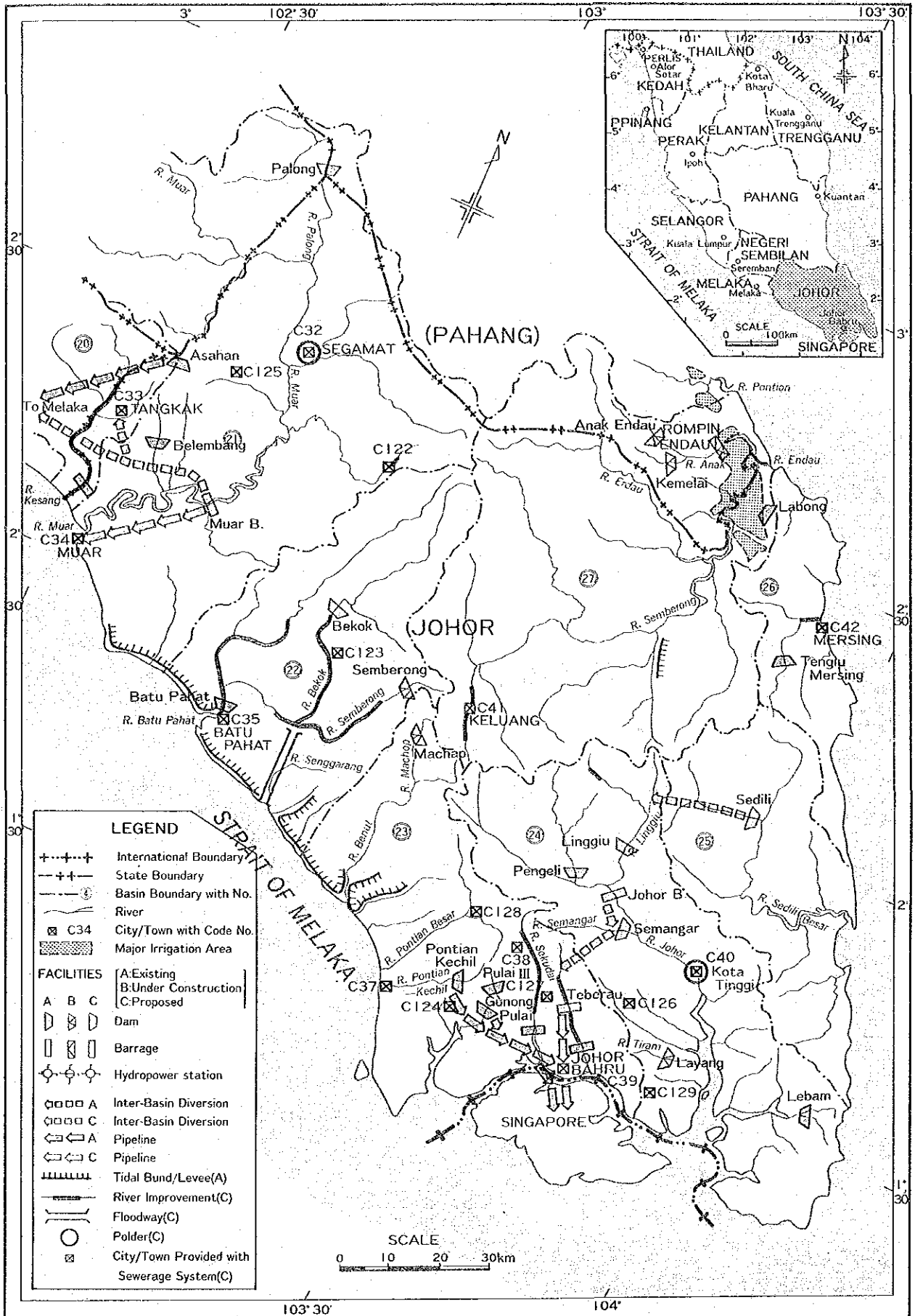
