Table 4 RIVER CHARACTERISTICS OF THE KEDAH RIVER (2/34)

	Item	Description	Source
1.	Location	Basin 3, Kedah/Perlis State	
2.	Catchment Area	3,695 km^2 (Basin)	2
3.	Annual Basin Rainfall	2,260 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Survey data not available. Natural trapezoidal cross sections without levees in upper reaches. Stretch in irrigation area canalized.	1
6.	River Morphology	Meanders in tidal reaches up to Langgar, but in a stable regime. Erosion observed at localized places along Pdg. Terap river, but the extent is not severe. River is generally in a stable regime.	2
7.	Estuary	Silting due to littoral drift is progressive. No serious problem at present, but big boats not navigable during low spring tide.	1 & 2
8.	Sediment	No sediment problem observed in middle/lower part. No information as to silting in canals and channels in irrigation area.	
9.	Salt Water Intrusion	Up to tidal barrage at 2 km downstream from Alor Setar. No specific problem existing.	2
10.	Flood	Overbank flood along Pdg. Terap due to limited channel capacity, K. Nerang - K. Pai. Flood around Alor Setar due to back water effect from barrage associated with high tide. In general, flood is not a serious problem in this basin.	1 & 2
11.	Other Items	Flood around Alor Setar limited to Kg. Genung - Kg. S. Bharu and other low-ling area along small rivers. Recorded max tide + 2.3m, barrage W.L. + 1.7m. Alor Setar G.L. + 1.5 - 1.7m.	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 5 RIVER CHARACTERISTICS OF THE MUDA RIVER (3/34)

	Item	Description	Source
1.	Location	Basin 5, Kedah/P. Pinang State	
2.	Catchment Area	4,300 km^2 (Basin)	2
3.	Annual Basin Rainfall	2,530 mm	2
4.	Annual Mean Runoff	108 m^3/s at Batu Pekaka (3,340 km^2), equiv. 1,015 mm	Ref. 26
5.	River Profile & Cross Sections	Not surveyed. Natural trapezoidal sections in whole reaches.	2
6.	River Morphology	Some meanders with localized erosion in lower/middle reaches, but no active meandering/erosioning reported and observed. River course generally in stable regime.	1 & 2
7.	Estuary	Present river width at outlet is 2/3 to 1/2 as compared with 1 : 63,360 map (1970). This is due to development of right bank sand dune created by littoral drift. However, no major adverse problem except difficulty in navigation.	2
8.	Sediment	It is likely that basin is yielding sediment. Shoals of medium/coarse sands existing in reaches K. Kechil - Batu Pekaka (mainly observed on map, not visible during field visit)	2 & Ref. 26
9.	Salt Water Intrusion	Tidal barrage near Kg. Nangka prevents tidal and saline intrusion. No adverse problem at present.	1 & 2
10.	Flood	Overbank flow in upper reaches (along Muda and Kechil rivers). Flooding in d/s area largely depends on water level at barrage and tide level.	1
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 6 RIVER CHARACTERISTICS OF THE PERAI/KULIM RIVER (4/34)

	Item	Description	Source
1.	Location	Basin 6, P. Pinang State	
2.	Catchment Area	895 km^2 (Basin)	2
3.	Annual Basin Rainfall	2,320 mm	2
4.	Annual Mean Runoff	6.3 m^3/s at Ara Kuda (130 km^2), equiv. 1,530 mm	Ref. 26
5.	River Profile & Cross Sections	No surveyed data available	1
6.	River Morphology	Meanders existing in tidal reaches in Swamp area, but the banks generally in stable condition.	2
7.	Estuary	Marine mud intruding in river mouth, but no present difficulty reported. Sediment after completion of barrage to be observed.	1 & 2
8.	Sediment	No sand bars and shoals. Mud deposit observed in lower reaches, but not causing mazor problem at present. Estimated yield rate at barrage site: 130,000 m^3/yr.	1 & 2
9.	Salt Water Intrusion	Presently up to 1 km d/s of kg. Mak Sulong. Up to barrage site after its completion.	Ref. 26
10.	Flood	Flood is of minor extent, but aggravated by tide level, causing inundation in lowlying areas. Owing to intensive land use in recent years, damage potential is increasing.	2
11.	Other Items	Perai barrage under construction. Canalization of Parai river also scheduled. These may solve flooding problem.	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 7 RIVER CHARACTERISTICS OF THE PINANG RIVER (5/34)

	Item	Description	Source
1.	Location	Basin 7, P. Pinang State	
2.	Catchment Area	300 km^2 (Basin), 61 km^2 (Pinang R.)	2
3.	Annual Basin Rainfall	2,790 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Profiles and sections surveyed by Municipal Office in 1966, for proposed river improvement (not implemented yet).	
6.	River Morphology	No noteworthy meanders. Erosion banks observed, but mostly of minor extend and local nature. In view of dens housings adjacent to river banks, revetment work may be needed.	1 & 2
7.	Estuary	Marine mud silting in river mouth (above mean sea level) and along coastal line. Navigation of small boat (only up to Jelutong road) difficult at low tide.	2
8.	Sediment	Sediment yield from housing development sites. Although quantity is not much, it may cause bed aggradation due to limited sediment carrying capacity.	1 & 2
9.	Salt Water Intrusion	No problem reported at present.	1
10.	Flood	Habitual flooding in low-lying riverine areas of George Town, particularly downstream from Scotland road.	1
11.	Other Items	Flood diversion channel from Jelutong river to sea completed.	

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 8 RIVER CHARACTERISTICS OF THE KERIAN RIVER (6/34)

	Item	Description	Source
1.	Location	Basin 8, P. Pinang/Kedah/Perak State	
2.	Catchment Area	1,400 km^2 (Basin)	
3.	Annual Basin Rainfall	2,790 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data. Naturally formed trapezoidal cross sections. Generally shallow.	1 & 2
6.	River Morphology	Meanders in tidal reaches and sluggish course in middle reaches. Bank erosion observed at meanders in middle reaches may be contributing sediment yield.	2
7.	Estuary	No noteworthy problems reported. Marine mud depositing on both banks of river mouth, but no difficulty in navigation.	1
8.	Sediment	Sand shoals observed at meanders in upper and middle reaches. High yield of sediment due to land development and logging. Ijok diversion headwork silted.	1 & 2
9.	Salt Water Intrusion	Up to tidal gate at Parit Bantar. No problem existing at present (no water intakes in reach downstream from barrage)	1
10.	Flood	Flood due to overbank flow, mostly in swamp area and some rubber estates. Only minor flooding at local places in Bander Bharu area. Flood normally recedes if tidal gates are opened.	
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 9 RIVER CHARACTERISTICS OF THE KURAU RIVER (7/34)

	Item	Description	Source
1.	Location	Basin 9, Perak State	
2.	Catchment Area	3,255 km^2 (Basin)	
3.	Annual Basin Rainfall	2,655 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data. Almost flat gradient up to Bukit Merah Reservoir. Naturally formed trapezoidal cross sections.	1 & 2
6.	River Morphology	Heavy meanders in tidal reaches. Banks are generally stable. No adverse problems reported.	1
7.	Estuary	Marine mud intruding into river mounth, causing gradual change of flow direction southward. But, no major difficulty of navigation.	1
8.	Sediment	Mild yield of sediment, but silting problem arising in reach upstream from Pondok Tanjong Town, due to irregal cultivation in forest area.	1
9.	Salt Water Intrusion	No adverse problems reported.	1
10.	Flood	Moderate extent of flood in upstream from Pondok Tanjong, due to overbank flow. Flood mostly in rubber estate and at some kampongs. Area downstream from Bt. Merah Reservoir is also subject to flood if the gates are full-opened.	1
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 10 RIVER CHARACTERISTICS OF THE PERAK RIVER (8/34)

	Item	Description	Source
1.	Location	Basin 10, Perak State	
2.	Catchment Area	14,000 km^2	Ref. 34
3.	Annual Basin Rainfall	2,340 mm	2
4.	Annual Mean Runoff	212 m^3/s at Iskandar (8,188 km^2), equiv. 817 mm	Ref. 34
5.	River Profile & Cross Section	Recently surveyed for a stretch from Teluk Anson to Kuala Kangsar.	1
6.	River Morphology	Natural trapezoidal cross sections in lower/ middle reaches, gorge shape in upper reaches. Meandering in lower reaches, but not so active except at Teluk Anson. Severe erosion at outer meanders at Teluk Ancon Town.	2
7.	Estuary	About 1.7 km width. No specific problem	2
8.	Sediment	Sand bars and shoals at middle reaches but no remarkable change of riverbed levels in Taluk Sena - Kg. Gajah area. High sediment yield from Kinta tributaries (e.g. Paris).	2
9.	Salt Water Intrusion	Tidal effect up to Kg. Gajah (84 km). Salt water intrusion up to Teluk Anson (58 km). No adverse problems at present. Small tidal gates protecting each drainage areas.	1
10.	Flood	Flow gradient 1 : 2,800 (1967 flood, Chanderoh - K. Kinta). Flow construction 500 - 1,000 m^3/s in Kg. Gajah - K. Kinta section. Overbank flood in Grik - Teluk Sena. Habitual flood in Teluk Anson due to tidal effect.	1 & Refs. 29 & 34
11.	Other Items	Average flood depth: 1967 flood - 1.5m, 1973 flood - 0.6m in Trans - Perak area. Only Perlis can produce flooding in lower reaches (1980).	Ref.

