TABLES

Table 2-1 Flooding Conditions in Habitual Flood Inundation Area

Area	Key Drainage System	Flooding Situation	Major Causes of Flooding	Remarks
Sungai Petani				
Kg. Benggali	Line P	• 0.3 to 0.5 m in depth twice to three times a year • Flooding for 1 to 2 hours	• Overflow along Line P due to poor drainage capacity • Development activities in upper reaches	
Kg. Haji Wahab	Sg. Petani	• 0.3 to 0.5 m in depth • Flooding by coincidence with heavy downpour and high tide	• Poor channel capacity due to sharp bend	
Kg. Pokok Limau	Sg. Pasir	• 0.5 to 1 m in depth after every heavy downpour • Flooding for 1 to 3 hours	• Poor capacity of channel and culvert	
Kg. Hj Rashid	Sg. Pasir	• 0.3 m in depth • Flooding by coincidence with heavy downpour and high tide	• Poor channel capacity	
Kg. Huda	Sg. Tukang	• 0.5 to 1 m in depth after every heavy downpour	• Poor drainage capacity • Development activities in upper reaches	
Melaka				
Kg. Sg. Putat & Kg. Pulau Nibong	Sg. Putat	• 0.5 to 1 m in depth after every heavy downpour • Flooding for 1 week	• Overflow along Sg. Putat due to poor drainage capacity • Development activities in upper reaches	Affected families: 32 in May 1998, 38 in Nov. 1998
Jl. Ayer Keroh Height	Sg. Bt. Bruang	• Flooding along national road after every heavy downpour	• Poor drainage pipe capacity • Industrial development in upper reaches	
Tanjung Minyak	Sg. Ayer Hitam	• Flooding along right bank after every heavy downpour	• Poor drainage capacity • Development activities in upper reaches	Affected families: 8 in Oct. 1996
Taman Rambai Indah	Sg. Ayer Salak	• Flooding on lower portion of estate after every heavy downpour	• Lack of enough platform level • Development activities in upper reaches	Affected families: 44 in Jan. 1997, 81 in Aug. 1998, 52 in Nov. 1998
Kg. Durian Daun Dalam	Trunk drain	• 0.4 m in depth after 1-hour heavy downpour	• Poor capacity of roadside drain • Depressed hinterland in entire drainage basin	
Kg. Lapan, Bachang	Roadside drain	• Flooding on lower portion after every heavy downpour	• Poor capacity of roadside drain • Depressed hinterland in entire drainage basin	
Kesidang	Trunk drain	• Flooding on lower portion after 1-hour heavy downpour	• Poor capacity of roadside and trunk drain • Depressed hinterland in entire drainage basin	
Kg. Sembilan	Trunk drain	• 0.5 m in depth after every heavy downpour • Flooding situation lasting for 30 years	• Poor capacity of trunk drain	

Table 3-1(1/2) Existing Land Use

(Unit: ha)