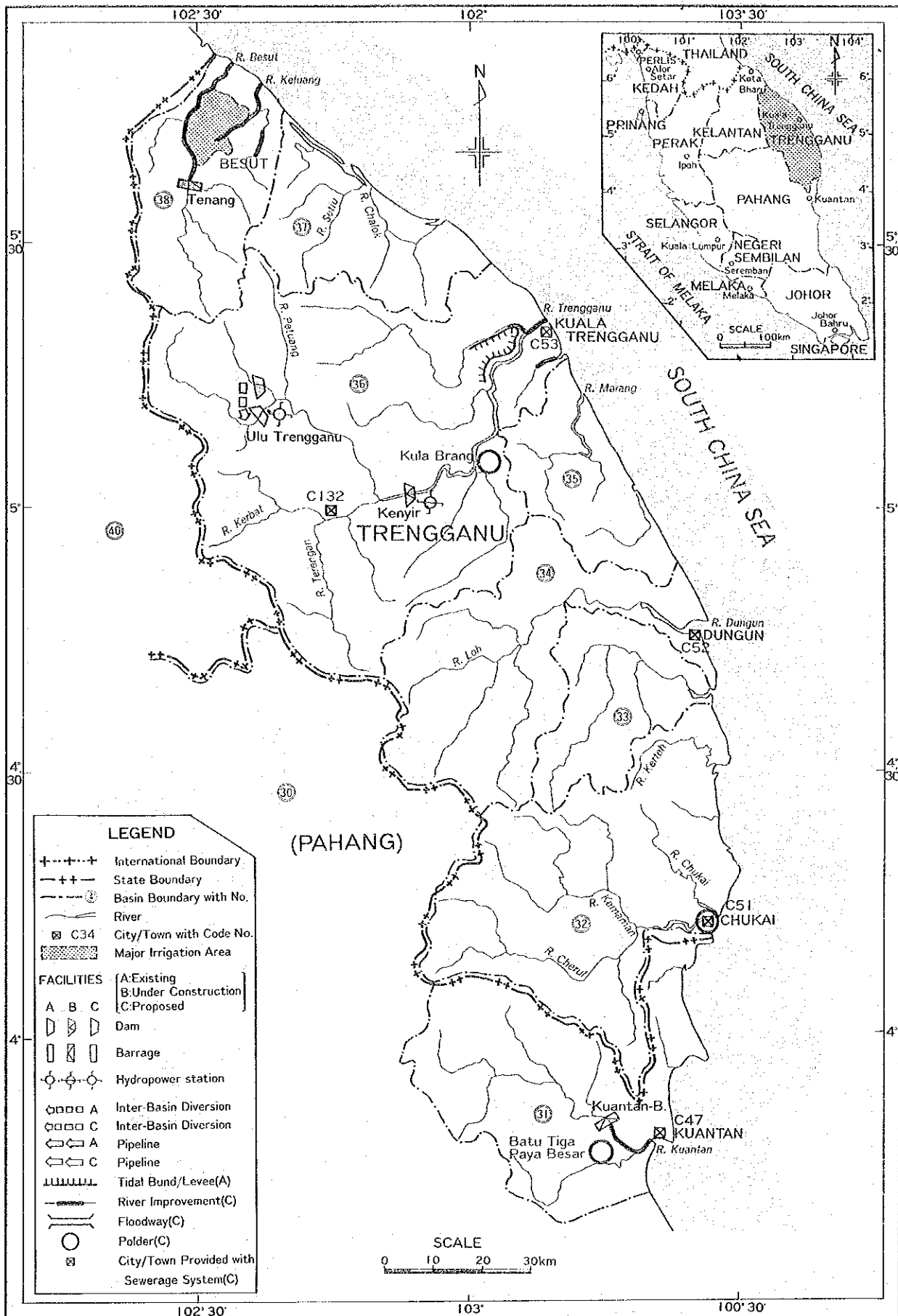