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 11 RIVER CHARACTERISTICS OF THE BERNAM RIVER (9/34)

	Item	Description	Source
1.	Location	Basin 11, Perak/Selangor State	
2.	Catchment Area	3,335 km^2 (Basin)	
3.	Annual Basin Rainfall	2,500 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data. Generally trapezoidal cross sections.	
6.	River Morphology	Heavy meanders in lower tidal reaches and sluggish course in middle reaches. No adverse behavious reported. Minor bank erosion observed at localized places.	1 & 2
7.	Estuary	Estuary wide and sufficiently deep for navigation. No major marine mud intrusion in river mouth.	1 & 2
8.	Sediment	Silting problem at Bernam pump house near Began Terap. Sediment yield from tin mines along Sg. Juki, Sg. Baharai.	1
9.	Salt Water Intrusion	No present problem. No water intakes in tidal areas.	1
10.	Flood	Minor flooding in riverine area along upper/middle reaches due to overbank flow.	2
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 12 RIVER CHARACTERISTICS OF THE SELANGOR RIVER (10/34)

	Item	Description	Source
1.	Location	Basin 13, Selangor State	
2.	Catchment Area	1,820 km^2 (Basin)	
3.	Annual Basin Rainfall	2,500 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Section	No survey data, except at some places.	1
6.	River Morphology	Heavy meanders in tidal reaches, sluggish course in swamp areas. Minor erosion at localized places. No adverse problems reported, except bank erosion at outer meander near Kuala Selangor Town.	1 & 2
7.	Estuary	Silting at river mouth causing a little difficulty of fish boat navigation during low tide.	1
8.	Sediment	Sediment yield from tin mines along main stream and tributaries. Riverbed silting remarkable in area upstream from Batang Berjuntai.	1
9.	Salt Water Intrusion	Possibly not up to Sg. Lambai confluence. No present problem.	1 & 2
10.	Flood	Flooding in upper/middle reaches due to overbank flow. Seemingly little tidal effect on flood in lower reaches.	2
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 13 RIVER CHARACTERISTICS OF THE KLANG RIVER (11/34)

	Item	Description	Source
1.	Location	Basin 15, Selangor State	
2.	Catchment Area	1,425 km^2 (Basin)	
3.	Annual Basin Rainfall	2,250 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Surveyed for whole length. Canalized channel in reaches near Kuala Lumpur.	1
6.	River Morphology	No active meanders reported. Stable banks in canalized channel. Minor local erosion at meanders in upper reach. Bank loosening in lower reaches due to tidal action.	1 & 2
7.	Estuary	No major problems at present. Soils loosened from banks may be contributing siltation at river mouth.	1 & 2
8.	Sediment	Sand bars/shoals in upper reaches. Possibly high yield of sediment from housing development sites and tin mines. Estimated yield rate at Klang Gate Dam: 476 $m^3/km^2/yr$.	2
9.	Salt Water Intrusion	No present problem (no water intake facilities in tidal reach). Tidal affect possibly up to Sg. Damansara Confluence.	1 & 2
10.	Flood	Flooding in upper/middle reaches due to overbank flow. Tide possibly affecting flood level in lower reaches.	2
11.	Other Items	River improvement in reach upstream from Puchong scheduled (partly underway).	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 14 RIVER CHARACTERISTICS OF THE LANGAT RIVER (12/34)

	Item	Description	Source
1.	Location	Basin 16, Selangor State	
2.	Catchment Area	1,815 km^2 (Basin)	
3.	Annual Basin Rainfall	2,210 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data. Almost flat gradient in lower reach of 90 km long. Naturally formed trapezoidal cross section.	1
6.	River Morphology	Meanders in tidal reaches, sluggish river course in swampy land. Generally stable banks in upper/middle reaches. Banks in lower tidal reaches are loosening, possibly causing aggradation of riverbed.	2
7.	Estuary	Silting at river mouth causes the difficulty of navigation and seems to aggravate flood levels. Sediment from upstream area rather than from sea.	1
8.	Sediment	Sediment problem existing. Yield from various development and tin mines. River flow turbid in whole reach downstream from Cherus Town.	1 & 2
9.	Salt Water Intrusion	No present problem (no water intake facility in lower reach). Tidal effect up to Kg. Sabohan Bagan (90 km).	1 & 2
10.	Flood	Flooding in upper/middle reaches, due to overbank flow. Tide level seems to aggravate floods in lower reaches.	1
11.	Other Items	Riverbed dredging in area from Telok Datok to Dengkil in progress.	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 15 RIVER CHARACTERISTICS OF THE LINGGI RIVER (13/34)

	Item	Description	Source
1.	Location	Basin 18, N. Sembilan State	
2.	Catchment Area	1,420 km^2 (Basin)	2
3.	Annual Basin Rainfall	2,090 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data available except for stretches near to Seremban where canalization was executed.	1
6.	River Morphology	Although localized erosion observed in middle/upper reaches, river courses generally in a stable regime.	2
7.	Estuary	No problem existing. 300 m river width, sufficient depth for navigation.	2
8.	Sediment	Progressive silting observed in reaches downstream of Seremban. Sediment mainly from tributaries (e.g. Temian R.) due to housing development.	1 & 2
9.	Salt Water Intrusion	Tidal influence up to Linggi, Lubuk China towns. No adverse problem existing.	1
10.	Flood	Overbank flood in middle reaches, tidal effect in lower swamp area. Flooding in Seremban Town in mainly due to limited capacity of Temiang river (silted by 1 - 1.5 m). Existing bridges seemingly construct the passage of flood flow.	1 & 2
11.	Other Items	Wastes and rubbishes from Seremben Town contaminating river flow. Canalization in 1971 flood reach completed for a short stretch. Land acquisition difficult.	1 & 2

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 16 RIVER CHARACTERISTICS OF THE MELAKA RIVER (14/34)

	Item	Description	Source
1.	Location	Basin 19, Melaka State	
2.	Catchment Area	1,010 km^2 (Basin)	2
3.	Annual Basin Rainfall	1,910 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Section	Survey made in partial area. Flow gradient 1/5,000 in Sg. Batang Melaka, almost flat in Sg. Melaka.	1
6.	River Morphology	Only minor meanders, generally river regime seems stable. Bank erosion observed in upper/middle reaches, but mostly of less extent at localized places.	2
7.	Estuary	No major problems reported, except that disilting work required to remove sediment transported from both river and sea.	1
8.	Sediment	Approx. 70% of basin is cultivated land. River seems to have been silted, but present sediment yield seems moderate.	2
9.	Salt Water Intrusion	Up to tidal barrage at 6 km upstream from river mouth. No present problem reported.	1
10.	Flood	Flooding in Melaka Town and surrounding villages and paddy land. Flood is due to limited flow capacity of shallow channel. Swamp acting as natural retarding basin.	2
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 17 RIVER CHARACTERISTICS OF THE KESANG RIVER (15/34)

	Item	Description	Source
1.	Location	Basin 20, Melaka/Johor State	
2.	Catchment Area	705 km^2 at river mouth	2
3.	Annual Basin Rainfall	1,800 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Survey data available for canalized reaches. River gradient 1/10,000. Composite section with V-shaped low-flow channel.	1
6.	River Morphology	Sluggish courses in lower reaches (1 : 63,360 maps), but canalization completed up to Kg. Simpang Bekoh.	2
7.	Estuary	No major problems reported.	1
8.	Sediment	Presumably high yield of sediment, in view of mining activity, logging operation, recent land development and less forest cover, but observed S/S records show little yield.	1
9.	Salt Water Intrusion	Up to tidal gate. No adverse problem at present.	1
10.	Flood	Overbank flood in u/s reaches, tidal effect in d/s swampy area.	2
11.	Other Items	Canalization completed in d/s area (tidal gate - Sg. Chochong confluence). Improve of u/s reaches under plan by DID	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 18 RIVER CHARACTERISTICS OF THE MUAR RIVER (16/34)

	Item	Description	Source
1.	Location	Basin 21, Johor/N. Sembilan State	
2.	Catchment Area	6,595 km^2 at river mouth	2
3.	Annual Basin Rainfall	1,810 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data available.	1
6.	River Morphology	Meanders in lower tidal reaches, but stable at present. Only minor erosions at local places in upper reaches and in mangrove bank areas. River generally in a stable regime. Propagation of water plants active.	1 & 2
7.	Estuary	No problem existing.	1
8.	Sediment	Upstream area developed mostly for rubber plantation, but no noteworthy sediment problems.	1
9.	Salt Water Intrusion	Up to Kg. Kepong (110 km from river mouth). Sometimes, interruption of pumping.	1
10.	Flood	Overbank flood in upper reaches due to limited channel capacity. Flooding in Segamat town in due to low-lying topography and rapid runoff from Segamat river.	1 & 2
11.	Other Items	Only piece-mill study made for flood mitigation scheme in Segamat area.	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 19 RIVER CHARACTERISTICS OF THE BATU PAHAT RIVER (17/34)

	Item	Description	Source
1.	Location	Basin 22, Johor State	
2.	Catchment Area	2,600 km^2 at river mouth	2
3.	Annual Basin Rainfall	2,110 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Surveyed in partial reaches. Not received for this study.	1
6.	River Morphology	Some meanders in middle reaches of Simpang Kiri., Simpang Kanan and Lenik rivers. Shallow channels at meanders causing floods at smaller discharge. Bank generally stable.	1 & 2
7.	Estuary	Sand bars on west bank, but seems not to cause adverse effect on flood level in upstream. No navigation difficulty reported.	1
8.	Sediment	No excessive sediment yield observed, except housing project on left bank of Simpang Kanan (near Batu Pahat town) causing silting in nearly areas.	1 & 2
9.	Salt Water Intrusion	Up to Seri Medang on Simpang Kiri and Pt. Raja on Simpang Kanan. No adverse problem at present.	1
10.	Flood	Overbank flow in middle and lower reaches.	1
11.	Other Items	Study on flood control dams on Simpang Kanan, Simpang Kiri and Bekoh in progress.	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 20 RIVER CHARACTERISTICS OF THE SCUDAI & TEHRAN RIVER (18/34)

	Item	Description	Source
1.	Location	Basin 23, Johor State	
2.	Catchment Area	315 km^2 (Scudai), 274 km^2 (Tehran incl. J.B.)	2
3.	Annual Basin Rainfall	2,530 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Surveyed in improved stretches	1
6.	River Morphology	No meanders except minor ones in lower tidal areas. Bank erosion only at local places.	2
7.	Estuary	No problem existing	1
8.	Sediment	Housing development in middle reaches, producing sediment and causing aggradation of river bed levels.	1
9.	Salt Water Intrusion	Up to PUB's tidal gates (PUB: Public Utility Board of Singapore). No adverse problem at present.	1
10.	Flood	Flow gradient approx. 1/1,000 (Krai-PUB intake. 1969 flood). Overbank flow due to limited channel capacity, plus back water effect from PUB's gates.	1
11.	Other Items	River improvement completed in reaches downstream from PUB gates. Improvement in upper reaches under planning.	

