

TABLES

SECTOR IV

***RIVER ENVIRONMENTAL
MANAGEMENT PLAN***

TABLE IV.1.1.1 LIST OF WATER SAMPLING LOCATIONS OF DOE

No.	Sta. No.	River	Latitude (W)	Longitude (E)	Distance from River mouth	Location name	Monitoring Period
1	5503601	Muda Main	5d35m	100d22m	?	Di Kota Kuala Muda	? - ? (Not existing)
2	5604601	?	?	?	?	?	? - ? (Not existing)
3	5504602	Muda Main	5d33m	100d25m	12.88 Km	Jambatan Merdeka di Bumbong Lima	1978 - Present
4	5505603	Muda Main	5d34m	100d30m	25.07 Km	Jambatan Keretapi di Pinang Tunggal	1978 - Present
5	5505612	Muda Main	5d31m	100d34m	39.44 Km	Jambatan Sidam di Kg. Sidam Kanan	? - ? (Not existing)
6	5606604	Muda Main	5d35m	100d37m	53.93 Km	Jambatan Syed Omar	1978 - Present
7	5607606	Tawar	5d36m	100d47m		Pekan Tawar, Tawar	1985 - Present
8	5608601	Tawar	5d34m	100d45m		Selepas Kilang Getah	1994 - Present
9	5608602	Tawar	5d34m	100d45m		sebelum Kilang Getah	1994 - Present
10	5608603	Naksah	5d33m	100d45m		Selepas Kilang Getah Bade nock	1994 - Present
11	5608605	Ketil	5d35m	100d49m		Di Kuala Pegang	1978 - Present
12	5609609	Ketil	5d41m	100d55m		Masjid Baling/ Jln. Lubuk Pedati	1987 - Present
13	5706607	Jerung	5d40m	100d35m		Upstream side of a factory	1992 - Present
14	5706610	Jerung	5d39m	100d35m		Downstream side of a factory	1992 - Present
15	5806614	Muda Main	5d49m	100d38m	102.23 Km	Jambatan di Jeniang	1988 - Present
16	5906607	Muda Main	5d56m	100d41m	123.16 Km	DJerei	? - ? (Not existing)
17	6007608	Muda Main	6d00m	100d43m	142.48 Km	Di Kg. Lubok Merbau	1988 - Present

TABLE IV.1.1.2 LIST OF WATER SAMPLING LOCATIONS OF JBA/JKR AND DOH

No.	Daerah	Name of Intake	Location of Intake	Observation Period
1	Kuala Muda	Pinang Tunggai	Kg. Pinang Tunggai (Sg. Muda)	7 - 1994 (present)
2	Sik	Grun	Janiang (Sg. Muda)	7 - 1994 (present)
3	Padang Terap	L. Merbau	Nani(Sg. Muda)	7 - 1994 (present)
4	Baling	Teloi Timur	Felda Teloi Kanan (sg. Muda)	7 - 1994 (present)
5	Sik	Bt. Lima	Sik (Sg. Chepir)	7 - 1994 (present)
6	Kuala Muda	Kuala Kethil	Kuala Kethil (Sg. Ketil)	7 - 1994 (present)
7	Baling	Sg. Limau	Baling (Sg. Ketil)	7 - 1994 (present)

Note: The sampling locations are obtained from DOH.
These are the regular(weekly) sampling locations.

TABLE IV.1.1.3 LIST OF WATER SAMPLING LOCATIONS OF DID

No.	Daerah	Name of Station	Location	Observation Period
1	Sik	Muda Reservoir	Muda Reservoir	7 - 1994
2	Baling	Jam Syed Omar	Bridge (Sg. Muda)	7 - 1994

Note: There is a sampling site in Pedu reservoir connected with Muda reservoir.

TABLE IV.1.1.4 WATER QUALITY INDEX OF MUDA RIVER
BY DOE CLASSIFICATION

YEAR	OVERALL INDEX WQI	INDEX BY- BOD	INDEX BY SS	INDEX BY NH4-N
1985	83	93	78	86
1986	86	95	73	88
1987	81	93	73	82
1988	82	91	74	79
1989	79	91	69	74
1990	81	92	72	80
1991	80	94	72	72
1992	79	95	71	87
1993	81	89	71	72
1994				
Mean	81.33	92.56	72.56	80.00

	OVERALL:	BOD:	SS:	NH4-N:
Dirty	< 60	< 80	< 70	< 71
Slightly dirty	61 - 80	80 ~ 90	70 ~ 75	71 ~ 91
Clean	81 <	90 <	75 <	91 <

Note: The index figures are obtained from DOE.

ABLE IV.1.1.5 GENERAL RATING SCALE FOR THE WATER QUALITY INDEX (WQI) BY DOE

USAGE	10	20	30	40	50	60	70	80	90	100%
General	very polluted									
Public Water Supply	not acceptable		doubtful		Necessary treatment becoming more extensive		slightly polluted		clean	
Recreation	not acceptable	obvious pollution appearing	only for boating	doubtful for water contact	becoming polluted still acceptable need bacteria count	acceptable for all water sports		monitor purific. required	purification not necessary	
Fish, selffish and Wildlife	not acceptable	coarse fish only	handy fish only	doubtful for sensitive fish	marginal for trout	acceptable for all fish				
Navigation	not acceptable									
Treated Water Transportation	not acceptable									
USAGE	10	20	30	40	50	60	70	80	90	100%

TABEL IV.1.2.1 DOE STANDARD FOR WATER QUALITY CLASSIFICATION
(Used for Water Quality Survey by JICA Study Team)

Class	pH	DO	Elect. Cond	Turb	SS	BOD	T.Coli.	NH4-N	As	Cd	Cr(VI)	Pb	Fe	T-Hg	P	Cn	F
		mg/l	umhos/cm	NTU	mg/l	mg/l	no./100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
I	6.5-8.5	7<	<250	<5.0	<25	<1	<100	<0.1	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
IIA	6.0-9.0	5.0-7.0	<500	<5.0	<50	<3	<1000	<0.3	<0.05	<0.005	<0.05	<0.05	<1.0	<0.001	<0.2	<0.02	<1.5
IIB	6.0-9.0	5.0-7.0	-	<5.0	<50	<3	<1000	<0.3	<0.05	<0.01	<0.05	<0.05	<1.0	<0.001	<0.2	<0.02	<1.5
III	5.0-9.0	3.0-5.0	-	-	<150	<6	<50000	<0.9	<0.40	<0.01	<1.4	<0.02	<1.0	<0.004	<0.1	<0.06	<10
IV	5.0-9.0	1.0-3.0	-	-	<300	<12	<50000	<2.7	<0.1	<0.01	<0.1	<5.0	<1.0	<0.002	-	-	<1.0
V	<5 or 9<	<1.0	-	-	300<	12<	50000<	2.7<	0.1<	0.01<	0.1<	5.0<	1.0<	0.002<	0.1<	0.06<	1.0<

Class	TDS	COD	F.Coli	T-N	Sc	NO2-N	NO3-N	Hardness	Cl-	Cu	Zn	Mn
	mg/l	mg/l	no./100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
I	<500	<10	<10	-	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.	N.L.
IIA	<1000	<25	<100	-	<0.01	<0.4	<7	<250	<200	<0.02	<5	<0.1
IIB	-	<25	<400	-	<0.01	<0.4	<7	<250	<200	<0.02	<5	<0.1
III	-	<50	<(2000)	-	<0.25	<0.4	-	-	-	-	<0.4	<0.1
IV	-	<100	<(2000)	-	<0.02	-	<5	<80	<80	<0.2	<2	<5
V	-	100<	-	-	0.02<	-	5<	80<	80<	0.2<	2<	5<

Note:

(1) Revised figures in 1994 are used

(2) Major use

Class I: Water supply I (No treatment necessary)

Class II: Water supply II (Conventional treatment required)

Class III: Water supply III (Extensive treatment required)

Class IV: Irrigation

Class V: None of the above

TABEL IV.1.2.2 RESULTS OF WATER QUALITY TESTS BY JICA STUDY TEAM (FIRST SURVEY)

Loca.	pH	DO mg/l	Elect. Cond umhos/cm	Turb NTU	SS mg/l	BOD mg/l	T.Coli. no./100ml	NH ₃ -N mg/l	As mg/l	Cd mg/l	C(VI) mg/l	Pb mg/l	Fe mg/l	T-Hg mg/l	P mg/l	Cn mg/l	F mg/l
First Sampling																	
M1	6.78	6.2	90	10	7	2.8	2300	1.4	<0.01	<0.01	0.01	<0.01	1.32	<0.01	1.76	ND	0.8
M2	6.78	6	100	13	11	3	460	1.8	<0.01	<0.01	0.02	<0.01	1.19	<0.01	1.65	ND	0.75
M3	6.4	6	100	34	67	2.3	2300	1.4	<0.01	<0.01	0.04	<0.01	1.47	<0.01	2.87	ND	0.1
M4	6.44	6.4	100	6	31	0.9	750	1.1	<0.01	<0.01	0.16	<0.01	1.38	<0.01	1.86	ND	0.25
M5	6.52	5.3	110	<5	27	ND	470	1.1	<0.01	<0.01	0.06	<0.01	1.3	<0.01	3.17	ND	0.65
CI	6.56	6	90	11	19	1.6	2300	0.7	<0.01	<0.01	0.02	<0.01	1.16	<0.01	1.76	ND	0.76
KI	5.92	5	100	12	27	3.6	1200	0.4	<0.01	<0.01	0.02	<0.01	1.33	<0.01	1.65	ND	0.81
SI	6.06	6.2	100	11	78	2.4	1200	1.1	<0.01	<0.01	0.05	<0.01	1.43	<0.01	6.35	ND	0.1
FI	5.94	6.2	110	<5	13	1	220	0.7	<0.01	<0.01	0.04	<0.01	1.28	<0.01	2.85	ND	0.65
F2	6.4	5.2	110	6	22	1.2	5500	1.4	<0.01	<0.01	0.09	<0.01	1.8	<0.01	1.97	ND	0.25
Second Sampling																	
M3	6.44	5.8	70	22	50	0.01	930	0.7	<0.01	<0.01	0.07	<0.01	1.66	<0.01	1.78	ND	0.4
KI	5.9	6.2	70	23	1.78	<0.01	4600	0.7	<0.01	<0.01	0.08	<0.01	1.6	<0.01	1.78	ND	0.6

Note: The sampling was carried out in November 1994

TABEL IV.1.2.3 RESULTS OF WATER QUALITY TESTS BY JICA STUDY TEAM (FIRST SURVEY)

(BASED ON DOE CLASSIFICATION)

Loca.	pH	DO mg/l	Elect. Cond umhos/cm	Turb NTU	SS mg/l	BOD mg/l	T.Coli. no./100ml	NH3-N mg/l	As mg/l	Cd mg/l	Cr(VI) mg/l	Pb mg/l	Fe mg/l	T-Hg mg/l	P mg/l	Cn mg/l	F mg/l
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First Sampling

M1	II	II	I	II	I	II	III	IV	II	II	II	II	V?	II?	V?	II?	II
M2	II	II	I	II	I	II	II	IV	II	II	II	II	V?	II?	V?	II?	II
M3	II	II	I	II	III	II	III	IV	II	II	II	II	V?	II?	V?	II?	II
M4	II	II	I	II	II	II	II	IV	II	II	III<	II	V?	II?	V?	II?	II
M5	II	II	I	I	II	I	II	IV	II	II	III<	II	V?	II?	V?	II?	II
C1	II	II	I	II	I	II	III	III	II	II	II	II	V?	II?	V?	II?	II
K1	III	II	I	II	III	III	III	III	II	II	II	II	V?	II?	V?	II?	II
S1	II	II	I	II	II	II	III	IV	II	II	II	II	V?	II?	V?	II?	II
F1	III	II	I	I	II	II	II	III	II	II	II	II	V?	II?	V?	II?	II
F2	II	II	I	II	II	II	III	IV	II	II	III<	II	V?	II?	V?	II?	II

Second Sampling

M3	II	II	I	II	I	I	II	III	II	II	III<	III	V?	II?	V?	II?	II
K1	III	II	I	II	I	I	III	III	II	II	III<	III	V?	II?	V?	II?	II

Note: The sampling was carried out in November 1994.

? means "still questionable" or "not accurate"

TABEL IV.1.2.4 RESULTS OF WATER QUALITY TESTS BY JICA TEAM (SECOND SURVEY)