Fig.5 Recommended Plan for the State of Johor



Fig. 6 Recommended Plan for the State of Pahang

GOVERNMENT OF MALAYSIA
 NATIONAL WATER RESOURCES STUDY MALAYSIA
 JAPAN INTERNATIONAL COOPERATION AGENCY



LEGEND

- + + + + International Boundary
- - - - State Boundary
- - - - Basin Boundary with No.
- River
- ☒ C34 City/Town with Code No.
- Major Irrigation Area

FACILITIES

	[A:Existing B:Under Construction C:Proposed]
▤ ▤ ▤	Dam
▭ ▭ ▭	Barrage
⊕ ⊕ ⊕	Hydropower station
⊕ ⊕ ⊕ A	Inter-Basin Diversion
⊕ ⊕ ⊕ C	Inter-Basin Diversion
⇄ A	Pipeline
⇄ C	Pipeline
▬▬▬▬	Tidal Bund/Levee(A)
▬▬▬▬	River Improvement(C)
▬▬▬▬	Floodway(C)
○	Polder(C)
☒	City/Town Provided with Sewerage System(C)

Fig.7 Recommended Plan for the State of Trengganu

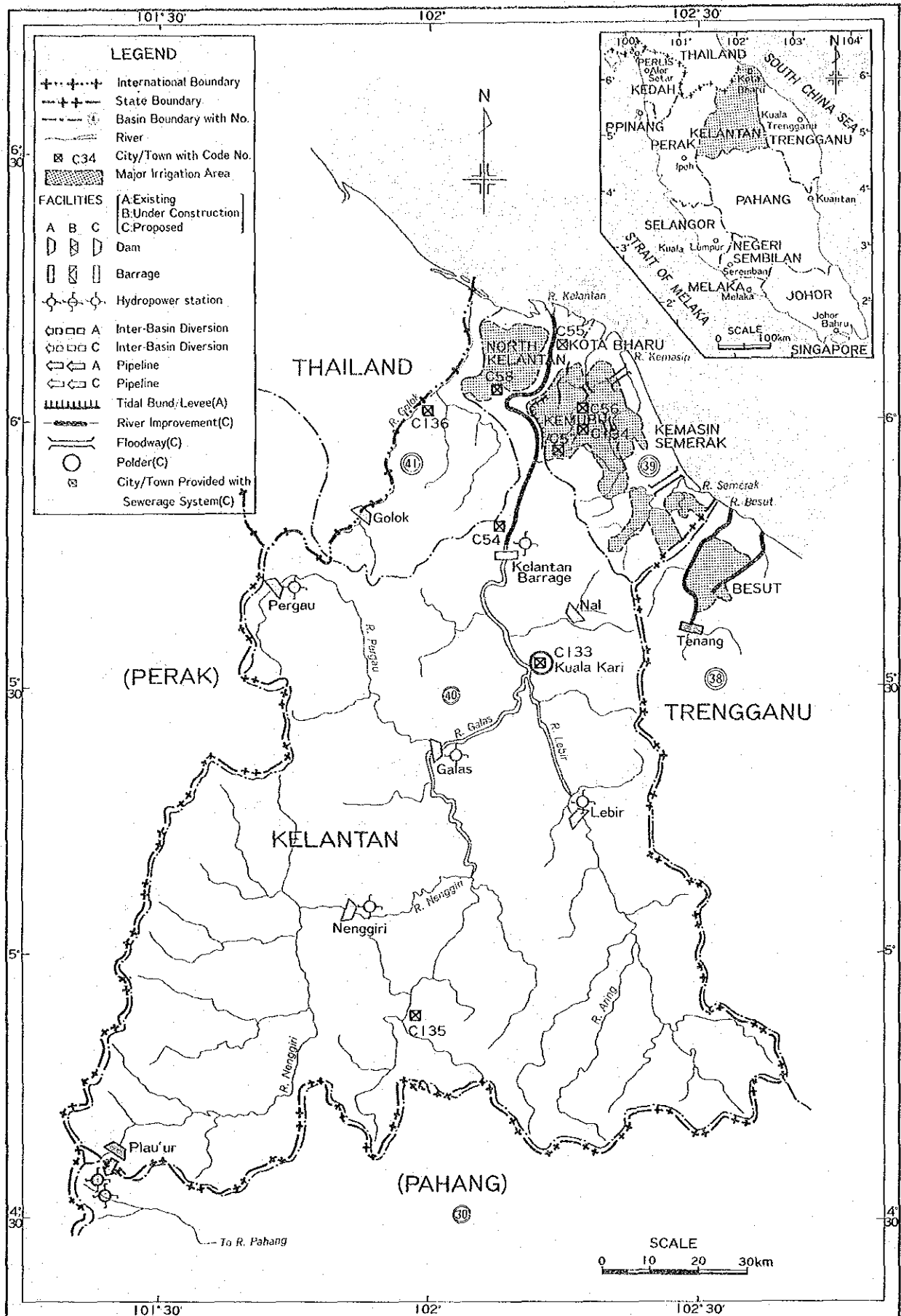


