

Table 37

WATER SOURCE DEVELOPMENT PLANS FOR THE STATES
OF PERLIS, KEDAH AND PULAU PINANG, ALTERNATIVE B2

(1) DAM

Location		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
State**	Basin No.							
(1) Perlis, Kedah and Pulau Pinang Region								
Perlis	1	Timah-Tasoh dam	WS,IR,FM	150	6	20	14	1986-1990
Kedah	3	Ahning dam	WS,IR	120	27	73	51	1983-1987
Kedah	3	Badak-Tamin dam	IR	114	137	95	34	1983-1987
Kedah	3	Sari dam	IR	61	73	51	31	1986-1990
Kedah	3	Durian dam	IR	75	88	63	35	1990-1994
Kedah	5	Naok-Reman dams	WS,IR	-	-	350	123	1983-1987
Kedah	5	Beris dam	WS,IR	115	21	75	25	1985-1989
Kedah	5	Tawar-Muda dam	WS,IR	135	21	75	37	1985-1989
Kedah	5	Legong dam	WS,IR	44	44	45	32	1986-1990
P. Pinang	6	Mengkuang Phase I & II	WS	4	24	24	55	1981-1985
Perak	10	Rui dam	WS,IR	215	313	163	796	1983-1987
(ii) Pulau Langkuawai								
Kedah	2	Aver Tawar dam	IR	11	8	10	219	1985-1989
Kedah	2	Ulu Melaka dam	IR	7	3	6	15	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
1	Pumping from the Muda irrigation canal	Kedah Perlis 3 to 1	4.1	*	1983-1987
3	Jeniang diversion barrage canal	Kedah 5 to 3	17.3	included in Naok-Reman dam	1983-1987
4	Naok diversion canal	Kedah 5 to 3	1.4	*	1985-1989
10	Rui diversion tunnel	Perak Kedah 10 to 5	10.5	(15)	1983-1987
6	Pipe line	Kedah P. Pinang 5 to 6	5.5	*	1985-1989
6	Pipe line	Kedah P. Pinang 5 to 6	1.3	*	1986-1990
6	Pipe line	Kedah P. Pinang 5 to 6	0.6	*	1991-1995
7	Pipe line	Kedah P. Pinang 5 to 7	3.4	*	1985-1989
7	Pipe line	Kedah P. Pinang 5 to 7	0.9	*	1986-1990
7	Pipe line	Kedah P. Pinang 5 to 7	0.9	*	1990-1994

Remarks; IR: Irrigation; WS: Water supply; FM: Flood Mitigation
U/C: Under Construction; *: Cost included in other distribution facilities
Construction cost = Financial cost at 1980 constant price
**: The state where the facilities are located
(): Included in dam cost

Table 38 WATER SOURCE DEVELOPMENT PLAN FOR KERIAN AND KURAU RIVER BASINS, ALTERNATIVE B2

(1) DAM

Location		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
State**									
Kedah/Perak	8		Kerian dam	WS, IR	112	92	120	970	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
8	Kerian diversion canal	Perak 8 to 9	8	*	1985-1989
		Perak Pinang 8 to 6	-	*	-

Remarks; IR: Irrigation, WS: Water supply
 Construction cost: Financial cost at 1980 constant price.
 * : Cost included in irrigation facilities
 **: The state where the facilities are located

Table 39 WATER SOURCE DEVELOPMENT PLAN FOR KINTA VALLEY, ALTERNATIVE B2

(1) DAM

Location		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
State*									
Perak	10		Kinta (B) dam	WS	155	27	37	169	1985-1989

Remarks; Construction cost is the financial cost at 1980 constant price.
 IR: Irrigation, WS: Water supply
 *: The state where the facilities are located

Table 40 WATER SOURCE DEVELOPMENT PLAN FOR BERNAM AND TENGI RIVER BASINS, ALTERNATIVE B2

(1) DAM

Location		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
State*									
Perak	11		Geling dam	IR	56	12	13	36	1985-1989

Remarks; IR: Irrigation, Construction cost: Financial cost at 1980 constant price.
 * : The state where the facilities are located

Table 41 WATER SOURCE DEVELOPMENT PLAN FOR
KELANG VALLEY, ALTERNATIVE B2

(1) DAM

Location		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
State*	Basin No.							
Selangor	13	Selangor dam	WS	201	270	190	575	1985-1989
Selangor	13	Barang Kali dam	WS	49	72	45	76	1986-1990
Selangor	15	Batu dam	WS	50	28	39	80	1983-1987
Selangor	15	Gombak dam	WS	87	28	60	28	1988-1992
Selangor	16	Semenyih dam	WS	54	42	44	89	U/C1982-1985
N. Sembilan	30	Kanaboi dam	WS	118	136	83	237	1990-1994
Pahang	30	Perting dam	WS	88	119	39	214	1994-1998

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
13	Selangor diversion pipe line	Selangor 13 to 15	15	**	1985-1989
16	Semenyih diversion pipe line	Selangor 16 to 15		**	U/C1981-1985
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

Remarks; *: The State where the facilities are located
 WS: Water supply; U/C: Under construction
 Construction cost is the financial cost at 1980 constant price.
 **: Cost included in water supply distribution facilities

Table 42 WATER SOURCE DEVELOPMENT PLAN FOR
SEPANG RIVER ALTERNATIVE B2

(1) DAM

Location		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
State	Basin No.							
N. Sembilan	30	Teriang dam	WS	60	105	42	225	1985-1989
N. Sembilan	30	Gelami dam	WS	58	9	15	25	1990-1994

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
30	Teriang diversion pipe line	N. Sembilan 30 to 17	Stage 1: 3	525	1985-1989
			Stage 2: 1	253	1990-1994

Remarks; WS: Water supply
Construction cost is the financial cost at 1980 constant price.

Table 43 WATER SOURCE DEVELOPMENT PLAN FOR
LINGGI RIVER BASIN, ALTERNATIVE B2

(1) DAM

Location		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
State	Basin No.							
N. Sembilan	18	Terip dam	WS,IR	23	40	38	19	1985-1989

Remarks; IR: Irrigation; WS: Water supply
Construction cost is the financial cost at 1980 constant price.

Table 44 WATER SOURCE DEVELOPMENT PLAN FOR
MELAKA-MUAR REGION ALTERNATIVE B2

(1) DAM

Location	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
N. Sembilan/ Pahang	21	Palong dam	WS, IR	316	56	46	16	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
21	Muar diversion barrage & canal	Johor Melaka 21 to 19&20	13	139	1985-1989

Remarks; IR: Irrigation; WS: Water supply;
Construction cost is the financial cost at 1980 constant price.

Table 45 WATER SOURCE DEVELOPMENT PLAN FOR
SOUTH JOHOR REGION, ALTERNATIVE B2

(1) DAM

Location	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
Johor	24	Semangar dam	WS	160	137	123	54	1985-1989
Johor	24	Lingglu dam	WS	237	203	182	25	1985-1989
Johor	25	Sedili dam	WS	227	124	164	18	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
23	Teberan 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 & pipe line	Johor 25 to 24	10	83	1985-1989

Remarks; IR: Irrigation; WS: Water supply
Construction cost is the financial cost at 1980 constant price.
*: excludes the cost of distribution pipe line for water supply

Table 46 WATER SOURCE DEVELOPMENT PLAN FOR ANAK
ENDAU RIVER BASIN, ALTERNATIVE B2

(1) DAM

Location		Facilities	Purpose	Catch- ment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State	Basin No.							
Pahang	27	Anak Endau dam	IR	36	28	12	45	U/C1983-1987
Pahang	27	Kemelai dam	IR	44	34	35	18	U/C1983-1987
Pahang	27	Anak Endau weir	IR	-	-	-	*	U/C1983-1987

Remarks; IR: Irrigation
Construction cost is the financial cost at 1980 constant price.
*: Cost included in irrigation facilities

Table 47 WATER SOURCE DEVELOPMENT PLAN FOR
KUANTAN RIVER BASIN, ALTERNATIVE B2

(1) DAM

Location		Facilities	Purpose	Catch- ment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State	Basin No.							
Pahang	31	Kuantan barrage	WS	-	-	-	20	U/C1981-1985

Remarks; WS: Water Supply; U/C: Under Construction
Construction cost is the financial cost at 1980 constant price.

Table 48 WATER SOURCE DEVELOPMENT PLAN FOR KEMASIN, KELANTAN
AND GOLOK RIVER BASINS, ALTERNATIVE B2

(1) DAM

Location		Facilities	Purpose	Catch- ment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State	Basin No.							
Kelantan	40	Nenggiri dam	WS,IR	3,940	49	490	195	1995-1999

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construc- tion Period
39	Kemasin diversion irrigation canal	Kelantan 40 to 39	1990: 11.7	*	-
			2000: 18.0		
41	Golok diversion irrigation canal	Kelantan 40 to 41	1990: 10.3	*	-
			2000: 24.2		

Remarks; WS: Water Supply; IR: Irrigation; HY: Hydropower
Construction cost is the financial cost at 1980 constant price.
*: Cost of hydropower generation is borne by the hydropower development plan.

Table 49 WATER SOURCE DEVELOPMENT PLANS FOR THE STATE OF PERLIS, KEDAH AND PULAU PINANG, ALTERNATIVE B3

(1) DAM

State**	Location 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
(i) Perlis, Kedah and Pulau Pinang Region								
Perlis	1	Timah-Tasoh dam	WS, IR, FM	150	6	20	14	1985-1989
Kedah	3	Ahning dam	WS, IR	120	27	73	51	1983-1987
Kedah	3	Badak-Temin dam	IR	114	19	59	21	1983-1987
Kedah	3	Sari dam	IR	61	14	38	23	1987-1991
Kedah	3	Durian dam	IR	75	17	45	25	1991-1995
Kedah	5	Naok-Reman dams	WS, IR	-	-	350	123	1983-1987
Kedah	5	Beris dam	WS, IR	115	12	35	15	1986-1990 U/C(Phase I)
P.Pinang	6	Mengkuang Phase I & II	WS	4	24	24	55	1981-1985
(ii) Pula Lang Kuawai								
Kedah	2	Ulu Melaka dam	IR	7	2	5	12	1985-1989
Kedah	2	Aver Tawar dam	IR	11	2	6	131	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
1	Pumping from the Muda irrigation canal	Kedah, Perlis 3 to 1	2.6	*	1983-1987
3	Jenjang diversion (barrage canal)	Kedah 5 to 3	5.0	included in Naok-Reman dams	1983-1987
4	Naok diversion (canal)	Kedah 5 to 4	0.8	*	1985-1989
6	Pipe line	Kedah, P. Pinang 5 to 6	2.3	*	1985-1989
6	Pipe line	Kedah, P. Pinang 5 to 6	1.3	*	1986-1990
7	Pipe line	Kedah, P. Pinang 5 to 7	1.2	*	1985-1989

Remarks; IR: Irrigation; WS: Water supply; FM: Flood mitigation;
 U/C: Under construction
 Construction cost Financial cost at 1980 constant price
 * : Cost included in other distribution facilities
 **: The state where the facilities are located.

Table 50 WATER SOURCE DEVELOPMENT PLAN FOR KERIAN AND KURAN RIVER BASINS, ALTERNATIVE B3

(1) DAM

Location		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
State									
Kedah/Perak	8	Kerian dam	WS, IR	112	9	40	54	1985-1989	

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
8	Kerian diversion (Canal)	Perak 8 to 9	3	*	1985-1989
		Perak to Pinang	-	*	

Remarks; IR: Irrigation, WS: Water supply
 Construction cost is the financial cost at 1980 constant price.
 * : Cost included in irrigation facilities

Table 51 WATER SOURCE DEVELOPMENT PLAN FOR KINTA VALLEY, ALTERNATIVE B3

(1) DAM

Location		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
State**									
Perak	10	Kinta (B) dam	WS	115	25	35	155	1985-1989	

Remarks; IR: Irrigation; WS: Water supply
 Construction cost: Financial cost at 1980 constant price
 **: The state where the facilities are located.

Table 52 WATER SOURCE DEVELOPMENT PLAN FOR
KELANG VALLEY, ALTERNATIVE B3

(1) DAM

Location		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
State*	Basin No.							
Selangor	13	Selangor dam	WS	201	270	182	504	1985-1989
Selangor	13	Barang Kali dam	WS	49	72	45	76	1992-1996
Selangor	15	Baru dam	WS	50	28	39	80	1983-1987
Selangor	15	Gombak dam	WS	87	28	28	7	1994-1998

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
13	Selangor diversion (pipe line)	Selangor 13 to 15	14	**	1985-1989
16	Semenyih diversion (pipe line)	Selangor 16 to 15	-	**	U/C 1981-1985

Remarks; WS: Water supply; U/C: Under construction
Construction cost is the financial cost at 1980 constant price.
* : The State where the facilities are located
** : Cost included in water supply distribution facilities

Table 53 WATER SOURCE DEVELOPMENT PLAN FOR
SEPADANG RIVER, ALTERNATIVE B3

(1) DAM

Location		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
State									
N. Sembilan	30	Teriang dam	WS	60	70	36	166	1985-1989	

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
30	Teriang diversion (pipe line)	N. Sembilan 30 to 17	1	477	1985-1989

Remarks; WS: Water supply
Construction cost is the financial cost at 1980 constant price.

Table 54 WATER SOURCE DEVELOPMENT PLAN FOR
LINGGI RIVER BASIN, ALTERNATIVE B2

(1) DAM

Location		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
State									
N. Sembilan	18	Terip dam	WS, IR	23	26	25	13	1985-1989	

Remarks; IR: Irrigation; WS: Water supply
Construction cost is the financial cost at 1980 constant price.

Table 55 WATER SOURCE DEVELOPMENT PLAN FOR
MELAKA-MUAR REGION, ALTERNATIVE B3

(1) DAM

Location		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
State									
N. Sembilan/ Pahang	21	Palong dam			316	30	20	13	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19 & 20	8	80	1985-1989

Remarks; IR: Irrigation; WS: Water supply;
Construction cost is the financial cost at 1980 constant price.

Table 56 WATER SOURCE DEVELOPMENT PLAN FOR SOUTH JOHOR REGION, ALTERNATIVE B3

(1) DAM

Location		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
State	Basin No.							
Johor	24	Semangar dam	WS	160	137	123	54	1985-1989
Johor	24	Linggiu dam	WS	237	203	182	25	1985-1989
Johor	25	Sedili dam	WS	227	87	115	13	1986-1990

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
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 & pipe line)	Johor 25 to 24	7	67	1986-1990

Remarks; WS: Water supply
 Construction cost is the financial cost at 1980 constant price.
 *: excludes the cost of distribution pipe line for water supply

Table 57 WATER SOURCE DEVELOPMENT PLAN FOR ANAK
ENDAU RIVER BASIN, ALTERNATIVE B3

(1) DAM

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
27	Anak Endau dam	IR	36	26	11	38	U/C1983-1987
27	Kemelai dam	IR	44	31	30	15	U/C1983-1987
27	Anak Endau weir	IR	-	-	-	*	U/C1983-1987

Remarks; IR: Irrigation
Construction cost is the financial cost in 1980 constant price.
*: Cost includes in irrigation facilities.

Table 58 WATER SOURCE DEVELOPMENT PLAN FOR
KUANTAN RIVER BASIN, ALTERNATIVE B3

(1) DAM

Basin No.	Facilities	Purpose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Suppl Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
31	Kuantan barrage	WS	-	-	-	20	U/C 1981-1985

Remarks; WS: Water supply; U/C: Under construction
Construction cost is the financial cost at 1980 constant price.

Table 59

WATER SOURCE DEVELOPMENT PLAN FOR KEMASIN, KELANTAN
AND GOLOK RIVER BASINS, ALTERNATIVE B3

(1) DAM

Basin No.	Facilities	Purpose	Catchment Area (km)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
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 /y)	Construction Cost (M\$10 ⁶)	Construction Period
39	Kemasin diversion (irrigation canal)	Kelantan 40 to 39	1990:11.7 2000:18.0	*	-
41	Golok diversion (irrigation canal)	Kelantan 40 to 41	1990:10.3 2000:24.2	*	-

Remarks; WS: Water supply; IR: Irrigation

Construction cost is the financial cost at 1980 constant price.

* : Cost of hydropower generation is borne by the hydropower development plan.

Table 60 DROUGHT LEVEL AND CORRESPONDING
RECURRENCE INTERVAL

Unit: Year

Plotting-position Formulas for Recurrence Interval (T)	Drought Level				
	1/N	2/N	3/N	4/N	5/N
Hazen : $2N/(2m - 1)$	38.0	12.7	7.6	5.4	4.2
Weibull (or Tomas): $(N + 1)/m$	20.0	10.0	6.7	5.0	4.0
Gringorten : $(N + 0.12)/(m - 0.44)$	34.1	12.3	7.5	5.4	4.2

Remarks; N = Total number of items (record period = 19)

m = Order number of items arranged in descending magnitude,
thus m = 1 for the largest item

Probability $P(X > x) = 1/T$

Source; Ref. 1

Table 61 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR PERLIS, KEDAH AND PULAU PINANG
REGION

Unit: 10⁶ m³/y

Storage Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Muda-Pedu dam	Mudah, Kedah	Existing	780	780
Ayer Hitam dam	P. Pinang	Existing	30	30
Timah-Tasoh dam	Perlis	1988	20	20
Ahning dam	Kedah	1988	73	73
Badak-Temin dam	Kedah	1990	59	59
Sari dam	Kedah	1992		38
Durian dam	Kedah	1996		45
Naok-Reman dams	Kedah	1988	350	350
Rui dam	Perak	1990	140	140
Beris dam	Kedah	1993		55
Mengkuang Phase I & II	P. Pinang	1986	24	24
Total Supply			1,476	1,614
Required Supply			1,387	1,606
Balance			+89	+8

Remarks; The breakdown of the required supply capacity which is 1.2 times of estimated water deficit under 1/19 drought for Basins 4, 6 and 7, and under 4/19 drought for Basins 1, 3 and 5 is shown in Table 71.