Loca.	pH	DO	Elect. Cond	Turb	SS	BOD	T.Coli.	NH3-N	As	Cd	C(VI)	Pb	Fe	T-Hg	P	Cn	F	TDS	COD	F.Coli.	T-N	Se
		mg/l	umhos/cm	NTU	mg/l	mg/l	no./100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	no./100ml	mg/l	mg/l
First Sampling																						
M1	7.30	4.0	55.0	17.0	4.0	2.6	2400	1.4	<0.01	<0.001	<0.05	0.01	0.8	<0.001	<0.1	<0.01	0.8	108	12.0	930	5.1	<0.05
M2	6.70	3.6	42.8	46.0	14.0	3.0	1300	1.4	<0.01	<0.001	<0.05	0.02	1.8	<0.001	<0.1	<0.01	0.5	86	34.0	1300	5.5	<0.05
M3	7.30	3.0	58.4	52.0	40.0	2.4	1200	0.3	<0.01	<0.001	<0.05	0.02	2.5	<0.004	<0.1	<0.01	0.7	40	17.0	1200	3.7	<0.05
M4	6.90	3.8	51.4	63.0	35.0	1.8	2200	2.2	<0.01	<0.001	<0.05	0.02	3.0	<0.002	<0.1	<0.01	0.7	21	12.0	1200	5.5	<0.05
M5	7.50	3.2	17.3 ms	51.0	83.0	1.8	2200	0.7	<0.01	<0.001	<0.05	0.06	1.6	<0.003	<0.1	<0.01	0.8	9921	302.0	750	5.5	<0.05
C1	6.60	3.4	33.3	31.0	10.0	0.6	14000	0.7	<0.01	<0.001	<0.05	0.02	1.9	<0.001	<0.1	<0.01	0.5	70	8.0	7200	5.5	<0.05
K1	7.30	3.4	101.0	28.0	21.0	1.2	2200	0.7	<0.01	<0.001	<0.05	0.01	1.8	<0.003	<0.1	<0.01	0.7	131	17.0	2200	7.4	<0.05
S1	6.50	4.0	28.5	64.0	45.0	4.2	3000	2.2	<0.01	<0.001	<0.05	0.01	3.3	<0.001	<0.1	<0.01	0.5	27	21.0	3000	3.7	<0.05
F1	6.60	4.0	37.7	21.0	8.0	4.2	4700	1.4	<0.01	<0.001	<0.05	0.01	1.5	<0.001	<0.1	<0.01	0.3	56	8.0	1200	3.7	<0.05
F2	6.50	1.9	194.2	125.0	53.0	19.8	30000	5.9	<0.01	<0.001	<0.05	0.01	3.8	<0.001	1.00	<0.01	0.7	115	179.0	30000	9.2	<0.05
Second Sampling																						
M1	7.3	4.4	44.9	98.0	64.0	1.6	12000	0.7	0.01	<0.001	<0.05	0.02	2.5	0.0007	0.1	<0.01	0.7	196.0	32.0	2200	1.8	0.03
M2	6.7	4.0	34.20	77.0	75.0	1.0	6000	0.7	<0.01	<0.001	<0.05	0.01	1.9	0.0002	0.2	<0.01	0.6	73.0	18.0	1700	3.7	<0.015
M3	7.4	4.2	39.70	67.0	70.0	0.6	4300	1.4	0.01	<0.001	<0.05	0.01	3.9	0.0004	0.2	<0.01	0.7	82.0	23.0	2300	1.8	<0.015
M4	7.3	4.0	48.60	71.0	40.0	3.6	2300	1.4	0.01	<0.001	<0.05	0.01	2.6	0.011	0.2	<0.01	0.7	64.0	19.0	900	1.8	<0.015
M5	8.0	3.4	24.8 ms	30.0	56.0	3.4	4300	1.4	<0.01	0.02	<0.05	0.07	0.7	0.0006	0.1	<0.01	0.7	179.8	269.0	150	1.8	0.02
C1	6.6	5.0	29.60	72.0	41.0	1.8	19000	0.7	<0.01	<0.001	<0.05	0.01	1.0	0.0001	0.2	<0.01	0.6	111.0	14.0	8600	1.8	0.02
K1	7.4	4.6	73.20	228.0	268.0	2.0	32000	2.9	0.01	<0.001	<0.05	0.01	19.3	0.0010	0.2	<0.01	0.7	136.0	32.0	5300	3.7	<0.015
S1	6.5	5.0	21.90	235.0	193.0	0.8	3500	0.7	<0.01	<0.001	<0.05	0.01	12.3	0.0012	0.2	<0.01	0.6	135.0	28.0	1400	1.8	0.03
F1	6.4	4.4	37.00	48.0	29.0	1.2	4700	0.7	0.02	<0.001	<0.05	<0.01	1.9	0.0002	0.1	<0.01	0.4	35.0	5.0	150	1.8	<0.015
F2	4.6	1.4	80.70	80.0	54.0	7.8	140000	2.2	0.01	<0.001	<0.05	0.01	3.8	0.0001	0.2	<0.01	0.7	54.0	27.0	28000	3.7	0.03

TABEL IV.1.2.5 RESULTS OF WATER QUALITY TESTS BY JICA TEAM (SECOND SURVEY)
(BASED ON THE DOE CLASSIFICATION)

Locs.	pH	DO mg/l	Elect. Cond umhos/cm	Turb NTU	SS mg/l	BOD mg/l	T. Coli. no./100ml	NH3-N mg/l	As mg/l	Cd mg/l	Cr(VI) mg/l	Pb mg/l	Fe mg/l	T-Hg mg/l	P mg/l	Cu mg/l	F mg/l	TDS mg/l	COD mg/l	F. Coli. no./100ml	T-N mg/l	Se mg/l
First Sampling																						
M1	II	III	I	II	I	II	III	IV	II	II	II	II	III	II	II	II	II	I	II	III	-	-
M2	II	III	I	II	II	II	III	IV	II	II	II	II	III<	II	II	II	II	I	III	III	-	-
M3	II	III	I	II<	II	II	III	II	II	II	II	II	III<	II	II	II	II	I	II	III	-	-
M4	II	III	I	II<	II	II	III	IV	II	II	II	II	III<	II	II	II	II	I	II	III	-	-
M5	II	III	-	II<	III	II	III	III	II	II	II	II	III<	II	II	II	II	-	-	III	-	-
C1	II	III	I	II	I	I	III	III	II	II	II	II	III<	II	II	II	II	I	I	III<	-	-
K1	II	III	I	II	I	II	III	III	II	II	II	II	III<	II	II	II	II	I	II	III<	-	-
S1	II	III	I	II<	II	III	III	IV	II	II	II	II	III<	II	II	II	II	I	II	III<	-	-
F1	II	III	I	II	I	III	III	IV	II	II	II	II	III<	II	II	II	II	I	I	III	-	-
F2	II	IV	I	II<	III	V	III	IV	II	II	II	II	II<	II	II	II	II	II	V	III<	-	-
Second Sampling																						
M1	II	III	II	II<	III	II	III	III	II	II	II	II	III<	II	II	II	II	I	III	III<	-	III<
M2	II	III	II	II<	III	II	III	III	II	II	II	II	III<	II	II	II	II	I	II	III	-	II
M3	II	III	II	II<	III	I	III	IV	II	II	II	II	III<	II	II	II	II	I	II	III<	-	II
M4	II	III	II	II<	II	III	III	IV	II	II	II	II	III<	-	II	II	II	I	II	III	-	II
M5	II	III	-	II	III	III	III	IV	II	II	II	III	II	II	II	II	II	-	-	III	-	III<
C1	II	II	II	II<	II	II	III	III	II	II	II	II	III<	II	II	II	II	I	II	III<	-	III<
K1	II	III	II	II<	IV	II	III	V	II	II	II	II	III<	II	II	II	II	I	III	III<	-	II
S1	II	II	II	II<	IV	I	III	III	II	II	II	II	III<	II	II	II	II	I	III	III	-	III<
F1	II	III	II	II	II	II	III	III	II	II	II	II	III<	II	II	II	II	I	I	III	-	II
F2	V	IV	II	II<	III	IV	V	IV	II	II	II	II	III<	II	II	II	II	II	III	III<	-	III<

Note: II< or III< mean that the further classification by DOE standards is impossible.
- means that no classification is available or not appropriate to make classification.

**TABLE IV.1.2.6 RESULTS OF WATER QUALITY TESTS
BY JICA STUDY TEAM (SECOND SURVEY)
(ADDITIONAL PARAMETERS)**

Parameter	Unit	Test Result	DOE Classification
Nitrate (NO ₃ as N)	mg/l	<0.1	< II
Nitrites (NO ₂ as N)	mg/l	<0.1	< II
T. Hardness	mg/l	13.9	< II
Chloride (Cl)	mg/l	5.7	< II
Copper (Cu)	mg/l	<0.01	II
Zinc (Zn)	mg/l	0.02	II
Mangan (Mn)	mg/l	0.08	II

Note : At Location No. M4

Salinity	0/00	9.6	-
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Note : At Location No. M5

TABLE IV.1.3.1 LIST OF RUBBER FACTORIES AND OIL-PALM FACTORIES

Factory Name	Factory No.	Location
KILANG GETAH (RUBBER FACTORY)		
Mardec Jenuang	255	Kampung Pasir, Jeniang
Felda Teloi Timur	401	Kuala Ketil
Tiong Huat Rubber	312	Sungai Petani
Kuala Muda Estate	309	Jalan Kuala Ketil, Sungai Petani
Kuala Ketil Rubber	29	Km4 1/2 , Jalan Merbau Pulas, Kuala Ketil
Batu Pekaka Estate	314	Bt.21, Jalan Kulim
Sg. Tawar Estate	45	Bt.16, Kuala Ketil
Mardec Baling	256	Bt.33, Kampung Cenerai, Kuala Pegang
Badenoch Estate	16	P.O.Box 304, Kuala Ketil
Pelam Estate	176	Malau, Baling
Padang Meiha Estate	275	Padang Serai, Kulim
ladang Pinang Tunggal	161	Bt.40, Jalan Kuala Ketil, Sungai Petani
Lubuk Segintah Estate	338	Lubuk Segintah Estate , Kuala Ketil
KILANG KELAPA SAWIT (OIL- PALM FACTORY)		
Setiakawan Palm Oil Mill	121	Lot 713, Mukim Padang Cina, Kulim
Taclico Co.	113	Lot 20,21 dan 29 Mukim Padang Meiha, Kulim

TABLE IV.1.3.2 TYPE AND QUALITY OF HERBICIDES USED IN MADA

(Unit : Metric Ton)

Type of Herbicides	Year												
	1980	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993		
2, 4-D IBE	100	180	250	280	250	250	200	160	150	150	150		
2, 4-D Sodium Salt	50	20	N.A.*	N.A.	N.A.	30	10	8	5	4	4		
2, 4-D Amine	5	20	150	150	140	130	60	50	40	30	30		
MCPA	1	N.A.	1	1	1	-	-	-	-	-	-		
Molinate	-	10	110	195	265	380	600	500	550	250	240		
Molinate + Propanil	-	-	-	-	-	8	10	10	10	5	6		
Oxadiazon	-	-	10	10	6	6	6	2	2	-	-		
Propanil	-	-	-	2	14	20	22	26	25	20	25		
Thiobencarb	-	-	-	-	-	50	50	10	-	-	-		
Thiobencarb + Propanil	-	-	-	-	-	-	-	-	-	6	8		
EPTC	-	-	-	-	-	-	20	19	20	50	58		
Pretilachlor	-	-	-	-	-	-	5	6	5	5	7		
Paraquat	10	80	300	320	320	320	330	300	270	250	225		
Glyphosate	-	-	-	-	-	-	-	-	-	20	25		
Fenoxaprop	-	-	-	-	-	-	-	-	7	5	8		
Sethoxydim	-	-	-	-	-	-	-	-	-	8	3		
Quinchlorac	-	-	-	-	-	-	-	-	-	2	2		
Others	N.A.	N.A.	1	2	3	6	5	6	8	9	9		
TOTAL	166	310	822	960	999	1200	1318	1097	1092	814	800		

N.A. : not available

Date : April 30, 1994

Source: Division of Agriculture, MADA

Ampang Jajar, 05990 Alor Setar,

Kedah, Malaysia

TABLE IV.1.3.3 TYPE AND QUANTITY OF INSECTICIDES
USED IN MADA

(Unit : Metric Ton)

Jenis Racun Serangga	Tahun			
	1980	1986	1990	1992
Gamma BHC (granulated formulation)	200	80	-	-
Endosulfan (granulated formulation)	280	60	15	5
Endosulfan (emulsifiable concentrate)	10	20	40	40
MTMC + phenthoate	120	25	20	12
Carbofuran	100	200	350	150
Propoxur	10	2	-	-
BPMC	10	20	20	3
MIPC	-	5	3	1
Monocrotophos	N.A.	2	20	-
Metamidophos	N.A.	1	10	-
IGR	-	-	-	2.5
Others	3	5	8	-
Total	733	420	486	213.5

N.A.: not available

TABLE IV.1.3.4

TYPE AND QUANTITY OF RODENTICIDES USED IN MADA

(Kuantiti Pengagihan Input Racun Tikus di Kawasan Muda

Dari Tahun 1981 Hingga 1/1992)

Tahun Input Racun	Year											
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1/1992
zinc phosphide (kg)	2129	575	2350	2345	2255	1065						
coumatetralyl (kg) (Racumin)	355	60	116	300	1275	125	75	50				
brodifacoum (kg) (Matikus)	745		72	2732	1862	2800	396	2484	2680	2330	448	120
warfarin (kg) (Yasomin)									250	350	2915	825
warfarin (kg) (Tikumin debu)					250	25	850	476		150	150	
chlorophacinone (liter) (Drat E.c)					55	468	319	164	173	16		
chlorophacinone (kg) (Drat Bait)										300	2498	98
bromadiolone (kg) (Ebor 401)								1517	3478	638	344	740
bromadiolone (kg) (Bromawax)											392	241

TABLE IV.1.3.5 GENERAL EVALUATION OF POTENTIAL POLLUTION SOURCES

No.	Pollution Source	General evaluation	
		Present	Future
A-a	Towns and major villages	B	A
A-b	Houses along river	B	B
B-a	Factory (Rubber & Oilpalm)	B	B
B-b	Industrial Estate	D	B
C	Commercial Industry	C	B
D	Live stock farm	B	B
E	Irrigation /Agriculture Land	B	B
F-a	Forest	C	C
F-b	Atmospheric fallout	C	C
F-c	Road,park etc.	C	C
F-d	Recreational site	D	C
F-e	Sand mining site	C	C
F-f	Water intake site	D	D
F-g	Ground water	D	C
F-h	Construction site	D	D

A : High potential

B : Comparatively High Potential

C : Comparatively Low Potential

D : Low Potential

Note : The evaluation is made from a synthetic viewpoint.

TABLE IV.1.4.1 ESTIMATE OF UNIT LOAD RELEASED FROM EACH POLLUTION SOURCE (1993)

	BOD	SS	TN	TP
1. Residential waste Water (g/person/day)				
Produced load				
urine & feces	16	20	7.3	0.7
mixed waste water	23	12	1.4	3.3
sub-total	39	32	8.7	4
Discharged ratio	0.7	0.5	0.75	0.75
Discharged Load	27.30	16.00	6.53	3.00
<hr/>				
2. Industrial Waste water (mg/l)				
Discharged load				
Rubber factory	70	120	140	15
Oil-palm factory	70	280	140	15
Small scale factory	70	140	20	8
Large scale factory	210	140	35	15
<hr/>				
3. Commercial Industry Waste Water (g/person/day)				
Discharged load				
Big town	24	15	6	0.9
Middle-small town	12	7.5	3	0.45
<hr/>				
4. Livestock Farming (g/head/day)				
Discharged load				
Pig	140	100	40	2
Cow	135	38	50	1.2
Chicken	7	5	2	0.1
Other cattle	20	10	4	0.2
<hr/>				
5. Farm Land Runoff (kg/ha/year)				
Discharged load				
Paddy	0	0	11	4
farm land(dry)	0	0	0.7	0.3
<hr/>				
6. Other pollutant load (Forest runoff,atmospheric fallout,etc.) (kg/sq.km/day)				
Discharged load	1	120	0.08	0.05
<hr/>				
Note: The load values are estimated from synthetic study based on some reference data.				