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 21 RIVER CHARACTERISTICS OF THE JOHOR RIVER (19/34)

	Item	Description	Source
1.	Location	Basin 24, Johor State	
2.	Catchment Area	3,250 km^2 at river mouth	2
3.	Annual Basin Rainfall	2,420 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data available	
6.	River Morphology	No noteworthy meanders and erosions at present. River mostly flows in swamp jungle areas.	1 & 2
7.	Estuary	No problems existing.	1
8.	Sediment	Comparatively low yield rate 76 $m^3/km^2/yr$ for Sg. Sayong at Layang-Layang (98 km^2). No adverse problem reported.	1 & Ref. 13
9.	Salt Water Intrusion	Up to a point upstream from confluence with Sg. Pelapah (approx. 50 km). Water supply at PUB pumping station sometimes affected.	1
10.	Flood	Flow gradient 1/2,100 (Rantan Panjang-Kota Tinggi). Flood due to overbank flow, only marginal tide effect on flood level at Kota Tinggi.	2
11.	Other Items	Improvement of tributaries (Sg. Tiram, Sg. Serai) completed.	

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 22 RIVER CHARACTERISTICS OF THE SEDILI BESAR RIVER (20/34)

	Item	Description	Source
1.	Location	Basin 25, Johor State	
2.	Catchment Area	1,820 km^2 (Basin)	2
3.	Annual Basin Rainfall	2,550 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Almost flat gradient with low headwater. No survey data available.	1
6.	River Morphology	Meanders in lower tidal reaches. No noteworthy erosion. River flows mostly in swamp jungle areas, and generally in a stable regime.	1 & 2
7.	Estuary	No major problem at present, but littoral sediment intruding into river mouth over a mile long. In further upstream area, water depth is deep, 5 - 6 m, up to Kg. Mawai. Some rock outcrops at river mouth.	1 & 2
8.	Sediment	No problem observed.	
9.	Salt Water Intrusion	Up to some upstream point from junction with Sg. Kayu. No adverse problem at present.	1
10.	Flood	Flooding in swamp land. No noteworthy damages due to low developed area.	1
11.	Other Items	(Site visited after dark and no visual observation possible. Above comments mostly based on information from DID and Marine Dept.)	

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 23 RIVER CHARACTERISTICS OF THE MERSING RIVER (21/34)

	Item	Description	Source
1.	Location	Basin 26, Johor State	
2.	Catchment Area	880 km^2 (Basin)	2
3.	Annual Basin Rainfall	2,820 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data available	1
6.	River Morphology	No noteworthy meanders and erosion. River in a stable regime.	1 & 2
7.	Estuary	Coastal sand dunes on both lands of river mouth, causing the navigation of marine fish boats difficult. Course of navigation channel moving year by year due to erratic bed scour by monsoon flow.	2
8.	Sediment	No problem reported.	1
9.	Salt Water Intrusion	No problem reported.	2
10.	Flood	Flooding mostly in swamp land. Overbank flow & tidal backwater.	1
11.	Other Items	Marine fish boats up to 2 km from river mouth. (In field visit, only lower reach was accessible.)	2

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 24 RIVER CHARACTERISTICS OF THE ENDAU RIVER (22/34)

	Item	Description	Source
1.	Location	Basin 27, Johor/Pahang State	
2.	Catchment Area	4,740 km^2 at river mouth	2
3.	Annual Basin Rainfall	2,620 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No surveyed data available.	
6.	River Morphology	Meanders existing in lower tidal reaches but not active. Banks seem stable with only minor erosion at local places (Sembrong, Kahan rivers). Rapids existing near Kuala Sg. Jasin.	
7.	Estuary	No major problem at present, but sand dune developing on both banks. River mouth shallow, but seems in a equilibrium condition.	1
8.	Sediment	No problems existing. No sand bars/shoals observed.	1
9.	Salt Water Intrusion	Tidal effect up to 80 km along river course. Confluence with Sg. Mentelong is saline at regular interval.	2
10.	Flood	Overbank flood in upper reaches (Kluang area) is causing a certain extent of damages. Flooding in lower reaches largely affected by tide levels, where damage is minor due to low developed area (mostly swamp land).	1 & 2
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1:63,360 maps

Table 25 RIVER CHARACTERISTICS OF THE ROMPIN RIVER (23/34)

	Item	Description	Source
1.	Location	Basin 28, Pahang State	
2.	Catchment Area	4,285 km^2	2
3.	Annual Basin Rainfall	2,370 mm	2
4.	Annual Mean Runoff	80 m^3/s at river mouth	Ref. 23
5.	River Profile & Cross Sections	No survey data available. River gradient almost flat up to 160 km.	Ref. 23
6.	River Morphology	Meanders in lower tidal reaches and some local erosion, but no adverse problems. Being protected by swamp jungle banks, generally in a stable regime.	2 & Refs. 22 & 23
7.	Estuary	River mouth is shallow. Coastal sediment intruding into river mouth, but seems in equilibrium condition. Future observation recommended.	2
8.	Sediment	Estimated sediment yield: 250 $m^3/km^2/yr$. Sediment transport capacity of river in balance with sediment yields.	Refs. 23 & 38
9.	Salt Water Intrusion	2,000 ppm at Sg. Limau confluence (50 km). 200 ppm at Kg. Taran (90 km). Tidal effect us to 95 km. Release of min. 5 m^3/s required for saline-free water at Rompin Irrigation intake.	Refs. 38
10.	Flood	Flooding in low-land forest and swamp land, in vast area (870 km2) but with little damage at present. Flood level at EL. 5.0 m, 2 m depths above ground.	2 & Refs. 23 & 38
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 26 RIVER CHARACTERISTICS OF THE MARCHONG/BEHAR RIVER (24/34)

	Item	Description	Source
1.	Location	Basin 29, Pahang State	
2.	Catchment Area	1,895 km^2 (Basin)	2
3.	Annual Basin Rainfall	2,680 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data available.	1
6.	River Morphology	Meanders and minor erosion in lower tidal reaches. Although detailed information not available, river to be in equilibrium condition in view of primeval river regime.	2
7.	Estuary	Shallow river mouth due to coastal sediment causing a difficulty of marine boat navigation. Condition at Behar river mouth seems slightly better. Future observation needed.	2
8.	Sediment	No problem reported. Condition to be similar to Rompin river basin.	1 & 2
9.	Salt Water Intrusion	No adverse problem at present	1
10.	Flood	Foundation over an area of 1,450 km^2, in low-land forest and swamp lands. Present damage is minor.	2
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 27 RIVER CHARACTERISTICS OF THE PAHANG RIVER (25/34)

	Item	Description	Source
1.	Location	Basin 30, Pahang State	
2.	Catchment Area	29,300 km^2	Ref. 21
3.	Annual Basin Rainfall	2,130 mm	2
4.	Annual Mean Runoff	722 m /s at Temerloh (19,000 km^2) equiv. 1,180 mm	Ref. 21
5.	River Profile & Cross Sections	Profile surveyed by DID. Cross sections not available except for those at gauges.	1
6.	River Morphology	River appears to meander, but generally controlled by high banks. Little evidences of significant instability and erosion of banks, except some local erosions in Lipis river and near Pekan. Localized erosion also in middle reaches. Generally in a stable regime.	2 & Ref. 21
7.	Estuary	Entrance is almost stable at present. River sediment is mainly depositing in south delta, which will ultimately be closed. Difficulty in marine boat navigation at low tide.	Ref. 21
8.	Sediment	4.5×10^6 m^3/yr at Temerloh. No significant aggradation/degradation of bed levels. Existence of shade shoals and S/S observation records suggest high yield.	Ref. 24
9.	Salt Water Intrusion	Tidal influence up to 23.4 km. No saline problem existing at present.	1 & Ref. 21
10.	Flood	Flow gradient 1/5,000. Bankful capacity: 2 - 3 year flood. Slight construction of flood flow at Lubuk Paku, but no serious effect to flood in U/S areas. Overbank flow from both Pahang and tributaries. No tidal effect on flooding at Pekan.	1
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 28 RIVER CHARACTERISTICS OF THE KUANTAN RIVER (26/34)