Fig. 8 Recommended Plan for the State of Kelantan

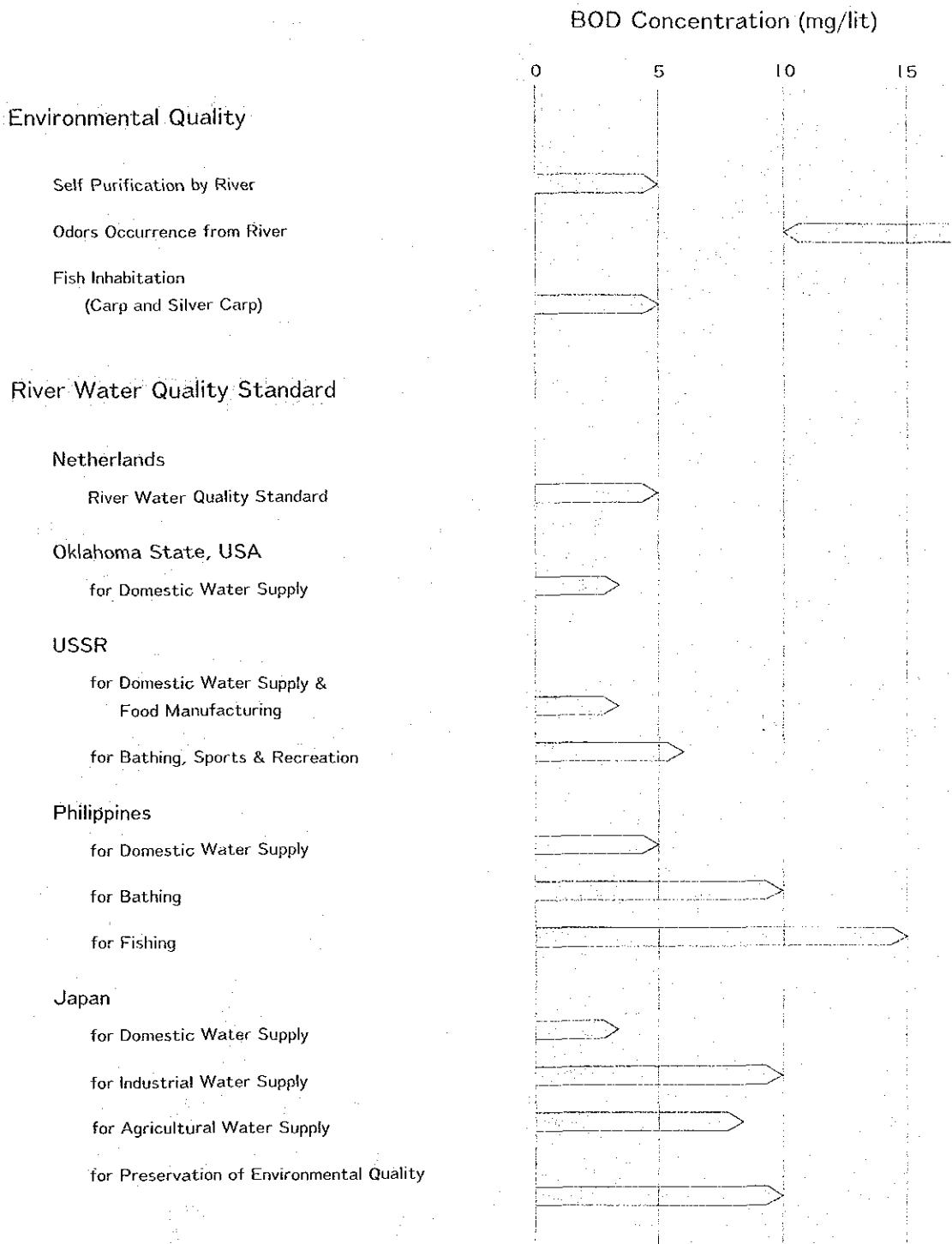


Fig.11 River Water Quality Standards in Terms of BOD Concentration

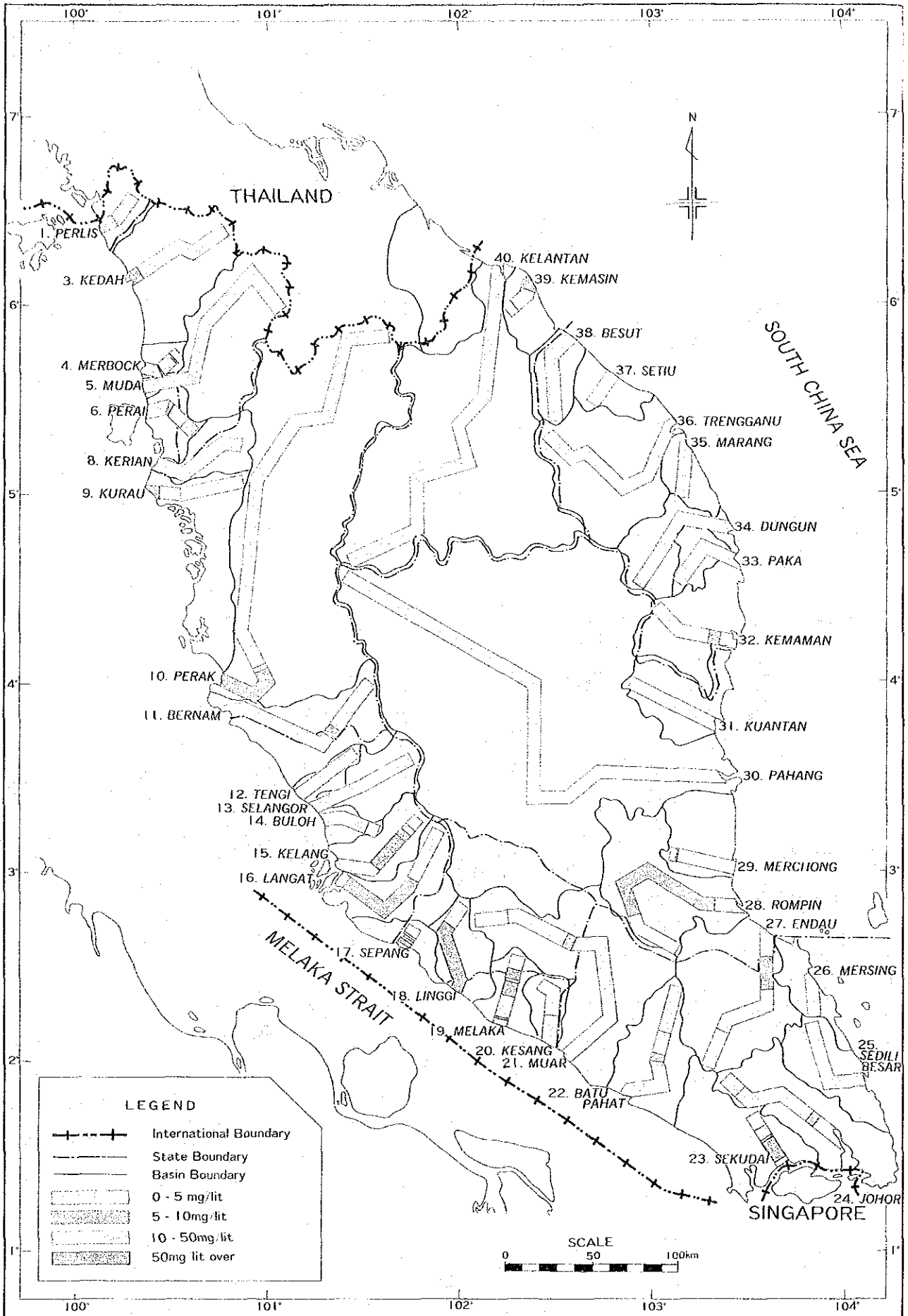
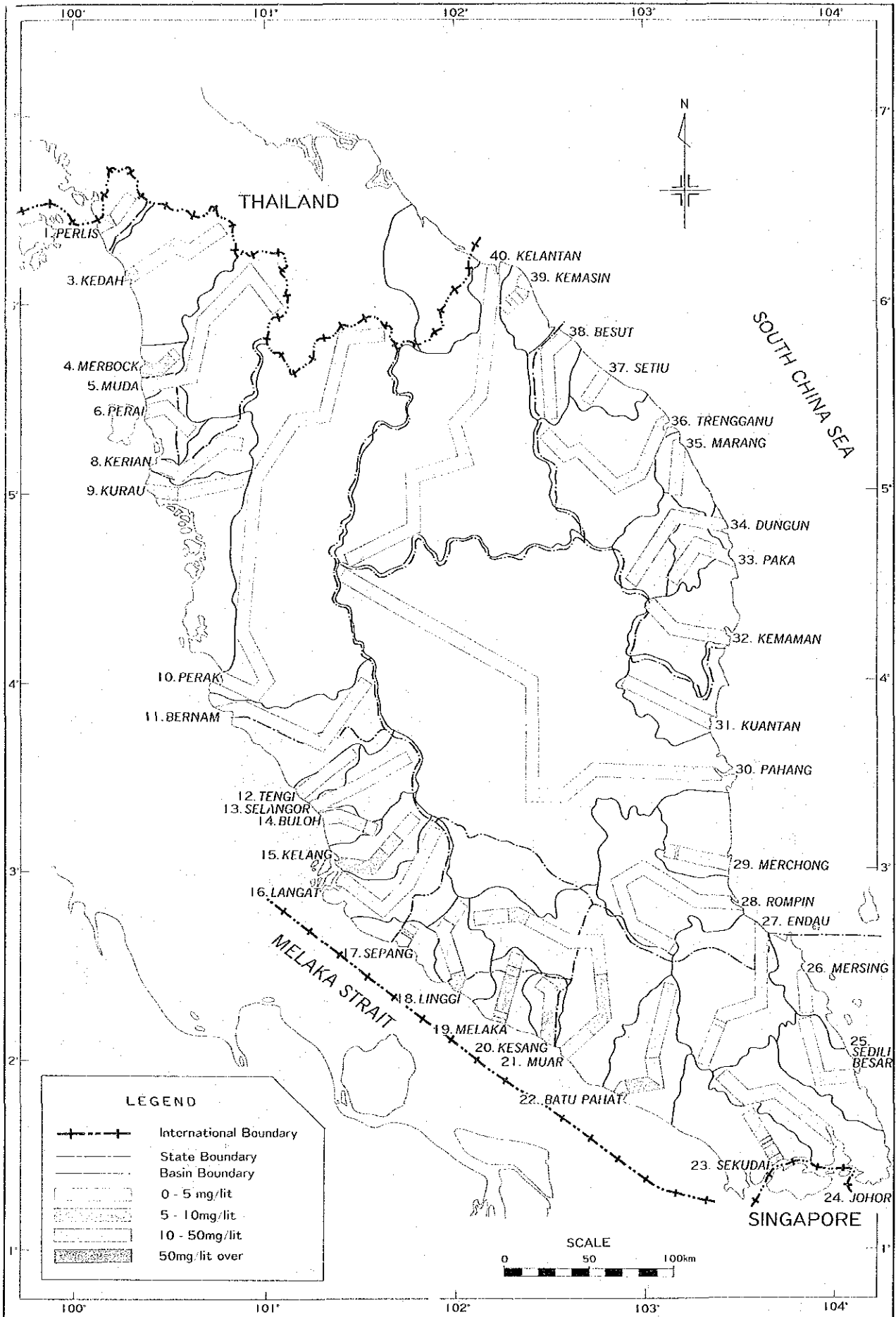