TABLE IV.1.4.2 ESTIMATE OF UNIT LOAD RELEASED FROM EACH POLLUTION SOURCE (2000)

	BOD	SS	TN	TP
1. Residential waste Water (g/person/day)				
Produced load				
urine & feces	16	20	7.3	0.7
mixed waste water	27	14	1.45	3.5
sub-total	43	34	8.75	4.2
Discharged ratio	0.65	0.45	0.75	0.75
Discharged Load Factor	27.95	15.30	6.56	3.15
<hr/>				
2. Industrial Waste water (mg/l)				
Discharged load				
Rubber factory	60	100	120	13
Oil-palm factory	60	230	120	13
Small scale factory	60	120	15	7
Large scale factory	180	120	30	13
<hr/>				
3. Commercial Industry Waste Water (g/person/day)				
Discharged load				
Big town	30	22	9	1.2
Middle-small town	15	11	4.5	0.6
<hr/>				
4. Livestock Farming (g/head/day)				
Discharged load				
Pig	125	90	36	1.8
Cow	120	36	45	1.1
Chicken	6	4.5	2	0.1
Other cattle	18	9	4	0.2
<hr/>				
5. Farm Land Runoff (kg/ha/year)				
Discharged load				
Paddy	0	0	10	3.5
farm land(dry)	0	0	0.6	0.25
<hr/>				
6. Other pollutant load (Forest runoff, atmospheric fallout, etc.) (kg/sq.km/day)				
Discharged load	1	120	0.08	0.05
<hr/>				
Note: The load values are estimated from synthetic study based on some reference data.				

TABLE IV.1.4.3 ESTIMATE OF UNIT LOAD RELEASED FROM EACH POLLUTION SOURCE (2010)

	BOD	SS	TN	TP
1. Residential waste Water (g/person/day)				
Produced load				
urine & feces	16	20	7.3	0.7
mixed waste water	32	17	1.8	3.7
sub-total	48	37	9.1	4.4
Discharged ratio	0.6	0.4	0.7	0.7
Discharged Load	28.80	14.80	6.37	3.08
2. Industrial Waste water (mg/l)				
Discharged load				
Rubber factory	50	90	110	12
Oil-palm factory	50	210	110	12
Small scale factory	50	110	13	6
Large scale factory	160	110	27	12
3. Commercial Industry Waste Water (g/person/day)				
Discharged load				
Big town	45	30	15	1.5
Middle-small town	22.5	15	7.5	0.75
4. Livestock Farming (g/head/day)				
Discharged load				
Pig	115	80	33	1.6
Cow	110	32	40	1
Chicken	5	4	1.8	0.08
Other cattle	16	8	3.5	0.18
5. Farm Land Runoff (kg/ha/year)				
Discharged load				
Paddy	0	0	9	3.2
farm land(dry)	0	0	0.5	0.2
7. Other pollutant load (Forest runoff,atmospheric fallout,etc.) (kg/sq.km/day)				
Discharged load	1	120	0.08	0.05
Note: The load values are estimated from synthetic study based on some reference data.				

TABLE IV.1.4.4 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (1993) (1/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
1. Residential waste Water				
Discharged Load Unit Value	28	16	6.5	3
Discharged Load (kg/day)				
Point M(P)				
Population	277200	277200	277200	277200
Load	7762	4435	1802	832
Point K				
Population	88216	88216	88216	88216
Load	2470	1411	573	265
2. Industrial Waste water				
Discharged Load U. V. (mg/l) = (0.001kg/cu.m)				
Rubber factory	70	120	140	15
Oil-palm factory	70	280	140	15
Small scale estate	70	140	20	8
Large scale estate	210	140	35	15
Discharge Load				
Point M(P)				
Rubber Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	12	12	12	12
Oil-palm load (kg/day)	2100	3600	4200	450
Oil-palm Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	2	2	2	2
load (kg/day)	350	1400	700	75
S. estate Area of estate (ha)	47.33	47.33	47.33	47.33
U. w. use (cu.m/ha/d)	25	25	25	25
load (kg/day)	82.83	165.66	23.67	9.47
L. estate Area of estate (ha)	0	0	0	0
U. w. use (cu.m/ha/d)	40	40	40	40
load (kg/day)	0	0	0	0
Total load (M(P))	2532.83	5165.66	4923.67	534.47
Point K				
Rubber Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	2	2	2	2
Oil-palm load (kg/day)	350	600	700	75
Oil-palm Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	0	0	0	0
load (kg/day)	0	0	0	0
S. estate Area of estate (ha)	1.29	1.29	1.29	1.29
U. w. use (cu.m/ha/d)	25	25	25	25
load (kg/day)	2.2575	4.515	0.645	0.258
Large fa: Area of estate (ha)	0	0	0	0
U. w. use (cu.m/ha/d)	40	40	40	40
load (kg/day)	0	0	0	0
Total load (K)	352.26	604.52	700.65	75.26

TABLE IV.1.4.4 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (1993) (2/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
3. Commercial Industry Waste Water (g/person/day)				
Discharge Load Factor	24.00	15.00	6.00	0.90
Discharge load factor (g/person/day) Middle-small town	12.00	7.50	3.00	0.45
Discharge load				
Point M(P) (kg/day)				
Big tow Population	0	0	0	0
Load(g/day)	0	0	0	0
Small t. Population	55440	55440	55440	55440
Load (g/day)	665	416	166	25
Total	665	416	166	25
Point K				
Big tow Population	0	0	0	0
Load(g/day)	0	0	0	0
Small t. Population	17643	17643	17643	17643
Load (g/day)	212	132	53	8
Total	212	132	53	8
<hr/>				
4. Livestock Farming				
Discharge load factor (g/head/day)				
Pig	140	100	40	2
Cow	135	38	50	1.2
Chicken	7	5	2	0.1
Other small cattle	20	10	4	0.2
Discharge load				
Point M(P)				
Pig Number	1039	1039	1039	1039
Load (kg/day)	145	104	42	2
Cow Number	35569	35569	35569	35569
Load (kg/day)	4802	1352	1778	43
Chicken Number	1163	1163	1163	1163
Load (kg/day)	8.14	5.82	2.33	0.12
Others Number	15080	15080	15080	15080
Load (kg/day)	301.6	150.8	60.32	3.016
Total (M(P))	5257.016	1612.137	1882.656	47.8931
Point K				
Pig Number	72	72	72	72
Load (kg/day)	10.08	7.20	2.88	0.14
Cow Number	15366	15366	15366	15366
Load (kg/day)	2074.41	583.91	768.30	18.44
Chicken Number	93	93	93	93
Load (kg/day)	0.65	0.47	0.19	0.01
Others Number	6516	6516	6516	6516
Load (kg/day)	130.32	65.16	26.06	1.30
Total (K)	2215.46	656.73	797.43	19.90

TABLE IV.1.4.4 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (1993) (3/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
5. Farm Land Runoff				
Discharged load U.V.	(kg/ha/year)			
Paddy	0	0	11	4
Farm land(dry)	0	0	0.7	0.3
Discharge load				
Point M(P)				
Paddy				
Area(ha)	4200	4200	4200	4200
Load (Kg/day)	0.00	0.00	126.58	46.03
Farm land				
Area(ha)	10000	10000	10000	10000
Load (Kg/day)	0.00	0.00	19.18	8.22
Total M(P)	0.00	0.00	145.75	54.25
Point K				
Paddy				
Area(Sq. ha)	700	700	700	700
Load (Kg/day)	0.00	0.00	1.34	0.58
Paddy				
Area(Sq. ha)	2000	2000	2000	2000
Load (Kg/day)	0.00	0.00	3.84	1.64
Total K	0.00	0.00	5.18	2.22
6. Other Pollutant load				
Discharged load U.V.	(kg/Sq. km/day)			
	1	120	0.08	0.05
Discharge load				
Point M(P)				
Area(Sq.km)	3188	3188	3188	3188
Load (Kg/day)	3188	382560	255.04	159.4
Point K				
Area(Sq. km)	868	868	868	868
Load (Kg/day)	868	104160	69.44	43.4
Summary of Discharge Load				
(kg/day)				
Point M(P)				
1. Residential waste Water	7762	4435	1802	832
2. Industrial Waste water	2533	5166	4924	534
3. Commercial Industry	665	416	166	25
4. Livestock	5257	1612	1883	48
5. Farm Land	0	0	146	54
6. Others	3188	382560	255	159
Total	19405	394189	9175	1653
Point K				
1. Residential waste Water	2470	1411	573	265
2. Industrial Waste water	352	605	701	75
3. Commercial Industry	212	132	53	8
4. Livestock	2215	657	797	20
5. Farm Land	0	0	1	1
6. Others	868	104160	69	43
Total	6117	106965	2195	412

TABLE IV.1.4.5 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (2000) (1/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
1. Residential waste Water				
Discharged Load Unit Value	28.00	16.00	6.50	3.15
Discharged Load (kg/day)				
Point M(P)				
Population	308836	308836	308836	308836
Load	8647	4941	2007	973
Point K				
Population	95241	95241	95241	95241
Load	2667	1524	619	300
2. Industrial Waste water				
Discharged Load U. V.	(mg/l) = (0.001kg/cu.m)			
Rubber factory	60	100	120	13
Oil-palm factory	60	230	120	13
Small scale estate	60	120	15	7
Large scale estate	180	120	30	13
Discharge Load				
Point M(P)				
Rubber Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	12	12	12	12
Oil-palm load (kg/day)	1800	3000	3600	390
Oil-palm Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	2	2	2	2
load (kg/day)	300	1150	600	65
S. estate Area of estate (ha)	69.12	69.12	69.12	69.12
U. w. use (cu.m/ha/d)	25	25	25	25
load (kg/day)	103.68	207.36	25.92	12.10
L. estate Area of estate (ha)	196.47	196.47	196.47	196.47
U. w. use (cu.m/ha/d)	40	40	40	40
load (kg/day)	1414.584	943.056	235.764	102.1644
Total load (M(P))	3618.26	5300.42	4461.68	569.26
Point K				
Rubber Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	2	2	2	2
Oil-palm load (kg/day)	300	500	600	65
Oil-palm Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	0	0	0	0
load (kg/day)	0	0	0	0
S. estate Area of estate (ha)	12.03	12.03	12.03	12.03
U. w. use (cu.m/ha/d)	25	25	25	25
load (kg/day)	18.045	36.09	4.51125	2.10525
Large fac. Area of estate (ha)	0	0	0	0
U. w. use (cu.m/ha/d)	40	40	40	40
load (kg/day)	0	0	0	0
Total load (K)	318.05	536.09	604.51	67.11

TABLE IV.1.4.5 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (2000) (2/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
3. Commercial Industry Waste Water (g/person/day)				
Discharge Load Factor	30.00	22.00	9.00	1.20
Discharge load factor (g/person/day) Middle-small town	15.00	11.00	4.50	0.60
Discharge load				
Point M(P) (kg/day)				
Big town Population	0	0	0	0
Load(g/day)	0	0	0	0
Small t. Population	68026	68026	68026	68026
Load (g/day)	1020	748	306	41
Total	1020	748	306	41
Point K				
Big town Population	0	0	0	0
Load(g/day)	0	0	0	0
Small t. Population	18720	18720	18720	18720
Load (g/day)	281	206	84	11
Total	281	206	84	11
4. Livestock Farming				
Discharge load factor (g/head/day)				
Pig	125	90	36	1.8
Cow	120	36	45	1.1
Chicken	6	4.5	2	0.1
Other small cattle	18	9	4	0.2
Discharge load				
Point M(P)				
Pig Number	1039	1039	1039	1039
Load (kg/day)	130	94	37	2
Cow Number	35569	35569	35569	35569
Load (kg/day)	4268	1280	1601	39
Chicken Number	1163	1163	1163	1163
Load (kg/day)	6.98	5.23	2.33	0.12
Others Number	15080	15080	15080	15080
Load (kg/day)	271.44	135.72	60.32	3.016
Total (M(P))	4676.573	1514.9475	1700.655	44.1284
Point K				
Pig Number	72	72	72	72
Load (kg/day)	9.00	6.48	2.59	0.13
Cow Number	15366	15366	15366	15366
Load (kg/day)	1843.92	553.18	691.47	16.90
Chicken Number	93	93	93	93
Load (kg/day)	0.56	0.42	0.19	0.01
Others Number	6516	6516	6516	6516
Load (kg/day)	117.29	58.64	26.06	1.30
Total (K)	1970.77	618.72	720.31	18.34

TABLE IV.1.4.5 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (2000) (3/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
5. Farm Land Runoff				
Discharged load U.V.	(kg/ha/year)			
Paddy	0	0	10	3.5
Farm land(dry)	0	0	0.6	0.25
Discharge load				
Point M(P)				
Paddy				
Area(ha)	3400	3400	3400	3400
Load (Kg/day)	0.00	0.00	93.15	32.60
Farm land				
Area(ha)	8000	8000	8000	8000
Load (Kg/day)	0.00	0.00	13.15	5.48
Total M(P)	0.00	0.00	106.30	38.08
Point K				
Paddy				
Area(Sq. ha)	580	580	580	580
Load (Kg/day)	0.00	0.00	0.95	0.40
Paddy				
Area(Sq. ha)	1600	1600	1600	1600
Load (Kg/day)	0.00	0.00	2.63	1.10
Total K	0.00	0.00	3.58	1.49
6. Other Pollutant load				
Discharged load U.V.	(kg/Sq. km/day)			
	1	120	0.08	0.05
Discharge load				
Point M(P)				
Area(Sq.km)	3188	3188	3188	3188
Load (Kg/day)	3188	382560	255.04	159.4
Point K				
Area(Sq. km)	868	868	868	868
Load (Kg/day)	868	104160	69.44	43.4
Summary of Discharge Load (kg/day)				
Point M(P)				
1. Residential waste Water	8647	4941	2007	973
2. Industrial Waste water	3618	5300	4462	569
3. Commercial Industry	1020	748	306	41
4. Livestock	4677	1515	1701	44
5. Farm Land	0	0	106	38
6. Others	3188	382560	255	159
Total	21151	395065	8837	1825
Point K				
1. Residential waste Water	2667	1524	619	300
2. Industrial Waste water	318	536	605	67
3. Commercial Industry	281	206	84	11
4. Livestock	1971	619	720	18
5. Farm Land	0	0	1	0
6. Others	868	104160	69	43
Total	6104	107045	2099	440