	Item	Description	Source
1.	Location	Basin 31, Pahang State	
2.	Catchment Area	2,025 km^2 (Basin)	Ref. 25
3.	Annual Basin Rainfall	2,660 mm	2
4.	Annual Mean Runoff	80.0 m^3/s at river mouth, 32.9 m^3/s at Bukit Kenau	Ref. 25
5.	River Profile & Cross Sections	Survey not carried out. Cross sections available only at river gauge stations.	2
6.	River Morphology	Meandering in lower swamp reaches, but seems stable. River banks generally stable, although some minor erosion at localized places. No immediate problem arising.	2
7.	Estuary	Sand dune develops on both banks. Navigation channel shallow (1.5 m depth at low tide, according to fishermen). Extent of sand dunes not changed so much from 1 : 63,630 maps (1971), therefore seems in equilibrium.	1 & 2
8.	Sediment	Extensive sand deposits and shoals, active sediment movement. Estimated yield for design; 300 $m^3/km^2/yr \times 2$. Tailings from Sg. Kenau, Sg. Belat. Agriculture develop. in upper Kuantan.	2 & Ref. 25
9.	Salt Water Intrusion	Salt water problem at JKR's Kg. Kobat intake (17 kg). Tidal effect up to 40 km. Release of min. flow of 300 - 350 mgd. recommended.	Ref. 25
10.	Flood	Flooding in Paya Besar/Batu Tiga area is due to interaction of flood flow, tidal action and internal drainage system. Flood water overflow into swamp area at south-west of confluence with Sg. Belat. Sand bars aggravating flood levels in upper/middle reaches.	2 & Ref. 25
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 29 RIVER CHARACTERISTICS OF THE KEMAMAN RIVER (27/34)

	Item	Description	Source
1.	Location	Basin 32, Trengganu State	
2.	Catchment Area	2,570 km^2 (Basin)	Ref. 25
3.	Annual Basin Rainfall	3,100 m	2
4.	Annual Mean Runoff	120 m3/s at river mouth, 47 m3/s at Kg. Tayor	Ref. 25
5.	River Profile & Cross Sections	Some cross sections contained in Ref. 25. C. Nor surveyed for whole reaches.	Ref. 25
6.	River Morphology	Meanders in tidal swamp areas, expecially in Chukai river. Minor erosions in tidal and middle reaches. But no adverse problems reported.	1 & 2
7.	Estuary	Show depth at river mouth due to coastal drift. Only small boats (3 m draft) navigable. Northern cape seems to prevent excessive intrusion of coastal sand into river mouth.	2
8.	Sediment	Active sediment movement and sand deposit in lower reaches. Deposit being extracted for construction materials.	Ref. 25
9.	Salt Water Intrusion	Saline up to 19 km upstream. Tidal effect up to Cherul river confluence (25 km). No saline problem at existing water supply intake (21 km).	Ref. 25
10.	Flood	Flooding in riverine villages and Chukai town. Overbank flow in upstream area and tidal effect in lower reaches.	1
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 30 RIVER CHARACTERISTICS OF THE DUNGUN RIVER (28/34)

	Item	Description	Source
1.	Location	Basin 34, Trengganu State	
2.	Catchment Area	1,875 km^2	
3.	Annual Basin Rainfall	3,290 mm	2
4.	Annual Mean Runoff	120.3 m^3/s at Jam. Terangan (1,479 km^2)	Ref. 40
5.	River Profile & Cross Sections	No survey data available. Naturally formed trapezoidal cross sections without levee.	1
6.	River Morphology	No heavy meanders. Stable banks being formed by hard ground. Only localized erosion in upper reaches.	1 & 2
7.	Estuary	Tanjung Dungun at northern part of river mouth seems to prevent excessive intrusion of coastal sands, but still sand bars existing in river mouth area. Sufficient navigation depth at present (fishermen). No immediate problem.	2
8.	Sediment	Sand deposit/shoals in middle/lower reaches. Tin mining in Bukit Besi area yielding sediment.	1 & 2
9.	Salt Water Intrusion	Possibly up to Kg. Kemudi. No saline problem at JKR Dungun Works (13 km from river mouth).	1
10.	Flood	Flooding in riverine towns and villages, due to overbank flow aggravated by tidal effect. No specific places of flow construction reported.	1 & 2
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 31 RIVER CHARACTERISTICS OF THE TRENGGANU RIVER (29/34)

	Item	Description	Source
1.	Location	Basin 36, Trengganu State	
2.	Catchment Area	4,650 km^2 at river mouth	Ref. 32
3.	Annual Basin Rainfall	3,570 mm	2
4.	Annual Mean Runoff	243.8 m^3/s at Kg. Tanggol (3,340 km^2)	Ref. 32
5.	River Profile & Cross Sections	Profile and cross sections shown in 32 b. No other data available.	Ref. 32
6.	River Morphology	Some bank erosion at upstream of K. Brang and at meanders in downstream areas. After the completion of Kenyl Dam, erosion may further develop, being caused by riverbed degradation. But, no need of immediate protection.	Ref. 32
7.	Estuary	Shallow river mouth causing the navigation of big ships difficult. Shoreline at river mouth changeable due to interaction between river flows and wave actions. In general, however, seems to be in a stable regime.	2 & Ref. 32
8.	Sediment	150 $m^3/km^2/yr$ before Kenyl Dam, 42 $m^3/km^2/yr$ after Dam completion. At present, sand shoals upstream of K. Brang much contributing silting in lower reaches.	Ref. 32
9.	Salt Water Intrusion	Up to Pulan Babi (17 km), Tidal effect up to 28 km. Saline problem existing at JKR's Pulan Musant Intake (2 weeks/year). 150 m^3/s release from Kenyl Dam may solve problem.	Ref. 32
10.	Flood	Flooding in all riverine towns and villages, incl. those along tributaries. Bank spillage occurs at 3,500 m^3/s (2-year flood). Besides backwater effect from Trengganu river, runoff from tributaries also cause flooding in the reaches.	Ref. 32
11.	Other Items	After completion of Kenyl Dam, no overbank flow occurs at less than 50-year flood, but flooding in tributaries still remarkable.	Ref. 32

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 32 RIVER CHARACTERISTICS OF THE SETIU RIVER (30/34)

	Item	Description	Sour
1.	Location	Basin 37, Trengganu State	
2.	Catchment Area	1,035 km^2 incl. Merang, Keluang basins	2
3.	Annual Basin Rainfall	3,280 mm	
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Survey data available for reaches where improvement work is scheduled.	1
6.	River Morphology	Meanders existing in middle/lower reaches, but in stable regime at present. River appears to incise the banks at local places upstream from Kg. Buloh, but controlled by stable banks.	2
7.	Estuary	Sediment from sea forming extensive dunes along coast, with intrusion of sand into river mouth. Shallow river mouth causing navigation difficult (Kuala Setiu not visited).	2
8.	Sediment	No estimate of yield rate so far, but probably less. No sand bars and shoals observed in upper/middle reaches.	2
9.	Salt Water Intrusion	Possibly not up to Kg. Guntong (17 km). No adverse problem reported.	1 &
10.	Flood	Overbank flow in riverine paddy and villages in upper/middle areas, little effect by tide level.	2
11.	Other Items	River improvement work is proposed in 4MP.	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 33 RIVER CHARACTERISTICS OF THE BESUT RIVER (31/34)

	Item	Description	Source
1.	Location	Basin 38, Trengganu State	
2.	Catchment Area	1,230 km^2 (Basin)	2
3.	Annual Basin Rainfall	3,270 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	Survey data not available. Bank incised natural trapezoidal sections in upper/middle reaches.	1 & 2
6.	River Morphology	Moderate meanders throughout reaches. River appears to incise the banks, but excessive erosion prevented by comparatively hard banks.	2
7.	Estuary	River mouth area silted by river-borne sediment as well as sediment from sea. Right bank coastal dune seems developing (remarkable change from condition in 1967 - 1 : 63,60 map).	2
8.	Sediment	Sand bars/shoals at almost all meanders downstream from Kg. La. No detailed survey so far, but possibly high yield. Agriculture development in upper reaches.	2
9.	Salt Water Intrusion	Possibly up to Kg. Baru (7 km). No adverse problem at present.	1
10.	Flood	Flooding along riverine villages and in coastal plain paddy area. Overbank flow occurs firstly at Sg. Angga confluence, Alor Lintah area and Kg. Baru. Sand deposits reducing flow area and aggravating flood level.	1 & 2
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 34 RIVER CHARACTERISTICS OF THE KEMASIN/SEMERAK RIVER (32/34)

	Item	Description	Sour
1.	Location	Basin 39, Kelantan State	
2.	Catchment Area	1,020 km^2 (Basin)	Ref. 20
3.	Annual Basin Rainfall	2,790 mm	2
4.	Annual Mean Runoff	Kemasin: 9.1 m^3/s at Haji Ali (243 km^2)	Ref. 20
5.	River Profile & Cross Sections	No survey data obtainable. Profile shown in Ref. 20.	Ref. 20
6.	River Morphology	Meanders exist in whole reaches, but no active meandering/erosion reported. River regime seems generally in stable, except at Kuala where river course changeable due to coastal action.	1 & Ref. 20
7.	Estuary	Active sand bars formation due to littoral drift. Navigation almost difficult (0.5 - 1.0 m depths at river mouth). Sand bars partially breached during flood flow period.	2
8.	Sediment	Estimated yield rate 0.2 - 0.3 mm/year. No adverse silting at present, except at river mouth. Coarse sediment seems to be trapped, not being carried out to sea.	2 & Ref. 20
9.	Salt Water Intrusion	Possibly up to Kg. Pusu Besar in Kemasin, up to upstream of Pasir Puteh in Semerak. Problem existing in irrigation water supply.	1
10.	Flood	Flooding in whole coastal plain area, due to insufficient natural drainage and spillage from rivers. Small flood every year, long flood every 4 year with flood spillage from Kelantan river.	Refs 19 & 20
11.	Other Items		

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 35 RIVER CHARACTERISTICS OF THE KELANTAN RIVER (33/34)