Table 62 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR PULAU LANGKAWI

Unit: 10⁶ m³/y

Storage Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Aver Tawar dam	Kedah	1990	6	6
Ulu Melaka dam	Kedah	1990	5	5
Total Supply			11	11
Required Supply			9	9
Balance			+2	+2

Remarks; The breakdown of the required supply capacity, which is 1.2 times of estimated water deficit under 4/19 drought, is shown in Table 72.

Table 63 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR KERIAN AND KURAU RIVER BASINS

Unit: 10⁶ m³/y

Storage Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Bukit Merah Reservoir	Kurau	Existing	76	76
Kerian dam	Kerian	1990	40	40
Total Supply			116	116
Required Supply			97	108
Balance			+19	+8

Remarks; The breakdown of the required supply capacity, which is 1.2 times of estimated water deficit under 4/19 drought, is shown in Table 73.

Table 64 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR KINTA VALLEY

Unit: 10⁶ m³/y

Storage Facilities	Location of Facilities	Year of Commission	Net Supply Capacity	
			Required Supply Capacity 1990	Supply Capacity 2000
Kinta dam	Kinta	1990	55	55
Total Supply			55	55
Required Supply			16	46
Balance			+39	+9

Remarks; The breakdown of the required supply capacity, which is 1.1 times of estimated water deficit in sub-basin under 1/19 drought, is shown in Table 74.

Table 65 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR KELANG VALLEY

Unit: 10⁶ m³/y

Storage/Diversion Facilities	Location of Facilities	Year of Commission	Net Supply Capacity	
			Required Supply Capacity 1990	Supply Capacity 2000
Kelang Gates dam	Kelang	Existing	53	53
Langat dam and diversion	Langat	Existing	32	32
Selangor dam and diversion	Selangor	1990	186	186
Batang Kali dam		1990	45	45
Batu dam	Kelang	1986	39	39
Gombak dam	Kelang	1991		60
Semenyih dam and diversion	Langat	1986	44	44
Kenaboi dam and diversion	N. Sembilan	1993		83
Perting dam and diversion	Pahang	1999		59
Kongkoi dam and diversion	N. Sembilan	1997		33
Total Supply			399	634
Required Supply			376	629
Balance			+23	+5

Remarks; The breakdown of the required supply capacity, which is 1.1 times of estimated water deficit under 1/19 drought, is shown in Table 75.

Table 66 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR SEPANG RIVER BASIN

Unit: $10^6 \text{ m}^3/\text{y}$

Storage/Diversion Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Teriang dam	N. Sembilan	1990	42	42
Gelami dam	N. Sembilan	1995	-	18
Teriang diversion	Stage 1	N. Sembilan	1990	
	Stage 2	N. Sembilan	1995	
Total Supply			42	60
Required Supply			28	56
Balance			+14	+4

Remarks; The breakdown of the required supply capacity, which is 1.2 times of estimated water deficit under 1/19 drought, is shown in Table 76.

Table 67 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR LINGGI RIVER BASIN

Unit: $10^6 \text{ m}^3/\text{y}$

Storage Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Terip dam	Linggi	1990	41	41
Total Supply			41	41
Required Supply			22	37
Balance			+19	+4

Remarks; The breakdown of the required supply capacity, which is 1.1 times of estimated water deficit under 1/19 drought, is shown in Table 77.

Table 68

RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR MELAKA-MUAR REGIONUnit: 10⁶ m³/y

Storage/Diversion Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Durian Tunggal dam	Melaka	Existing	48	48
Asahan dam	Muar	Existing	0	0
Belembang dam	Muar	Existing	0	0
Palong dam	N. Sembilan/Pahang	1990	107	107
Muar parrage and diversion	Johor	1990	-	-
Muar dam	N. Sembilan	1995	-	37
Total Supply			155	192
Required Supply			128	171
Balance			+27	+21

Remarks; The breakdown of the required supply capacity, which is 1.2 times of estimated water deficit under 1/19 drought for Basins 19 and 20 (Melaka and Kesang) and under 4/19 drought for Basin 21 (Muar) is shown in Table 78.

Table 69

RECOMMENDED WATER DEMAND AND SUPPLY BALANCE
PROGRAM FOR SOUTH JOHOR REGIONUnit: 10⁶ m³/y

Storage/Diversion Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Pontian Kechil, Gunong Pulai and Pulai III dams	Pontian Kechil and Pulai	Existing	7	7
Teberau barrage	Teberau	1990	-	-
Johor barrage	Johor	1990	-	-
Semangar dam and diversion	Johor	1990	123	123
Linggiu dam	Johor	1990	182	182
Pengeli dam	Johor	1994	84	84
Sedili dam and diversion	Sedili Besar	1990	164	164
Total Supply			560	560
Required Supply			419	558
Balance			+141	+2

Remarks; The breakdown of the required supply capacity, which is 1.1 times of estimated water deficit under 1/19 drought level, is shown in Table 79.

Table 70 RECOMMENDED WATER DEMAND AND SUPPLY BALANCE PROGRAM FOR KELANTAN BASIN

Unit: 10^6 m³/y

Storage/Diversion Facilities	Location of Facilities	Year of Commission	Net Supply Capacity/ Required Supply Capacity	
			1990	2000
Nenggiri dam	Kelantan	1988	360 + a*	360 + a
Nal dam	----- under study -----			
Total Supply			360 + a	360 + a
Required Supply			22	360
Balance			+338 + a	+a

Remarks; The breakdown of the required supply capacity, which is 1.2 times of estimated deficit under 4/19 drought, is shown in Table 80.

*: For the hydropower generation the regulated capacity of 960×10^6 m³/y is planned and thus surplus supply capacity ($a < 600 \times 10^6$ m³/y) could be attained.

Table 71 BREAKDOWN OF REQUIRED SUPPLY CAPACITY ESTIMATED FOR PERLIS, KEDAH AND PULAU PINANG REGION

(A) Required Supply Capacity

Unit: 10^6 m³/y

No.	Basin	Drought Level	1990	2000
1	Perlis	4/19	40	60
3	Kedah	4/19	198	1,084
4	Merbok	1/19	17	22
5	Muda	4/19	137	166
6	Perai	1/19	140	181
7	Pulau Pinang	1/19	66	93
Total			1,396	1,615

The deficit estimated by integrated basin water usage (Basins 5, 6 & 7) is redistributed among Muda, Perai and Pulau Pinang Basins in proportion to the individual deficit shown in Tables 18 and 19 taking into account each predominant drought level, and the required supply capacity is obtained (1.2 times of the estimated water deficit).

(B) Deficit of Integrated Basins 5, 6 and 7

Unit: 10^6 m³/y

Basin No.	Catchment Area (km ²)	Drought Level					
		B1 (1/19)		B2 (2/19)		B3 (4/19)	
		1990	2000	1990	2000	1990	2000
Combined basins of 5, 6 and 7	4,200 + 600 + 220 = 5,020	393	508	328	427	186	242

Table 72 BREAKDOWN OF REQUIRED SUPPLY CAPACITY ESTIMATED FOR PULAU LANGKAWI

No.	Basin	Drought Level	Unit: 10 ⁶ m ³ /y	
			1990	2000
2	Pulau Langkawi	4/19	9	9

Remarks; The required supply capacity is 1.2 times of estimated deficit under 4/19 drought shown in Tables 18 and 19.

Table 73 BREAKDOWN OF REQUIRED SUPPLY CAPACITY ESTIMATED FOR KERIAN AND KURAU RIVER BASINS

(A) Required Supply Capacity

No.	Basin	Drought Level	Unit: 10 ⁶ m ³ /y	
			1990	2000
8	Kerian	4/19	4	5
9	Kurau	4/19	93	103
Total			97	108

The deficit estimated by integrated basin water usage (Basins 8 and 9) is redistributed for Kerian and Kurau Basins in proportion to the individual deficit shown Tables 18 and 19, and the required supply capacity is obtained (1.2 times of the estimated water deficit).

(B) Deficit of integrated Basins 8 and 9

Basin No.	Catchment Area (km ²)	Drought Level					
		B1 (1/19)		B2 (2/19)		B3 (4/19)	
		1990	2000	1990	2000	1990	2000
Combined basins of 8 and 9	1,360 + 1,155 = 2,515	207	227	144	160	81	90

Table 74 BREAKDOWN OF REQUIRED SUPPLY CAPACITY
ESTIMATED FOR KINTA VALLEY

(A) Required Supply Capacity Unit: 10⁶ m³/y

Basin No.	Sub-basin	Drought Level	1990	2000
10	Kinta Valley	1/19	16	46

The required supply capacity is 1.1 times of estimated deficit under 1/19 drought in the sub-basin.

(B) Deficit of Sub-basin Unit: 10⁶ m³/y

Sub-basin (Catchment Area)	River Utilization Ratio in 2000	Drought Level					
		B1 (1/19)		B2 (2/19)		B3 (4/19)	
		1990	2000	1990	2000	1990	2000
Ipoh area (875 km ²)	19%	14	42	13	28	9	26

Table 75 BREAKDOWN OF REQUIRED SUPPLY CAPACITY
ESTIMATED FOR KELANG VALLEY

(A) Required Supply Capacity Unit: 10⁶ m³/y

Area	1990	2000
Selangor Intake Area (Lower)	16	16
Upper Kuala Lumpur	329	582
Semenyih Intake Area	31	31
Total	376	629

The required supply capacity of the above three area is obtained by redistributing the integrated required supply capacity at the Selangor intake and the Semenyih intake (1.1 times of integrated deficit). The integrated deficit at the Selangor and Semenyih intakes are calculated by super-imposing a half of the deficit of upper Kuala Lumpur for the two sites.

(B) Integrated Deficit at Selangor and Semenyih Intakes Unit: 10⁶ m³/y

Sub-basin	Catchment Area (km ²)	Drought Level					
		B1 (1/19)		B2 (2/19)		B3 (4/19)	
		1990	2000	1990	2000	1990	2000
Selangor Intake	1,418	142	243	128	233	67	140
Semenyih Intake	1,156	200	330	187	310	119	217

Table 76 BREAKDOWN OF REQUIRED SUPPLY CAPACITY
ESTIMATED FOR SEPANG RIVER BASIN

No.	Basin	Drought Level	Unit: 10 ⁶ m ³ /y	
			1990	2000
17	Sepang	1/19	28	56

Remarks; The required supply capacity is 1.2 times of estimated deficit (includes 0.1 for distribution loss due to 90 km pipe line system) under 1/19 drought shown in Tables 18 and 19.

Table 77 BREAKDOWN OF REQUIRED SUPPLY CAPACITY
ESTIMATED FOR LINGGI RIVER BASIN

(A) Required Supply Capacity

Basin No.	Sub-basin	Drought Level	Unit: 10 ⁶ m ³ /y	
			1990	2000
18	Upper Selemban	1/19	22	37

The required supply capacity is 1.1 times of estimated deficit under 1/19 drought in the sub-basin.

(B) Deficit in Sub-basin

Unit: 10⁶ m³/y

Sub-basin (Catchment Area)	River Utilization Ratio in 2000	Drought Level					
		B1 (1/19)		B2 (2/19)		B3 (4/19)	
		1990	2000	1990	2000	1990	2000
Upper Selemban (168 km ²)	34%	20	33	19	31	16	31

Table 78 BREAKDOWN OF REQUIRED SUPPLY CAPACITY
ESTIMATED FOR MELAKA-MUAR RIVER BASIN

(A) Required Supply Capacity Unit: 10⁶ m³/y

Basin	B1 (1/19)		B2 (2/19)		B3 (4/19)	
	1990	2000	1990	2000	1990	2000
19 Melaka	97*	133	33	47	29	38
20 Kesang	19*	20*	3	3	1	1
21 Muar	167	194	33	42	12*	18*

*: Required capacity for Recommended Plan

The deficit estimated by integrated basin water usage (Basins 19, 20 and 21) is redistributed among Basins 19, 20 and 21 in proportion to the individual deficit shown in Tables 18 and 19 taking into account each predominant drought level, and the required supply capacity is obtained (1.2 times of the estimated water deficit).

(B) Deficit of Integrated Basins 19, 20 and 21 Unit: 10⁶ m³/y

Basin	B1 (1/19)		B2 (2/19)		B3 (4/19)	
	1990	2000	1990	2000	1990	2000
Integrated Basins 19, 20 & 21	236	289	58	77	35	47

Table 79 BREAKDOWN OF REQUIRED SUPPLY CAPACITY
ESTIMATED FOR SOUTH JOHOR REGION

(A) Required Supply Capacity Unit: 10⁶ m³/y

Area	1990	2000
i) Teberau basin	84	145
ii) Basin 24A at Johor barrage	*10	*15
iii) Singapore	*318 + 7	*391 + 7

* The deficit of Basin 24A estimated by integrated basin water usage (Basins 23C & 24A) is allocated for Singapore and Basin 24A area in proportion to the share of water demand.

(B) Deficit of Sub-basins Unit: 10⁶ m³/y

Sub-basin	River Utilization Ratio in 2000	Drought Level					
		B1		B2		B3	
		1990	2000	1990	2000	1990	2000
23A: Benut Basin (518 km ²)	0%	-	-	-	-	-	-
23B: Pontian B & Sekudai Basin (1,007 km ²)	6%	-	-	-	-	-	-
23C: Teberau Basin (275 km ²) (Johor Bahru)	57%	76	132	44	103	42	94
24A: Singapore & Johor (1,085 km ²)	36%	298	369	237	317	215	287
24B: The Rest of 24 (1,405 km ²)	2%	-	-	-	-	-	-

Table 80 BREAKDOWN OF REQUIRED SUPPLY CAPACITY
ESTIMATED FOR KELANTAN BASIN

(A) Required Supply Capacity Unit: 10⁶ m³/y

No.	Basin	Drought Level	1990	2000
40	Kelantan	4/19	22	360

The required supply capacity is 1.1 times of estimated deficit under 4/19 drought in Kelantan Basin.

(B) Deficit of Kelantan Basin (Refer to Tables 18 & 19) Unit: 10⁶ m³/y

Basin (Catchment Area)	Drought Level					
	B1 (1/19)		B2 (2/19)		B3 (4/19)	
	1990	2000	1990	2000	1990	2000
Kelantan (Basin 40) (12,600)	309	799	102	407	18	300

Remarks; The diversion water demand for Kemasin irrigation (Basin 39) and Golok irrigation schemes (Basin 41) are taken into account in estimation of the deficit of Basin 40.