River Basin	Sub-Basin No.	Catchment Area	Area for Each Land Use Category										
			Residential	Commercial	Industry	Institutional	Recreation	Natural	Paddy	Dry Crop	Road	Pond	Others
Air Mendidieh	AM- 1	6.96	3.43	-	-	-	-	-	-	-	3.53	-	-
	AM- 2	5.36	2.97	-	-	-	1.12	-	-	-	1.27	-	-
	AM- 3	24.53	9.84	3.92	-	-	0.55	-	-	-	8.06	1.20	0.96
	AM- 4	8.87	6.81	-	-	-	0.44	-	-	-	1.62	-	-
	AM- 5	25.42	-	-	-	15.71	-	-	-	-	1.37	3.22	5.12
	AM- 6	13.69	6.61	-	-	-	1.03	-	-	-	1.66	0.49	3.90
	AM- 7	54.47	-	1.52	-	-	-	-	-	-	1.53	-	51.42
	AM- 8	17.69	3.35	-	-	-	-	-	-	-	2.15	-	12.19
	AM- 9	1.59	0.21	-	-	-	-	-	-	-	0.36	-	1.02
	AM- 10	9.58	4.02	-	-	-	-	-	-	-	1.13	-	4.43
	AM- 11	11.36	3.36	-	-	6.20	-	-	-	-	1.45	-	0.35
	AM- 12	14.35	3.38	0.42	-	-	0.88	-	-	-	1.12	-	8.55
	AM- 13	46.42	26.42	-	-	-	2.18	-	-	-	13.93	-	3.89
	AM- 14	12.43	5.73	-	-	4.28	-	-	-	-	2.42	-	-
	AM- 15	19.73	10.43	1.62	-	-	-	-	-	-	6.22	-	1.46
	AM- 16	50.32	9.29	3.61	-	14.05	-	-	-	-	8.03	-	15.34
	AM- 17	10.93	3.73	1.13	-	1.58	-	-	-	-	0.88	-	3.61
	AM- 18	25.35	11.52	5.40	-	0.67	-	-	-	-	2.03	-	5.73
	AM- 19	3.38	1.28	0.88	-	-	-	-	-	-	0.33	-	0.89
	sub-total	362.43	112.38	18.50	-	42.49	6.20	-	-	-	59.09	4.91	118.86
Line G	LG- 1	75.86	-	-	-	1.02	-	-	-	74.61	0.03	0.07	0.13
	LG- 2	69.59	30.53	1.29	-	0.36	9.12	-	-	4.65	16.46	1.56	5.62
	LG- 3	4.86	-	-	-	-	-	-	-	3.86	0.82	-	0.18
	LG- 4	17.70	4.42	-	0.28	-	3.13	-	-	-	4.92	-	4.95
	LG- 5	16.04	-	-	3.45	-	-	-	-	-	1.19	0.06	11.34
	LG- 6	28.04	9.58	1.83	-	-	3.62	-	-	-	5.46	0.56	6.99
	LG- 7	20.49	1.22	0.60	-	-	-	-	-	-	0.79	-	17.88
	LG- 8	15.72	1.89	-	-	-	-	-	-	-	0.55	-	13.28
	LG- 9	7.05	1.96	-	-	-	-	-	-	-	0.45	-	4.64
	LG- 10	12.53	2.32	-	-	-	-	-	-	-	1.17	-	9.04
	LG- 11	4.79	1.53	-	1.30	-	-	-	-	-	0.61	-	1.35
	LG- 12	26.87	3.92	0.66	-	0.12	-	-	-	13.20	3.13	-	5.84
	Sub-total	299.54	57.37	4.38	5.03	1.50	15.87	-	-	96.32	35.58	2.25	81.24

Note: Dub-basin No. LG-12 in Line G is excluded from the existing catchment area, but could be included through alternative plan on drainage channel network.

Table 3-1(2/2) Existing Land Use

River Basin	Sub-Basin No.	Total Area (ha)	Area for Each Land Use Category (ha)										
			Residential	Commercial	Industry	Institutional	Recreation	Natural	Paddy	Dry Crop	Road	Pond	Others
Pokkok Mangg	L- 1	88.17	22.58	2.03	-	0.13	-	-	-	41.30	-	-	14.38
	L- 2	76.20	20.35	-	1.20	0.28	-	-	-	47.42	-	-	0.37
	L- 3	103.58	38.48	0.40	-	2.38	-	-	-	49.07	-	-	1.29
	P- 1	28.77	4.12	5.40	-	0.12	-	-	-	-	-	-	12.39
	P- 2	60.57	30.96	-	-	-	2.85	-	-	10.10	-	-	8.92
	P- 3	34.78	10.04	-	-	0.10	-	-	-	18.38	-	-	3.75
	P- 4	15.47	7.33	-	-	0.14	-	-	-	3.26	-	-	0.02
	P- 5	63.36	31.11	0.79	0.88	1.07	-	-	-	14.27	-	-	4.22
	Sub-total	470.90	164.97	8.62	2.08	4.22	2.85	-	-	183.80	-	-	45.34
Ayer Salak	DP- 1	134.60	-	-	-	-	-	-	-	-	-	-	132.60
	DP- 2	98.10	-	-	52.58	-	-	-	-	5.11	-	-	19.78
	DP- 3	128.90	-	-	-	-	-	-	-	128.90	-	-	-
	AB- 1	365.14	35.94	-	-	1.11	1.49	-	-	297.74	-	-	19.17
	AB- 2	220.35	11.32	-	1.14	-	-	-	-	175.15	-	-	25.69
	AS- 1	1,134.25	163.94	-	71.24	-	1.97	-	-	676.32	-	-	138.38
	Sub-total	2,081.34	211.20	-	124.96	1.11	3.46	-	-	1,283.22	-	-	335.62