Fig. 12 Projected BOD Concentration in Major Rivers in Peninsular Malaysia for 2000 without the Recommended Plan Implemented



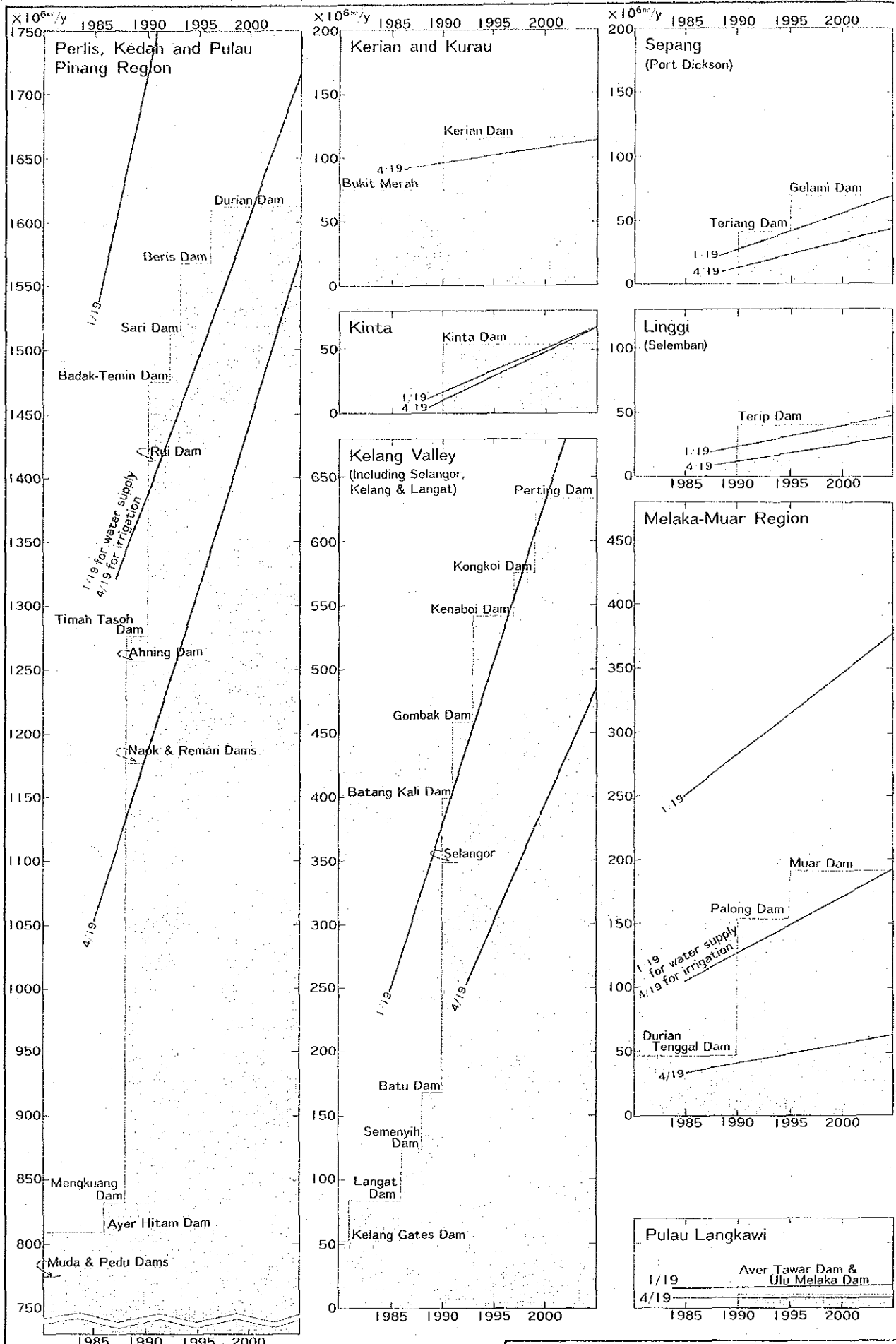


Fig.14 Recommended Water Demand and Supply Balance(1/2)