Table 81 RECOMMENDED WATER SOURCE DEVELOPMENT PLANS FOR THE STATES OF PERLIS, KEDAH AND PULAU PINANG

(1) DAM

Location		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
State**	Basin No.							
(i) Perlis, Kedah and Pulau Pinang Region								
Perlis	1	Timah-Tasoh dam	WS, IR, FM	150	6	20	14	1983-1987
Kedah	3	Ahning dam	WS, IR	120	27	73	51	1983-1987
Kedah	3	Badak-Temin dam	IR	114	19	59	21	1985-1989
Kedah	3	Sari dam	IR	61	14	38	23	1987-1991
Kedah	3	Durian dam	IR	75	17	45	25	1991-1995
Kedah	5	Naok-Reman dams	WS, IR	-	-	350	123	1983-1987
Kedah	5	Beris dam	WS, IR	115	15	55	19	1988-1992
P. Pinang	6	Mengkuang Phase I & II	WS	4	24	24	55	U/C(Phase I) 1981-1985
Perak	10	Rui dam	WS, IR	215	145	140	447	1985-1989
(ii) Pulau Langkuawai								
Kedah	2	Aver Tawar dam	IR	11	2	6	131	1985-1989
Kedah	2	Ulu Melaka dam	IR	7	2	5	12	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
1	Pumping from the Muda irrigation canal	Kedah, Perlis 3 to 1	2.5	*	1983-1987
3	Jeniang diversion (barrage & canal)	Kedah 5 to 3	8.4	Included in Naok-Reman dams	1983-1987
4	Naok diversion	Kedah 5 to 4	1.5	*	1985-1989
10	Rui diversion (tunnel)	Perak, Kedah 10 to 5	8.9	(14)	1985-1989
6	Pipeline	Kedah, P. Pinang 5 to 6	7.5	*	1985-1989
6	Pipeline	Kedah, P. Pinang 5 to 6	1.3	*	1986-1990
6	Pipeline	Kedah, P. Pinang 5 to 6	1.2	*	1991-1995
7	Pipeline	Kedah, P. Pinang 5 to 7	2.3	*	1985-1989
7	Pipeline	Kedah, P. Pinang 5 to 7	1.0	*	1968-1990
7	Pipeline	Kedah, P. Pinang 5 to 7	0.8	*	1991-1995

Remarks; IR: Irrigation, WS: Water supply, FM: Flood mitigation
 U/C: Under construction, () Included in dam cost
 Construction cost: Financial cost at 1980 constant price
 *: Cost included in other distribution facilities
 **: The state where the facilities are located

Table 82 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN FOR KERIAN AND KURAU RIVER BASINS

(1) DAM

Location		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
State **	Basin No.							
Kedah/Perak	8	Kerian dam	WS,IR	112	9	40	54	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
8	Kerian diversion (canal)	Perak 8 to 9	3	*	1985-1989
		Perak to Pinang 8 to 6	-	*	

Remarks; IR: Irrigation, WS: Water supply
 Construction cost: Financial cost at 1980 constant price
 *: Cost included in irrigation facilities
 **: The state where the facilities are located

Table 83 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN FOR KINTA VALLEY

(1) DAM

Location		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
State*	Basin No.							
Perak	10	Kinta (B) dam	WS	155	53	55	364	1985-1989

Remarks; IR: Irrigation, WS: Water supply,
 Construction cost: Financial cost at 1980 constant price
 *: The state where the facilities are located

Table 84 RECOMMENDED WATER SOURCE DEVELOPMENT
PLAN FOR KELANG VALLEY

(1) DAM

Location		Facilities	Pur- pose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State*	Basin No.							
Selangor	13	Selangor dam	WS	201	270	186	541	1985-1989
Selangor	13	Batang Kali dam	WS	49	72	45	76	1985-1989
Selangor	15	Batu dam	WS	50	28	39	80	1983-1987
Selangor	15	Gombak dam	WS	87	28	60	28	1986-1990
Selangor	16	Semenyih dam	WS	54	42	44	89	U/C 1981-1985
N. Sembilan	30	Kenaboi dam	WS	118	136	83	237	1988-1992
Pahang	30	Perting dam	WS	88	119	59	214	1994-1998
N. Sembilan	30	Kongkoi dam	WS	54	69	33	224	1992-1996

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
13	Selangor diversion (pipeline)	Selangor 13 to 15	15	**	1985 - 1989
16	Semenyih diversion (pipeline)	Selangor 16 to 15		**	U/C 1981 - 1985
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

Remarks; WS: Water supply, U/C: Under construction
Construction cost: Financial cost at 1980 constant price
*: The state where the facilities are located
**: Cost included in water supply distribution facilities

Table 85 RECOMMENDED WATER SOURCE DEVELOPMENT
PLAN FOR SEPANG RIVER BASIN

(1) DAM

Location			Pur- pose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State	Basin No.	Facilities						
N. Sembilan	30	Teriang dam	WS	60	105	42	225	1985-1989
N. Sembilan	30	Gelami dam	WS	58	9	18	27	1990-1994

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construc- tion Period
30	Teriang diversion (pipeline)	N. Sembilan 30 to 17	Stage 1: 3 Stage 2: 1	525 300	1985-1989 1990-1994

Remarks; WS: Water supply, Construction cost: Financial cost at 1980 constant price

Table 86 RECOMMENDED WATER SOURCE DEVELOPMENT
PLAN FOR LINGGI RIVER BASIN

Location			Pur- pose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State	Basin No.	Facilities						
N. Sembilan	18	Terip dam	WS,IR	23	43	41	21	1985-1989

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

Table 87 RECOMMENDED WATER SOURCE DEVELOPMENT
PLANS FOR MELAKA-MUAR REGION

(1) DAM

Location			Pur- pose	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State	Basin No.	Facilities						
N. Sembilan	21	Muar dam	WS,IR	209	36	37	20	1990-1994
N. Sembilan/ Pahang	21	Palong dam	WS,IR	316	140	107	27	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construc- tion Period
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19 & 20	15	160	1985-1989

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

Table 88

RECOMMENDED WATER SOURCE DEVELOPMENT
PLAN FOR SOUTH JOHOR REGION

(1) DAM

Location		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
State	Basin No.							
Johor	24	Semangar dam	WS	160	137	123	54	1985-1989
Johor	24	Linggiu dam	WS	237	203	182	25	1985-1989
Johor	24	Pengeli dam	WS	143	65	84	30	1989-1993
Johor	25	Sedili dam	WS	227	124	164	18	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
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

Remarks; WS: Water supply, Construction cost: Financial cost at 1980 constant price
*: Excludes the cost of distribution pipeline for water supply

Table 89

RECOMMENDED WATER SOURCE DEVELOPMENT
PLAN FOR ANAK ENDAU RIVER BASIN

Location		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
State	Basin No.							
Pahang	27	Anak Endau weir	(IR)	-	-	-	*	U/C 1983-1987
Pahang	27	Anak Endau dam	IR	36	26	11	38	U/C 1983-1987
Pahang	27	Kemelai dam	IR	44	31	30	15	U/C 1983-1987

Remarks; IR: Irrigation, Construction cost: Financial cost at 1980 constant price
*: Cost included in irrigation facilities

Table 90 RECOMMENDED WATER SOURCE DEVELOPMENT
PLAN FOR KUANTAN RIVER BASIN

Location		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
State	Basin No.							
Pahang	31	Kuantan barrage	WS	-	-	-	20	U/C1981-1985

Remarks; WS: Water supply, U/C: Under construction
Construction cost: Financial cost at 1980 constant price

Table 91 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN FOR
KEMASIN, KELANTAN AND GOLOK RIVER BASINS

(1) DAM

Location		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
State	Basin No.							
Kelantan	40	Nenggiri dam	HY,WS,IR	3,940	35	360	165*	1983-1987
Kelantan	40	Nal dam**	IR	-	-	-	-	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
39	Kemasin diversion (irrigation canal)	Kelantan 40 to 39	1990: 11.7 2000: 18.0	***	-
41	Golok diversion (irrigation canal)	Kelantan 40 to 41	1990: 10.3 2000: 24.2	***	-

Remarks; IR: Irrigation, WS: Water supply, HY: Hydropower
Construction cost: Financial cost at 1980 constant price
*: Cost of hydropower generation is borne by the hydropower development plan.
**: Planned by DID but features are not finalized yet.
***: Cost included in irrigation facilities

Table 92 RECOMMENDED WATER SOURCE DEVELOPMENT
PLAN FOR GOLOK PLAIN

Location		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
State	Basin No.							
Kelantan	41	Golok dam	IR	64	5	32	39	1985-1989

Remarks; IR: Irrigation, Construction cost: Financial cost at 1980 constant price

Table 93 RECOMMENDED WATER SOURCE DEVELOPMENT PLANS
FOR KEDAH/PERLIS/PULAU PINANG UNDER THE
CONDITIONS OF LOWER ECONOMIC GROWTH

(1) DAM

State**	Location Basin No.	Facilities	Purpose	Catch- ment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
(i) Perlis, Kedah and Pulau Pinang Region								
Perlis	1	Timah-Tasoh dam	WS, IR, FM	150	6	20	14	1986-1990
Kedah	3	Ahning dam	WS, IR	120	27	73	51	1983-1987
Kedah	3	Badak-Temin dam	IR	114	19	59	21	1983-1987
Kedah	3	Sari dam	IR	61	14	38	23	1989-1993
Kedah	5	Naok-Reman dams	WS, IR	-	-	350	123	1983-1987
Perak	10	Rui dam	WS, IR	215	145	140	447	1985-1989
P. Pinang	6	Mengkuang Phase 1&2	WS	4	24	24	55	U/C1981-1985

(11) Pulau Lang Kuawai

Kedah	2	Ulu Melaka dam	IR	7	2	5	12	1985-1989
Kedah	2	Aver Tawar dam	IR	11	2	6	131	

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construc- tion Period
1	Pumping from the Muda Irrigation Canal	Kedah, Perlis 3 to 1	2.5	*	1983-1987
3	Jeniang diversion (barrage & canal)	Kedah 5 to 3	8.6	included in Naok-Reman dams	1983-1987
4	Naok diversion (canal)	Kedah 5 to 4	1.1	*	1985-1989
10	Rui diversion (tunnel)	Perak, Kedah 10 to 5	8.9	(14)	1985-1989
6	Pipe line	Kedah, P. Pinang 5 to 6	6.7	*	1985-1989
6	Pipe line	Kedah, P. Pinang 5 to 6	1.3	*	1986-1990
6	Pipe line	Kedah, P. Pinang 5 to 6	0.6	*	1991-1995
7	Pipe line	Kedah, P. Pinang 5 to 7	1.9	*	1985-1989
7	Pipe line	Kedah, P. Pinang 5 to 7	0.6	*	1986-1990
7	Pipe line	Kedah, P. Pinang 5 to 7	0.6	*	1991-1995

Remarks; IR: Irrigation; WS: Water supply; FM: Flood mitigation;
U/C: Under construction
Construction cost: Financial cost at 1980 constant price
* : Cost included in other distribution facilities
** : The state where the facilities are located

Table 94 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR THE KERIAN AND KURAU RIVER BASINS UNDER
THE CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

Location		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
State	Basin No.							
Kedah/Perak	8	Kerian dam	WS, IR	112	7	22	30	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
8	Kerian diversion	Perak 8 to 9	2	*	1985-1989
		Perak to Pinang 8 to 6	-	*	

Remarks; WS: Water supply
Construction cost is the financial cost at 1980 constant price.
* : Cost included in irrigation facilities

Table 95 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR KINTA VALLEY UNDER THE CONDITION OF
LOWER ECONOMIC GROWTH

(1) DAM

Location		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
State*	Basin No.							
Perak	10	Kinta (B) dam	WS	155	20	28	133	1985-1989

Remarks; IR: Irrigation; WS: Water supply
Construction cost: Financial cost at 1980 constant price
*: The state where the facilities are located

Table 96

RECOMMENDED WATER SOURCE DEVELOPMENT PLAN FOR KELANG VALLEY UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

State*	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
Selangor	13	Selangor dam	WS	201	270	182	504	1985-1989
Selangor	13	Batang Kali dam	WS	49	72	45	76	1985-1989
Selangor	15	Batu dam	WS	50	28	39	80	U/C 1982-1985
Selangor	15	Gombak dam	WS	87	28	60	28	1988-1992
Selangor	16	Semanyih dam	WS	54	42	44	89	U/C 1982-1985
N. Sembilan	30	Kenaboi dam	WS	118	136	83	237	1991-1995

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
13	Selangor diversion (pipe line)	Selangor 13 to 15	14	**	1985-1989
16	Semanyih diversion (pipe line)	Selangor 16 to 15		**	U/C 1981-1985
30	Kenaboi diversion (tunnel)	N. Sembilan, Selangor 30 to 15	5	11	1991-1995

Remarks; WS: Water supply, U/C: Under construction
 Construction cost is the financial cost at 1980 constant price.
 * : The State where the facilities are located
 **: Cost included in water supply distribution facilities

Table 97 RECOMMENDED SOURCE DEVELOPMENT PLAN FOR SEPANG RIVER
BASIN UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

Location		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
State	Basin No.							
N. Sembilan	30	Teriang dam	WS	60	70	36	166	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
30	Teriang diversion (pipe line)	N. Sembilan 30 to 17	1	477	1985-1989

Remarks; WS: Water supply
Construction cost is the financial cost at 1980 constant price.

Table 98 RECOMMENDED SOURCE DEVELOPMENT PLAN FOR LINGGI RIVER
BASIN UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

Location		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
State	Basin No.							
N. Sembilan	18	Terip dam	WS, IR	23	27	26	13	1985-1989

Remarks; IR: Irrigation; WS: Water supply
Construction cost is the financial cost at 1980 constant price.

Table 99 RECOMMENDED SOURCE DEVELOPMENT PLAN FOR MELAKA-MUAR
REGION UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

Location		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
State	Basin No.							
N. Sembilan/ Pahang	21	Palong dam	WS, IR	316	140	107	27	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construction Cost (M\$10 ⁶)	Construction Period
21	Muar diversion (barrage & canal)	Johor to Melaka 21 to 19 & 20	15	160	1985-1989

Remarks; WS: Water supply
Construction cost is the financial cost at 1980 constant price.

Table 100 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR SOUTH JOHOR REGION UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH

(1) DAM

Location		Facilities	Purpose	Catch- ment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Net Supply Capacity (10 ⁶ m ³ /y)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
State	Basin No.							
Johor	24	Semangar dam	WS	160	137	123	54	1985-1989
Johor	24	Linggiu dam	WS	237	203	182	25	1985-1989
Johor	24	Pangeli dam	WS	143	65	84	30	1985-1989
Johor	25	Sedili dam	WS	227	84	110	12	1986-1990

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /s)	Construc- tion Cost (M\$10 ⁶)	Construc- tion Period
23	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 & pipe line)	Johor 25 to 24	7	67	1986-1990

Remarks; WS: Water supply
Construction cost is the financial cost at 1980 constant price.
*: excludes the cost of distribution pipe line for water supply

Table 101 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR ANAK ENDAU RIVER BASIN UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

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
27	Anak Endau dam	IR	36	26	11	38	U/C1983-1987
27	Kemelai dam	IR	44	31	30	15	U/C1983-1987
27	Anak Endau weir	IR	-	-	-	*	U/C1983-1987

Remarks; IR: Irrigation
Construction cost is the financial cost at 1980 constant price.
*: Cost includes in irrigation facilities

Table 102 RECOMMENDED WATER SOURCE DEVELOPMENT PLAN
FOR KUANTAN RIVER BASIN UNDER THE
CONDITION OF LOWER ECONOMIC GROWTH

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
31	Kuantan barrage	WS	-	-	-	20	U/C 1981-1985

Remarks; WS: Water supply; U/C: Under construction
Construction cost is the financial cost at 1980 constant price.

Table 103 RECOMMENDED SOURCE DEVELOPMENT PLAN FOR
KEMASIN, KELANTAN AND GOLOK RIVER BASINS
UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

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
40	Nenggiri dam	HY, WS, IR	3,940	35	360	165*	1995-1999
40	Nal dam**	IR	-	-	-	-	1985-1989

(2) DIVERSION FACILITIES

Basin No.	Diversion Facilities	Basin Transfer (Basin No.)	Diversion Discharge Capacity (m ³ /y)	Construction Cost (M\$10 ⁶)	Construction Period
39	Kemasin diversion (irrigation canal)	Kelantan 40 to 39	1990:11.7 2000:18.0	***	-
41	Golok diversion (irrigation canal)	Kelantan 40 to 41	1990:10.3 2000:24.2	***	-

Remarks; WS: Water supply, IR: Irrigation, HY: Hydropower
Construction cost is the financial cost at 1980 constant price.
* : Cost of hydropower generation is borne by the hydropower development plan.
** : Planned by DID but features are not finalized yet.
***: Cost included irrigation facilities.

Table 104 RECOMMENDED SOURCE DEVELOPMENT PLAN FOR GOLOK PLAIN
UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

(1) DAM

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
41	Golok dam	IR	64	5	32	39	1985-1989

Remarks; IR: Irrigation
Construction cost is the financial cost at 1980 constant price.

Table 105 WITHDRAWAL IN THE SPECIFIED SUB-BASIN (1/2)

Unit: 10⁶ m³/y

Sub-basin (Catchment Area)	City & Rural	Case of Target Economic Growth				Case of Lower Economic Growth			
		1990		2000		1990		2000	
		Domestic Water	Indus- trial Water	Domestic Water	Indus- trial Water	Domestic Water	Indus- trial Water	Domestic Water	Indus- trial Water
10A:	C13*	36.2	47.4	49.3	104.4	33.4	36.0	39.1	66.0
Kinta valley (875 km ²)	C113*	0.8	0.2	1.3	0.4	-	-	-	-
		No irrigation		No irrigation		No irrigation		No irrigation	
Total			84.6		155.4		69.4		105.1
15A:	C22*	34.5	56.4	73.6	77.6	31.8	50.5	58.6	67.9
Upper	C23*	5.5	11.5	15.6	21.7	5.1	9.8	12.4	18.2
Kuala Lumpur (340 km ²)	C24*	46.5	203.9	111.3	279.8	42.9	182.4	88.5	244.3
	C25*	163.6	126.9	264.4	174.5	151.6	113.9	211.2	152.4
	C116*	1.3	0.9	1.9	1.2	1.1	0.9	1.5	1.1
	C117*	1.8	3.7	2.6	3.6	1.6	3.4	2.0	3.2
	Rural	9.6	1.0	10.7	0.6	10.4	1.5	21.3	0.6
		No irrigation		No irrigation		No irrigation		No irrigation	
Total			667.1		1039.1		606.9		883.2
13B:	Rural		12.2		12.4		13.6		20.6
Lower Selangor intake (1,418 km ²)		No irrigation		No irrigation		No irrigation		No irrigation	
Total			12.2		12.4		13.6		20.6
16A:	Rural	20.0	-	21.0	-	20.8	-	31.8	-
Semenyih intake (1,156 km ²)		Irriga- tion	41.0	Irriga- tion	41.0	Irriga- tion	41.0	Irriga- tion	41.0
Total			61.0		62.0		61.8		72.8
18A:	C29*	20.2	10.9	32.0	17.2	18.5	9.1	25.4	12.0
Upper Selemban (168 km ²)	Rural	3.8	-	3.8	-	3.8	-	3.8	-
Total			34.9		53.0		27.6		37.4

Remarks; The value without * is net withdrawal, but the value with * is source water demand (i.e. no return flow is taken into account).