Table 3-2(1/2) Projectec Land Use in the Year 2020

River Basin	Sub-Basin No.	Total Area (ha)	Area for Each Land Use Category (ha)										
			Residential	Commercial	Industry	Institutional	Recreation	Natural	Paddy	Dry Crop	Road	Pond	Others
Air Mendidieh	AM- 1	6.96	3.43	-	-	-	-	-	-	-	3.53	-	-
	AM- 2	5.36	2.97	-	-	-	1.12	-	-	-	1.27	-	-
	AM- 3	24.53	10.62	3.92	-	-	0.55	-	-	-	8.24	1.20	-
	AM- 4	8.87	6.81	-	-	-	0.44	-	-	-	1.62	-	-
	AM- 5	25.42	-	-	-	23.77	-	-	-	-	1.65	-	-
	AM- 6	13.69	8.26	0.93	-	1.63	1.03	-	-	-	1.84	-	-
	AM- 7	54.47	22.82	13.62	-	-	1.66	-	-	-	16.37	-	-
	AM- 8	17.69	11.70	-	-	-	1.30	-	-	-	4.69	-	-
	AM- 9	1.59	0.21	0.76	-	-	-	-	-	-	0.62	-	-
	AM- 10	9.58	3.86	3.20	-	-	-	-	-	-	2.52	-	-
	AM- 11	11.36	3.58	-	-	6.20	-	-	-	-	1.58	-	-
	AM- 12	14.35	9.36	0.42	-	-	1.03	-	-	-	3.54	-	-
	AM- 13	46.42	28.60	-	-	-	3.10	-	-	-	14.72	-	-
	AM- 14	12.43	6.07	-	-	4.28	-	-	-	-	2.08	-	-
	AM- 15	19.73	11.89	1.62	-	-	-	-	-	-	6.22	-	-
	AM- 16	50.32	10.29	8.10	-	23.40	-	-	-	-	8.53	-	-
	AM- 17	10.93	0.59	8.54	-	1.58	-	-	-	-	0.22	-	-
	AM- 18	25.35	4.22	15.72	-	-	-	-	-	-	5.41	-	-
	AM- 19	3.38	-	2.42	-	-	-	-	-	-	0.96	-	-
	Sub-total	362.43	145.28	59.25	-	60.86	10.23	-	-	-	85.61	1.20	-
Line G	LG- 1	75.86	48.70	-	-	1.02	10.75	-	-	-	15.39	-	-
	LG- 2	69.59	33.79	1.29	-	3.44	9.48	-	-	-	17.49	1.56	2.54
	LG- 3	4.86	2.93	-	-	-	-	-	-	-	1.75	-	0.18
	LG- 4	17.70	7.34	-	0.28	-	4.18	-	-	-	5.90	-	-
	LG- 5	16.04	5.27	0.23	7.27	-	0.81	-	-	-	2.46	-	-
	LG- 6	28.04	12.81	1.83	-	2.69	4.16	-	-	-	5.99	0.56	-
	LG- 7	20.49	13.84	0.89	-	-	1.57	-	-	-	4.19	-	-
	LG- 8	15.72	10.59	-	-	-	1.18	-	-	-	3.95	-	-
	LG- 9	7.05	4.77	-	-	-	0.53	-	-	-	1.75	-	-
	LG- 10	12.53	7.82	0.45	-	-	0.92	-	-	-	3.34	-	-
	LG- 11	4.79	3.47	-	-	-	-	-	-	-	1.32	-	-
	LG- 12	26.87	17.00	1.56	-	0.12	0.69	-	-	-	6.41	-	1.09
	Sub-total	299.54	168.33	6.25	7.55	7.27	34.27	-	-	-	69.94	2.12	3.81

Note: Dub-basin No. LG-12 in Line G is excluded from the existing catchment area, but could be included through alternative plan on drainage channel network.