	Item	Description	Source
1.	Location	Basin 40, Kelantan State	
2.	Catchment Area	13,100 km^2 (Basin)	Ref. 19
3.	Annual Basin Rainfall	2,540 mm	2
4.	Annual Mean Runoff	593 m^3/s at Guillemard Bridge (12,100 km^2)	Ref. 19
5.	River Profile & Cross Sections	Profile between K. Krai - Kota Bharu as per Ref. 19 e. 19 cross sections surveyed by ENEX.	Ref. 19
6.	River Morphology	Only internal meander pattern within a straight channel. Banks are under continuous attack by gullying in places, causing riverbed aggravation of 5 mm/yr.	Ref. 19
7.	Estuary	Delta region is growing due to river-borne sediments as well as by sediment transported westward along coast. Formation of sand bars and pits active.	Ref. 19
8.	Sediment	Estimated yield rate: 140 $m^3/km^2/yr$. Development in hinterlands accelerating sediment yield. 80% from Galas/Lebir catchments. Sediment is excessive in lower reaches, 20 mm/yr bed aggravation.	Ref. 19
9.	Salt Water Intrusion	Possible intrusion up to Pasir Mas. No problem at present, but adverse effect possible on future irrigation intake. 80 m^3/s release required to limit intrusion at Kota Bharu.	Ref. 19
10.	Flood	Flooding in almost all Kelantan plain over an area of 1,700 km^2. Flood due to overspill from Kelantan river, less tidal effect. Minimum channel capacity 3,000 m^3/s near river mouth.	Ref. 19
11.	Other Items	Flood gradient: 1/3,70, 1/4,500 in up- and downstream of Guillemard bridge respectively.	Ref. 19

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 36 RIVER CHARACTERISTICS OF THE GOLOK RIVER (34/34)

	Item	Description	Source
1.	Location	Basin 41, Kelantan State	
2.	Catchment Area	895 km^2 (Malaysia)	1
3.	Annual Basin Rainfall	2,950 mm	2
4.	Annual Mean Runoff		
5.	River Profile & Cross Sections	No survey data available. Cross section at Rantau Panjang gauge available.	1
6.	River Morphology	River appears to meander, but no adverse problem reported at present. Erosion observed at meanders in middle/ upper reaches.	
7.	Estuary	Formation of sand dunes progressive due to westward littorel drift. Shallow river mouth causing marine fish boat navigation difficult.	1 & 2
8.	Sediment	Sand bars in upper reaches (1 : 63,360 map). Sediment yield partly due to logging operation. Yield rate possibly large.	1 & 2
9.	Salt Water Intrusion	Possibly not up to Kg. Jumbu. No problem reported at present.	1 & 2
10.	Flood	Flooding in whole coastal plain, due to insufficient natural drainage and spillage from Golok river. Bankful capacity at Rantau Panjang around 300 m^3/s.	1 & 2
11.	Other Items	River basin study starting in 1981.	1

Source; 1. Information from DID State Office
2. Observations on field visit and on 1 : 63,360 maps

Table 37 FLOODS IN PENINSULAR MALAYSIA (1/10)

State	1925	1926	1931	1936
Peris	—	—	—	—
Kedah	—	Severe flooding in South Kedah	—	—
Pulau Pinang	—	—	—	—
Perak	Flooding in Sg. Kinta	Severe flooding in Sg. Perak with great damage	Severe flooding in Sg. Perak, Sg. Kinta	Flooding in Sg. Kinta, Sg. Bintang Padang
Selangor	Severe flooding in Sg. Klang, Sg. Selangor, Sg. Bernam	Severe flooding in Sg. Klang, Sg. Langat, Sg. Selangor	—	Flooding in Sg. Bernam
Negeri Sembilan	—	—	Flooding in Sg. Linggi	—
Melaka	—	—	—	—
Johor	—	—	—	—
Pahang	—	Severe flooding with heaviest rainfall at Kemanan. 70-75" for 5 days.	—	—
Trengganu	—	Severe flooding with extensive damages.		
Kelantan	—	Severe flooding with extensive damages. Kota Bharu inundated 3 to 4 in water depth.	Severe flooding with damages	

[ ] Major flood event

Table 38 FLOODS IN PENINSULAR MALAYSIA (2/10)

State	1947	1948	1949	1950
Perlis	Flooding in Sg. Perlis	—	—	—
Kedah	Flooding in Sg. Muda, Sg. Padang Terap	—	Flooding in South Kedah	—
Pulau Pinang	—	—	—	—
Perak	Severe flooding in Sg. Perak and in Krian District.	Flooding in Sg. Krian	—	—
Selangor	—	Flooding in Sg. Klang	—	—
Negeri Sembilan	—	—	—	—
Melaka	—	—	—	—
Johor	—	—	—	—
Pahang	—	—	—	—
Trengganu	Flooding in Sg. Besut.	—	Flooding in Sg. Besut, Sg. Trengganu.	—
Kelantan	—	—	Flooding in Sg. Kelantan	—

[ ] Major flood event

Table 39 FLOODS IN PENINSULAR MALAYSIA (3/10)

State	1951	1952	1953	1954
Perlis	—	—	—	—
Kedah	—	Flooding in Sg. Muda	—	Local flooding in some area for short duration. No severe damage.
Pulau Pinang	Flooding in Sg. Kulim	Flooding in Sg. Kulim	—	Kulim area flooded for 3 days. Only 6 acres damaged.
Perak	Flooding in Sg. Perak	Flooding in Sg. Krian	Flooding in Sg. Perak, Sg. Bidor, Sg. Bintang Padang	Flooding in Bidor Catchment for 3 days. No major damage.
Selangor	Flooding in Sg. Klang, Sg. Langat	Flooding in Sg. Langat	Flooding in Sg. Langat	—
Negeri Sembilan	Flooding in Sg. Linggi	—	—	Tampin district flooded for 5 days.
Melaka	—	Flooding in Sg. Kesang	—	5 days flooding in Malacca Town. 264 acres paddy destroyed.
Johor	Flooding in Sg. Muar, Sg. Segamat	Flooding in Sg. Muar, Sg. Segamat	—	Severe floodings in all states, 3 days with severe damages, 4 deaths.
Pahang	—	—	—	Some local floodings with only little damage.
Trengganu	—	—	—	Severe flooding along coastal belt. Besut flooded for 1 week.
Kelantan	Flooding in Sg. Besut	—	—	No serious floods or damages.

Major flood event

Table 40 FLOODS IN PENINSULAR MALAYSIA (4/10)

State	1955	1956	1957	1958
Perlis	—	—	—	—
Kedah	—	—	—	—
Pulau Pinang	—	—	—	—
Perak	Bidor Bahrang and Kinta Rivers caused minor flooding.	Minor floodings.	Minor flooding, no severe damage.	Sg. Kerian, Bat Padang and Mane flooded 3 days, minor damage.
Selangor	K.L. low lying areas flooded for short duration, no damage.	Minor floods in small areas only.	Severe flooding in Klang Valley, 4,000 people evacuated.	Minor flooding of short durati
Negeri Sombilan	—	Tampin area flooded 2 days, no damage.	—	—
Melaka	Malacca flooded for 1 day, damage to nuseries only.	—	—	—
Johor	—	3 days minor flooding very little damage.	Sri Menanti area flooded 4 - 20 days. Damage to crops.	—
Pahang	—	—	—	Minor flooding of short duration.
Trengganu	—	Minor flood, no serious damage.	Flooding in Dec. 11 days, all roads flooded 3 - 8 feet.	—
Kelantan	—	—	—	Minor floods for 4 days, slight damage.

[ ] Major flood even

Table 41 FLOODS IN PENINSULAR MALAYSIA (5/10)

State	1959	1960	1961	1962
Perlis	—	Minor flooding for 4 days, no damage.	Minor flooding.	Minor flooding in Kangar Town.
Kedah	—	Minor flooding, 60 acres of paddy damaged.	Minor flooding.	Flooding for scattered areas affected 6,000 acres of paddy.
Pulau Pinang	Minor flooding without damage.	Minor flooding for short duration. No damage.	—	Minor flooding with slight damage.
Perak	Minor flooding, without damage.	Minor flooding 2 - 6 days slight crop damage and loss of poultry.	Minor flooding 1 - 23 days with slight damage to paddy and kampong land.	Minor flooding for 2 - 7 days with slight damage.
Selangor	Minor flooding for a few days.	Minor flooding for 10 days with slight damage in vegetable.	Minor flooding 3 - 4 days with slight damage.	Minor flooding in riverine areas with slight damage.
Negeri Sembilan	Minor flooding of short duration.	Minor flooding for 6 - 10 days, but slight damage.	Flooding in Rembau, Linggi and Pedas with damage to 2 road bridges.	Minor flooding, no damage.
Melaka	—	Minor flooding in Parit Jawa for 4 days with slight damage.	Localized flooding. No damage.	—
Johor	Minor flooding in Assam Bubok.	Minor flooding in Parit Jawa for 4 days with slight damage.	Localized flooding. No damage.	Minor flooding, 2 - 3 days slight damage.
Pahang	Minor flooding, no damage.	Minor flooding for short duration, slight damage.	Minor flooding.	Minor flooding. Slight damage.
Trengganu	Minor flooding, no damage.	Minor flooding, no damage.	Minor flooding for 3 days. No damage.	Minor flooding. No damage.
Kelantan	Minor flooding in Pasir Puteh District.	Minor flooding. No damage.	Minor flooding. No damage.	Minor flooding with slight damage.