Table 106 WITHDRAWAL IN THE SPECIFIED SUB-BASINS (2/2)

Unit: 10⁶ m³/y

Sub-basin (Catchment Area)	City & Rural	Case of Target Economic Growth				Case of Lower Economic Growth			
		1990		2000		1990		2000	
		Domestic Water	Indus- trial Water	Domestic Water	Indus- trial Water	Domestic Water	Indus- trial Water	Domestic Water	Indus- trial Water
23A: Benut river (518 km ²)	D53	Irriga- tion 0.8	6.0 0.2	Irriga- tion 1.3	6.0 0.1	Irriga- tion 0.8	6.0 0.2	Irriga- tion 2.1	6.0 0.2
Total			7.0		7.4		7.0		8.3
23B: Pontian Kechil, Sakudai and other rivers (1,007 km ²)	C37* C38 C124* C127 C128 D50 D51 Singapore	3.7 1.2 0.9 0.3 0.3 3.5 1.3 7.0	10.6 8.9 2.0 0.8 0.7 0.3 0.2	7.9 0.1 1.4 0.1 0.6 6.4 2.4 7.0	19.0 15.7 3.0 1.4 1.1 0.2 0.2	3.4 1.1 0.8 0.3 -	9.1 8.3 1.7 0.7 -	6.0 0.1 1.0 0.1 -	13.6 12.7 1.9 1.0 -
Total			41.7	No irrigation	66.5	No irrigation	37.3	No irrigation	51.6
23C: Teberau river (275 km ²)	C39* C129* D51	38.6 1.0 1.3	46.6 2.4 0.2	75.5 2.3 2.4	83.2 5.0 0.2	35.7 1.0 1.3	39.6 2.0 0.2	60.1 1.7 2.6	60.0 3.4 0.2
Total			90.1	No irrigation	168.6	No irrigation	79.8	No irrigation	128.0
24A: Johor barrage site (1,085 km ²)	C40* D53 D52	1.8 0.4 0.9	5.3 0.1 0.4	3.6 0.7 1.3	9.3 0.1 0.3	1.7 0.4 0.9	4.5 0.1 0.4	2.7 1.1 2.6	6.8 0.1 0.3
Total	Singapore		319.0	Irriga- tion 1.0	407.0	Irriga- tion 1.0	277.0	Irriga- tion 1.0	382.0
Total			328.9		423.3		286.0		396.6
24B: (1,405 km ²)	C126* D51 D52	1.0 1.2 0.9	11.6 0.2 0.4	2.1 2.3 1.3	20.7 0.1 0.3	1.0 1.2 0.9	9.1 0.2 0.4	1.5 2.4 2.6	13.8 0.2 0.3
Total			15.3	No irrigation	26.8	No irrigation	12.8	No irrigation	20.8

Remarks; The value without * is net withdrawal, but the value with * is source water demand (i.e. no return flow is taken into account).

Table 107 POTENTIAL DAM SITES (1/6)

State	Basin No.	Name of Dam	Catchment Area (km ²)	Annual Inflow (10 ⁶ m ³ /y)
Perlis	1	Timah Tasoh	150.0	127
		Buloh	13.0	11.0
		Serai	10.0	8.5
		Arau	50.0	42.3
Kedah	2	Perangin	4.8	6.9
		Nylor	4.4	6.2
		Saga	1.6	2.2
		Ayer Tawar	10.8	15.4
		Ulu Melaka	7.2	10.3
		Chenang	6.5	9.2
Kedah	3	Tok Kassin	14.0	15.8
		Agon	25.0	28.3
		Kechil	19.0	21.5
		Kah Ing	18.0	20.3
		Ayan	16.0	18.1
		Badak Temin	114	129
		Ahning	120	136
		Sari	61.0	68.9
		Durian	75.0	84.8
Kedah	4	Simpahan	15.6	19.5
		Sung Kap	10.9	13.7
Kedah	5	S. Ma	24.0	31.8
		Beris	115	153
		Kerik	20.0	26.5
		Charok Kasai	10.0	13.3
		Charok Sama Gajah	23.0	30.5
		Weng	37.0	49.1
		Legong	44.0	58.3
		Merbok	-	-
		Naok	-	-
		Charok Tebar	38.0	50.4
		Chiak	23.3	30.9
		Tawa-Muda	135	179
Reman	31	41.1		
P. Pinang	6	Mengkuang (1)	-	-
		Mengkuang (2)	3.89	5.8
		Kulim	128	191
Kedah	8	Sira	28.6	42.8
Kedah & Perak	8	Kerian	111	166
Perak	8	Selama	78.9	118.2
		Bintang	-	-

Table 108 POTENTIAL DAM SITES (2/6)

State	Basin No.	Name of Dam	Catchment Area (km ²)	Annual Inflow (10 ⁶ m ³ /y)
Perak	9	Tugoh-Tupai	-	-
		9-A (1)	23.0	31.1
		9-A (2)	14.0	18.9
		9-A (3)	11.5	15.5
		9-A (4)	12.0	16.2
Perak	10	Rui (1)	215	204
		Rui (2)	-	-
		Berok	113	107
		Kuak	-	-
		10-A (1)	36.0	34.1
		10-A (2)	13.5	12.8
		10-A (3)	8.5	8.1
		Kinta-A	42.5	40.3
		Kinta-B	155	147
Perak	11	Bil	26.0	28.7
		Geling	55.7	61.4
		Chenderiang	198	218
		Sungkai	193	213
Selangor	13	Selangor	201	238
		Batang Kali	48.5	57.3
Selangor	14	Cherakah	5.6	4.2
		Subang	2.7	2.0
		Lambeng	0.9	0.7
Selangor	15	N. Hummack	7.7	7.2
		Gombak	88.0	81.8
Selangor	16	Long	12.8	11.4
		Semenyih	53.7	47.8
N. Sembilan	18	Terip	23.0	21.1
		Pantai (Headworks)	17.0	15.6
		18-A	5.0	4.6
		18-B	18.5	17
N. Sembilan	19	19-A (Keru)	18.5	13.9
Melaka	20	Ayer Beberas	14.0	7.4
		Bahuddin	-	-
		20-C	4.0	2.1
		20-D	5.5	2.9
N. Sembilan	21	Pelangi	16.0	10.0
		Kepis	53	33.1
		Gemas	114	71.1
		Muar	209	130

Table 109 POTENTIAL DAM SITES (3/6)

State	Basin No.	Name of Dam	Catchment Area (km ²)	Annual Inflow (10 ⁶ m ³ /y)
N. Sembilan	21	Jelai	190	119
		21-A	10.0	6.2
		21-B	9.5	5.9
		Palong Upper	277	173
N. Sembilan & Pahang	21	Palong	316	197
Johor	21	Palong Lower	341	213
Johor	21	Muar Barrage	5,300	3,307
		Muar (2)	2,890	1,803
Johor	23	Pelentong	22.1	23.8
		Senai	23.5	25.3
Johor	24	Pengeli	143	136
		Linggiu (A)	237	225
		Linggiu (B)	-	-
		Selayut	53.5	50.8
		Kepala Orang	14.8	14.0
		Semangar	160	152
		Semangar Barrage	-	-
		Johor Barrage	1,085	1,030
		Johor	741	703
Johor	25	Sedili	-	-
		Ulu Sedili Besar	227	248
Johor	26	Jaman	18.5	25.1
		Mayong	58.9	80.0
Johor	27	Kemedon	197	229
		Kahang	243	282
		Medek	215	249
		Temehel	31	36.0
Pahang	27	Kemelai	44	51.0
		Anak Endau	36	41.8
		Anak Endau Weir	180	209
Pahang	28	Pontian Weir	170	152
		Jeram (Lower)	470	421
		Sekin	170	152
		Jekatih	343	307
		Pukin	138	124
		Kepasing	144	129
		Jeram (Middle)	400	358
		Jeram (Upper)	335	300
		Aur	97	87

Table 110 POTENTIAL DAM SITES (4/6)

State	Basin No.	Name of Dam	Catchment Area (km ²)	Annual Inflow (10 ⁶ m ³ /y)
Pahang	29	Merbo	15.8	19.3
		Merchong	90.5	110.3
Pahang	30	Nengtiga Weir	125	110
		Maran	25,000	21,925
		Bera Lower	316	277
		Bera Upper	86	75.4
		Teris 1	190	167
		Teris 2	150	132
		Teris 3	120	105
		Kelau 1	710	623
		Kelau 2	330	289
		Kelau 3	320	281
		Bentong Lower	650	570
		Bentong Upper	590	517
		Telemong	360	316
		Benus	93	82
		Pahang	30	Perting
Tekam	400			351
Tembeling Lower	5,150			4,517
Tembeling Upper	2,850			2,420
Tahan	380			333
Lipis	450			395
Dayang	7.0			6.1
Sia	62			54.4
Liang 1	240			211
Liang 2	-			-
Sempam Baru	-			-
Tanum 1	730			640
Tanum 2	600			526
Tanum 3	460			403
Pahang	30			Jelai Kechil
		Telom	1,200	1,052
		K. Bertam	352	308
		Ulu Lemoi	62.0	54.4
		K. Serau	111	97
		Kechau	540	474
		Lompat 1	180	158
		Lompat 2	90.0	78.9
		Kerau	200	175
		Tembeling Upper 2	840	737
		Tekai Upper 2	910	798
		Kiol	60.0	52.6
		Seboi	70.0	61.4
Jenalik	100	88.7		

Table 111 POTENTIAL DAM SITES (5/6)

State	Basin No.	Name of Dam	Catchment Area (km ²)	Annual Inflow (10 ⁶ m ³ /y)
Pahang	30	Serau	670	588
		Jelai	3,060	2,684
		Telom Upper	1,180	1,035
		Bera	258	226
N. Sembilan	30	Kongkoi	53.8	47.2
		Lower Kenaboi	118.4	103.8
		Upper Kenaboi	41.8	36.7
		Teriang	60.0	52.6
Pahang	31	Kuantan	128	249
		Kenau	110	214
		Chereh	147	285
		Kuantan Upper	167	325
Trengganu	32	Kemaman	209	314
		Cherul	387	581
Trengganu	33	Paka	105	139
Trengganu	34	Kelmin (Diversion)	35.6	60.9
		Jengai Upper	90	154
		Jengai Lower	116	199
		Loh & Datok	211	361
Trengganu	35	Kerak	26.2	47.6
		Gali	17.8	32.3
		Marong	11.4	20.7
		Asing	29.3	53.2
Trengganu	36	Ulu Trengganu	420	819
		Upper Trengganu 5	1,000	1,951
		Nerus 1	86.7	169.2
		Nerus 2	63.7	124.3
		Kasar 1	40	78
		Kasar 2	30.8	60.1
		Telemong 1	96.3	187.9
		Telemong 2	58.3	113.7
		Telemong 3	50.4	98.3
		Sekayu	45.3	88.4
		Lalang	72.3	141.1
		Chah (Diversion)	25.3	49.4
		Pelong 1	68.9	134.4
		Pelong 2	22.6	44.1
		Kelasah	35.8	69.8
Trenggan	1,975	3,853		
Trengganu	37	Cuntong	62.2	121.4

Table 112 POTENTIAL DAM SITES (6/6)

State	Basin No.	Name of Dam	Catchment Area (km ²)	Annual Inflow (10 ⁶ m ³ /y)
Trengganu	38	Angga	79.6	130.7
		Pelagat	41.3	67.8
		Tenang	14.4	23.6
Kelantan	40	Kelantan Barrage	12,100	17,787
		Kembu	-	-
		Sokor	220	323
		Dabong (Galas)	7,480	10,996
		Nenggiri	3,940	5,792
		Rek	-	-
		Jeram Panjang (Lebir)	2,474	3,637
		Jeram Kiak	2,290	3,366
		Tualang	2,480	3,646
		Nal	136	200
		Pergau 1	227	334
Pergau 2	1,420	2,087		
Kelantan	41	Jelok	18.0	26.5
		Golok	63.6	93.5

Table 113 FEATURES OF DAM (1/46)

The State of Perlis Catchment Area (km²) : 50.0
 Basin No. : 1 Annual Discharge (10⁶ m³/y): 42.3
 Name of Dam: Arau Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	35.8	35.8	-	15.4
Active storage (10 ⁶ m ³):	37.1	37.1		
Gross storage (10 ⁶ m ³):	38.6	38.6		
Reservoir surface area (km ²):	2.0	2.0		
Dam volume (10 ⁶ m ³):	0.24	0.24		
Potential annual energy (MWh)	1,246	1,246		522

Project Cost (M\$10⁶)

Dam	:	15.8		
Engineering & administration	:	1.6		
Land & resettlement	:	0.2		
Physical contingency	:	7.4		
Total dam project cost	:	25.0	10.8	

Table 114 FEATURES OF DAM (2/46)

The State of Perlis Catchment Area (km²) : 150
 Basin No. : 1 Annual Discharge (10⁶ m³/y): 127
 Name of Dam: Tima Tasoh Purpose: IR, WS, (FM)

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	78.8	20.0	20.0	*20.0
Active storage (10 ⁶ m ³):	33.5	6.0		
Gross storage (10 ⁶ m ³):	38.0	10.5		
Reservoir surface area (km ²):	17.0	11.0		
Dam volume (10 ⁶ m ³):		0.15		
Potential annual energy (MWh)		348.4	348.4	348.4

Project Cost (M\$10⁶)

Dam	:	9.7		
Engineering & administration	:	1.0		
Land & resettlement	:	0.1		
Physical contingency	:	3.2		
Total dam project cost	:	14.0	14.0	14.0

Remarks; *: For recommended plan

Table 115

FEATURES OF DAM (3/46)

The State of Kedah Catchment Area (km²) : 10.8
 Basin No. : 2 Annual Discharge (10⁶ m³/y): 15.4
 Name of Dam: Aver Tawar Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	10.0	10.0	10.0	*6.0
Active storage (10 ⁶ m ³) :	8.24	8.24		2.0
Gross storage (10 ⁶ m ³) :	8.56	8.56		--
Reservoir surface area (km ²) :	0.5	0.5		0.3
Dam volume (10 ⁶ m ³) :	2.9	2.9		--
Potential annual energy (MWh) :	--	--	--	--

Project Cost (M\$10⁶)

Dam	:	152.9	152.9	91.7
Engineering & administration	:	15.3	15.3	9.2
Land & resettlement	:	0.1	0.1	0.1
Physical contingency	:	50.5	50.5	30.3
Total dam project cost	:	218.8	218.8	131.3

Remarks; *: For recommended plan

Table 116

FEATURES OF DAM (4/46)

The State of Kedah Catchment Area (km²) : 4.4
 Basin No. : 2 Annual Discharge (10⁶ m³/y): 6.2
 Name of Dam: Nylor Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	3.5	3.5		2.0
Active storage (10 ⁶ m ³) :	3.4	3.4		
Gross storage (10 ⁶ m ³) :	3.5	3.5		
Reservoir surface area (km ²) :	0.20	0.20		
Dam volume (10 ⁶ m ³) :	0.38	0.38		
Potential annual energy (MWh) :	61.0	61.0		--

Project Cost (M\$10⁶)

Dam	:	25.31	5.8
Engineering & administration	:	2.53	0.6
Land & resettlement	:	0.02	0.1
Physical contingency	:	8.36	1.9
Total dam project cost	:	36.22	8.4

Table 117 FEATURES OF DAM (5/46)

The State of Kedah
 Basin No. : 2
 Name of Dam: Ulu Melaka

Catchment Area (km²) : 7.2
 Annual Discharge (10⁶ m³/y): 10.3
 Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	5.7	5.7	5.7	*5.0
Active storage (10 ⁶ m ³):	5.50	5.5		2.0
Gross storage (10 ⁶ m ³):	5.71	5.7		---
Reservoir surface area (km ²):	1.0	1.0		0.3
Dam volume (10 ⁶ m ³):	0.57	0.57		---
Potential annual energy (MWh):	153	153	153	64

Project Cost (M\$10⁶)

Dam :	10.7		8.3
Engineering & administration :	1.1		0.8
Land & resettlement :	0.1		0.1
Physical contingency :	3.5	2.8	
Total dam project cost :	15.4	15.4	11.9

Remarks; *: For recommended plan

Table 118 FEATURES OF DAM (6/46)

The State of Kedah
 Basin No. : 3
 Name of Dam: Ahning

Catchment Area (km²) : 120
 Annual Discharge (10⁶ m³/y): 136
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	100.4	100.4	100.4	*73.0
Active storage (10 ⁶ m ³):	116.4	116.4		27.0
Gross storage (10 ⁶ m ³):	120.0	120.0		---
Reservoir surface area (km ²):	12.0	12.0		10.0
Dam volume (10 ⁶ m ³):	0.88	0.88		---
Potential annual energy (MWh):	3,499	3,499	3,499	2,544

Project Cost (M\$10⁶)