Table 3-2(2/2) Projectec Land Use in the Year 2020

River Basin	Sub-Basin No.	Total Area (ha)	Area for Each Land Use Category (ha)										
			Residential	Commercial	Industry	Institutional	Recreation	Natural	Paddy	Dry Crop	Road	Pond	Others
Pokkok Mangg	L- 1	88.17	58.89	4.93	0.00	0.13	5.18	0.00	0.00	0.00	0.00	0.00	0.00
	L- 2	76.20	53.80	0.49	0.39	0.28	4.78	0.00	0.00	0.00	0.00	0.00	0.00
	L- 3	103.58	73.36	0.40	0.00	2.38	4.98	0.00	0.00	0.00	0.00	0.00	0.53
	P- 1	28.77	9.85	8.59	0.00	0.12	0.82	0.00	0.00	0.00	0.00	0.00	0.00
	P- 2	60.57	43.18	0.00	0.00	0.00	4.71	0.00	0.00	0.00	0.00	0.00	1.46
	P- 3	34.78	25.53	0.00	0.00	0.10	2.21	0.00	0.00	0.00	0.00	0.00	0.00
	P- 4	15.47	9.63	0.00	0.00	0.14	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	P- 5	63.36	44.75	0.71	0.00	1.07	1.95	0.00	0.00	0.00	0.00	0.00	0.00
	Sub-total	470.90	318.99	15.12	0.39	4.22	24.96	0.00	0.00	0.00	0.00	0.00	1.99
Ayer salak	DP- 1	134.60	18.94	0.00	80.22	0.00	2.71	0.00	0.00	0.00	0.00	0.00	0.00
	DP- 2	98.10	0.00	0.00	71.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	DP- 3	128.90	0.00	0.00	97.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AB- 1	365.14	100.71	5.37	69.14	1.11	10.74	0.00	0.00	0.00	0.00	126.21	0.12
	AB- 2	220.35	58.05	1.33	100.91	0.00	6.68	0.00	0.00	0.00	0.00	0.00	1.06
	AS- 1	1,134.25	389.89	0.00	383.30	0.00	34.25	0.00	0.00	0.00	0.00	81.31	0.00
	Sub-total	2,081.34	567.58	6.70	803.03	1.11	54.37	0.00	0.00	0.00	0.00	207.52	1.18

Table 3-3 Alternative Drainage Improvement Plans and Selected Optimum Plan

Drainage Area	Alt. No.	Improvement Measures Involved								Number of Houses to be Relocated	Project Cost (RM million)	Selected Optimum Plan
		Channel Improvement	Construction of New Trunk Drain	Construction of Diversion Channel	Rehabilitation of Existing Flood Detention Pond	Construction of New Flood Detention Pond	Construction of On-site Detention Pond	Installation of Storage Tank in a House Lot	Construction of Drainage Pump			
Sg. Air Mendidih	Alt.1	√								37	9.1	
	Alt. 2	√				√				33	9.0	
	Alt. 3	√				√	√			30	8.8	○
	Alt. 4	√				√	√	√		22	30.1	
Line-G	Alt.1	√								2	6.2	
	Alt. 2	√			√					2	5.8	
	Alt. 3	√			√	√				1	5.3	
	Alt. 4	√		√	√	√				0	5.2	○
Prt. Pokok Mangga	Alt.1	√								48	18.2	
	Alt. 2	√					√			36	18.0	
	Alt. 3	√						√		36	64.5	
	Alt. 4	√	√							29	14.6	○
	Alt. 5	√	√				√			28	14.9	
	Alt. 6	√	√					√		28	61.4	
	Alt. 7	√		√					√	30	44.6	
Sg. Ayer Salak	Alt.1	√								63	37.2	
	Alt. 2	√			√					60	36.2	
	Alt. 3	√			√	√				38	29.3	○

Note : Each of alternative plans involves the improvement measures marked by "√".

Table 3-4(1/2) Annual Disbursement Schedule for Priority Projects

Sg.Petani (Sg. Air Mendidih) Unit : 1000 RM

Year	Total		2001		2002		2003		2004		2005		2006~
Classification of Cost/Currency	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	
1 Construction Cost													
Drainage channel	1,949	571	0	0	0	0	650	190	650	190	650	190	
Detention facilities	819	273	0	0	0	0	273	91	273	91	273	91	
2 Land Acquisition Cost													
Land acquisition (ch.)	4,175	0	0	0	1,392	0	1,392	0	1,392	0	0	0	
Land acquisition (dp.)	272	0	0	0	136	0	136	0	0	0	0	0	
3 Administration Cost	179	0	36	0	36	0	36	0	36	0	36	0	
4 Engineering Services Cost	375	169	187	84	47	21	47	21	47	21	47	21	
Sub-Total (1. To 4.)	7,768	1,013	223	84	1,610	21	2,533	303	2,397	303	1,005	303	
5 Physical Contingency	777	101	22	8	161	2	253	30	240	30	101	30	
Sub-Total (1. To 5.)	8,545	1,114	245	93	1,771	23	2,786	333	2,636	333	1,106	333	
6 Price Contingency	1,347	51	11	1	163	1	393	12	508	16	272	20	
Total (1. To 6.)	9,892	1,165	257	94	1,934	24	3,179	345	3,144	349	1,378	353	
Annual O&M Cost (ch.)			-		-		-		12		24		35
Annual O&M Cost (dp.)			-		-		-		-		-		112