Major flood event

Table 42 FLOODS IN PENINSULAR MALAYSIA (6/10)

State	1963	1964	1965	1966
Perlis	Only minor flood affecting 1,000 acres of paddy.	Minor flooding with slight damage.	Minor flooding in 2 waves.	Minor flooding no damage.
Kedah	Flooding in scattered areas, affecting 1,400 acres of paddy, 10 days.	Flooding for 19 days affected 2,100 acres of paddy field.	Minor floods throughout State incl. Muda River.	Minor flooding in low-lying area of North and South Kedah.
Pulau Pinang	Flooding in Central area causing damage to paddy nuseries in 30 acres.	George Town flooded due to heavy rain. In P.N. minor flooding for 3 days.	2 major floodings in Muda River. Loss to crops and livestock $40,000.	Minor flooding in low-lying riverine area along Sg. Muda.
Perak	Minor flooding in Krian Irrigation area. Usual flooding in lower Perak District.	Severe flooding in Dinding & Krian District over 160,000 acres. Crop damage $100,000.	Repeated floods Trans Perak with damage.	Minor flooding in several local places. No damages.
Selengor	Disastrous flood due to failure of mining bund caused death of 14 persons. Local floods in Sg. Langat, Bernam, Selangor.	Minor flooding in Sg. Gombak reaches and in Klang District. No major damages.	Minor floods in low-lying area along Sg. Klang, Sg. Gombak.	Minor localized flooding in Sg. Gombak, Selangor, no damage.
Negeri Sembilan	Minor flooding less than 12 hrs., but almost in every districts.	Minor flooding for short duration.	Minor flooding at a number of places.	Minor local floods in hinterland areas, for short duration, no damage.
Melaka	Minor flooding for less than 12 hrs. but almost in every districts.	Minor flooding.	Minor flooding in Sg. Duyong, Sg. Durian Tunggal, Sg. Chohong, with slight damage.	Inundation of 1,130 ha in Merlimau Drainage.
Johor	1-day flood in Sg. Segamat area. Local flooding in Kesang Tasek paddy area.	Local/flash floodings in almost whole area of State, no major damage.	Local flash flooding in Muar and Kliang districts, with slight damage.	Minor localized floods in Muar and Segamat districts, 3 - 14 days, no damage.
Pahang	Only localized flooding in Sg. Bentong, Sg. Semantan.	Minor flooding in low-lying area of Sg. Pahang. No major damage.	Minor flooding in Termelch, Raub, Bentong areas. Minor damages.	Widespread floods in Sg. Kuantan, Berat, Pahang, with slight damages.
Trengganu	No flooding of consequence.	Slight inundation in coastal area due to high tide and poor drainage.	Flooding in Besut and Trengganu areas, 14,000 acres of crops damaged. Damage to property $500,000.	Low riverine area flooded for 2 - 3 days no major damage.
Kelantan	Minor flooding in scattered places, for short duration.	No flooding.	Flooding for 2 weeks in low-lying area. Paddy damage $1.6 million, property $1 million.	3 normal flooding, affecting 9,500 acres of paddy land, 2 - 3 days.

Major flood event

Table 43 FLOODS IN PENINSULAR MALAYSIA (7/10)

State	1967	1968	1969	1970
Perlis	2 floods inundated Kangar Town.	—	No flood.	No flood.
Kedah	Flooding in various areas, 2 - 5 days, no serious damage.	Minor floods, only slight damage to paddy.	Only minor floods with little damage.	Some floods in Central and South Kedah.
Pulau Pinang	No major floods except for low riverine areas along Sg. Muda.	No flood.	Minor flood in low-lying area along Sg. Muda.	Flooding in Province Wellesley inundated 10,000 acres of low land.
Perak	Most severe floods in Sg. Perak, inundating all riverine towns & paddy land over 200,000 acres.	Only mild localized flood of 1 - 2 days duration.	Minor localized floods in various districts, some damages to paddy nuseries and vegetable.	Flooding in riverine area along Sg. Perak including Kuala Kangsar.
Selangor	Minor local floodings at various areas, but no major damage.	Minor localized floodings.	Minor floods in various areas. Inundation in Sg. Besar area 20,000 acres, but a slight damage.	Floodings in Kuala Selangor and Sabak Bernam Districts. 10,000 acres affected.
Negeri Sembilan	Flooding in Jelebu district, and in hinterland.	Due to Dec. storm, several thousand acres of paddy inundated, but no damage.	Minor localized floods of short duration.	No flood.
Melaka	Minor flooding in low-lying area in Bachang, no damage.	Minor localized floods with no damage.	Minor localized flooding with slight damage.	No flood.
Johor	Widespread flooding in almost all rivers in the State. Crop damage $1.5 million.	End 1967 flood continued in Jan. No other floods.	Widespread severe flooding throughout State, total damage $1.5 million. 38 live lost.	No significant flood.
Pahang	Severe floodings in Central & East Pahang with considerable damage incl. 5 death.	Only minor floods with no significant damage.	Minor flooding causing traffic out for short duration.	No major flood other than Dec. flood which continued in Jan. 1971.
Trengganu	Severe flooding in all rivers in North Trengganu, with damage more than $4.5 million.	No flooding.	No major flood	Flooding in various parts of State, inundation 4 - 9 feet lasting 5 - 12 days.
Kelantan	Most severe flood, inundating whole Kelantan plain, 38 inundating total damage $23.5 million.	Moderate floodings of short duration with no damage.	One major flood with damage to some 2,100 acres of paddy and other property.	Low-lying area of Sg. Kelantan flooded. Kota Bahru was under 0.5 - 4 feed water.

[ ] Major flood event

Table 44 FLOODS IN PENINSULAR MALAYSIA (8/10)

State	1971	1972	1973
Perlis	No significant flood.	3 floods in Kangar area. Kangar Town inundated.	2 floods lasting 4 - 5 days, no damage recorded.
Kedah	Moderate flood in Sg. Muda, Sg. Kechil, Sg. Pdg. Terap. Muda Irrigation scheme also inundated.	Only minor floods in various districts.	Low-lying area along Sg. Muda, Padang Terap Katil flooded.
Pulau Pinang	Flooding in riverine area along Sg. Muda, in Sg. Tembus, paddy area. Sg. Perai also flooded.	A mild flood in riverine area along Sg. Muda. No major damage.	
Perak	Flooding in riverine area along Sg. Perak, with similar magnitude with 1970, 1972 floods.	Sg. Perak overflowed and inundated riverine area from Kuala Kangsar to Kg. Gajah.	Rverene area along Sg. Perak incl. Kuala Kangsar flooded, total damage $190,000.
Selangor	Largest flood in whole state, incl. Kuala Lumpur with estimated damage $34 million.	Minor localized flooding in several places.	Localized minor flooding in Kuala Selangor and Kuala Lumpur.
Negeri Sembilan	Unprecedented large flood in all rivers, estimated damage $4.3 million.	—	Minor localized floods, 5% Seremban City was under 3 feed of water.
Melaka	Unprecedented flood in almost all rivers, with damage $2 million. Melaka Town flooded.	No flood.	No flood.
Johor	Widespread severe floods, especially East and West areas. Estimated total damage $6.1 million.	Localized flood in Mersing area.	Only minor flash flood in Mersing District, with negligible damage.
Pahang	Widespread severe flooding in Jan. and Dec. in Sg. Pahang. Severe flood also in Sg. Kwantan.	Flooding in Sg. Pahang, damage to property $108,200.	Riverine area along Sg. Kunatan, Sg. Pahang flooded, total damage $206,000.
Trengganu	Flooding in low-lying area of major rivers, but of less severe extent.	Widespread flooding in low-lying area of major rivers, especially in Northern districts.	Widespread flooding in lower reaches of major rivers.
Kelantan	Low riverine area of Sg. Kelantan flooded. Magnitude similar to 1970 flood.	Low riverine area along Sg. Kelantan flooded, 5 feet max. in Kota Bahru.	Largest flood since 1967., 4 deaths 21,000 access of paddy damaged.

[ ] Major flood event

Table 45 FLOODS IN PENINSULAR MALAYSIA (9/10)

State	1974	1975	1976
Perlis	No flood.	No flood.	Worst flood in these 30 years. Flooding in Kangar Town and in most of tributaries.
Kedah	Minor flooding in low-lying land in Sg. Baru, Kota Setar.	Minor localized floods at several places, no report of damage.	A few minor local floods in North Kedah, no report of damage.
Pulau Pinang	A localized flash flood in Sg. Air Terjun area, no damage.	Minor floods in riverine area along Sg. Muda.	Flooding in riverine area of Georgetown, Butterworth, Muda irrigation area, total damage $550,000.
Perak	Localized floods in several areas, incl. failure of mining bunds near Ipoh damaging $3 million.	Flood in Trans Perak significant.	No noteworthy flood.
Selangor	Small localized floods in Kuala Lumpur & Kajang districts, no damage.	Minor flood in Ulu Selangor, no damage.	Minor local flash floods in Ulu Langat, Segamat Industrial areas, no report of damage.
Negeri Sembilan	Minor localized flooding in Sg. Linggi, Seremban, Kuala Pilah, Rembau districts. No major damage.	No flood.	No flood.
Melaka	No flood.	No flood.	No flood.
Johor	No flood.	Minor localized floodings in Pontian Segamat, Mersing district, no major damage.	Flooding in scattered areas, 10 - 15 days.
Pahang	No flood.	Minor floods in Kuantan, Temerloh, Pehan areas, 7 days.	No flood.
Trengganu	Some flooding in coastal area of lower reached of major rivers.	Some flooding in coastal area, peak level 3rd highest recorded.	Minor flooding in some coastal areas.
Kelantan	Flooding in Pergau Valley, d/s Kota Bahru, Sg. Kemasin area, Sg. Golok area.	2 major floods in low-lying areas incl. Kota Bahru, Rantau Panjang, 3 deaths, crop damage $3.5 million.	Minor local inundation in Sg. Golok, Semarak Valley, Kemasin Valley areas. Total damage $600,000.