TABLE IV.1.4.6 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (2010) (1/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
1. Residential waste Water				
Discharged Load Unit Value	29.00	15.00	6.30	3.15
Discharged Load (kg/day)				
Point M(P)				
Population	368843	368843	368843	368843
Load	10696	5533	2324	1162
Point K				
Population	107450	107450	107450	107450
Load	3116	1612	677	338
2. Industrial Waste water				
Discharged Load U. V.	(mg/l) = (0.001kg/cu.m)			
Rubber factory	50	90	110	12
Oil-palm factory	50	210	110	12
Small scale estate	50	110	13	6
Large scale estate	160	110	27	12
Discharge Load				
Point M(P)				
Rubber Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	12	12	12	12
Oil-palm load (kg/day)	1500	2700	3300	360
Oil-palm Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	2	2	2	2
load (kg/day)	250	1050	550	60
S. estate Area of estate (ha)	196.24	196.24	196.24	196.24
U. w. use (cu.m/ha/d)	25	25	25	25
load (kg/day)	245.30	539.66	63.78	29.44
L. estate Area of estate (ha)	557.86	557.86	557.86	557.86
U. w. use (cu.m/ha/d)	40	40	40	40
load (kg/day)	3570.304	2454.584	602.4888	267.7728
Total load (M(P))	5565.60	6744.24	4516.27	717.21
Point K				
Rubber Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	2	2	2	2
Oil-palm load (kg/day)	250	450	550	60
Oil-palm Q of factory (cu.m/d)	2500	2500	2500	2500
No. of factory	0	0	0	0
load (kg/day)	0	0	0	0
S. estate Area of estate (ha)	34.15	34.15	34.15	34.15
U. w. use (cu.m/ha/d)	25	25	25	25
load (kg/day)	42.69	93.91	11.10	5.12
Large fac. Area of estate (ha)	0	0	0	0
U. w. use (cu.m/ha/d)	40	40	40	40
load (kg/day)	0	0	0	0
Total load (K)	292.69	543.91	561.10	65.12

TABLE IV.1.4.6 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (2010) (2/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
3. Commercial Industry Waste Water				
	(g/person/day)			
Discharge Load Factor	45.00	30.00	15.00	1.50
Discharge load factor (g/person/day)	22.50	15.00	7.50	0.75
Middle-small town				
Discharge load				
Point M(P)				
	(kg/day)			
Big town Population	18358	18358	18358	18358
Load(g/day)	826	551	275	28
Small t. Population	68848	68848	68848	68848
Load (g/day)	1549	1033	516	52
Total	2375	1583	792	79
Point K				
Big town Population	0	0	0	0
Load(g/day)	0	0	0	0
Small t. Population	21220	21220	21220	21220
Load (g/day)	477	318	159	16
Total	477	318	159	16
<hr/>				
4. Livestock Farming				
Discharge load factor				
	(g/head/day)			
Pig	115	80	33	1.6
Cow	110	32	40	1
Chicken	5	4	1.8	0.08
Other small cattle	16	8	3.5	0.18
Discharge load				
Point M(P)				
Pig Number	1039	1039	1039	1039
Load (kg/day)	119	83	34	2
Cow Number	35569	35569	35569	35569
Load (kg/day)	3913	1138	1423	36
Chicken Number	1163	1163	1163	1163
Load (kg/day)	5.82	4.65	2.09	0.09
Others Number	15080	15080	15080	15080
Load (kg/day)	241.28	120.64	52.78	2.7144
Total (M(P))	4279.17	1346.62	1511.9204	40.03884
Point K				
Pig Number	72	72	72	72
Load (kg/day)	8.28	5.76	2.38	0.12
Cow Number	15366	15366	15366	15366
Load (kg/day)	1690.26	491.71	614.64	15.37
Chicken Number	93	93	93	93
Load (kg/day)	0.47	0.37	0.17	0.01
Others Number	6516	6516	6516	6516
Load (kg/day)	104.26	52.13	22.81	1.17
Total (K)	1803.26	549.97	639.99	16.66

TABLE IV.1.4.6 ESTIMATE OF TOTAL LOAD RELEASED FROM EACH POLLUTANT SOURCE (2010) (3/3)

Pollutant Source and Related Description	BOD	SS	TN	TP
5. Farm Land Runoff				
Discharged load U.V.	(kg/ha/year)			
Paddy	0	0	9	3.2
Farm land(dry)	0	0	0.5	0.2
Discharge load				
Point M(P)				
Paddy				
Area(ha)	2325	2325	2325	2325
Load (Kg/day)	0.00	0.00	57.33	20.38
Farm land				
Area(ha)	6000	6000	6000	6000
Load (Kg/day)	0.00	0.00	8.22	3.29
Total M(P)	0.00	0.00	65.55	23.67
Point K				
Paddy				
Area(Sq. ha)	400	400	400	400
Load (Kg/day)	0.00	0.00	0.55	0.22
Paddy				
Area(Sq. ha)	1300	1300	1300	1300
Load (Kg/day)	0.00	0.00	1.78	0.71
Total K	0.00	0.00	2.33	0.93
6. Other Pollutant load				
Discharged load U.V.	(kg/Sq.km/day)			
	1	120	0.08	0.05
Discharge load				
Point M(P)				
Area(Sq.km)	3188	3188	3188	3188
Load (Kg/day)	3188	382560	255.04	159.4
Point K				
Area(Sq. km)	868	868	868	868
Load (Kg/day)	868	104160	69.44	43.4
Summary of Discharge Load				
(kg/day)				
Point M(P)				
1. Residential waste Water	10696	5533	2324	1162
2. Industrial Waste water	5566	6744	4516	717
3. Commercial Industry	2375	1583	792	79
4. Livestock	4279	1347	1512	40
5. Farm Land	0	0	66	24
6. Others	3188	382560	255	159
Total	26104	397767	9464	2181
Point K				
1. Residential waste Water	3116	1612	677	338
2. Industrial Waste water	293	544	561	65
3. Commercial Industry	477	318	159	16
4. Livestock	1803	550	640	17
5. Farm Land	0	0	1	0
6. Others	868	104160	69	43
Total	6557	107184	2107	480

TABLE IV.1.4.7 ESTIMATE OF POPULATION IN MUDA RIVER BASIN (1993)

Mukim	Population	Point M(P)		Point K	
		Ratio	Population	Ratio	Population
Padang Terap					
Tekai	19061	0.3	5718	0	0
Sik					
Sok	8508	1	8508	0	0
Jeneri	11669	1	11669	0	0
Silk	37112	1	37112	0.1	3711
Pendang					
Padang Kerbau	9852	0.1	985	0	0
Padang Peling	4173	0.8	3338	0	0
Baling					
Siong	11966	1	11966	0.5	5983
Bongor	5741	1	5741	1	5741
Baling	8169	1	8169	1	8169
Pulai	20629	1	20629	1	20629
Terui Kanan	15137	1	15137	0.3	4541
Kupang	23845	1	23845	1	23845
Tawar	18685	1	18685	0.7	13080
Bakai	12587	1	12587	0.2	2517
Kuala Muda					
Gurun	32765	0.2	6553	0	0
Sungai Petani	106699	0.2	21340	0	0
Terui Kiri	8966	1	8966	0	0
Sidam Kiri	6843	1	6843	0	0
Pinang Tunggal	3341	1	3341	0	0
Sungai Pasir	50870	0	0	0	0
Pekula	9165	0	0	0	0
Kuala	2647	0	0	0	0
Haji Kudong	1141	0	0	0	0
Kota	3043	0	0	0	0
Rantau Panjang	2705	0	0	0	0
Kulim					
Sidam kanan	9999	1	9999	0	0
Naga Lilit	7033	0.2	1407	0	0
Padang Meha	7549	0.9	6794	0	0
Bagan Sena	5398	1	5398	0	0
Karangan	7563	1	7563	0	0
Padang China	7782	0.2	1556	0	0
Terap	4376	0.1	438	0	0
Sedim	3231	0.4	1292	0	0
Mahang	3192	0.3	958	0	0
Seberang Perai Utara					
Mukim 2	6113	0	0	0	0
Mukim 3	9100	0.3	2730	0	0
Mukim 12	19832	0.4	7933	0	0
Total			277200		88216

TABLE IV.1.4.8 ESTIMATE OF POPULATION IN MUDA RIVER BASIN (2006)

Mukim	Population	Point M(P)		Point K	
		Ratio	Population	Ratio	Population
Padang Terap					
Tekai	21482	0.3	6445	0	0
Sik					
Sok	10385	1	10385	0	0
Jeneri	11882	1	11882	0	0
Silk	45250	1	45250	0.1	4525
Pendang					
Padang Kerbau	9924	0.1	992	0	0
Padang Peling	5666	0.8	4533	0	0
Baling					
Siong	12400	1	12400	0.5	6200
Bongor	6313	1	6313	1	6313
Baling	8179	1	8179	1	8179
Pulai	23042	1	23042	1	23042
Terui Kanan	16937	1	16937	0.3	5081
Kupang	25275	1	25275	1	25275
Tawar	20121	1	20121	0.7	14085
Bakai	12708	1	12708	0.2	2542
Kuala Muda					
Gurun	35786	0.2	7157	0	0
Sungai Petani	135703	0.2	27141	0	0
Terui Kiri	8731	1	8731	0	0
Sidam Kiri	6607	1	6607	0	0
Pinang Tunggal	3086	1	3086	0	0
Sungai Pasir	79546	0	0	0	0
Pekula	11245	0	0	0	0
Kuala	2803	0	0	0	0
Haji Kudong	1116	0	0	0	0
Kota	3292	0	0	0	0
Rantau Panjang	2776	0	0	0	0
Kulim					
Sidam kanan	11513	1	11513	0	0
Naga Lilit	8239	0.2	1648	0	0
Padang Meha	7422	0.9	6680	0	0
Bagan Sena	5560	1	5560	0	0
Karangan	10101	1	10101	0	0
Padang China	7507	0.2	1501	0	0
Terap	4595	0.1	460	0	0
Sedim	2895	0.4	1158	0	0
Mahang	3118	0.3	935	0	0
Seberang Perai Utara					
Mukim 2	6304	0	0	0	0
Mukim 3	9687	0.3	2906	0	0
Mukim 12	22975	0.4	9190	0	0
Total			308836		95241

TABLEIV.1.4.9 ESTIMATE POPULATION IN MUDA RIVER BASIN (2010)

Mukim	Population	Point M(P)		Point K	
		Ratio	Population	Ratio	Population
Padang Terap					
Tekai	25392	0.3	7618	0	0
Sik					
Sok	13818	1	13818	0	0
Jeneri	12117	1	12117	0	0
Silk	61196	1	61196	0.1	6120
Pendang					
Padang Kerbau	10019	0.1	1002	0	0
Padang Peling	8935	0.8	7148	0	0
Baling					
Siong	13052	1	13052	0.5	6526
Bongor	7290	1	7290	1	7290
Baling	8202	1	8202	1	8202
Pulai	27307	1	27307	1	27307
Terui Kanan	19987	1	19987	0.3	5996
Kupang	27598	1	27598	1	27598
Tawar	22612	1	22612	0.7	15828
Bakai	12912	1	12912	0.2	2582
Kuala Muda					
Gurun	40682	0.2	8136	0	0
Sungai Petani	193980	0.2	38796	0	0
Terui Kiri	8358	1	8358	0	0
Sidam Kiri	6256	1	6256	0	0
Pinang Tunggal	2737	1	2737	0	0
Sungai Pasir	151703	0	0	0	0
Pekula	15211	0	0	0	0
Kuala	3036	0	0	0	0
Haji Kudong	1077	0	0	0	0
Kota	3701	0	0	0	0
Rantau Panjang	2882	0	0	0	0
Kulim					
Sidam kanan	14203	1	14203	0	0
Naga Lilit	10533	0.2	2107	0	0
Padang Meha	7232	0.9	6509	0	0
Bagan Sena	5827	1	5827	0	0
Karangan	15678	1	15678	0	0
Padang China	7075	0.2	1415	0	0
Terap	4931	0.1	493	0	0
Sedim	2467	0.4	987	0	0
Mahang	2996	0.3	899	0	0
Seberang Perai Utara					
Mukim 2	6580	0	0	0	0
Mukim 3	10564	0.3	3169	0	0
Mukim 12	28536	0.4	11414	0	0
Total			368843		107450

TABLE IV.1.4.10 ESTIMATE OF LIVESTOCK IN MUDA RIVER BASIN (STATE OF KEDAH)

District	Ratio		Buffalo/Cow		Pig		Chicken		Other cattle				
	Point M(P)	Point K	Total No.	Point M(P)	Point K	Total No.	Point M(P)	Point K	Total No.	Point M(P)	Point K		
Pandang	0.1	0	16569	1657	0	546	55	0	4	0	5071	507	0
Sik	1	0.1	5120	5120	512	91	91	9	0	0	1482	1482	148
P. Terap	0.1	0	16743	1674	0	86	9	0	46	5	4614	461	0
Yan	0	0	4224	0	0	0	0	0	19	0	3545	0	0
B. Baru	0	0	4810	0	0	166	0	0	27	0	1980	0	0
K. Setar	0	0	19501	0	0	190	0	0	240	0	13780	0	0
K. Pasu	0	0	15906	0	0	0	0	0	831	0	8694	0	0
K. Muda	0.3	0	18231	5469	0	1017	305	0	2839	852	8146	2444	0
Kulim	0.3	0	10272	3082	0	1668	500	0	634	190	7419	2226	0
Langkawi	0	0	5840	0	0	0	0	0	0	0	850	0	0
Baling	1	0.8	18567	18567	14854	79	79	63	116	116	7960	7960	6368
Total			135783	35569	15366	3843	1039	72	4756	1163	63541	15080	6516

Note: Data source : Veterinary Department (1993)

The ratios are roughly estimated on the basis of the ratio of the area within the basin in each district.