Sg.Petani (Line G) Unit : 1000 RM

Year	Total		2,001		2,002		2,003		2,004		2,005		2006~
Classification of Cost/Currency	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	
1 Construction Cost													
Drainage channel	1,584	444	0	0	0	0	528	148	528	148	528	148	
Detention facilities	945	296	0	0	0	0	315	99	315	99	315	99	
2 Land Acquisition Cost													
Land acquisition (ch.)	786	0	0	0	262	0	262	0	262	0	0	0	
Land acquisition (dp.)	512	0	0	0	256	0	256	0	0	0	0	0	
3 Administration Cost	164	0	33	0	33	0	33	0	33	0	33	0	
4 Engineering Services Cost	342	148	171	74	43	19	43	19	43	19	43	19	
Sub-Total (1. To 4.)	4,333	889	204	74	593	19	1,436	265	1,180	265	918	265	
5 Physical Contingency	433	89	20	7	59	2	144	27	118	27	92	27	
Sub-Total (1. To 5.)	4,766	978	224	81	653	20	1,580	292	1,298	292	1,010	292	
6 Price Contingency	792	44	10	1	60	0	223	11	250	14	249	18	
Total (1. To 6.)	5,558	1,022	234	82	713	21	1,803	303	1,548	306	1,259	310	
Annual O&M Cost (ch.)			-		-		-		2		5		7
Annual O&M Cost (dp.)			-		-		-		-		-		98

Note : Physical Contingency (10% of 1. To 4.)
Price Contingency (4.5% for LC & 1.2 % for FC)
ch. = drainage channel
dp. = detention facilities

Table 3-4(2/2) Annual Disbursement Schedule for Priority Projects

Melaka (Pokok Mangga)

Unit : 1000 RM

Year	Total		2,001		2,002		2,003		2,004		2,005		2006~
Classification of Cost/Currency	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	
1 Construction Cost													
Drainage channel	7,205	2,021	0	0	0	0	2,402	674	2,402	674	2,402	674	
2 Land Acquisition Cost													
Land acquisition (ch.)	3,573	0	0	0	1,191	0	1,191	0	1,191	0	0	0	
3 Administration Cost	461	0	92	0	92	0	92	0	92	0	92	0	
4 Engineering Services Cost	980	404	490	202	122	51	122	51	122	51	122	51	
Sub-Total (1. To 4.)	12,219	2,425	582	202	1,406	51	3,807	724	3,807	724	2,616	724	
5 Physical Contingency	1,222	243	58	20	141	5	381	72	381	72	262	72	
Sub-Total (1. To 5.)	13,441	2,668	640	222	1,546	56	4,188	797	4,188	797	2,878	797	
6 Price Contingency	2,277	121	29	3	142	1	591	29	806	39	709	49	
Total (1. To 6.)	15,718	2,788	669	225	1,689	57	4,779	826	4,994	835	3,586	846	
Annual O&M Cost (ch.)			-		-		-		18		36		54

Melaka (Ayer Salak)

Unit : 1000 RM

Year	Total		2,001		2,002		2,003		2,004		2,005		2006~
Classification of Cost/Currency	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	
1 Construction Cost													
Drainage channel	1,880	695	0	0	0	0	627	232	627	232	627	232	
Detention facilities	954	468	0	0	0	0	318	156	318	156	318	156	
2 Land Acquisition Cost													
Land acquisition (ch.)	22,683	0	0	0	7,561	0	7,561	0	7,561	0	0	0	
Land acquisition (dp.)	1,809	0	0	0	905	0	905	0	0	0	0	0	
3 Administration Cost	200	0	40	0	40	0	40	0	40	0	40	0	
4 Engineering Services Cost	367	222	183	111	46	28	46	28	46	28	46	28	
Sub-Total (1. To 4.)	27,892	1,385	223	111	8,551	28	9,496	415	8,591	415	1,030	415	
5 Physical Contingency	2,789	139	22	11	855	3	950	42	859	42	103	42	
Sub-Total (1. To 5.)	30,681	1,524	246	122	9,407	31	10,445	457	9,450	457	1,133	457	
6 Price Contingency	4,450	69	11	1	866	1	1,475	17	1,819	22	279	28	
Total (1. To 6.)	35,131	1,593	257	124	10,272	31	11,920	474	11,270	479	1,412	485	
Annual O&M Cost (ch.)			-		-		-		67		135		202
Annual O&M Cost (dp.)			-		-		-		-		-		331

Note : Physical Contingency (10% of 1. To 4.)
Price Contingency (4.5% for LC & 1.2 % for FC)
ch. = drainage channel
dp. = detention facilities