[ ] Major flood event

Table 46 FLOODS IN PENINSULAR MALAYSIA (10/10)

State	1977	1978	1979
Perlis	No flood.	No flood.	No flood.
Kedah	Minor localized floods at Kuala Nalang, Pendang, Baling areas, no damage.	Minor local flooding in Pendang District.	Local floodings in Padang Terap and Kota Setar Districts.
Pulau Pinang	Minor floods in riverine area of Georgetown, Bayan Baru, Butterworth, no major damage.	Minor local flooding in Penang Island, Butterworth, no damage.	Minor local floodings in Georgetown, Butterworth and Bukit Kertajam area.
Perak	No flood in Sg. Perak (impounding of Trengganu Dam is continuing). Minor local flood in Krian riverine area.	Spill-over from Bt. Merah Reservoir caused a minor flood in Sg. Kuau.	Local flooding in Sg. Chanderiang, Sg. Kampar due to overflow and bund breaching.
Selangor	Minor flash floods mostly in inland areas, for short duration.	Only minor flash floods, no damage reported.	Localized flooding in Sg. Selangor 25 occassions of flash flood in K.L. area.
Negeri Sembilan	No flood.	No flood.	No flood.
Melaka	No flood.	No flood.	No flood.
Johor	Minor floods at scattered places, no major damage reported.	Widespread flooding in South Johor, 5 lives lost, total damage $650,000.	Major floodings in western area, total damage $293,200 mainly in Segamat District.
Pahang	Minor flood at Bentong in hinterland area caused road traffic suspension for 1 day.	Local flooding in East Pahang caused traffic suspension, with some damage to road and houses.	Severe flooding (20-year) in Sg. Kuantan. In Sg. Pahang, minor damage to Paya Ganchong Irrigation Scheme.
Trengganu	No flood.	Minor floods due to isolated storms at scattered areas, total damage estimated $138,000.	Severe flood in Sg. Trengganu total damage $561,525.
Kelantan	Minor localized inundation due to 2 rainstorms, in low-lying areas.	Minor floods in 4 river systems caused inundation of roads for 3 days max., no major damages other than traffic suspension.	Major flood over state 15-year return period, 9 deaths. Total damage $1.3 million.

Major flood event

Table 47 FLOOD DAMAGE AND FLOOD CONTROL MEASURES IN COUNTRIES OF ESCAPE REGION

	Max. Annual Flood Damage during 1972 - 1979				Average Annual Damage, 1972 - 1979
	Year	Loss of Life and Missing	Area Inundated and/or Damaged (km2)	Damage a/ (US$ x 106)	(US$ x 106)
Typhoon-affected area					
Hong Kong	1972	209	-	14	4
Japan	1972	508	9,470	3,011	1,690
Malaysia	1978	-	242	2	1
Philippines	1972	884 c/	...	227	105
Republic of Korea	1972	682	153	114 b/	66
Thailand	1978	106	...	169	35
Viet Nam	1977	-	695	135	...
Sub Total					(1,901)
Cyclone-affected area					
Australia	1974	50	...	416	82
Bangladesh	1974	2,225	...	380	...
Burma	1975	-	...	129	42
India	1977	10,000	79,000	1,294	857
Indonesia	1976	95	...	3	...
New Zealand	1976	-	...	31	13
Sri Lanka	1978	1,000	...	88	...
Sub Total					(994)
Total					2,895

	Length of Dikes (km) 1970	Length of Dikes (km) 1978	No. of Basins with Flood Forecasting System in 1978	Annual Expenditure on Flood Control Works 1978 (US$ x 106)
Typoon-affected area				
Hong Kong	28	...	-	...
Japan	16,600	18,260	17	4,887
Malaysia	...	406	5	4.6
Philippines	598	630	1	44
Republic of Korea	4,900	6,070	1	93
Thailand	1,207	...	-	...
Viet Nam	...	...	-	...
Sub Total				
Cyclone-affected area				
Australia	...	...	120	...
Bangladesh	...	4,469 d/	-	...
Burma	...	...	-	...
India	7,000	10,834	55	164 e/
Indonesia	1,500	4,036 d/	-	150
New Zealand	2,510	3,000	50	6.6
Sri Lanka	110	...	-	...
Sub Total				
Total				

Remarks: a/ In 1975 prices.
b/ The damage in 1979 was US$217 million, and there were 390 dead and missing.
c/ In 1978, 1,057 dead and missing.
d/ As at 1976.
e/ Total plan outlay for flood control Rs.6,750 million for period 1978 - 1983.

Source : Ref. PJ. 4.

Table 48 FLOOD DAMAGES IN PAST MAJOR FLOODS (1/2)

Unit: M$10^3

Type of Damage	Pahang Jan. 1971 Damage	(%)	Pahang Dec. 1971 Damage	(%)	Pahang Dec. 1972 Damage	(%)	Kelantan Jan. 1967 Damage	(%)
1. Rural Industries								
a. Crops	6,000		4,000		1,600		24,850	
b. Livestocks	200		40		10		6,390	
c. Forests	20		-		-		-	
d. Fisheries	40		5		-		-	
Sub-total	6,260	(21)	4,045	(30)	1,610	(29)	31,240	(40)
2. Structures & Properties								
a. Utilities & Facilities	4,200	(14)	1,270	(9)	620	(11)	9,287	(12)
b. Public Buildings	2,200	(18)	225	(2)	20	(0)	1,368	(2)
c. Housings	8,800	(30)	3,650	(27)	1,310	(24)	16,340	(20)
d. Industrial Facilities	380	(1)	190	(1)	30	(1)	-	
Sub-total	15,580	(53)	5,335	(39)	1,980	(36)	26,995	(34)
3. Indirect Damages								
a. Activities Interrupted	6,600		3,530		1,615		12,305	
b. Rescue & Relief	1,200		600		300		8,350	
Sub-total	7,800	(26)	4,130	(31)	1,915	(35)	20,655	(26)
Total Damage	29,640	(100)	13,510	(100)	5,505	(100)	78,890	(100)
(Price level)	(1974)		(1974)		(1974)		(1976)	
No. of Evacuee	153,000		43,000		6,900		320,000 (Evac) 430,000 (affected)	

Source; Refs. 21a, 19a, 19c and 19d

Table 49 FLOOD DAMAGES IN PAST MAJOR FLOODS (2/2)

Unit: M$10^3

Type of Damage	Kemasin-Semerak 67		Kuantan Jan. 1971		Kuala Lumpur Jan. 1971	
	Damage	(%)	Damage	(%)	Damage	(%)
1. Rural Industries						
a. Crops	8,500		183		-	
b. Livestocks	-		412		-	
c. Forests	-		-		-	
d. Fisheries	-		6		-	
Sub-total	8,500	(47)	601	(20)	-	(0)
2. Structures & Properties						
a. Utilities & Facilities	2,214	(12)	146	(5)	17,492	(51)
b. Public Buildings	270	(2)	Incl. in 2a		Incl. in 2a	
c. Housings	5,400	(30)	1,246	(41)	13,712	(40)
d. Industrial Facilities	-		450	(15)	3,063	(9)
Sub-total	7,884	(44)	1,842	(61)	34,267	(100)
3. Indirect Damages						
a. Activities Interrupted	700		323		10% incl. in 2	
b. Rescue & Relief	980		240		-	
Sub-total	1,680	(9)	563	(19)	-	
Total Damage	18,064	(100)	3,006	(100)	34,267	(100)
(Price level)	(1979)		(1979)		(1977)	
No. of Evacuee	75,000		11,000			

Source; Refs. 20, 25b and 12

Table 50 EXISTING TELEMETRIC FLOOD WARNING SYSTEM (1/2)

	Kelantan River	Trengganu and Besut Rivers
River Stage Gauge:	Kuala Krai (5521444) Tualang (5222452) Dabong (5320443) Guillemard (5721442)	Dura (5029433)
Rainfall Gauge:	Gua Musang (4819027) Aring (4923001) Dabong (5320038) Lalok (5322044) Jeli (5718033)	Dura (5029034) Sg. Tong (5328044) Panchor (5524002) Kg. Menerong (4930038)
Repeater Station:	Bt. Bakar	Bt. Besar K. Brang Bt. Bintang
Receiving Station:	Kota Bharu	K. Trengganu Kg. Raja
Data Transmission:	Automatic radio transmission by teleprinter to state DID and further by teletype circuits to DID HQ in K.L.	Automatic radio transmission by teleprinter to state DID and further by teletype circuits to DID HQ in K.L.
Data Processing:	By DID HQ computer, based on Sacrament Model	By DID HQ computer based on Sacrament Model
Issue of Warning:	Forecast output conveyed from DID HQ to state DID and transmitted to State Flood Committee	Forecast output conveyed from DID HQ to State DID and transmitted to State Flood Committee.

Source; Refs. 3, 5 and 39

Table 51 EXISTING TELEMETRIC FLOOD WARNING SYSTEM (2/2)

	Pahang River		Perak River
River Stage Gauge:	Sg. Yap	(4023412)	Kg. Kederong (Stn. No. 5411446)
	J. Bungor	(4121413)	
	Bt. Betong	(4129415)	J. Iskandar (Stn. No. 4809443)
	K. Tahan	(4324454)	
Rainfall Gauge:	Sg. Yap	(4023001)	Lalang(Stn. No. 5610063)
	Bt. Betong	(4219001)	Kuala Kederong (Stn. No. 5411066)
	Ulu Tekai	(4227001)	
	Kuala Tahan	(4324001)	
	G. Brinchang	(4513033)	
	L. Grendale	(2924096)	
Repeater Station:	Bt. Singgora		Grik
	Bt. Peninjau		Taiping
Receiving Station:	Kuantan		Ipoh
Data Transmission:	Automatic radio transmission by teleprinter to State DID and further by teletype circuits to DID Headquarters.		Automatic radio transmission by teleprinter to State DID office.
Data Processing:	By DID HQ computer, based on unit Hydrograph Analysis		By State DID, based on Stage Correlation Technique.
Issue of Warning:	Forecast output conveyed from DID HQ to State DID, and transmitted to State Flood Committee.		By State DID to State Flood Committee.