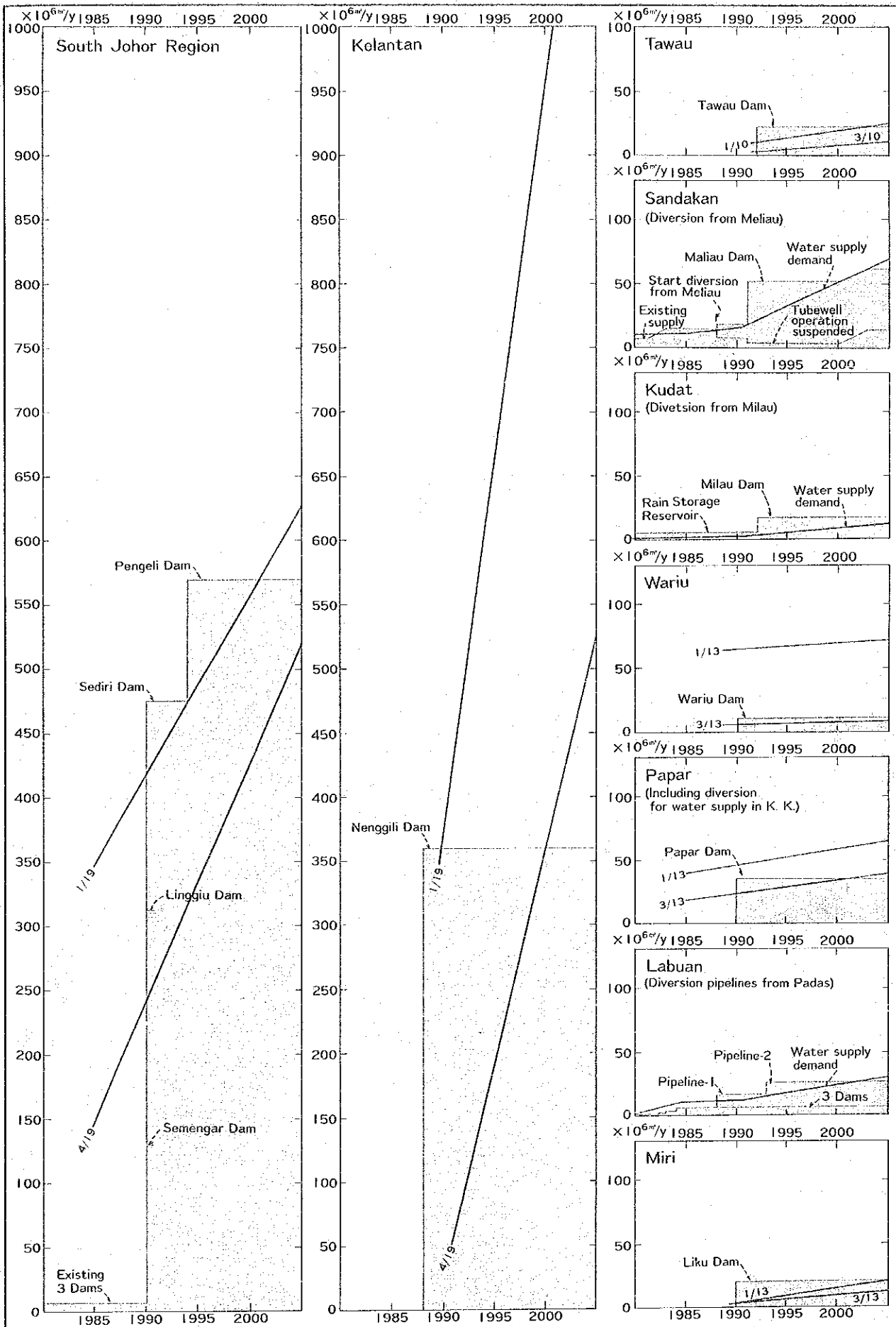


Fig. 15 Recommended Water Demand and Supply Balance(2/2)