TABLE IV.1.4.11 CATCHMENT AREA AT CHECK POINTS
FOR WATER POLLUTION LOAD

Sub-basin		Point M (P)	Point K
Name	Km ²		
DB1	164.6	164.6	
DB2	200.5	200.5	
DB3	275.5	275.5	
DB4	269.8	269.8	
DB5	73.6	73.6	

BB1	122.5	122.5	

MB1	236.0	236.0	
MB2	96.7	96.7	
MB3	211.8	211.8	
MB4	89.0	89.0	
MB5	63.8	63.8	
MB6	262.6	262.6	
MB7	60.3	60.3	
MB8	25.8	25.8	
MB9	28.4	28.4	
MB10	162.0	162.0	
MB11	29.0		
MB12	9.0		

CB1	135.2	135.2	
CB2	18.2	18.2	
CB3	57.3	57.3	
CB4	22.0	22.0	
CB5	68.4	68.4	
CB6	33.8	33.8	

KB1	147.6	147.6	147.6
KB2	162.0	162.0	162.0
KB3	79.1	79.1	79.1
KB4	86.7	86.7	86.7
KB5	146.8	146.8	146.8
KB6	81.8	81.8	81.8
KB7	121.0	121.0	121.0
KB8	43.4	43.4	43.4

SB1	264.6	264.6	
SB2	246.9	246.9	

RB1	114.3	114.3	
Total area	4,210.0	4,172.0	868.4
Actual area*	3,226.0	3,188.0	868.4

* Excluding the area of Muda dam catchment

(Total of DB1 ~ DB5 : 984.0 km²)

TABLE IV.1.4.12 ESTIMATE OF WATER POLLUTION LOAD AT CHECK POINTS (1993)

	BOD	SS	TN	TP
Point M(P)				
Discharged load(kg/day)	19405	394189	9175	1653
Runoff ratio of Pollutant load	0.60	0.90	0.80	0.90
Pollutant load(kg/day)	11643	354770	7340	1488
Pollutant load(mg/s)	134757	4106135	84954	17219
Annual mean discharge (cu.m/s)	84	84	84	84
Pollutant load(mg/l)	1.60	48.88	1.01	0.20
Point K				
Discharged load(kg/day)	6117	106965	2195	412
Runoff ratio of Pollutant load	0.70	0.90	0.80	0.90
Pollutant load(kg/day)	4282	96269	1756	371
Pollutant load(mg/s)	49559	1114219	20324	4292
Annual mean discharge (cu.m/s)	30	30	30	30
Pollutant load(mg/l)	1.65	37.14	0.68	0.14

TABLE IV.1.4.13 ESTIMATE OF WATER POLLUTION LOAD AT CHECK POINTS (2000)

	BOD	SS	TN	TP
Point M(P)				
Discharged load(kg/day)	21151	395065	8837	1825
Runoff ratio of Pollutant load	0.60	0.90	0.80	0.90
Pollutant load(kg/day)	12691	355559	7070	1643
Pollutant load(mg/s)	146882	4115260	81824	19010
Annual mean discharge (cu.m/s)	84	84	84	84
Pollutant load(mg/l)	1.75	48.99	0.97	0.23
Point K				
Discharged load(kg/day)	6104	107045	2099	440
Runoff ratio of Pollutant load	0.70	0.90	0.80	0.90
Pollutant load(kg/day)	4273	96341	1679	396
Pollutant load(mg/s)	49454	1115052	19435	4583
Annual mean discharge (cu.m/s)	30	30	30	30
Pollutant load(mg/l)	1.65	37.17	0.65	0.15

TABLE IV.1.4.14 ESTIMATE OF WATER POLLUTION LOAD AT CHECK POINTS (2010)

	BOD	SS	TN	TP
Point M(P)				
Discharged load(kg/day)	26104	397767	9464	2181
Runoff ratio of Pollutant load	0.60	0.90	0.80	0.90
Pollutant load(kg/day)	15662	357990	7571	1963
Pollutant load(mg/s)	181278	4143406	87630	22719
Annual mean discharge (cu.m/s)	84	84	84	84
Pollutant load(mg/l)	2.16	49.33	1.04	0.27
Point K				
Discharged load(kg/day)	6557	107184	2107	480
Runoff ratio of Pollutant load	0.70	0.90	0.80	0.90
Pollutant load(kg/day)	4590	96466	1686	432
Pollutant load(mg/s)	53124	1116500	19509	5000
Annual mean discharge (cu.m/s)	30	30	30	30
Pollutant load(mg/l)	1.77	37.22	0.65	0.17

TABLE IV.2.2.1 CATCHMENT AREA AT CHECK POINTS
FOR RIVER MAINTENANCE FLOW

Sub-basin		Point M (JG)	Point M (JS)	Point M (LV)	Point K(K)	Point C(B)
Name	Km2					
DB1	164.6	164.6	164.6	164.6		
DB2	200.5	200.5	200.5	200.5		
DB3	275.5	275.5	275.5	275.5		
DB4	269.8	269.8	269.8	269.8		
DB5	73.6	73.6	73.6	73.6		
BB1	122.5	122.5	122.5	122.5		
MB1	236.0	236.0	236.0	236.0		
MB2	96.7	96.7	96.7	96.7		
MB3	211.8	211.8	211.8	211.8		
MB4	89.0	89.0	89.0	89.0		
MB5	63.8	63.8	63.8	63.8		
MB6	262.6	262.6	262.6	262.6		
MB7	60.3	60.3	60.3	60.3		
MB8	25.8	25.8	25.8	25.8		
MB9	28.4	28.4	28.4	28.4		
MB10	162.0	162.0	162.0	162.0		
MB11	29.0	29.0	29.0	29.0		
MB12	9.0	9.0	9.0	9.0		
CB1	135.2	135.2	135.2	135.2		135.2
CB2	18.2	18.2	18.2	18.2		18.2
CB3	57.3	57.3	57.3	57.3		57.3
CB4	22.0	22.0	22.0	22.0		22.0
CB5	68.4	68.4	68.4	68.4		68.4
CB6	33.8	33.8	33.8	33.8		33.8
KB1	147.6	147.6	147.6	147.6	147.6	
KB2	162.0	162.0	162.0	162.0	162.0	
KB3	79.1	79.1	79.1	79.1	79.1	
KB4	86.7	86.7	86.7	86.7	86.7	
KB5	146.8	146.8	146.8	146.8	146.8	
KB6	81.8	81.8	81.8	81.8	81.8	
KB7	121.0	121.0	121.0	121.0	121.0	
KB8	43.4	43.4	43.4	43.4	43.4	
SB1	264.6	264.6	264.6	264.6		
SB2	246.9	246.9	246.9	246.9		
RB1	114.3	114.3	114.3	114.3		
Total area	4,210.0	1,740.0	3,330.0	4,010.0	704.0	232.7
Acutual area*	3,226.0	756.0	2,346.0	3,026.0	704.0	232.7

* Excluding the area of Muda dam catchment
(Total of DB1 ~ DB5 : 984.0 km2)

TABLE IV.2.2.2 SUMMARY OF FLOW RECORDS AT REPRESENTATIVE POINTS FOR RIVER MAINTENANCE FLOW STUDY

Description	Unit	Ldg. Victoria	Jeniang	Nami	K Pegang	PointM(JG)	PointM(JS)	PointM(LV)	Point K(K)	Point C(B)
		Sta.	Sta.	Sta.	Sta.	*	**	**	***	***
River		Mudamain	Mudamain	Mudamain	Ketil	Muda	Muda	Muda	Ketil	Chepir
Mean rainfall	mm	2354	2197	2127	2265	-	-	-	-	-
Catchment area	Sq.km	4010	1740	1220	704	1740	3330	4010	704	233
C.A(Excl.Muda d.)	Sq.km	3026	756	236	704	756	2346	3026	704	233
Mini.Q	Cu.m/sec	18	6.7	4	4.1	6.7	14.0	18.0	4.1	1.4
	Cu.m/s/sq.km	0.0059	0.0089	0.0169	0.0058	0.0089	0.0059	0.0059	0.0058	0.0058
Dry(355day)Q	Cu.m/sec	20.3	7.7	4.4	4.7	7.7	15.7	20.3	4.7	1.5
	Cu.m/s/sq.km	0.0067	0.0102	0.0186	0.0067	0.0102	0.0067	0.0067	0.0067	0.0067
Low(275day)Q	Cu.m/sec	47	23	11	10.1	23.0	36.4	47.0	10.1	3.3
	Cu.m/s/sq.km	0.0155	0.0304	0.0466	0.0143	0.0304	0.0155	0.0155	0.0143	0.0143
Normal(185day)Q	Cu.m/sec	87	39.1	21.6	18.1	39.1	67.4	87.0	18.1	6.0
	Cu.m/s/sq.km	0.0288	0.0517	0.0915	0.0257	0.0517	0.0288	0.0288	0.0257	0.0257
Mean Q	Cu.m/sec	104.9	45.2	24.8	24.1	45.2	81.3	104.9	24.1	8.0
	Cu.m/s/sq.km	0.0347	0.0598	0.1051	0.0342	0.0598	0.0347	0.0347	0.0342	0.0342
Wet(95day)Q	Cu.m/sec	145.4	61.6	33.5	29.6	61.6	112.7	145.4	29.6	9.8
	Cu.m/s/sq.km	0.0481	0.0815	0.1419	0.0420	0.0815	0.0481	0.0481	0.0420	0.0420
Max. Q	Cu.m/sec	366.7	294.1	144.7	259.7	294.1	284.3	366.7	0.3689	86.0
	Cu.m/s/sq.km	0.1212	0.3890	0.6131	0.3689	0.3890	0.1212	0.1212	0.3689	0.3689

Note :

Q ; Discharge is mean of annual(1959-1991) records based on daily mean

355days Q ; Exceeding this Q for 355 days a year

* ; Estimated based on the data of Jeniang sta.

** ; Estimated based on the data of L.Victoria sta.

*** ; Estimated based on the data of K.Pegang sta.

TABLE IV.2.2.3 CALCULATION OF MAINTENANCE FLOW FOR FISH

Reference P.		M(JG)	M(JS)	M(LV)	K(K)	C(B)
Water Depth	m	0.3	0.5	0.5	0.3	0.25
n		0.035	0.035	0.035	0.035	0.035
i		1/1700	1/3500	1/5000	1/1400	1/1100
B	m	20	30	90	30	25
m		3.33	3.5	2	3.3	1.25
P	m	22.1	33.6	92.2	32.1	25.8
R	m	0.28	0.47	0.49	0.29	0.24
A	Suq. m	6.3	15.9	45.5	9.3	6.3
v	m/s	0.3	0.29	0.25	0.33	0.34
Q	Cu.m/s	1.88	4.63	11.45	3.1	2.12

TABLE IV.2.2.4 CALCULATION OF MAINTENANCE FLOW FOR LANDSCAPE

Reference P.		M(JG)	M(JS)	M(LV)	K(K)	C(B)
Channel Width	m	80	100	110	70	30
R. W. S. Width	m	16	20	22	14	6
n		0.035	0.035	0.035	0.035	0.035
i		1/1700	1/3500	1/5000	1/1400	1/1100
b	m	10	15	15	10	5
h	m	0.9	0.7	1.8	0.6	0.4
m		3.33	3.5	2	3.3	1.25
P	m	16.2	20.1	23	14.1	6.3
R	m	0.72	0.61	1.45	0.51	0.35
A	Suq. m	11.7	12.2	33.5	7.2	2.2
v	Suq.m/s	0.56	0.35	0.52	0.49	0.43
Q	Cu.m/s	6.5	4.23	17.37	3.49	0.94

Note: The river bed width is checked at the deeper portion.

TABLE IV. 3.1.1 GENERAL CONDITON OF LAND USE ALONG MUDA RIVER

Land Use Classification	Muda main Lower reach	Muda main Middle reach	Muda main Upper reach	Ketil Lower-M.	Chepir Lower-M.
Non-Agri. Vegetation					
Natural Forest	*	**	****	**	**
Shrub/bush	****	****	****	****	****
Swamp	***	*	*	**	**
Grass land	**	**	**	**	**
Agricultural Land					
Rubber	***	****	*	****	****
Oil palm	***	***	*	***	**
Paddy	****	*	*	*	***
Orchard	***	***	*	***	***
Others	**	**	*	**	**
Others/Non Vegetation					
Building/Housing	***	***	*	***	***
Road, Railway, etc.	N	N	N	N	N
Clear land	*	***	*	***	**
Waterway					
River	N	N	N	N	N
Canal/channel	N	N	N	N	N
Lake/reservoir/pond	N	N	N	N	N
<p>Note:</p> <p>**** : Extensive use *** : Partial use (comparatively large area) ** : Partial use (comparatively small area) * : Very limited use / no use N : Not included for this assessment</p> <p>Muda Lower : River mouth to Confluence with Ketil river Muda Middle : Confluence with Ketil to Downstream side of Muda dam Muda Upper : Muda reservoir area Ketil : Confluence with Muda to Upstream side of Balingtown Chepir : Confluence with Muda to Upstream side of Sik town</p> <p>The assessment is tentative and will be checked again.</p>					

TABLE IV. 3.1.2 GENERAL CONDITION OF GOVERNMENT LAND ALONG MUDA RIVER
(LENGTH OF GOVERNMENT LAND ALONG RIVER)

River Stretch	Right bank (m)				Left bank (m)			
	50 - 100 m	100-200 m	200 m <	Total	50 - 100m	100-200 m	200 m <	Total
Muda main.								
Stretch 1	220	0	0	220	650	390	480	1520
Stretch 2	5290	380	530	6200	1810	560	0	2370
Stretch 3	3990	3330	4130	11450	4820	680	830	6330
Stretch 4	5090	2530	4940	12560	8140	2330	4340	14810
Stretch 5	730	950	13180	14860	2240	2120	4000	8360
Stretch 6	*	*	*		*	*	*	
Stretch 7	**	**	**		**	**	**	
Total(1-5)	15320	7190	22780	45290	17660	6080	9650	33390
Ketil river								
Stretch 1	4940	1650	220	6810	5240	4590	3170	13000
Stretch 2	1280	100	0	1380	1020	0	0	1020
Total	6220	1750	220	8190	6260	4590	3170	14020
Chepir river								
Stretch 1	1350	690	150	2190	570	320	90	980
Stretch 2	350	0	0	360	320	0	0	320
Total	1710	690	150	2550	890	320	90	1300
Beris river								
Stretch 1	**	**	**		**	**	**	

Muda river mainstream

Stretch 1 : Approx. 17 km ; River mouth - Railway bridge (p. Tunggai)
 Stretch 2 : Approx. 44 km ; Railway bridge - Confluence with Ketil river
 Stretch 3 : Approx. 25km ; Conflu. with Ketil - Conflu. with Chepir river
 Stretch 4 : Approx. 42km ; Conflu. with Chepir - Conflu. with Beris river
 Stretch 5 : Approx. 18km ; Conflu. with Beris - Nami bridge
 Stretch 6 : Approx. 22km ; Nami bridge - Muda dam
 Stretch 7 : Muda dam reservoir area

Ketil river

Stretch 1 : Approx. 18km ; Conflu. with Muda river - Conflu. with Kupang river
 Stretch 2 : Approx. 30km ; Conflu. with Kupang - Conflu. with Lau river

Chepir river

Stretch 1 : Approx. 7km ; Conflu. with Muda river - Conflu. with Tekil river
 Stretch 2 : Approx. 13km ; Conflu. with Tekil river - Conflu. with Tebal river

Beris river

Stretch 1 : Conflu. with Muda river - Proposed Beris reservoir area

* : Not checked due to insufficient cadastral maps.