Dam :	49.1		
Engineering & administration :	4.9		
Land & resettlement :	0.1		
Physical contingency :	15.9		
Total dam project cost :	70.0	70.0	51.1

Remarks; *: For recommended plan

Table 119 FEATURES OF DAM (7/46)

The State of Kedah Catchment Area (km²) : 114
 Basin No. : 3 Annual Discharge (10⁶ m³/y): 129
 Name of Dam: Badak Temin Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	95.1	95.1	95.1	*59.0
Active storage (10 ⁶ m ³):	137.0	137.0		19.0
Gross storage (10 ⁶ m ³):	140.0	140.0		--
Reservoir surface area (km ²):	9.5	9.5		4.0
Dam volume (10 ⁶ m ³):	0.84	0.84		--
Potential annual energy (MWh):	3,314	3,314	3,314	2,056

Project Cost (M\$10⁶)

Dam	:			
Engineering & administration	:			
Land & resettlement	:			
Physical contingency	:			
Total dam project cost	:	34.0	34.0	21.0

Remarks; *: For recommended plan

Table 120 FEATURES OF DAM (8/46)

The State of Kedah Catchment Area (km²) : 61.0
 Basin No. : 3 Annual Discharge (10⁶ m³/y): 68.9
 Name of Dam: Sari Purpose:

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	50.8	50.8	50.8	*38.0
Active storage (10 ⁶ m ³):	73.2	73.2		14.0
Gross storage (10 ⁶ m ³):	75.0	75.0		--
Reservoir surface area (km ²):	5.1	5.1		3.0
Dam volume (10 ⁶ m ³):	0.37	0.37		--
Potential annual energy (MWh):	1,635	1,635	1,635	1,223

Project Cost (M\$10⁶)

Dam	:			
Engineering & administration	:			
Land & resettlement	:			
Physical contingency	:			
Total dam project cost	:	31.0	31.0	23.0

Remarks; *: For recommended plan

Table 121 FEATURES OF DAM (9/46)

The State of Kedah Catchment Area (km²) : 75.0
 Basin No. : 3 Annual Discharge (10⁶ m³/y): 84.8
 Name of Dam: Durian Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	63.0	63.0	63.0	*45.0
Active storage (10 ⁶ m ³) :	87.8	87.8		17.0
Gross storage (10 ⁶ m ³) :	90.0	90.0		---
Reservoir surface area (km ²) :	6.3	6.3		3.0
Dam volume (10 ⁶ m ³) :	0.55	0.55		---
Potential annual energy (MWh) :	2,027	2,027	2,027	1,223

Project Cost (M\$10⁶)

Dam	:			
Engineering & administration	:			
Land & resettlement	:			
Physical contingency	:			
Total dam project cost	:	35.0	35.0	25.0

Remarks; *: For recommended plan

Table 122 FEATURES OF DAM (10/46)

The State of Kedah Catchment Area (km²) : 15.6
 Basin No. : 4 Annual Discharge (10⁶ m³/y): 19.5
 Name of Dam: 4-A (Simpahan) Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	21.2	21.2		
Active storage (10 ⁶ m ³) :	15.0	15.0		
Gross storage (10 ⁶ m ³) :	15.5	15.5		
Reservoir surface area (km ²) :	0.81	0.81		
Dam volume (10 ⁶ m ³) :	2.03	2.03		
Potential annual energy (MWh) :	1,300	1,300		

Project Cost (M\$10⁶)

Dam	:			
Engineering & administration	:			
Land & resettlement	:			
Physical contingency	:			
Total dam project cost	:	17.0		

Table 123

FEATURES OF DAM (11/46)

The State of Kedah
 Basin No. : 5
 Name of Dam: Naok & Reman dams

Catchment Area (km²) :
 Annual Discharge (10⁶ m³/y):
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	312.0	350.0	350.0	*350.0
Active storage (10 ⁶ m ³):				
Gross storage (10 ⁶ m ³):				
Reservoir surface area (km ²):				
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh)	10,869	10,869	10,869	10,869

Project Cost (M\$10⁶)

Dam :
 Engineering & administration :
 Land & resettlement :
 Physical contingency :

Total dam project cost : 122.5 122.5 122.5 122.5

Remarks; *: For recommended plan

Table 124

FEATURES OF DAM (12/46)

The State of Kedah
 Basin No. : 5
 Name of Dam: Beris

Catchment Area (km²) : 115
 Annual Discharge (10⁶ m³/y): 153
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	105.9	75.0	55.0	*55.0
Active storage (10 ⁶ m ³):	76.6	21.2		15.0
Gross storage (10 ⁶ m ³):	80.1	24.7		--
Reservoir surface area (km ²):		5.9		4.0
Dam volume (10 ⁶ m ³):		0.15		--
Potential annual energy (MWh)	3,400	2,408		

Project Cost (M\$10⁶)

Dam :
 Engineering & administration :
 Land & resettlement :
 Physical contingency :

Total dam project cost : 25.0 19.0 19.0

Remarks; *: For recommended plan

Table 125 FEATURES OF DAM (13/46)

The State of Kedah
 Basin No. : 5
 Name of Dam: Tawar Muda

Catchment Area (km²) : 135
 Annual Discharge (10⁶ m³/y): 179
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	141.3	75.0	75.0	75.0
Active storage (10 ⁶ m ³):	126.0	20.8		
Gross storage (10 ⁶ m ³):	130.0	24.9		
Reservoir surface area (km ²):		7.6		
Dam volume (10 ⁶ m ³):		0.39		
Potential annual energy (MWh):		2,613	2,613	2,613

Project Cost (M\$10⁶)

Dam	:	25.8		
Engineering & administration	:	2.6		
Land & resettlement	:	0.1		
Physical contingency	:	8.5		
Total dam project cost	:	37.0	37.0	37.0

Table 126 FEATURES OF DAM (14/46)

The State of Kedah
 Basin No. : 5
 Name of Dam: Legong

Catchment Area (km²) : 44
 Annual Discharge (10⁶ m³/y): 58.3
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	45.4	45.0	45.0	
Active storage (10 ⁶ m ³):	43.8	43.8		
Gross storage (10 ⁶ m ³):	45.1	45.1		
Reservoir surface area (km ²):	4.5	4.5		
Dam volume (10 ⁶ m ³):	0.33	0.33		
Potential annual energy (MWh):	1,176	1,176	1,176	

Project Cost (M\$10⁶)

Dam	:	22.0		
Engineering & administration	:	2.2		
Land & resettlement	:	0.1		
Physical contingency	:	7.7		
Total dam project cost	:	32.0	32.0	

Table 127 FEATURES OF DAM (15/46)

The State of Kedah
 Basin No. : 5
 Name of Dam: Weng
 Catchment Area (km²) : 37.0
 Annual Discharge (10⁶ m³/y): 49.1
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	38.0	38.0		
Active storage (10 ⁶ m ³):	36.8	36.8		
Gross storage (10 ⁶ m ³):	37.9	37.9		
Reservoir surface area (km ²):	3.8	3.8		
Dam volume (10 ⁶ m ³):	0.27	0.27		
Potential annual energy (MWh) :	993	993		

Project Cost (M\$10⁶)

Dam	:	18.6
Engineering & administration	:	1.9
Land & resettlement	:	0.1
Physical contingency	:	6.4
Total dam project cost	:	27.0

Table 128 FEATURES OF DAM (16/46)

The State of Kedah
 Basin No. : 5
 Name of Dam: Charok Tebar
 Catchment Area (km²) : 38.0
 Annual Discharge (10⁶ m³/y): 50.4
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	39.0	39.0		
Active storage (10 ⁶ m ³):	37.8	37.8		
Gross storage (10 ⁶ m ³):	38.9	38.9		
Reservoir surface area (km ²):	3.9	3.9		
Dam volume (10 ⁶ m ³):	0.29	0.29		
Potential annual energy (MWh) :	1,019	1,019		

Project Cost (M\$10⁶)

Dam	:	19.1
Engineering & administration	:	1.9
Land & resettlement	:	0.1
Physical contingency	:	5.9
Total dam project cost	:	27.0

Table 129 FEATURES OF DAM (17/46)

The State of Kedah Catchment Area (km²) : 23.3
 Basin No. : 5 Annual Discharge (10⁶ m³/y): 30.9
 Name of Dam: Chiak Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	24.0	24.0		
Active storage (10 ⁶ m ³):	23.2	23.2		
Gross storage (10 ⁶ m ³):	23.9	23.9		
Reservoir surface area (km ²):	2.4	2.4		
Dam volume (10 ⁶ m ³):	0.18	0.18		
Potential annual energy (MWh):	838	838		

Project Cost (M\$10⁶)

Dam	:	11.7
Engineering & administration	:	1.2
Land & resettlement	:	0.1
Physical contingency	:	4.0
Total dam project cost	:	17.0

Table 130 FEATURES OF DAM (18/46)

The State of Kedah Catchment Area (km²) : 3.89
 Basin No. : 6 Annual Discharge (10⁶ m³/y): 5.8
 Name of Dam: Mengkuang Scheme Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		* 23.7	23.7	23.7
Active storage (10 ⁶ m ³):		23.7		
Gross storage (10 ⁶ m ³):				
Reservoir surface area (km ²):		1.90		
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh):		335	335	335

Project Cost (M\$10⁶)

Dam	:	
Engineering & administration	:	
Land & resettlement	:	
Physical contingency	:	
Total dam project cost	:	55.0 55.0 55.0

Remarks; *: For recommended plan

Table 131 FEATURES OF DAM (19/46)

The State of Perak
 Basin No. : 8
 Name of Dam: Sira
 Catchment Area (km²) : 29
 Annual Discharge (10⁶ m³/y): 42.8
 Purpose: WS, IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	47.0	47.0	37.9	--
Active storage (10 ⁶ m ³) :				
Gross storage (10 ⁶ m ³) :				
Reservoir surface area (km ²) :				
Dam volume (10 ⁶ m ³) :				
Potential annual energy (MWh) :				

Project Cost (M\$10⁶)

Dam :			
Engineering & administration :			
Land & resettlement :			
Physical contingency :			
Total dam project cost :		178.0	176.1

Table 132 FEATURES OF DAM (20/46)

The State of Perak
 Basin No. : 8
 Name of Dam: Kerian
 Catchment Area (km²) : 112
 Annual Discharge (10⁶ m³/y): 166
 Purpose: WS, IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	148.0	134.0	144.1	*40.0
Active storage (10 ⁶ m ³) :	122.3	122.3		9.0
Gross storage (10 ⁶ m ³) :	125.7	125.7		--
Reservoir surface area (km ²) :	3.63	3.63		1.0
Dam volume (10 ⁶ m ³) :	8.75	8.75		--
Potential annual energy (MWh) :	18,201	18,201		

Project Cost (M\$10⁶)

Dam :		948.3	37.9
Engineering & administration :		94.8	3.8
Land & resettlement :		0.1	0.1
Physical contingency :		313.0	12.5
Total dam project cost :	1,356.2	541.4	54.3

Remarks; *: For recommended plan

Table 133 FEATURES OF DAM (21/46)

The State of Perak Catchment Area (km²) : 215.0
 Basin No. : 10 Annual Discharge (10⁶ m³/y): 204
 Name of Dam: Rui Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	163,0	163,0	163,0	*140,0
Active storage (10 ⁶ m ³):	153,5	153,5		
Gross storage (10 ⁶ m ³):	166,4	166,4		
Reservoir surface area (km ²):	3,8	3,8		
Dam volume (10 ⁶ m ³):	5,54	5,54		
Potential annual energy (MWh):	3,387	3,095	3,095	

Project Cost (M\$10⁶)

Dam	:	531,6		
Engineering & administration	:	53,2		
Land & resettlement	:	0,4		
Physical contingency	:	175,5		
Total dam project cost	:	760,6	760,6	447

Remarks; *: For recommended plan

Table 134 FEATURES OF DAM (22/46)

The State of Perak Catchment Area (km²) : 155
 Basin No. : 10 Annual Discharge (10⁶ m³/y): 147
 Name of Dam: Kinta B Purpose: WS, IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*55,0	37,0	35,0
Active storage (10 ⁶ m ³):		53,0	27,0	25,0
Gross storage (10 ⁶ m ³):		--		
Reservoir surface area (km ²):		2,0		
Dam volume (10 ⁶ m ³):		--		
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam	:	254,8	118,2	108,5
Engineering & administration	:	25,5	11,8	10,9
Land & resettlement	:	0,1	0,1	0,1
Physical contingency	:	84,1	39,0	35,8
Total dam project cost	:	364,4	169,1	155,3

Remarks; *: For recommended plan

Table 135 FEATURES OF DAM (23/46)

The State of Selangor Catchment Area (km²) : 55.7
 Basin No. : 11 Annual Discharge (10⁶ m³/y): 61.4
 Name of Dam: Geling Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	32.3	32.0	13.0	
Active storage (10 ⁶ m ³):	29.5	29.5		
Gross storage (10 ⁶ m ³):	36.2	36.2		
Reservoir surface area (km ²):	1.0	1.0		
Dam volume (10 ⁶ m ³):	0.93	0.93		
Potential annual energy (MWh) :				

Project Cost (M\$10⁶)

Dam :	62.0	
Engineering & administration :	6.0	
Land & resettlement :	0.0	
Physical contingency :	21.0	
Total dam project cost :	89.0	36.0

Table 136 FEATURES OF DAM (24 /46)

The State of Perak Catchment Area (km²) : 26.0
 Basin No. : 11 Annual Discharge (10⁶ m³/y): 28.7
 Name of Dam: Bil Purpose:

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		15.0		
Active storage (10 ⁶ m ³):		13.0		
Gross storage (10 ⁶ m ³):		16.1		
Reservoir surface area (km ²):		0.2		
Dam volume (10 ⁶ m ³):		0.77		
Potential annual energy (MWh) :				

Project Cost (M\$10⁶)

Dam :	52.0	
Engineering & administration :	5.0	
Land & resettlement :	0.0	
Physical contingency :	17.0	
Total dam project cost :	74.0	

Table 137 FEATURES OF DAM (25/46)

The State of Selangor Catchment Area (km²) : 193
 Basin No. : 12 Annual Discharge (10⁶ m³/y): 213
 Name of Dam: Sungkai Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	172.0	100.0	--	--
Active storage (10 ⁶ m ³):	178.4	76.6		
Gross storage (10 ⁶ m ³):	190.0	99.7		
Reservoir surface area (km ²):	4.0	3.0		
Dam volume (10 ⁶ m ³):		7.0		
Potential annual energy (MWh)	30,026		--	--

Project Cost (M\$10⁶)

Dam	:	371.0
Engineering & administration	:	37.0
Land & resettlement	:	0.0
Physical contingency	:	122.0
Total dam project cost	:	530.0

Table 138 FEATURES OF DAM (26/46)

The State of Selangor Catchment Area (km²) : 201
 Basin No. : 13 Annual Discharge (10⁶ m³/y): 238
 Name of Dam: Selangor Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*186.0	190.0	182.0
Active storage (10 ⁶ m ³):		270.0	275.0	263.0
Gross storage (10 ⁶ m ³):		--		
Reservoir surface area (km ²):		6.0		
Dam volume (10 ⁶ m ³):		--		
Potential annual energy (MWh)				

Project Cost (M\$10⁶)

Dam	:	378.3	402.0	352.6
Engineering & administration	:	37.8	40.2	35.3
Land & resettlement	:	0.1	0.1	0.1
Physical contingency	:	124.8	132.7	116.4
Total dam project cost	:	541.0	575.1	504.4

Remarks; *: For recommended plan

Table 139 FEATURES OF DAM (27/46)

The State of Selangor Catchment Area (km²) : 49.0
 Basin No. : 13 Annual Discharge (10⁶ m³/y): 57.3
 Name of Dam: Batang Kali Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*45.0		
Active storage (10 ⁶ m ³):		72.0		
Gross storage (10 ⁶ m ³):				
Reservoir surface area (km ²):		1.0		
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :
 Engineering & administration :
 Land & resettlement :
 Physical contingency :

Total dam project cost : 76.0

Remarks; *: For recommended plan

Table 140 FEATURES OF DAM (28/46)

The State of Selangor Catchment Area (km²) : 87.0
 Basin No. : 15 Annual Discharge (10⁶ m³/y): 81.8
 Name of Dam: Gombak Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	65.1	*60.0	60.0	60.0
Active storage (10 ⁶ m ³):	67.0	28.0	28.0	28.0
Gross storage (10 ⁶ m ³):	72.2	3.0		
Reservoir surface area (km ²):				
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :
 Engineering & administration :
 Land & resettlement :
 Physical contingency :

Total dam project cost : 28.3 28.3 28.3

Remarks; *: For recommended plan

Table 141 FEATURES OF DAM (29/46)

The State of Selangor Catchment Area (km²) : 53.7
 Basin No. : 16 Annual Discharge (10⁶ m³/y): 47.8
 Name of Dam: Semenyih Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	43.9	*43.9	43.9	
Active storage (10 ⁶ m ³):	42.0	42.0		
Gross storage (10 ⁶ m ³):	44.2	44.2		
Reservoir surface area (km ²):	15.4	15.4		
Dam volume (10 ⁶ m ³):	1.1	1.1		
Potential annual energy (MWh)	2,501	2,501	2,501	