** : Not checked by length for reservoir area

TABLE IV.3.2.1 REQUIRED FACILITIES FOR ALTERNATIVE ACTIVITIES
IN RIVER CORRIDOR ZONE

Activities	Required Facilities / Structure (Example)
1. Sport	
(1) Jogging, Exercise	Ground / road / path, exercise facilities
(2) Cycling	Road / path, Rental cycle service
(3) Football	Football ground
(4) Tennis	Tennis court
(5) Boat/Canoe	Moorage, Jetty
(6) Golf	Golf course
(7) Swimming	Pool
(8) Others	
2. General Recreation	
(1) Fishing	Jetty, revetment, embankment, pond
(2) Walking/rest	Road / path, bench, hut
(3) Picnic/hiking	Road / path / trail with sign boards
(4) Camping	Camping ground with facilities
(5) Bird watching	Watching hut, trail, sign boards
(6) Landscape view	Bench, platform, hut
(7) Amusement (by facilities)	Amusement park facilities
(8) Play / game on the ground	Play ground facilities
(9) Play in water	Channel, pond, pool
(10) Others	
3. Others	
(1) Marketing of local food	Fish market / vegetable & fruit market
(2) Eating & Drinking	River side restaurant / cafeteria
(3) Getting information of Muda river, etc.	Information center
(4) Getting knowledge of River & dam	River & dam museum
(5) Getting knowledge of Fishery / fish	Fish & Fishery museum, aquarium
(6) River crossing	Ferry sevice with jetty / platform
(7) Watching show	Theater, multi purpose ground
(8) Joining / watching events	Multi purpose ground
(9) Agricultural activities	Rental farmland, sign board
(10) Others	

TABLE IV.3.2.2 APPROPRIATENESS OF ALTERNATIVE ACTIVITIES IN EACH RIVER CORRIDOR ZONE

Activities	Nature Reserve Zone	Nature Use Zone	Agriculture Land Zone	Development Zone
1. Sport				
(1) Jogging, Exercise	X	OO	OO	OO
(2) Cycling	X	OO	OO	OO
(3) Football	X	X	X	OO
(4) Tennis	X	X	X	OO
(5) Boat/Canoe	X	OO	O	OO
(6) Golf	X	X	X	OO
(7) Swimming	X	O	X	OO
2. General Recreation				
(1) Fishing	X	OO	O	OO
(2) Walking/rest	O	OO	OO	OO
(3) Picnic/hiking	O	OO	OO	O
(4) Camping	O	OO	O	O
(5) Bird watching	O	OO	O	O
(6) Landscape view	O	OO	OO	OO
(7) Amusement (by facilities)	X	X	X	OO
(8) Play / game on the ground	X	O	X	OO
(9) Play in water	O	O	X	OO
3. Others				
(1) Marketing of local food	X	O	O	OO
(2) Eating & Drinking	X	O	O	OO
(3) Getting information of Muda river	X	O	O	OO
(4) Getting knowledge of River & dam	X	O	X	OO
(5) Getting knowledge of Fishery / fish	X	O	X	OO
(6) River crossing	O	O	O	OO
(7) Watching show	X	X	X	OO
(8) Joining / watching events	X	O	O	OO
(9) Agricultural activities	X	O	OO	O
OO: Appropriate use O: Appropriate in some conditions X: Not appropriate				

TABLE IV.5.2.1

FEATURES OF BERIS DAM PROJECT

Name :	Beris Dam Project (Proposed)
Location :	Sik District, State of Kedah Beris river (Tributary of Muda river)
Purpose :	(1) Irrigation water supply (2) Domestic and industrial water supply (3) Recreation (Additionally proposed)
Project Descriptions :	(1) Catchment area : 116 sq. km (2) Annual inflow (average) : 112.5 million cu.m (3) Reservoir FWL : El. 86.4 m (NWL : El.84.0 m , LWL : El. 68.0m) (4) Reservoir area at FWL : 16.1 sq. km (5) Effective storage capacity : 114.0 million cu.m (6) Main dam type : Concrete faced rockfill type (7) Maindam crest : El. 88.0 m (8) Main dam embankment volume : 158,000 cu.m (9) Spillway type: Overflow ogee with side channel, chute and bucket (10) Saddle dam type : Earth-core rockfill (11) Saddle dam embankment volume: 120,000 cu.m
Present Status :	The Beris dam was first identified as one of the dams recommended by JICA in 1983-1985. The investigation and design was already carried out by a local consultant. The preliminary environmental impact assessment was carried out in 1993. The tentative budget for D/D review and construction was approved in the 7th national plan.
Reference Comments :	The project execution is one of the great concerns for DID. The resettlement is the most significant issue at present.

TABLE IV.5.2.2

FEATURES OF JENIANG TRANSFER PROJECT

Name :	JENIANG TRANSFER AND NAOK DAM & REMAN DAM PROJECT
Location :	Sik District (Jeniang barrage), Pendang District (Naok & Reman dams) Muda river, Naok river , Reman river
Purpose :	(1) Irrigation water supply (2) Domestic & industrial water supply
Project Descriptions :	<p>(1) Jeniang Barrage : Gated concrete weir with crest level at El. 27.5m and crest width of 33.0 m.</p> <p>(2) Transfer canal : No lining, Length ; 8 km, Capacity ; 40 cu.m/s</p> <p>(3) Conveyance canal : No lining, Length ; 22 km, Capacity ; 40 cu.m/s</p> <p>(4) Naok dam : Catchment area ; 15 sq. km, Reservoir area; 5.7 sq. km, Dam type ; Earthfill, Crest level ; El. 32.0m Crest length ; 2750 m</p> <p>(5) Reman dam : Catchment area ; 32.2sq. km, Reservoir area; 17.6sq. km, Main Dam type ; Zoned rockfill, Crest level ; El. 60.0m Crest length ;170 m</p>
Present Status :	<p>The project was first identified as one of the dams recommended by JICA.</p> <p>The feasibility study of Reman dam was carried out in 1984.</p> <p>The design was carried out by a local consultant.</p> <p>The tentative budget for D/D review was approved in the 7th national plan.</p>
Reference points :	<p>DID considers that the budget for construction will be approved in the 8th plan.</p> <p>The resettlement issue will be not significant .</p>

TABLE IV.5.2.3 FEATURES OF LOWER REACH IMPROVEMENT PROJECT

Name :	MUDA RIVER LOWER REACH IMPROVEMENT PROJECT
Location :	Kuala Muda & kelim Districts(Kedah) , Mukim 1, 2, & 3 Districts (Pulau Pinang) From River mouth to Ldg. Victoria Bridge , Muda river main stream
Purpose :	(1) Flood control/mitigation (2) Recreation (Supplementary purpose)
Project Descriptions :	(1) River lengh of improvement section : Approxi. 40 km (2) River section : Compound type with low water channel (Excavation) and high water channel (Embankment) (3) Dike : Earthfill, on both banks (4) New Muda barrage : Gated concrete weir of approxi. 300m in lengh. (5) River mouth improvement : Dredging and submerged jetty
Present Status :	The river improvement works of lower reach was once proposed by JICA study, however, no further study was made since then. The revised improvement works was newly proposed in this study report.
Reference Comments :	The river flow capacity would be remarkably increased , however the land acquisition of comparatively large area will be necessary. The improvement section is located on the border line between the two states.

TABLE IV.5.2.4 FEATURES OF BERIS RECREATIONAL PARK

Name : BERIS RESERVOIR RECREATIONAL PARK
Location : Sik District (Kedah) Beris dam reservoir
Purpose : (1) Recreation (2) Activation of regional economy
<p>Project Descriptions :</p> <p>Park Area (during HWL); Peninsula side : approxi. 212 ha Island : approxi. 10 ha Recreational park with the following areas and facilities.</p> <ul style="list-style-type: none"> (a) Beris park information center (b) Dam musium (c) Reservoir front park (d) Camping sites (e) Handcraft center (f) Fruite market (g) Culture show theater (h) Lodging quater (i) Boat & Fishing service (j) Restrant/Cafeteria (k) Bird sanctuary (l) Park (for walking and rest) (m) Others
<p>Present Status :</p> <p>The Beris dam construction is schedled to be started within a few years. The proposed area is mountain area with comparatively gentle slopes and covered with forest and farm lands.</p>
<p>Reference Comments :</p> <p>The recreational park is expected to be constructed as a part of the Beris dam project. The park will become a significant location in the inland region for the activation of the regional economy.</p>

TABLE IV. 5.2.5 FEATURES OF MUDA BARRAGE RECREATIONAL PARK

<p>Name : MUDA BARRAGE RECREATIONAL PARK</p>
<p>Location : Kuala Muda District (Kedah) and Mukim 2 District (Pulau Pinang) Both sides of Muda barrage</p>
<p>Purpose : (1) Recreation (2) Education</p>
<p>Project Descriptions :</p> <p>Park Area (River channel and Muda barrage are not counted.) ; Left bank : approxi. 56 ha Right bank : approxi.18 ha The park is extended to both banks on the high water channel of river improvement and the two areas are connected by the new Muda barrage which is also proposed to be constructed. In the park area, the following areas and facilities will be prepared.</p> <ul style="list-style-type: none"> (a) Muda river information center (b) River side park (c) Fishing pond (d) Boat/canoe service (e) Children's swimming pond/channel (f) Cycling road (g) Car parking lot (h) Football/multi-purpose ground
<p>Present Status :</p> <p>The existing Muda barrage is located in the area which will be removed in the future. The area is generally not used extensively although some areas are used for farm land or pasture. Comparatively big ponds are located on the left bank, Penang side.</p>
<p>Reference Comments :</p> <p>The park is expected to be constructed as a part of Lower reach river improvement works. Muda barrage is used as a part of the park.</p>

TABLE IV. 5.2.6 FEATURES OF BUMBUNG LIMA RECREATIONAL PARK

Name : BUMBUNG LIMA RECREATIONAL PARK
Location : Mukim 3 District (Pulau Pinang) Muda river side, Both sides of Highway
Purpose : (1) Recreation (2) Nature conservation
<p>Project Descriptions :</p> <p>Park Area (River channel area is not counted) Total : approxi. 68ha (upstream side : 38 ha , downstream side : 30 ha)</p> <p>The park is extended to the both sides of the highway on the high water channel (left bank) of proposed river improvement works.</p> <p>The following areas and facilities will be prepared in the park area..</p> <ul style="list-style-type: none"> (a) Sport/multi-purpose ground (b) River side park (c) Fishing pond (d) Boat/canoe service (e) Children's swimming pond/channel (f) Cycling road (g) Car parking lots (h) Bio-tope (Nature observation) (i) Others
<p>Present Status :</p> <p>There are several ponds (used for mining) are located. The area is not used extensively although there are some houses located in a part of the proposed area. The north-south highway runs through the proposed park area.</p>
<p>Reference Comments :</p> <p>The park is expected to be constructed as a part of Lower reach river improvement works.</p>

TABLE IV.5.3.1 CONTENT OF ACTIVITY CATEGORIES FOR EIA MATRIX

Categories	To be considered or not ?		
	Dam	River Improve.	Rec. Park
ACTIVITIES			
(A) Site Investigation			
(a) Site reconnaissance	O	O	O
(b) Topographic survey	O	O	O
(c) Geological & soil investigation	O	O	O
(d) Survey of fauna & flora	O	O	O
(B) Site preparation and Construction			
(a) Access road	OO	OO	O
(b) Site clearing	OO	O	O
(c) Foundation work	OO	X	X
(d) Earth works (exca. & embank.)	OO	OO	O
(e) Drilling and blasting	OO	X	X
(f) Demolition of existing structure	O	O	O
(g) Concrete works	OO	O	O
(h) Building works	O	X	O
(i) Mechanical/metal works	OO	O	O
(j) Electrical works	OO	O	O
(l) Wooden works	O	O	O
(m) Road construction works	OO	O	O
(o) Drainage works	O	O	O
(p) Transportation	O	O	O
(q) Waste disposal	O	O	O
(r) Labor force activities for constru.	O	O	O
(C) Operation and Maintenance			
(a) Operation of facilities	OO	O	O
(b) Repair & mainte. work of facilities	O	O	O
(c) Labor force activities for O & M	O	X	O
SCHEME ITSELE			
(D) Existence of Structures/Facilities	OO	OO	OO
OO : Probably necessary to consider O : Probably necessary but not significant X : Probably not necessary to consider			

TABLE IV.5.3.2

ENVIRONMENTAL FACTORS SELECTED FOR EIA

Factor	Description of each factor
A. Social Environment	
(a) Resettlement	- Relocation and Resettlement for land acquisition
(b) Economic activities	- Loss of living opportunity (lands etc.) - Change of economic structure
(c) Transportation/Public Facilities	- Impact on existing transportation system - Impact on school hospital, etc.
(d) Division of Communities	- Separation of local communities due to blocking of transportation system
(e) Archaeological/Cultural Heritage	- Loss or reduction of value to archeological cultural, and religious structures
(f) Vested Right	- Hindrance to water use right, fishery right, entering right to forest, etc.
(g) Health and Hygiene	- Degradation of hygienic conditions caused by waste disposal and vector insects
(h) Waste Disposal	- Construction waste/debris, contaminated mud, sludges, general wastes, etc.
(i) Accident	- Increase of danger on ground collapse, land sliding, traffic accidents, etc.
B. Natural Environment	
(a) Topography and Geology	- Change of significant land forms and geological features caused by earthwork etc.
(b) Soil Erosion	- Soil erosion originated by runoff through earthworks, timber cutting etc.
(c) Ground water	- Water contamination caused by excessive pumping, decreasing seepage capacity, etc.
(d) River and Reservoir/pond	- Change of discharge, velocity, riverbed due to reclamation, new channel construction etc.
(e) Coastal Zone	- Scouring or sedimentation at coastal area due to change of drifting sands and waves
(f) Fauna (Wildlife)	- Reduction of breeding and extermination of endangered species
(g) Flora (Vegetation)	- Reduction of breeding and extermination of endangered species
(h) Climate	- Climatic changes arising by implementation of large scale development of earthworks and structures.
(i) Landscape	- Change of landscape due to earth works and new structures
C. Public Nuisance	
(a) Air Pollution	- Air pollution caused by exhaust gas and poisonous gas from vehicles and factories
(b) Water Pollution	- Water contamination caused by inflow of soil, chemical substances, oil, etc.
(c) Soil Contamination	- Soil contamination caused by runoff and diffusion of effluent, poisonous substances, etc.
(d) Noise and Vibration	- Noise and vibration caused by running vehicle pumping operation, etc.
(e) Ground Subsidence	- Ground Surface subsidence caused by change of foundation condition and lowering of ground water level
(f) Odour	- Occurrence of exhaust gas and odour