Project Cost (M\$10⁶)

Dam	:			
Engineering & administration	:			
Land & resettlement	:			
Physical contingency	:			
Total dam project cost	:	89.0	89.0	

Remarks; *: For recommended plan

Table 142 FEATURES OF DAM (30/46)

The State of N. Sembilan Catchment Area (km²) : 23.0
 Basin No. : 18 Annual Discharge (10⁶ m³/y): 21.1
 Name of Dam: Terip Purpose: IR,WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*41.4	38.0	25.0
Active storage (10 ⁶ m ³):		43.1	40.0	26.0
Gross storage (10 ⁶ m ³):				
Reservoir surface area (km ²):		4.1	4.0	2.2
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh)		1,443	1,376	749

Project Cost (M\$10⁶)

Dam	:			
Engineering & administration	:			
Land & resettlement	:			
Physical contingency	:			
Total dam project cost	:	21.3	19.0	13.0

Remarks; *: For recommended plan

Table 143 FEATURES OF DAM (31/46)

The State of N. Sembilan Catchment Area (km²) : 209
 Basin No. : 21 Annual Discharge (10⁶ m³/y): 130
 Name of Dam: Muar Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*36.5		
Active storage (10 ⁶ m ³) :		36.0		
Gross storage (10 ⁶ m ³) :				
Reservoir surface area (km ²) :		2.5		
Dam volume (10 ⁶ m ³) :		0.08		
Potential annual energy (MWh) :		1,292		

Project Cost (M\$10⁶)

Dam :	13.5
Engineering & administration :	1.4
Land & resettlement :	0.1
Physical contingency :	4.5
Total dam project cost :	19.5

Remarks; *: For recommended plan

Table 144 FEATURES OF DAM (32/46)

The State of Melaka & Pahang Catchment Area (km²) : 316
 Basin No. : 21 Annual Discharge (10⁶ m³/y): 197
 Name of Dam: Palong Purpose: WS, IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		107.0	46.0	20.0
Active storage (10 ⁶ m ³) :		140.0	56.0	30.0
Gross storage (10 ⁶ m ³) :		149.0		
Reservoir surface area (km ²) :		42.7		
Dam volume (10 ⁶ m ³) :		0.16		
Potential annual energy (MWh) :		1,846		

Project Cost (M\$10⁶)

Dam :	18.4	11.2	9.3
Engineering & administration :	1.8	1.1	0.9
Land & resettlement :	0.1	1.0	0.1
Physical contingency :	6.1	3.7	3.1
Total dam project cost :	26.5	16.2	13.4

Remarks; *: For recommended plan

Table 145 FEATURES OF DAM (33/46)

The State of Johor Catchment Area (km²) : 160
 Basin No. : 24 Annual Discharge (10⁶ m³/y): 152
 Name of Dam: Semangar Purpose: WS, IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*123.0	123.0	123.0
Active storage (10 ⁶ m ³):		137.0	137.0	137.0
Gross storage (10 ⁶ m ³):		140.0	140.0	140.0
Reservoir surface area (km ²):		22.0		
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :	26.1		
Engineering & administration :	2.6		
Land & resettlement :	15.7		
Physical contingency :	9.2		
Total dam project cost :	53.7	53.7	53.7

Remarks; *: For recommended plan

Table 146 FEATURES OF DAM (34/46)

The State of Johor Catchment Area (km²) : 237
 Basin No. : 24 Annual Discharge (10⁶ m³/y): 225
 Name of Dam: Linggiu-Jengeli Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*182.0	182.0	182.0
Active storage (10 ⁶ m ³):		203.0	203.0	203.0
Gross storage (10 ⁶ m ³):		207.0	207.0	207.0
Reservoir surface area (km ²):		30.0		
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :	16.8		
Engineering & administration :	1.7		
Land & resettlement :	1.0		
Physical contingency :	5.8		
Total dam project cost :	25.3	25.3	25.3

Remarks; *: For recommended plan

Table 147 FEATURES OF DAM (35/46)

The State of Jchor Catchment Area (km²) : 143.0
 Basin No. : 24 Annual Discharge (10⁶ m³/y): 136
 Name of Dam: Pengeli Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*84.0		
Active storage (10 ⁶ m ³) :		65.0		
Gross storage (10 ⁶ m ³) :				
Reservoir surface area (km ²) :		11.0		
Dam volume (10 ⁶ m ³) :				
Potential annual energy (MWh) :				

Project Cost (M\$10⁶)

Dam :	21.1
Engineering & administration :	2.1
Land & resettlement :	0.2
Physical contingency :	7.0
Total dam project cost :	30.4

Remarks; *: For recommended plan

Table 148 FEATURES OF DAM (36/46)

The State of Johor Catchment Area (km²) : 227
 Basin No. : 25 Annual Discharge (10⁶ m³/y): 248
 Name of Dam: Sedili Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*164.0	164.0	110.0
Active storage (10 ⁶ m ³) :		124.0	124.0	84.0
Gross storage (10 ⁶ m ³) :		129.0	129.0	90.0
Reservoir surface area (km ²) :		30.0		
Dam volume (10 ⁶ m ³) :				
Potential annual energy (MWh) :				

Project Cost (M\$10⁶)

Dam :	11.8	8.3
Engineering & administration :	1.2	0.8
Land & resettlement :	1.1	0.7
Physical contingency :	4.2	2.9
Total dam project cost :	18.4	12.7

Remarks; *: For recommended plan

Table 149 FEATURES OF DAM (37/46)

The State of Pahang Catchment Area (km²) : 36
 Basin No. : 27 Annual Discharge (10⁶ m³/y): 41.8
 Name of Dam: Anak Endau Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		33.0	12.0	*11.1
Active storage (10 ⁶ m ³) :		38.0	28.0	26.0
Gross storage (10 ⁶ m ³) :				
Reservoir surface area (km ²) :				1.0
Dam volume (10 ⁶ m ³) :				
Potential annual energy (MWh) :				

Project Cost (M\$10⁶)

Dam :				
Engineering & administration :				
Land & resettlement :				
Physical contingency :				
Total dam project cost :		76.0	45.2	38.1

Remarks; *: For recommended plan

Table 150 FEATURES OF DAM (38/46)

The State of Pahang Catchment Area (km²) : 44
 Basin No. : 27 Annual Discharge (10⁶ m³/y): 51.0
 Name of Dam: Kemelai Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		41.0	35.0	*30.0
Active storage (10 ⁶ m ³) :		47.0	34.0	31.0
Gross storage (10 ⁶ m ³) :				
Reservoir surface area (km ²) :				3.0
Dam volume (10 ⁶ m ³) :				
Potential annual energy (MWh) :				

Project Cost (M\$10⁶)

Dam :				
Engineering & administration :				
Land & resettlement :				
Physical contingency :				
Total dam project cost :		30.0	18.3	15.1

Remarks; *: For recommended plan

Table 151 FEATURES OF DAM (39/46)

The State of N. Sembilan Catchment Area (km²) : 58.0
 Basin No. : 30 Annual Discharge (10⁶ m³/y): 50.9
 Name of Dam: Gelami Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*18.0	15.0	--
Active storage (10 ⁶ m ³):		9.0	8.0	
Gross storage (10 ⁶ m ³):		11.0	9.5	
Reservoir surface area (km ²):		1.8	1.7	
Dam volume (10 ⁶ m ³):		0.3	0.2	
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :	18.8	17.1
Engineering & administration :	1.9	1.7
Land & resettlement :	0.3	0.3
Physical contingency :	6.3	5.7
Total dam project cost :	27.3	24.8

Remarks; *: For recommended plan

Table 152 FEATURES OF DAM (40/46)

The State of N. Sembilan Catchment Area (km²) : 118.0
 Basin No. : 30 Annual Discharge (10⁶ m³/y): 103.5
 Name of Dam: Kenaboi Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*83.0	83.0	
Active storage (10 ⁶ m ³):		136.0	136.0	
Gross storage (10 ⁶ m ³):		139.0	139.0	
Reservoir surface area (km ²):		3.0		
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :	165.6	165.6
Engineering & administration :	16.6	16.6
Land & resettlement :	0.1	0.1
Physical contingency :	54.7	54.7
Total dam project cost :	236.9	236.9

Remarks; *: For recommended plan

Table 153 FEATURES OF DAM (41/46)

The State of N. Sembilan Catchment Area (km²) : 54.0
 Basin No. : 30 Annual Discharge (10⁶ m³/y): 47.2
 Name of Dam: Kongkoi Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*33.0	--	--
Active storage (10 ⁶ m ³) :		69.0		
Gross storage (10 ⁶ m ³) :		71.0		
Reservoir surface area (km ²) :		2.0		
Dam volume (10 ⁶ m ³) :				
Potential annual energy (MWh) :				
<u>Project Cost (M\$10⁶)</u>				
Dam :		156.2		
Engineering & administration :		15.6		
Land & resettlement :		0.1		
Physical contingency :		51.6		
Total dam project cost :		223.5	--	--

Remarks; *: For recommended plan

Table 154 FEATURES OF DAM (42/46)

The State of Pahang Catchment Area (km²) : 88
 Basin No. : 30 Annual Discharge (10⁶ m³/y): 77
 Name of Dam: Perting Purpose: WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*59.0	59.0	
Active storage (10 ⁶ m ³) :		119.0		
Gross storage (10 ⁶ m ³) :		122.0		
Reservoir surface area (km ²) :		1.0		
Dam volume (10 ⁶ m ³) :				
Potential annual energy (MWh) :				
<u>Project Cost (M\$10⁶)</u>				
Dam :		149.3		
Engineering & administration :		14.9		
Land & resettlement :		0.1		
Physical contingency :		49.3		
Total dam project cost :		213.7	213.7	

Remarks; *: For recommended plan

Table 155 FEATURES OF DAM (43/46)

The State of Pahang
 Basin No. : 30
 Name of Dam: Bera

Catchment Area (km²) : 258
 Annual Discharge (10⁶ m³/y): 226
 Purpose: WS, IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	180.2	180.0		
Active storage (10 ⁶ m ³):	171.4			
Gross storage (10 ⁶ m ³):	179.1			
Reservoir surface area (km ²):	48.0			
Dam volume (10 ⁶ m ³):	0.15			
Potential annual energy (MWh)	3,136			

Project Cost (M\$10⁶)

Dam	:			
Engineering & administration	:			
Land & resettlement	:			
Physical contingency	:			
Total dam project cost	:	21.0	excluding diversion cost	

Table 156 FEATURES OF DAM (44/46)

The State of Pahang
 Basin No. : 30
 Name of Dam: Teriang

Catchment Area (km²) : 60.0
 Annual Discharge (10⁶ m³/y): 52.6
 Purpose: IR, WS

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):		*42.0	42.0	36.0
Active storage (10 ⁶ m ³):		105.0	105.0	70.0
Gross storage (10 ⁶ m ³):		107.0	107.0	72.0
Reservoir surface area (km ²):		7.0	7.0	4.2
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh)				

Project Cost (M\$10⁶)

Dam	:	157.1	115.7	
Engineering & administration	:	15.7	11.6	
Land & resettlement	:	0.1	0.1	
Physical contingency	:	51.9	38.2	
Total dam project cost	:	224.8	224.8	165.6

Remarks; *: For recommended plan

Table 157 FEATURES OF DAM (45/46)

The State of Kelantan Catchment Area (km²) : 3,940.0
 Basin No. : 40 Annual Discharge (10⁶ m³/y): 5,792
 Name of Dam: Nenggiri Purpose: WS, IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):	3,911.7	960.0	490.0	*360.0
Active storage (10 ⁶ m ³):	3,684.8	201.0	49.0	35.0
Gross storage (10 ⁶ m ³):	4,000.0	516.3		
Reservoir surface area (km ²):		200.0	182.0	182.0
Dam volume (10 ⁶ m ³):		1.95	1.55	1.23
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :	131.0	104.0	83.0
Engineering & administration :	13.0	10.0	8.0
Land & resettlement :	43.0	36.0	36.0
Physical contingency :	56.0	45.0	38.0
Total dam project cost :	243.0	195.0	165.0

Remarks; *: For recommended plan

Table 158 FEATURES OF DAM (46/46)

The State of Kelantan Catchment Area (km²) : 63.6
 Basin No. : 41 Annual Discharge (10⁶ m³/y): 93.5
 Name of Dam: Golok Purpose: IR

Features	Maximum Scale	Alternative		
		1/19	2/19	4/19
Net supply capacity (10 ⁶ m ³ /y):				*32.0
Active storage (10 ⁶ m ³):				4.7
Gross storage (10 ⁶ m ³):				6.6
Reservoir surface area (km ²):				3.2
Dam volume (10 ⁶ m ³):				
Potential annual energy (MWh):				

Project Cost (M\$10⁶)

Dam :			
Engineering & administration :			
Land & resettlement :			
Physical contingency :			
Total dam project cost :			39.0

Remarks; *: For recommended plan

Table 159 FUTURE POWER DEMAND IN PENINSULAR MALAYSIA PROJECTED BY NEB

Fiscal Year	Estimated Demand			Installed Capacity (MW)
	Energy (GWh)	Maximum Power (MW)*	Load Factor (%)	
1979	7,651	1,350	64.7	1,796
1980	(8,590)	1,440	68.1	2,156
1985	14,910	2,430	70.0	4,198
1990	23,080	3,780	69.7	5,458
1995	(34,580)	5,730	68.9	7,748
2000	51,820	8,600	68.8	10,727

Remarks; * : Approximate value
The energy values in parentheses were interperated from the values in 1985, 1990 and 2000.

Table 160 MAXIMUM POWER DEMAND PER CAPITA IN PENINSULAR MALAYSIA

Year	Projected Population (10 ³)	Max. Power Demand (MW)	Max. Power Demand Per Capita (Watt)	Per Capita GRP (1970M\$)	
				Target Economic Growth	Lower Economic Growth
1980	11,849	1,440	121.5	1,832	1,832
1985	13,357	2,430	181.9	2,346	2,271
1990	14,820	3,780	255.1	3,153	2,733
1995	16,103	5,730	355.8	4,106	3,182
2000	17,497	8,600	491.5	5,313	3,691

Table 161 MAXIMUM POWER DEMAND FORECAST UNDER THE LOWER ECONOMIC GROWTH

Year	Maximum Power Demand Per Capita (Watt)	Maximum Power Demand in Lower Economic Growth (MW)
1980	121.5	1,440
1985	175.0	2,340
1990	215.0	3,190
1995	260.0	4,190
2000	310.0	5,420

Table 162 RECOMMENDED HYDROPOWER DEVELOPMENT PLAN
IN PENINSULAR MALAYSIA

Basin No.	Project	Catchment Area (km ²)	Active Storage Capacity (10 ⁶ m ³)	Surface Area (km ²)	Installed Capacity (MW)	Annual Energy (GWh)	Purpose	Construction Cost (M\$10 ⁶)	Date of Commission
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	361*	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	12,100	-	-	40	275	HY	300	1995
30	Jelai	3,060	138	88	10	34	HY	69	1996
30	Tanum 1	730	140	18	5	14	HY	59	1997
Total		61,761	8,420	1,170	1,026	4,863		3,576	

Remarks: IR = Irrigation, WS = Water supply, HY = Hydropower, FM = Flood mitigation
Construction cost = Financial cost at 1980 constant price
() = Incidental function
* = Includes cost for water supply (M\$165 x 10⁶)

Table 163 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 (GWh)	Purpose	Construction Cost (M\$10 ⁶)	Date of Commission
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	361*	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	

Remarks; IR = Irrigation, WS = Water supply, HY = Hydropower, FM = Flood mitigation
Construction cost = Financial cost at 1980 constant price
() = Incidental function
* = Includes cost for water supply (M\$165 x 10⁶)

Table 164 FEATURES OF HYDROPOWER PROJECT (1/13)

Basin No. : 30 Catchment Area (km²) : 2850
 Name of Dam: Tembeling Upper Annual Discharge (10⁶ m³/y): 259
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	4,000
	Active storage	(10 ⁶ m ³)	1,730
	Average outflow	(m ³ /sec)	54.9
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	250
	Dam volume	(10 ⁶ m ³)	1.2
	Dam height	(m)	
	Installed capacity	(MW)	110
	Annual energy	(GWh)	440
	Rated head	(m)	57
<u>Project Cost (M\$10⁶):</u>	Dam		66.6
	Generating equipment		95.9
	TL & SS		30.9
	Land & resettlement dam		25.0
	Land & resettlement TL & SS		0.5
	Physical contingency		71.5
	Engineering & administration		19.3
	<u>Total Project Cost</u>		309.8

Table 165 FEATURES OF HYDROPOWER PROJECT (2/13)

Basin No. : 30 Catchment Area (km²) : 1,390
 Name of Dam: Takai & Penut Annual Discharge (10⁶ m³/y): 1,26
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	1,820
	Active storage	(10 ⁶ m ³)	1,070
	Average outflow	(m ³ /sec)	33.9
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	68
	Dam volume	(10 ⁶ m ³)	1.8
	Dam height	(m)	
	Installed capacity	(MW)	74
	Annual energy	(GWh)	370
	Rated head	(m)	45
<u>Project Cost (M\$10⁶):</u>	Dam		99.9
	Generating equipment		64.9
	TL & SS		9.0
	Land & resettlement dam		6.8
	Land & resettlement TL & SS		0.1
	Physical contingency		59.4
	Engineering & administration		17.3
	<u>Total Project Cost</u>		257.7

Table 166 FEATURES OF HYDROPOWER PROJECT (3/13)

Basin No. : 30 Catchment Area (km²) : 1,200
 Name of Dam: Telom Hilir Annual Discharge (10⁶ m³/y): 1,092
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	700
	Active storage	(10 ⁶ m ³)	(500)
	Average outflow	(m ³ /sec)	
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	28
	Dam volume	(10 ⁶ m ³)	1.0
	Dam height	(m)	
	Installed capacity	(MW)	
	Annual energy	(GWh)	
	Rated head	(m)	350
<u>Project Cost (M\$10⁶):</u>	Dam		55.5
	Generating equipment		54.0
	TL & SS		21.1
	Land & resettlement dam		2.8
	Land & resettlement TL & SS		0.4
	Physical contingency		44.0
	Engineering & administration		13.0
	<u>Total Project Cost</u>		191.0

Table 167 FEATURES OF HYDROPOWER PROJECT (4/13)

Basin No. : 30 Catchment Area (km²) : 890
 Name of Dam: Jelai Kechil Annual Discharge (10⁶ m³/y):
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	2,000
	Active storage	(10 ⁶ m ³)	560
	Average outflow	(m ³ /sec)	
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	70
	Dam volume	(10 ⁶ m ³)	1.68
	Dam height	(m)	
	Installed capacity	(MW)	60
	Annual energy	(GWh)	300
	Rated head	(m)	35
<u>Project Cost (M\$10⁶):</u>	Dam		93.7
	Generating equipment		66.0
	TL & SS		8.4
	Land & resettlement dam		7.0
	Land & resettlement TL & SS		0.1
	Physical contingency		57.6
	Engineering & administration		16.8
	<u>Total Project Cost</u>		249.8

Table 168 FEATURES OF HYDROPOWER PROJECT (5/13)

Basin No. : 30 Catchment Area (km²) :
 Name of Dam: Maran Annual Discharge (10⁶ m³/y):
 Purpose : HY, IR

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	(barrage)
	Active storage	(10 ⁶ m ³)	
	Average outflow	(m ³ /sec)	
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	107
	Dam volume	(10 ⁶ m ³)	0.16
	Dam height	(m)	
	Installed capacity	(MW)	130
	Annual energy	(GWh)	680
	Rated head	(m)	10
<u>Project Cost (M\$10⁶):</u>	Dam		10.7
	Generating equipment		272.0
	TL & SS		8.9
	Land & resettlement dam		10.7
	Land & resettlement TL & SS		0.1
	Physical contingency		99.5
	Engineering & administration		29.1
	Total Project Cost		431.1

Table 169 FEATURES OF HYDROPOWER PROJECT (6/13)

Basin No. : 30 Catchment Area (km²) : 3,060
 Name of Dam: Jelai Annual Discharge (10⁶ m³/y): 2,7
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	229.8
	Active storage	(10 ⁶ m ³)	138
	Average outflow	(m ³ /sec)	4.4
	Full supply level	(m)	88.4
	Dam crest elevation	(m)	91.4
	Reservoir surface area	(km ²)	88
	Dam volume	(10 ⁶ m ³)	0.19
	Dam height	(m)	21.3
	Installed capacity	(MW)	10
	Annual energy	(GWh)	34
	Rated head	(m)	15.9
<u>Project Cost (M\$10⁶):</u>	Dam		12.6
	Generating equipment		20.9
	TL & SS		6.7
	Land & resettlement dam		8.8
	Land & resettlement TL & SS		0.1
	Physical contingency		16.0
	Engineering & administration		4.0
	Total Project Cost		69.3

Table 170 FEATURES OF HYDROPOWER PROJECT (7/13)

Basin No. : 30 Catchment Area (km²) : 730
 Name of Dam: Tanum 1 Annual Discharge (10⁶ m³/y): 664
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	161.9
	Active storage	(10 ⁶ m ³)	140
	Average outflow	(m ³ /sec)	4.4
	Full supply level	(m)	119.5
	Dam crest elevation	(m)	122.5
	Reservoir surface area	(km ²)	18
	Dam volume	(10 ⁶ m ³)	0.26
	Dam height	(m)	21.9
	Installed capacity	(MW)	5
	Annual energy	(GWh)	14
	Rated head	(m)	17.5
<u>Project Cost (M\$10⁶):</u>	Dam		17.3
	Generating equipment		14.2
	TL & SS		7.9
	Land & resettlement dam		1.8
	Land & resettlement TL & SS		0.1
	Physical contingency		13.6
	Engineering & administration		3.9
	<u>Total Project Cost</u>		59.01

Table 171 FEATURES OF HYDROPOWER PROJECT (8/13)

Basin No. : 36 Catchment Area (km²) : 420
 Name of Dam: Ulu Trengganu Annual Discharge (10⁶ m³/y): 865
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	840
	Active storage	(10 ⁶ m ³)	(600)
	Average outflow	(m ³ /sec)	
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	45.8
	Dam volume	(10 ⁶ m ³)	1.28
	Dam height	(m)	
	Installed capacity	(MW)	100
	Annual energy	(GWh)	360
	Rated head	(m)	145
<u>Project Cost (M\$10⁶):</u>	Dam		71.0
	Generating equipment		58.9
	TL & SS		19.8
	Land & resettlement dam		4.5
	Land & resettlement TL & SS		0.3
	Physical contingency		50.9
	Engineering & administration		14.9
	<u>Total Project Cost</u>		220.6

Table 172 FEATURES OF HYDROPOWER PROJECT (9/13)

Basin No. : 40 Catchment Area (km²) : 7,480
 Name of Dam: Galas (Dabong) Annual Discharge (10⁶ m³/y):10,920
 Purpose : HY

	Description	Unit	Features	
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	580	
	Active storage	(10 ⁶ m ³)		
	Average outflow	(m ³ /sec)		
	Full supply level	(m)		
	Dam crest elevation	(m)		
	Reservoir surface area	(km ²)		105
	Dam volume	(10 ⁶ m ³)		2.23
	Dam height	(m)		
	Installed capacity	(MW)		
	Annual energy	(GWh)		530
	Rated head	(m)		50
<u>Project Cost (M\$10⁶):</u>	Dam		99.0	
	Generating equipment		124.7	
	TL & SS		23.5	
	Land & resettlement dam		10.5	
	Land & resettlement TL & SS		0.4	
	Physical contingency		84.8	
	Engineering & administration		24.7	
	Total Project Cost		367.8	

Table 173 FEATURES OF HYDROPOWER PROJECT (10/13)

Basin No. : 40 Catchment Area (km²) :
 Name of Dam: Kelantan Barrage Annual Discharge (10⁶ m³/y):
 Purpose : NY

	Description	Unit	Features		
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	barrage		
	Active storage	(10 ⁶ m ³)			
	Average outflow	(m ³ /sec)			
	Full supply level	(m)			
	Dam crest elevation	(m)			
	Reservoir surface area	(km ²)		114.0	
	Dam volume	(10 ⁶ m ³)			
	Dam height	(m)			
	Installed capacity	(MW)			40
	Annual energy	(GWh)			275
	Rated head	(m)			10
<u>Project Cost (M\$10⁶):</u>	Dam		65.9		
	Generating equipment		78.4		
	TL & SS		5.4		
	Land & resettlement dam		65.9		
	Land & resettlement TL & SS		0.1		
	Physical contingency		69.2		
	Engineering & administration		14.9		
	Total Project Cost		299.9		

Table 174 FEATURES OF HYDROPOWER PROJECT (11/13)

Basin No. : 40 Catchment Area (km²) : 227
 Name of Dam: Pergau Annual Discharge (10⁶ m³/y): 331
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	70
	Active storage	(10 ⁶ m ³)	68
	Average outflow	(m ³ /sec)	2.2
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	4
	Dam volume	(10 ⁶ m ³)	1.17
	Dam height	(m)	
	Installed capacity	(MW)	100
	Annual energy	(GWh)	540
	Rated head	(m)	472
<u>Project Cost (M\$10⁶):</u>	Dam		64.9
	Generating equipment		44.4
	TL & SS		22.6
	Land & resettlement dam		0
	Land & resettlement TL & SS		0.4
	Physical contingency		43.0
	Engineering & administration		13.0
	Total Project Cost		189.8

Table 175 FEATURES OF HYDROPOWER PROJECT (12/13)

Basin No. : 40 Catchment Area (km²) : 3,940
 Name of Dam: Nenggiri Annual Discharge (10⁶ m³/y): 5,752
 Purpose : HY

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	240
	Active storage	(10 ⁶ m ³)	(200)
	Average outflow	(m ³ /sec)	
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	48.5
	Dam volume	(10 ⁶ m ³)	2.57
	Dam height	(m)	
	Installed capacity	(MW)	82
	Annual energy	(GWh)	430
	Rated head	(m)	40
<u>Project Cost (M\$10⁶):</u>	Dam		114.1
	Generating equipment		102.4
	TL & SS		30.9
	Land & resettlement dam		4.8
	Land & resettlement TL & SS		0.5
	Physical contingency		83.2
	Engineering & administration		24.7
	Total Project Cost		360.8

Table 176 FEATURES OF HYDROPOWER PROJECT (13/13)

Basin No. : 40 Catchment Area (km²) : 2,474
 Name of Dam: Jeram Panjang (Lebir) Annual Discharge (10⁶ m³/y): 3,612
 Purpose : HY, WS, IR

	Description	Unit	Features
<u>Principal Features</u> :	Gross storage	(10 ⁶ m ³)	4,397
	Active storage	(10 ⁶ m ³)	2,834
	Average outflow	(m ³ /sec)	89.9
	Full supply level	(m)	
	Dam crest elevation	(m)	
	Reservoir surface area	(km ²)	247
	Dam volume	(10 ⁶ m ³)	5.21
	Dam height	(m)	
	Installed capacity	(MW)	120
	Annual energy	(GWh)	410
	Rated head	(m)	56
<u>Project Cost (M\$10⁶):</u>	Dam		231.5
	Generating equipment		99.8
	TL & SS		22.9
	Land & resettlement dam		46.9
	Land & resettlement TL & SS		0.4
	Physical contingency		131.1
	Engineering & administration		35.4
	Total Project Cost		568.1

Table 177 ADJUSTMENT FACTOR FOR kW AND kWh VALUE

(1) Power (kW) Adjustment Factor:

Loss Factor	Hydropower (%)	Oil-fired (%)
Transmission loss	4.0	2.0
Forced outage	0.5	5.0
Station service	0.3	5.0
Overhaul and inspection	2.0	15.0

$$\text{Adjustment Factor} = \frac{(1 - 0.04)(1 - 0.005)(1 - 0.003)(1 - 0.02)}{(1 - 0.02)(1 - 0.05)(1 - 0.05)(1 - 0.15)}$$

$$= 1.241$$

(2) Energy (kWh) Adjustment Factor:

Loss Factor	Hydropower (%)	Oil-fired (%)
Transmission loss	4.0	2.0
Station service	0.3	5.0

$$\text{Adjustment Factor} = \frac{(1 - 0.04)(1 - 0.003)}{(1 - 0.02)(1 - 0.05)}$$

$$= 1.028$$

Table 178 DEFINITION OF SAFE RIVER MAINTENANCE FLOW PERIOD, SAFE WATER SUPPLY PERIOD AND DROUGHT DAMAGE RATIO

Description	Alternative			
	B1	B2	-	B3
Drought level	1/19	2/19	3/19	4/19
Deficit under Q97% maintenance flow (10 ⁶ m ³ /y)	DA1	DA2	DA3	DA4
Deficit under Q99% maintenance flow (10 ⁶ m ³ /y)	DB1	DB2	DB3	DB4
Period of deficit under Q97% maintenance flow (days/y)	PA1	PA2	PA3	PA4
Period of deficit under Q99% maintenance flow (days/y)	PB1	PB2	PB3	PB4
Shortage in 1/19 drought under Q97% maintenance flow (10 ⁶ m ³ /y)	SA1=0	SA2= DA1-DA2	SA3= DA1-DA3	SA4= DA1-DA4
Shortage in 1/19 drought under Q99% maintenance flow (10 ⁶ m ³ /y)	SB1=0	SB2= DB1-DB2	SB3= DB1-DB3	SB4= DB1-DB4
Damage period of shortage in 1/19 drought under Q97% (days/y)	PDA1=0	PDA2= SA2/C	PDA3= SA3/C	PDA4= SA4/C
Damage period of shortage in 1/19 drought under Q99% (days/y)	PDB1=0	PDB2= SB2/C	PDB3= SB3/C	PDB4= SB4/C
*Safe river maintenance flow period in 1/19 drought (days/y)	365	365- PDA2	365- PDA3	365- PDA4
*Safe water supply period in 1/19 drought (days/y)	365	365- PDB2	365- PDB3	365- PDB4
Shortage in 19 years under Q97% maintenance flow (10 ⁶ m ³)	TS1=0	TS2=SA2	TS3=SA3 +(DA2-DA3)	TS4=SA4 +(DA2-DA3) +(DA3-DA4)
*Drought damage ratio in 19 years (%)	R1=0	R2= TS2/TDW	R3= TS3/TDW	R4= TS4/TDS

in which, $C = DA1/PA1$,

$$TDW = \sum_{i=1}^{19} (Q97\% \text{ maintenance flow} + \text{withdrawal})_i$$

Table 179 SAFE WATER SUPPLY PERIOD AND SAFE RIVER MAINTENANCE FLOW PERIOD WITH/WITHOUT ALTERNATIVE STRUCTURAL MEASURES IN 1990

Unit : day

Basin No.	Basin Name	Safe Water Supply Period				Safe River Maintenance Flow Period			
		B1	B2	B3	Without Structures (1/N)	B1	B2	B3	Without Structures (1/N)
1.	Perlis	365	357	309	230	365	338	290	205
2.	Plau Langkawi	365	365	351	285	365	350	316	265
3.	Kedah	365	365	333	133	365	352	317	138
4.	Merbok	365	365	354	290	365	360	326	275
5.	Muda	365	365	362	270	365	344	285	200
6.	Perai	365	350	340	184	365	337	284	184
7.	Pulau Pinang	365	365	336	164	365	357	303	154
9.	Kurau	365	357	294	184	365	330	267	164
10.	Perak (Kinta)	365	365	365	332	365	365	337	307
11.	Bernam	365	320	290	156	365	310	280	136
12.	Tengi	365	320	290	365	365	310	280	273
13.	Selangor	365	365	326	339	365	357	276	261
15.	Kelang	365	365	326	194	365	357	276	189
16.	Langat	365	365	326	299	365	357	276	245
17.	Sepang	365	365	322	194	365	356	275	184
18.	Linggi	365	365	344	248	365	355	247	192
19.	Melaka	365	365	288	102	365	353	244	92
20.	Kesang	365	304	256	212	365	272	224	212
21.	Muar	365	304	256	143	365	272	224	132
23.	Pontian Kechil (23C)	365	370	253	152	365	238	218	152
24.	Johor (24A)	365	269	250	152	365	239	220	152
31.	Kuantan	365	365	365	365	365	363	360	359
39.	Kemasin	365	365	363	310	365	315	310	247
40.	Kelantan	365	365	363	269	365	315	310	243

Remarks; N = 19
 'B1, B2 and B3' mean the condition after the alternative source facilities are implemented, and 'without structures' means natural flow condition.

Table 180 SAFE WATER SUPPLY PERIOD AND SAFE RIVER MAINTENANCE FLOW PERIOD WITH/WITHOUT ALTERNATIVE STRUCTURAL MEASURES IN 2000

Unit : day

Basin No.	Basin Name	Safe Water Supply Period				Safe River Maintenance Flow Period			
		B1	B2	B3	Without Structures (1/N)	B1	B2	B3	Without Structures (1/N)
1.	Perlis	365	350	305	195	365	330	284	174
2.	Plau 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 (Kinta)	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.	Selangor	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 (23C)	365	270	250	152	365	238	218	147
24.	Johor (24A)	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

Remarks; N = 19

'B1, B2 and B3' mean the condition after the alternative source facilities are implemented, and 'without structures' means natural flow condition.