TABLE IV.5.4.1

**ASSESSMENT MATRIX OF ENVIRONMENTAL IMPACT
FOR BERIS DAM PROJECT**

Environment Factors	Breakdown of Project / Scheme				Remarks
	Activities			Existence of Structures	
	Site Invest.	Construction	O & M		
1. Social Environment					
1.1 Resettlement	N	U1	N	A3	Some villages submerged
1.2 Economic Activities	N	B2	B1	B2	Increase of income/job
1.3 Transportation / Public Facilities	N	A1	N	B1	More convenient by the project
1.4 Division of Communities	N	A2	N	A2	Due to resettlement
1.5 Archaeological / Cultural Heritage	U1	U1	U1	U1	No significant site
1.6 Vested Right	U1	U1	U1	U1	No definite right now
1.7 Health and Hygiene	N	A1	N	U1	Generally not significant
1.8 Waste Disposal	A1	A1	A1	N	Increase of waste
1.9 Accident	N	A1	N	N	Only during construction
2. Natural Environment					
2.1 Topography and Geology	A1	U1	N	A1	Effect not significant
2.2 Soil Erosion	A1	A2	N	A2	By logging & land clearing
2.3 Ground Water	N	N	N	U1	
2.4 River and Reservoir / pond	N	N	N	A1	
2.5 Coastal Zone	N	N	N	A1	Far to the coast
2.6 Fauna (Wildlife)	N	A1	N	U1	No valuable species
2.7 Flora (Vegetation)	N	A1	N	U1	Forest logging
2.8 Climate	N	N	N	N	
2.9 Landscape	N	A1	N	B2	Beautiful water front
3. Public Nuisance					
3.1 Air Pollution	N	N	N	N	
3.2 Water Pollution	N	A2	N	U1	Reservoir eutrophication
3.3 Soil Contamination	N	A1	N	N	
3.4 Noise and Vibration	A1	A1	N	N	
3.5 Ground Subsidence	N	N	N	N	
3.6 Odour	N	A1	N	U1	

Assessment Classification

A1 : Adverse impact - minor

A2 : Adverse impact - medium / moderate

A3 : Adverse impact - major / significant

U1 : Unknown due to insufficient data but probably minor impact (A1) or no adverse impact

U2 : Unknown due to insufficient data but probably adverse impact (A2 or A3)

N : No adverse impact

B1 : Beneficial / positive impact - minor

B2 : Beneficial / positive impact - major

TABLE IV.5.4.2

ASSESSMENT MATRIX OF ENVIRONMENTAL IMPACT
FOR JENIANG TRANSFER PROJECT

Environment Factors	Breakdown of Project / Scheme				Remarks
	Activities			Existence of Structures	
	Site Invest.	Construction	O & M		
1. Social Environment					
1.1 Resettlement	N	U1	N	A2	Some houses submerged
1.2 Economic Activities	N	B2	B1	B1	Increase of income/job
1.3 Transportation / Public Facilities	N	A1	N	B1	More convenient by the project
1.4 Division of Communities	N	A1	N	A1	
1.5 Archaeological / Cultural Heritage	U1	U1	U1	U1	No significant site
1.6 Vested Right	U1	U1	U1	U1	No definite right now
1.7 Health and Hygiene	N	A1	N	U1	Generally not significant
1.8 Waste Disposal	A1	A1	A1	N	Increase of waste
1.9 Accident	N	A1	N	N	Only during construction
2. Natural Environment					
2.1 Topography and Geology	A1	U1	N	A1	Effect not significant
2.2 Soil Erosion	A1	A2	N	A1	By logging & land clearing
2.3 Ground Water	N	N	N	U1	
2.4 River and Reservoir / pond	N	N	N	A1	
2.5 Coastal Zone	N	N	N	A1	Far to the coast
2.6 Fauna (Wildlife)	N	U1	N	U1	No valuable species
2.7 Flora (Vegetation)	N	U1	N	U1	Forest logging
2.8 Climate	N	N	N	N	
2.9 Landscape	N	A1	N	B2	Beautiful water front
3. Public Nuisance					
3.1 Air Pollution	N	N	N	N	
3.2 Water Pollution	N	A2	N	U1	Reservoir eutrophication
3.3 Soil Contamination	N	A1	N	N	
3.4 Noise and Vibration	A1	A1	N	N	
3.5 Ground Subsidence	N	N	N	N	
3.6 Odour	N	A1	N	U1	

Assessment Classification

A1 : Adverse impact - minor

A2 : Adverse impact - medium / moderate

A3 : Adverse impact - major / significant

U1 : Unknown due to insufficient data but probably minor impact (A1) or no adverse impact

U2 : Unknown due to insufficient data but probably adverse impact (A2 or A3)

N : No adverse impact

B1 : Beneficial / positive impact - minor

B2 : Beneficial / positive impact - major

TABLE IV.5.4.3

ASSESSMENT MATRIX OF ENVIRONMENTAL IMPACT
FOR LOWER REACH RIVER IMPROVEMENT WORKS

Environment Factors	Breakdown of Project / Scheme				Remarks
	Activities			Existence of Structures	
	Site Invest.	Construction	O & M		
1. Social Environment					
1.1 Resettlement	N	U1	N	A2	Some houses relocated
1.2 Economic Activities	N	B2	B1	N	Increase of income/job
1.3 Transportation / Public Facilities	N	N	N	N	
1.4 Division of Communities	N	A1	N	N	
1.5 Archaeological / Cultural Heritage	U1	U1	U1	U1	No significant site
1.6 Vested Right	U1	U1	U1	U1	No definite right now
1.7 Health and Hygiene	N	A1	N	U1	
1.8 Waste Disposal	A1	A1	A1	N	
1.9 Accident	N	A1	N	N	
2. Natural Environment					
2.1 Topography and Geology	N	U1	N	A1	
2.2 Soil Erosion	A1	A1	N	N	
2.3 Ground Water	N	N	N	U1	
2.4 River and Reservoir / pond	N	A1	N	A1	
2.5 Coastal Zone	N	N	N	B1	River mouth improved
2.6 Fauna (Wildlife)	N	U1	N	U1	No valuable species
2.7 Flora (Vegetation)	N	A1	N	U1	
2.8 Climate	N	N	N	N	
2.9 Landscape	N	A1	N	B1	
3. Public Nuisance					
3.1 Air Pollution	N	N	N	N	
3.2 Water Pollution	N	A1	N	N	
3.3 Soil Contamination	N	A1	N	N	
3.4 Noise and Vibration	A1	A1	N	N	
3.5 Ground Subsidence	N	N	N	N	
3.6 Odour	N	A1	N	U1	

Assessment Classification

A1 : Adverse impact - minor

A2 : Adverse impact - medium / moderate

A3 : Adverse impact - major / significant

U1 : Unknow due to insufficient data but probably minor impact (A1) or no adverse impact

U2 : Unknow due to insufficient data but probably adverse impact (A2 or A3)

N : No adverse impact

B1 : Beneficial / positive Impact - minor

B2 : Beneficial / positive impact - major

TABLE IV.5.4.4

**ASSESSMENT MATRIX OF ENVIRONMENTAL IMPACT
FOR BERIS RESERVOIR RECREATIONAL PARK SCHEME**

Environment Factors	Breakdown of Project / Scheme				Remarks
	Activities			Existence of Structures	
	Site Invest.	Construction	O & M		
1. Social Environment					
1.1 Resettlement	N	U1	N	U1	
1.2 Economic Activities	N	B2	B1	B2	Increase of income/job
1.3 Transportation / Public Facilities	N	A1	N	B1	More convenient
1.4 Division of Communities	N	N	N	N	
1.5 Archaeological / Cultural Heritage	U1	U1	U1	U1	No significant site
1.6 Vested Right	U1	U1	U1	U1	No definite right now
1.7 Health and Hygiene	N	A1	N	U1	
1.8 Waste Disposal	A1	A1	A1	A1	Depend on management
1.9 Accident	N	A1	N	N	
2. Natural Environment					
2.1 Topography and Geology	N	U1	N	A1	
2.2 Soil Erosion	A1	A1	N	A1	
2.3 Ground Water	N	N	N	U1	
2.4 River and Reservoir / pond	N	N	N	N	
2.5 Coastal Zone	N	N	N	N	
2.6 Fauna (Wildlife)	N	U1	N	U1	
2.7 Flora (Vegetation)	N	A1	N	A1	
2.8 Climate	N	N	N	N	
2.9 Landscape	N	A1	N	B2	Beautiful park
3. Public Nuisance					
3.1 Air Pollution	N	N	N	N	
3.2 Water Pollution	N	A1	N	A2	Drainage from park
3.3 Soil Contamination	N	A1	N	N	
3.4 Noise and Vibration	N	A1	N	N	
3.5 Ground Subsidence	N	N	N	N	
3.6 Odour	N	A1	N	U1	

Assessment Classification

A1 : Adverse impact - minor

A2 : Adverse impact - medium / moderate

A3 : Adverse impact - major / significant

U1 : Unknown due to insufficient data but probably minor impact (A1) or no adverse impact

U2 : Unknown due to insufficient data but probably adverse impact (A2 or A3)

N : No adverse impact

B1 : Beneficial / positive impact - minor

B2 : Beneficial / positive impact - major

TABLE IV.5.4.5

**ASSESSMENT MATRIX OF ENVIRONMENTAL IMPACT
FOR MUDA BARRAGE RECREATIONAL PARK SCHEME**

Environment Factors	Breakdown of Project / Scheme				Remarks
	Activities			Existence of Structures	
	Site Invest.	Construction	O & M		
1. Social Environment					
1.1 Resettlement	N	U1	N	N	
1.2 Economic Activities	N	B2	B1	B1	Increase of income/job
1.3 Transportation / Public Facilities	N	A1	N	B1	
1.4 Division of Communities	N	N	N	N	
1.5 Archaeological / Cultural Heritage	N	U1	N	U1	Existing Muda barrage
1.6 Vested Right	N	U1	N	U1	No definite right now
1.7 Health and Hygiene	N	A1	N	U1	
1.8 Waste Disposal	A1	A1	A1	A1	Depend on management
1.9 Accident	N	A1	N	N	
2. Natural Environment					
2.1 Topography and Geology	N	U1	N	U1	
2.2 Soil Erosion	A1	A1	N	N	
2.3 Ground Water	N	N	N	U1	
2.4 River and Reservoir / pond	N	A1	N	A1	Cut off of river
2.5 Coastal Zone	N	N	N	N	
2.6 Fauna (Wildlife)	N	N	N	N	No valuable species
2.7 Flora (Vegetation)	A1	N	N	N	
2.8 Climate	N	N	N	N	
2.9 Landscape	N	A1	N	B2	Beautiful park & water front
3. Public Nuisance					
3.1 Air Pollution	N	N	N	N	
3.2 Water Pollution	N	A1	N	U1	
3.3 Soil Contamination	N	A1	N	N	
3.4 Noise and Vibration	N	A1	N	N	
3.5 Ground Subsidence	N	N	N	N	
3.6 Odour	N	A1	N	N	

Assessment Classification

A1 : Adverse impact - minor

A2 : Adverse impact - medium / moderate

A3 : Adverse impact - major / significant

U1 : Unknow due to insufficient data but probably minor impact (A1) or no adverse impact

U2 : Unknow due to insufficient data but probably adverse impact (A2 or A3)

N : No adverse impact

B1 : Beneficial / positive impact - minor

B2 : Beneficial / positive impact - major

TABLE IV.5.4.6

**ASSESSMENT MATRIX OF ENVIRONMENTAL IMPACT
FOR BUMBONG LIMA RECREATIONAL PARK SCHEME**

Environment Factors	Breakdown of Project / Scheme				Remarks
	Activities			Existence of Structures	
	Site Invest.	Construction	O & M		
1. Social Environment					
1.1 Resettlement	N	U1	N	A2	Some houses relocated
1.2 Economic Activities	N	B2	B1	B1	Increase of income/job
1.3 Transportation / Public Facilities	N	A1	N	B1	
1.4 Division of Communities	N	N	N	N	
1.5 Archaeological / Cultural Heritage	N	U1	N	U1	Existing Muda barrage
1.6 Vested Right	N	U1	N	U1	No definite right now
1.7 Health and Hygiene	N	A1	N	U1	
1.8 Waste Disposal	A1	A1	A1	A1	Depend on management
1.9 Accident	N	A1	N	N	
2. Natural Environment					
2.1 Topography and Geology	N	U1	N	U1	
2.2 Soil Erosion	A1	A1	N	N	
2.3 Ground Water	N	N	N	U1	
2.4 River and Reservoir / pond	N	A1	N	A1	Cut off of river
2.5 Coastal Zone	N	N	N	N	
2.6 Fauna (Wildlife)	N	N	N	U1	No valuable species
2.7 Flora (Vegetation)	N	N	N	N	
2.8 Climate	N	N	N	N	
2.9 Landscape	N	A1	N	B2	Beautiful park & water front
3. Public Nuisance					
3.1 Air Pollution	N	N	N	N	
3.2 Water Pollution	N	A1	N	U1	
3.3 Soil Contamination	N	A1	N	N	
3.4 Noise and Vibration	N	A1	N	N	
3.5 Ground Subsidence	N	N	N	N	
3.6 Odour	N	A1	N	N	

Assessment Classification

A1 : Adverse impact - minor

A2 : Adverse impact - medium / moderate

A3 : Adverse impact - major / significant

U1 : Unknow due to insufficient data but probably minor impact (A1) or no adverse impact

U2 : Unknow due to insufficient data but probably adverse impact (A2 or A3)

N : No adverse impact

B1 : Beneficial / positive impact - minor

B2 : Beneficial / positive impact - major

**TABLE IV.5.4.7 EXPLANATION NOTE OF MITIGATION MEASURES FOR
BERIS DAM PROJECT (1/4)**

Factor :	Resettlement
Content :	Resettlement of inhabitants living in and around the proposed reservoir area to new areas prepared by the government
Cause :	<ul style="list-style-type: none"> (1) Submerged area by new reservoir (2) Land for road to be relocated (3) Land for dam and other structures/facilities (4) Land for water front development (5) Land for construction (6) Reserved land for environmental conservation of reservoir area
Probable Impact :	<ul style="list-style-type: none"> (1) Desire/Sentiment of inhabitants who want to stay in the same village/location (2) Uneasiness to their living conditions including income in a resettlement land. (3) Disruption of present community
Comments on Impact :	<ul style="list-style-type: none"> (1) It is informed that they are not cooperative to the project at present (2) The villages have nearly 200 years history with 6 generations. (3) Inhabitants without their own land agree to the resettlement. (4) Among nearly 1200 houses of 12 villages, approxi. 500 houses will be submerged. (5) The explanation on resettlement to the inhabitants seems to be not definite at present.
Mitigation Measures :	<ul style="list-style-type: none"> (1) Communication with the inhabitants (2) Sufficient information and data on the project and resettlement. (3) Removal of interference by political power, if any. (4) Reasonable compensation for resettlement (5) Assistance / guidance for their stable income (6) Preparation of resettlement land based on their desire
Necessary monitoring / Investigation for the further study :	<ul style="list-style-type: none"> (1) Detailed survey of inhabitants to be resettled (2) Survey on regional socio-economy. (3) Past examples of resettlement by similar projects. (4) Detailed investigation of resettlement alternative sites.