Table 181 SAFE WATER SUPPLY PERIOD AND SAFE RIVER
MAINTENANCE FLOW PERIOD WITHOUT
STRUCTURAL MEASURED IN 2000

Basin No.	Safe Water Supply Period			Safe River Maintenance Flow Period		
	1/N	2/N	4/N	1/N	2/N	4/N
	Unit: day					
1	195	200	249	174	185	244
2	285	294	313	265	259	316
3	133	136	174	133	136	163
4	275	235	321	200	260	281
5	225	260	309	195	239	299
6	179	188	248	169	178	233
7	148	117	185	143	107	175
8	354	344	350	324	321	334
9	169	183	235	164	178	225
10	332	324	349	307	317	324
11	156	305	257	131	254	187
12	365	365	365	339	345	365
13	339	345	365	290	310	360
14	365	365	365	339	345	365
15	159	152	220	143	152	205
16	299	320	360	245	250	324
17	143	147	205	133	142	195
18	239	274	320	187	183	289
19	87	66	205	72	66	185
20	212	299	349	207	265	355
21	132	299	350	132	279	309
22	147	319	313	137	270	298
23	152	207	269	147	202	204
24	147	202	264	132	197	255
25	178	300	319	167	295	278
26	157	290	267	152	290	274
27	162	295	274	147	237	246
28	173	300	320	162	290	295
29	173	300	295	157	252	285
30	352	360	365	322	304	349
31	365	365	365	319	340	360
32	365	365	365	334	350	365
33	365	365	365	359	360	365
34	359	360	365	324	335	365
35	334	355	365	289	325	344
36	334	345	365	289	258	339
37	349	360	365	314	335	355
38	238	289	340	218	243	329
39	310	339	344	258	243	286
40	269	303	320	238	203	274
41	295	339	360	253	298	309

Remarks; N - 19

Table 182 SAFE WATER SUPPLY PERIOD AND SAFE RIVER
MAINTENANCE FLOW PERIOD WITH/WITHOUT
RECOMMENDED STRUCTURAL MEASURES IN 1990

Basin No.	Basin Name	Safe Water Supply Period		Safe River Maintenance Flow Period	
		With Structures	Without Structures	With Structures	Without Structures
1.	Perlis	309	230	290	205
2.	Langkawi	351	285	316	265
3.	Kedah	333	133	317	138
4.	Merbok	365	290	365	275
5.	Muda	362	270	285	200
6.	Perai	365	184	365	184
7.	Pinang	365	164	365	154
9.	Kurau	294	184	267	164
10.	Perak (Kinta)	365	332	365	307
11.	Bernam	365	156	280	136
12.	Tangi	365	365	365	273
13.	Selangor	365	339	365	261
15.	Kelang	365	194	365	189
16.	Langat	365	299	365	245
17.	Sepang	365	194	365	184
18.	Linggi	365	248	365	192
19.	Melaka	365	102	365	92
20.	Kesang	365	212	365	212
21.	Muar	365	143	365	132
23.	Pontian Kechil	365	152	365	152
24.	Johor	365	152	365	152
31.	Kuantan	365	365	365	359
39.	Kemasin	359	310	310	247
40.	Kelantan	359	269	310	243

Table 183 SAFE WATER SUPPLY PERIOD AND SAFE RIVER MAINTENANCE FLOW PERIOD WITH/WITHOUT RECOMMENDED STRUCTURAL MEASURES IN 2000

Basin No.	Basin Name	Unit : days			
		Safe Water Supply Period		Safe River Maintenance Flow Period	
		With Structures	Without Structures	With Structures	Without Structures
1.	Perlis	305	195	284	174
2.	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.	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

Remarks; 'with structures' means the condition after the recommended water source facilities are implemented, and 'without structures' means the natural flow condition both under the 1/N drought.

Table 184 SAFE WATER SUPPLY PERIOD AND SAFE RIVER MAINTENANCE FLOW PERIOD WITH/WITHOUT RECOMMENDED STRUCTURAL MEASURES IN 1990 UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Basin No.	Basin Name	Unit : day			
		Safe Water Supply Period		Safe River Maintenance Flow Period	
		With Structures	Without Structures	With Structures	Without Structures
1.	Perlis	310	230	292	210
2.	Langkawi	351	285	316	265
3.	Kedah	334	138	317	139
4.	Merbok	365	290	365	275
5.	Muda	362	270	285	200
6.	Perai	365	184	365	184
7.	Pinang	365	169	365	159
9.	Kurau	294	184	267	169
10.	Perak (Kinta)	365	332	365	307
11.	Bernam	365	156	281	136
12.	Tengi	365	365	365	339
13.	Selangor	365	340	365	290
15.	Kelang	365	199	365	189
16.	Langat	365	299	365	245
17.	Sepang	365	199	365	189
18.	Linggi	365	253	365	202
19.	Melaka	365	112	365	92
20.	Kesang	365	212	365	212
21.	Muar	365	143	365	132
23.	Pontian Kechil	365	152	365	152
24.	Johor	365	152	365	152
31.	Kuantan	365	365	365	359
39.	Kemasin	360	315	312	264
40.	Kelantan	360	269	312	243

Table 185 SAFE WATER SUPPLY PERIOD AND SAFE RIVER
 MAINTENANCE FLOW PERIOD WITH/WITHOUT
 RECOMMENDED STRUCTURAL MEASURES IN 2000
 UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Basin No.	Basin Name	Unit : day			
		Safe Water Supply Period		Safe River Maintenance Flow Period	
		With Structures	Without Structures	With Structures	Without Structures
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

Table 186 DROUGHT DAMAGE RATIO WITH ALTERNATIVE
WATER SOURCE FACILITIES IN 1990 AND 2000

Basin No.	Basin Name	1990			2000		
		B1	B2	B3	B1	B2	B3
1.	Perlis	0	0.67	3.68	0	0.8	3.27
2.	Langkawi	0	0.16	0.98	0	0.16	0.98
3.	Kedah	0	2.00	9.69	0	0.57	5.14
4.	Merbok	0	0.14	0.71	0	0.03	0.88
5.	Muda	0	0.17	1.29	0	0.22	1.72
6.	Perai	0	0.81	2.99	0	0.31	1.82
7.	Pinang	0	0.23	1.04	0	0.09	1.42
9.	Kurau	0	0.88	3.96	0	0.80	3.72
10.	Perak (Kinta)	0	0	0.81	0	0.01	0.79
11.	Bernam	0	2.53	2.77	0	2.52	2.77
12.	Tengi	0	0	0.04	0	0	0.04
13.	Selangor	0	0.04	0.28	0	0.04	0.28
15.	Kelang	0	0.08	0.91	0	0.05	1.08
16.	Langkat	0	0.07	0.61	0	0.07	0.61
17.	Sepang	0	0.07	0.96	0	0.06	1.21
18.	Linggi	0	0.15	3.97	0	0.16	3.97
19.	Melaka	0	0.56	6.97	0	0.28	6.40
20.	Kesang	0	2.73	5.69	0	2.62	5.61
21.	Muar	0	1.93	2.60	0	1.99	2.76
23.	Pontian Kechil	0	1.48	1.85	0	1.40	1.93
24.	Johor	0	1.41	1.91	0	1.34	1.77
31.	Kuantan	0	0	0.01	0	0.04	0.13
39.	Kemasin	0	0.22	0.60	0	0.19	0.52
40.	Kelantan	0	0.38	0.68	0	0.38	0.59

Remarks; The condition under the 1/N drought

Table 187 DROUGHT DAMAGE RATIO WITH RECOMMENDED WATER SOURCE FACILITIES IN 1990 AND 2000

Basin No.	Basin Name	1990		Unit : Percentage 2000	
		Target Economic Growth	Lower Economic Growth	Target Economic Growth	Lower Economic Growth
1.	Perlis	3.68	3.74	3.27	3.52
2.	Langkawi	0.98	0.98	0.98	0.98
3.	Kedah	9.69	5.33	5.14	5.54
4.	Merbok	0	0	0	0
5.	Muda	1.29	1.29	1.72	1.72
6.	Perai	0	0	0	0
7.	Pinang	0	0	0	0
9.	Kurau	3.96	4.08	3.72	4.01
10.	Perak (Kinta)	0	0	0	0
11.	Bernam	2.77	2.77	2.77	2.77
12.	Tengi	0.04	0.04	0.04	0.04
13.	Selangor	0	0	0	0
15.	Kelang	0	0	0	0
16.	Langkat	0	0	0	0
17.	Sepang	0	0	0	0
18.	Linggi	0	0	0	0
19.	Melaka	0	0	0	0
20.	Kesang	0	0	0	0
21.	Muar	0	0	0	0
23.	Pontian Kechil	0	0	0	0
24.	Johor	0	0	0	0
31.	Kuantan	0	0	0	0
39.	Kemasin	0.60	0.50	0.52	0.58
40.	Kelantan	0.68	0.65	0.59	0.67

Remarks; The flow condition under 1/N drought

Table 188 STANDARD LAND COMPENSATION AND
RESETTLEMENT COST

Unit: M\$10⁶/km²

(A) Compensation on Land

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		

(B) Resettlement

Urban	M\$30,000/household
Rural	M\$10,000/household

Remarks; S = very good access; A = good access; B = poor access;
C = very poor access

Table 189

NUMBER OF ALTERNATIVE WATER SOURCE FACILITIES

Unit: number of sites

State	Facility	Alternative B1				Alternative B2				Alternative B3			
		5MP	6MP	7MP	Total	5MP	6MP	7MP	Total	5MP	6MP	7MP	Total
Perlis	dam	1	1	0	2	0	1	0	1	1	0	0	1
Kedah	dam	13	3	0	16	8	3	0	11	5	2	1	8
P. Pinang	dam	1	0	0	1	1	0	0	1	1	0	0	1
Perak	dam	3	0	0	3	3	0	0	3	2	0	0	2
Selangor	dam	4	2	0	6	2	2	0	4	1	0	2	3
N. Sembilan	dam	2	3	1	6	2	2	0	4	2	0	0	2
Melaka		no facilities											
Johor	dam	4	0	0	4	3	0	0	3	2	1	0	3
	barrage	3	0	0	3	3	0	0	3	3	0	0	3
	Total	6	0	0	6	5	0	0	5	4	1	0	5
Pahang	dam	3	0	1	4	2	0	1	3	2	0	0	2
Trengganu		no facilities											
Kelantan	dam	0	0	1	1	0	0	1	1	0	0	1	1
Total	dam	31	9	3	43	21	8	2	31	16	3	4	23
	barrange	3	0	0	3	3	0	0	3	3	0	0	3
	Total	34	9	3	46	24	8	2	34	19	3	4	26

Remarks; The number is counted as of commission year.

Table 190 NUMBER OF RECOMMENDED WATER SOURCE FACILITIES

Unit: number of sites

State	Facility	Recommended Plan				Recommended under Lower Economic Growth			
		5MP	6MP	7MP	Total	5MP	6MP	7MP	Total
Perlis	dam	1	0	0	1	0	1	0	1
Kedah	dam	6	2	1	9	5	1	0	6
Pulau Pinang	dam	1	0	0	1	1	0	0	1
Perak	dam	3	0	0	3	3	0	0	3
Selangor	dam	1	2	0	3	1	2	0	3
Negeri Sembilan	dam	2	3	1	6	2	0	1	3
Melaka	dam	No facilities				No facilities			
Johor	dam	4	0	0	4	3	1	0	4
	barrage	3	0	0	3	2	0	0	1
	Total	7	0	0	7	5	1	0	6
Pahang	dam	2	1	0	3	2	0	0	2
Trengganu	dam	No facilities				No facilities			
Kelantan	dam	3	0	0	3	2	0	0	2
Total	dam	23	8	2	33	19	5	1	25
	barrage	3	0	0	3	2	0	0	1
	Total	26	8	2	36	21	5	1	26

Remarks; The number is counted as of commission year.

Table 191: NUMBER OF RECOMMENDED HYDROPOWER DAMS

Unit: number of sites

	5MP	6MP	7MP	Total
Recommended Plan	5	6	2	13
Recommended under lower economic growth	4	2	5	11

Remarks; The number is counted as of commission year.

Table 192

MANPOWER REQUIREMENT FOR WATER
SOURCE FACILITIES, ALTERNATIVE B1

<u>Construction</u>	Unit: number of staff			
	4MP	5MP	6MP	7MP
Grade A: Engineer	0	34	9	3
B: Technical Assistant	0	34	9	3
C: Technician	0	68	18	6
D: Others	0	102	27	9
Total Govt. Staff	0	238	63	21

O & M

	4MP	5MP	6MP	7MP
Grade A: Engineer	0	34	43	46
B: Technical Assistant	0	34	43	46
C: Technician	0	34	43	46
D: Others	0	136	172	184
Total Govt. Staff	0	238	301	322

Construction & O&M

	4MP	5MP	6MP	7MP
Grade A: Engineer	0	68	52	49
B: Technical Assistant	0	68	52	49
C: Technician	0	102	61	52
D: Others	0	238	199	193
Total Govt. Staff	0	476	364	343

Remarks; O&M: Operation and maintenance

Table 193 MANPOWER REQUIREMENT FOR WATER SOURCE FACILITIES, ALTERNATIVE B2

Unit: number of staff

<u>Construction</u>	4MP	5MP	6MP	7MP
Grade A: Engineer	0	24	8	2
B: Technical Assistant	0	24	8	2
C: Technician	0	48	16	4
D: Others	0	72	24	6
Total Govt. Staff	0	168	56	14

<u>O & M</u>	4MP	5MP	6MP	7MP
Grade A: Engineer	0	24	32	34
B: Technical Assistant	0	24	32	34
C: Technician	0	24	32	34
D: Others	0	96	128	136
Total Govt. Staff	0	168	224	238

<u>Construction & O&M</u>	4MP	5MP	6MP	7MP
Grade A: Engineer	0	48	40	36
B: Technical Assistant	0	48	40	36
C: Technician	0	72	48	38
D: Others	0	168	152	142
Total Govt. Staff	0	336	280	252

Remarks; O&M: Operation and maintenance

Table 194. MANPOWER REQUIREMENT FOR WATER SOURCE FACILITIES, ALTERNATIVE B3

<u>Construction</u>		Unit: number of staff			
		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	19	3	4
	B: Technical Assistant	0	19	3	4
	C: Technician	0	38	6	8
	D: Others	0	57	9	12
Total Govt. Staff		0	133	21	28

<u>O & M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	19	22	26
	B: Technical Assistant	0	19	22	26
	C: Technician	0	19	22	26
	D: Others	0	76	88	104
Total Govt. Staff		0	133	154	182

<u>Construction & O&M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	38	25	30
	B: Technical Assistant	0	38	25	30
	C: Technician	0	57	28	34
	D: Others	0	133	97	116
Total Govt. Staff		0	266	175	210

Remarks; O&M: Operation and maintenance

Table 195

MANPOWER REQUIREMENT FOR RECOMMENDED
WATER SOURCE FACILITIES

<u>Construction</u>		Unit: number of staff			
		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	26	8	2
	B: Technical Assistant	0	26	8	2
	C: Technician	0	52	16	4
	D: Others	0	78	24	6
Total Govt. Staff		0	182	56	14
<u>O & M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	26	34	36
	B: Technical Assistant	0	26	34	36
	C: Technician	0	26	34	36
	D: Others	0	104	136	144
Total Govt. Staff		0	182	238	252
<u>Construction & O&M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	52	42	38
	B: Technical Assistant	0	52	42	38
	C: Technician	0	78	50	40
	D: Others	0	182	160	150
Total Govt. Staff		0	364	294	266

Remarks; O&M: Operation and maintenance

Table 196

MANPOWER REQUIREMENT FOR RECOMMENDED
WATER SOURCE FACILITIES UNDER THE CONDITION
OF LOWER ECONOMIC GROWTH

Construction Unit: number of staff

	4MP	5MP	6MP	7MP
Grade A: Engineer	0	21	5	1
B: Technical Assistant	0	21	5	1
C: Technician	0	42	10	2
D: Others	0	63	15	3
Total Govt. Staff	0	147	35	7

O & M

	4MP	5MP	6MP	7MP
Grade A: Engineer	0	21	26	27
B: Technical Assistant	0	21	26	27
C: Technician	0	21	26	27
D: Others	0	84	104	108
Total Govt. Staff	0	147	182	189

Construction & O&M

	4MP	5MP	6MP	7MP
Grade A: Engineer	0	42	31	28
B: Technical Assistant	0	42	31	28
C: Technician	0	63	36	29
D: Others	0	147	119	111
Total Govt. Staff	0	294	217	196

Remarks; O&M: Operation and maintenance

Table 197 MANPOWER REQUIREMENT FOR RECOMMENDED HYDROPOWER DAMS

(A) Recommended Plan

Unit: number of staff

<u>Construction</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	5	6	2
B:	Technical Assistant	0	10	12	4
C:	Technician	0	10	12	4
D:	Others	0	15	18	6
Total Govt. Staff		0	40	48	16
<u>O & M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	5	11	13
B:	Technical Assistant	0	10	22	26
C:	Technician	0	5	11	13
D:	Others	0	20	44	52
Total Govt. Staff		0	40	88	104
<u>Construction & O&M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	10	17	15
B:	Technical Assistant	0	20	34	30
C:	Technician	0	15	23	17
D:	Others	0	35	62	58
Total Govt. Staff		0	80	136	120

(B) Recommended Plan Under Lower Economic Growth

<u>Construction</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	4	2	5
B:	Technical Assistant	0	8	4	10
C:	Technician	0	8	4	10
D:	Others	0	12	6	15
Total Govt. Staff		0	32	16	40
<u>O & M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	4	6	11
B:	Technical Assistant	0	8	12	22
C:	Technician	0	4	6	11
D:	Others	0	16	24	44
Total Govt. Staff		0	32	48	88
<u>Construction & O&M</u>		4MP	5MP	6MP	7MP
Grade A:	Engineer	0	8	8	16
B:	Technical Assistant	0	16	16	32
C:	Technician	0	12	10	21
D:	Others	0	28	30	59
Total Govt. Staff		0	64	64	128

Remarks; O&M: Operation and maintenance