**TABLE IV.5.4.7 EXPLANATION NOTE OF MITIGATION MEASURES FOR
BERIS DAM PROJECT (2/4)**

Factor : Division of Communities
Content : Communication and society of villages will be divided by the resettlement.
Cause : (1) Resettlement of a part of village people. (2) Division of existing roads by new reservoir. (3) New temporary comers for construction (4) Construction activities
Probable Impact : (1) Administrative organization (2) Association and communication of existing community. (3) Regional economic activity
Comments on Impact : (1) Nearly 500 families among 1200 families will be resettled. (2) Alternative road plan is included in the project. (3) The community has nearly 200 years history.
Mitigation Measures : (1) Compensation to non-resettled people (2) Construction of new transportation network (3) Reorganization of administrative division (4) Establishment of new telecommunication service (5) Assistance & guidance for new job, if required (6) Construction plan to make less effect on the matter
Necessary monitoring / Investigation for the further study : (1) Survey on regional socio-economy (2) Suvey on new transportation system (3) Survey of living conditions of inhavitants including non-resettled people

**TABLE IV.5.4.7 EXPLANATION NOTE OF MITIGATION MEASURES FOR
BERIS DAM PROJECT (3/4)**

Factor : Soil Erosion
Content : Soil erosion will be occurred due to removal of ground surface generally with vegetation and caused adverse environmental impacts.
Cause : (1) Logging (2) land clearing for farming (3) Reservoir water level fluctuation (4) Construction works (roads, structures)
Probable Impact : (1) Slope failure (2) Water contamination (3) Sedimentation in the reservoir (4) Undesirable landscape
Comments on Impact : (1) Presently most area is covered with vegetation/ forest. (2) Slope failure is scarce in the region at present. (3) Soil erosion is not extensive in the area.
Mitigation Measures : (1) Drainage works (2) Plantation (3) Slope protection works (4) Construction plan inconsideration of soil erosion. (5) Land use control
Necessary monitoring / Investigation for the further study : (1) Topographic survey (2) Geological survey (3) Soil survey (4) Vegetation/ forest survey

**TABLE IV.5.4.7 EXPLANATION NOTE OF MITIGATION MEASURES FOR
BERIS DAM PROJECT (4/4)**

Factor : Water pollution
Content : Reservoir water may be contaminated and the water pollution may cause the eutrophication, turbid water, etc.
Cause : (1) Inflow of nitrogen (N) and phosphorus (P) (2) Vegetation in the reservoir (3) Inflow of turbid water (4) Sedimentation of carcass of aquatic life (5) Activities in the water front
Probable Impact : (1) Shortage of oxygen and cause danger to fishes (2) Odor and cause uncomfortable condition for visitors/users. (3) Water pollution of the downstream river
Comments on Impact : (1) Generally the eutrophication is most serious in reservoir. (2) Stream water is usually clean at present.
Mitigation Measures : (1) Control and treatment of pollution loads in the basin (2) Circulation system of reservoir water (3) Removal of vegetation before impounding (4) Selective intake water level facilities (5) Control of river basin development (6) Inspection and management for waste
Necessary monitoring / Investigation for the further study : (1) Pollution sources survey (2) Survey for prediction of water pollution loads (3) Survey on water utilization in the reservoir as well as downstream river. (4) Water quality survey

TABLE IV. 5.4.8 EXPLANATION NOTE OF MITIGATION MEASURES FOR JENIANG TRANSFER CANAL PROJECT (1/3)

Factor	: Resettlement
Content	: Resettlement of inhabitants living in and around the proposed reservoir area to new areas prepared by the government
Cause	: (1) Submerged area by new reservoir (2) Land for road to be relocated (3) Land for dam and other structures/facilities (4) Land for water front development (Not planned yet) (5) Land for construction works (access road, quarry site, plants, etc.) (6) Reserved land for environmental conservation of reservoir area
Probable Impact	: (1) Desire/Sentiment of inhabitants who want to stay in the same village/location (2) Uneasiness to their living conditions including income in a resettlement land. (3) Disruption of present community
Comments on Impact	: (1) It seems that the impact of resettlement is not so difficult in comparison with that for Beris dam (2) The data of houses and inhabitants to be resettled are not sure yet, the number seems to be much less than that of Beris dam project. (3) Most areas are now covered with secondary forest , mainly rubber trees
Mitigation Measures	: (1) Communication with the inhabitants (2) Sufficient information and data on the project and resettlement. (3) Removal of interference by political power, if any. (4) Reasonable compensation for resettlement (5) Assistance / guidance for their stable income (6) Preparation of resettlement land based on their desire
Necessary monitoring / Investigation for the further study	: (1) Detailed survey of inhabitants to be resettled (2) Survey on regional socio-economy. (3) Past examples of resettlement by similar projects. (4) Detailed investigation of resettlement alternative sites.

TABLE IV. 5.4.8 EXPLANATION NOTE OF MITIGATION MEASURES FOR JENIANG TRANSFER CANAL PROJECT (2/3)

Factor : Soil Erosion
Content : Soil erosion will be occurred due to removal of ground surface generally with vegetation and caused adverse environmental impacts.
Cause : (1) Logging (2) land clearing for farming (3) Reservoir water level fluctuation (4) Construction works (roads, structures)
Probable Impact : (1) Slope failure (2) Water contamination (3) Sedimentation in the reservoir (4) Undesirable landscape
Comments on Impact : (1) Presently most area is covered with vegetation/ forest. (2) Slope failure is scarce in the region at present. (3) Soil erosion is not extensive in the area.
Mitigation Measures : (1) Drainage works (2) Plantation (3) Slope protection works (4) Construction plan inconsideration of soil erosion. (5) Land use control
Necessary monitoring / Investigation for the further study : (1) Topographic survey (2) Geological survey (3) Soil survey (4) Vegetation/ forest survey

TABLE IV. 5.4.8 EXPLANATION NOTE OF MITIGATION MEASURES FOR
JENIANG TRANSFER CANAL PROJECT (3/3)

Factor :	Water pollution
Content :	Reservoir water may be contaminated and the water pollution may cause the eutrophication, turbid water, etc.
Cause :	<ol style="list-style-type: none"> (1) Inflow of nitrogen (N) and phosphorus (P) (2) Vegetation in the reservoir (3) Inflow of turbid water (4) Sedimentation of carcass of aquatic life (5) Activities in the water front
Probable Impact :	<ol style="list-style-type: none"> (1) Shortage of oxygen and cause danger to fishes (2) Odor and cause uncomfortable condition for visitors/users. (3) Water pollution of the downstream river
Comments on Impact :	<ol style="list-style-type: none"> (1) Generally the eutrophication is most serious in reservoir. (2) Streams for two reservoirs are very small . (3) There are two reservoirs with dam and a barrage . (4) Most water in the reservoirs is pumped up from the canal.
Mitigation Measures :	<ol style="list-style-type: none"> (1) Control and treatment of pollution loads in the basin (2) Circulation system of reservoir water (3) Removal of vegetation before impounding (4) Selective intake water level facilities (5) Control of river basin development (6) Minimization of water front activities. (7) Inspection and proper management against waste
Necessary monitoring / Investigation for the further study :	<ol style="list-style-type: none"> (1) Pollution sources survey (2) Survey for prediction of water pollution loads (3) Survey on water utilization in the reservoir as well as downstream river. (4) Water quality survey

TABLE IV.5.4.9 EXPLANATION NOTE OF MITIGATION MEASURES FOR LOWER REACH RIVER IMPROVEMENT WORKS

Factor :	Resettlement
Content :	Resettlement of inhabitants living in and around the proposed area for river improvement works to new areas prepared by the government
Cause :	<ol style="list-style-type: none"> (1) Widening of present river channel. (2) Construction of dikes (3) Cutoff of present meandering river channel (4) Land for water front development (5) Land for construction (access road, borrow area, etc.)
Probable Impact :	<ol style="list-style-type: none"> (1) Desire/Sentiment of inhabitants who want to stay in the same village/location (2) Uneasiness to their living conditions including income in a resettlement land. (3) Change of convenient living located close to the river (4) Disruption of present community
Comments on Impact :	<ol style="list-style-type: none"> (1) There are not a few houses located within the river improvement section. (2) But, they are generally scattered along the river. (3) The resettlement would be not serious in comparison with that for a dam project. (4) It would be easy to find the relocated location nearby their present house. (5) The loss of their lands with farm land will be serious for some people.
Mitigation Measures :	<ol style="list-style-type: none"> (1) Communication with the inhabitants (2) Sufficient information and data on the project and resettlement. (3) Removal of interference by political power, if any. (4) Reasonable compensation for resettlement (5) Assistance / guidance for their stable income (6) Preparation of resettlement land based on their desire (nearby their house in the same village)
Necessary monitoring / Investigation for the further study :	<ol style="list-style-type: none"> (1) Detailed survey of inhabitants to be resettled (2) Survey on regional socio-economy. (3) Past examples of resettlement by similar projects. (4) Detailed investigation of resettlement alternative sites.

TABLE IV.5.4.10 EXPLANATION NOTE OF MITIGATION MEASURES FOR BERIS RESERVOIR RECREATIONAL PARK

Factor :	Water pollution
Content :	Reservoir water may be contaminated and the water pollution may cause the eutrophication, turbid water, etc.
Cause :	<ol style="list-style-type: none"> (1) Inflow of nitrogen (N) and phosphorus (P) (2) Vegetation in the reservoir (3) Inflow of turbid water (4) Sedimentation of carcass of aquatic life (5) Activities in the park (waste and drainage)
Probable Impact :	<ol style="list-style-type: none"> (1) Shortage of oxygen and cause danger to fishes (2) Ordor & mal-colour and cause uncomfortable condition for visitors/users. (3) Water pollution of the downstream river
Comments on Impact :	<ol style="list-style-type: none"> (1) Generally the eutrophication is most serious in reservoir. (2) Stream water is usually clean at present. (3) Significance of impact depend on the control & management system. (4) Many visiters are expected.
Mitigation Measures :	<ol style="list-style-type: none"> (1) Control and treatment of pollution loads in the basin (2) Circulation system of reservoir water (3) Removal of vegetation before impounding (4) Selective intake water level facilities (5) Control of river basin development (6) Proper drainage with treatment system. (7) Inspection and control of visitors and workers in the park
Necessary monitoring / Investigation for the further study :	<ol style="list-style-type: none"> (1) Pollution sources survey (2) Survey for prediction of water pollution loads (3) Survey on water utilization in the reservoir as well as downstream river. (4) Water quality survey

TABLE IV.5.4.11 EXPLANATION NOTE OF MITIGATION MEASURES FOR BUMBONG LIMA RECREATIONAL PARK

Factor : Resettlement
Content : Resettlement of inhabitants living in the proposed area recreational park to new areas prepared by the government
Cause : (1) Land for park area (2) Land for construction ,in any
Probable Impact : (1) Desire/Sentiment of inhabitants who want to stay in the same village/location (2) Uneasiness to their living conditions including income in a resettlement land. (3) Convenient and comfortable life close to the river (4) Disruption of present community
Comments on Impact : (1) There are some houses (20 or more) located in the downstream side of the highway. (2) It would be not difficult to find their new locations nearby thier present houses. (3) It is probable that they are happy to have a beautiful park nearby . (4) They can live in the same village without division of the communities.
Mitigation Measures : (1) Communication with the inhabitants (2) Sufficient information and data on the project and resettlement. (3) Removal of interference by political power, if any. (4) Resonable compersation for resettlement (5) Assistance / guidance for their stable income (6) Preparation of resettlement land based on their desire (in the same village)
Necessary monitoring / Investigation for the further study : (1) Detailed survey of inhabitants to be resettled (2) Survey on regional socio-economy. (3) Past examples of resettlement by similar projects. (4) Detailed investigation of resettlement alternative sites.

TABLE IV.5.4.12 TYPICAL MEASURES FOR WATER QUALITY CONSERVATION IN RIVERS AND RESERVOIRS

	Measures	Remarks
Measures in the basin and Before Inflow	Effluent Control	Factory, Domestic animal farm
	Sewerage System	Tertiary treatment , if required
	Reduction of pollutant loads Inflow	Oxidation pond, Settling pond, Tertiary treatment plant
	Separation of polluted flow and river flow	Bypass of polluted water
	Cooperation of inhabitants	River beautification activities Water conservation publicity activities O & M of septic tank Combined septic tank
	Measures for livestock farm	Restoration to farm lands ,etc.
Measures after Inflow	Dredging of bed muds	
	Removal of floating substances	Filtering, etc.
	Additional water supply	Supplementary water from dam Supply of clean water
	Utilization of self-purification function of river	Thin layer flow purification by aeration Fishes Aquatic plants
	Construction of water quality improvement facilities	Oxidation type purification channel by flowing through gravels Running water conservation channel
	Separate flow way of polluted channel	Running water conservation channel