Source; Refs. 3, 5 and 39

Table 52 EXISTING FLOOD WARNING SET-UP (1/3) (MAJOR RIVERS)

Basin No.	Name of River/ Tributary	W.L. Reporting Station Station	W.L. Reporting Station No.	Area Warned	Warning Time (hr)
1	Perlis/Tasoh	Konkerit Baru	6502432	Kangar	18
5	Muda	Jeniang	5806414	Kuala Ketil, Pinang Tunggal	12-20 48-72
		Jam Syed Omar	5606410	Pinang Tunggal	36-48
3	Kedah/Pdg. Terap	K. Nerang on Sg. Pdg. Terap	-	Kuala Pai	11-22
7	Pinang	Perak Road Br.	-	George Town	1-3
10	Perak	K. Kederong (Tele)	5411446	Kuala Kangsar, Parit	15-18 30-40
		Iskandar (Tele)	4809443	Telok Anson	60-90
11	Bernam	Bernam River Headworks	-	Kg. Ketom (near Sabak)	8-12
13	Selangor	Rantau Panjang	3414421	D/S reaches of K. Selangor	6
		Rasa	3516422		
15	Klang/Batu	Kg. Sg. Tua	3216439	K.L. U/S area	2
	Batu	Sentul	3116434	K.L. U/S area	4
	Gombak	Pekeliling	3116433	K.L. U/S area	4
	Kelang	Lrg. Yap Kwan Seng	3117402	K.L. U/S area	1-2
	Kelang	Jam Suleiman	3116430	K.L. U/S area down to Petaling	4
	Kelang	Puchong		Kg. Batu 13 etc.	8-10
16	Langat	Kajang	291401	Kg. Dengkil	10
		Dengkil	2816441	Banting	12-17
18	Linggi	Pantai Bt. 6-1/2	-	Area down st. from seremban	3-16
19	Melaka	Pindah Headworks	-	Durian Tunggal, Batu Berendam, Melaka	4-8 15-17 36-40
21	Muar	Kuala Pilah	2722413	Rompin Londah	10 14
		Buloh Kasap	2527411	Villages in D/S reaches	
22	Batu Pahat/ Lenik	Sg. Lenik	-	Pasir Seri Medan	116-150
	Bekok	Jln. Yong Peng/Labis	2130422	Yong Peng	50-99
	Semberong	Brizay Bridge	1931423	Tg. Semberon	122

Table 53 EXISTING FLOOD WARNING SET-UP (2/3) (MAJOR RIVERS)

Basin No.	Name of River/ Tributary	W.L. Reporting Station Station	W.L. Reporting Station No.	Area Warned	Warning Time (hr)
24	Johor/Johor	Rantau Panjang	1737451	Kota Tinggi	
	Seudai	Sedenak	-	(Pre-warning)	
		Seleng	-	Sekudai	short
		Senai	-	Senai	short
26	Mersing	Bandar Mersing	-	Mersing	short
30	Pahang/Lipis	Benta	4019401	Kuala Lipis	4
				Jerantut Ferry	16.5
				Temerloh	32
				Chenor	42
				Pekan	68
	Jelai	Kuala Lipis	-	Jerantut Ferry	12.5
				Temerloh	28
				Chenor	38
				Pekan	64
	Tembeling	Kuala Tahan (Tele)	4324454	Jerantut Ferry	19
				Temerloh	20
				Chenor	30
				Pekan	56
	Tembeling	K. Tembeling	4023412	Jerantut Ferry	4.5
				Temerloh	20
				Chenor	30
				Pekan	56
	Pahang	Jerantut Ferry	-	Temerloh	15.5
				Chenor	25.5
				Pekan	51.5
	Pahang	Temerloh	3424411	Chenor	10
				Pekan	36
	Pahang	Chenor	-	Pekan	26
	Semantan	Lanchang	-	Temerloh	13
				Chenor	23
				Pekan	49
31	Kuantan	Kuala Kenau	3930401	Pasir Kemudi	2.5
				Kuantan	2.5
		Pasir Kemudi	-	Kuantan	2.5
32	Kemaman	Air Puteh	4232454	Rantau Panjang, Sg. Pinang	4-8
		Sg. Pinang	-	Chukai	7-11
34	Dungun	Jam Jerangau	4832411	Kg. Keliyu Dungun	6-10

Table 54 EXISTING FLOOD WARNING SET-UP (3/3) (MAJOR RIVERS)

Basin No.	Name of River/ Tributary	W.L. Reporting Station Station	No.	Area Warned	Warning Time (hr)
36	Trengganu	Kg. Dura (Telemeter)	5029433	Kuala Brang Kg. Tanggol Kuala Telemong Trengganu	3-4 6-7 8-10 12-15
		Kuala Brang (Telemeter)	5030435	Kg. Tanggol Kuala Telemong Trengganu	3-4 5-7 9-12
		Kg. Tanggol	5130432	Trengganu	6-9
37	Setiu	Kg. Buloh	-	Villages in D/S reaches	7-18
39	Semerak	Pasir Puteh		Pasir Puteh & D/S area	8
40	Kelantan/Glas	Dabong (Telemeter)	5320443	Dabong & D/S	-
	Labis	Tualang (Telemeter)	5522452	Laloh & D/S	-
	Kelantan	Kuala Krai (Telemeter)	5521444	K. Krai & D/S Kota Bharu	24
	Kelantan	Guillemard Br. (Tele)	5721442	Tanah Merah area & D/S	-
	Kelantan	Kota Bharu	6122441	Kota Bharu & D/S reaches	-
41	Golok	Rantau Panjang	6019411	Rantau Panjang area	6
		Kuala Jambu	-	Peng Kubor area	-

Table 55 FLOOD PRONE AREA BY BASIN (1/2)
(FOR SELECTED FLOOD EVENT)

Basin No.	River Basin	State	Basin Catchment (km^2)	Flood Area (km^2)	Percent Flood Plain Area (%)	Flood Event
1.	Perlis	Perlis/Kedah	790	39	5	1976
2.	Langkawi	Kedah	475	-	-	-
3.	Kedah	Perlis/Kedah	3,695	16	0.4	1975
4.	Merbok, etc.	Kedah	520	-	-	-
5.	Muda/Tembus	Kedah/Pinang	4,300	142	3	1973
6.	Perai, etc.	Pinang/Kedah	895	17	2	1971
7.	P. Pinang	P. Pinang	300	1	0.3	1980
8.	Kerian	Pinang/Kedah/ Perak	1,420	17	1	-
9.	Beruas/Kurau	Perak	3,255	151	5	1964/80
10.	Perak	Perak	14,700	1,387	9	1967
11.	Bernam	Perak/Kedah	3,335	70	2	1971
12.	Tengi, etc.	Selangor	565	68	12	1971
13.	Selangor	Selangor	1,820	199	11	1971
14.	Buloh, etc.	Selangor	560	123	22	1971
15.	Klang	Selangor	1,425	142	10	1971
16.	Langat	N. Sembilan/ Selangor	1,815	409	23	1971
17.	Sepang, etc.	Selangor/ N. Sembilan	640	165	26	1971
18.	Linggi/Bharu	N. Sembilan/ Melaka	1,420	131	9	1971
19.	Melaka, etc.	Melaka/ N. Sembilan	1,010	89	9	1971
20.	Kesang	Melaka/Johor	705	105	15	1971
21.	Muar	Johor/ N. Sembilan/ Pahang	6,595	353	5	1971
22.	Batu Pahat	Johor	2,600	430	17	1971
23.	South-west Johor Rivers incl. Scudai, Tebrau	Johor	2,660	713	27	1969/78

Table 56 FLOOD PRONE AREA BY BASIN (2/2)
(FOR SELECTED FLOOD EVENT)

Basin No.	River Basin	State	Basin Catchment (km^2)	Flood Area (km^2)	Percent Flood Plain Area (%)	Flood Event
24.	Johor	Johor	3,250	91	3	1969/ 1978
25.	Sedili Besar	Johor	1,820	294	16	1969
26.	Mersing, etc.	Johor	850	122	14	1971
27.	Endau	Johor/Pahang	4,740	756	16	1969
28.	Rompin	Pahang/Johor	4,285	877	20	1971
29.	Merchong/Behar	Pahang	1,820	1,446	79	1971
30.	Pahang	Pahang/ N. Sembilan	29,300	3,004	10	1971
31.	Kuantan	Pahang	2,025	247	12	1971
32.	Kemaman, etc.	Trengganu	2,570	315	12	1972/73
33.	Paka	Trengganu	850	67	8	1973
34.	Dungun	Trengganu	1,875	215	11	1973
35.	Merchong/ Marang	Trengganu	760	159	21	1976
36.	Trengganu	Trengganu	4,650	612	13	1967
37.	Merang/Setiu	Trengganu	1,035	363	35	1967
38.	Besut	Trengganu	1,230	249	20	1967
39.	Kemasin/ Semerak	Kelantan	(included in 40)			
40.	Kelantan	Kelantan	15,015	1,732	12	1967
41.	Golok	Kelantan	(included in 40)			
	Peninsular Total:		131,680	15,316	12	

Table 57 FLOOD AREA STATISTICS - DEFINITION OF TERMS

Land Use Classifications:

Urban	:	Urban and associated areas including estate buildings (IE, IU)
Mining	:	Tin and other mining areas (IT, IX)
Horticultures	:	Horticultures including market gardening (2H, 2M, 2E)
Rubber	:	Rubber (3Gy, 3Gm, 3Gs)
Oil Palm	:	Oil palm plantation (3Oy, 3Om, 3Os)
Coconut Palm	:	Coconut plantation (3Cy, 3Cm, 3Co)
Other Crops	:	Other permanent crops such as pineapple, coffee, cocoa, sugarcane, fruit trees, banana, etc. (3N-3R)
Paddy	:	Croplands represented by paddy (4P, 4C, 4X)
Pasture/Grassland	:	Pasture and grassland (5, 6)
Forest Land	:	Forests including recently cleared land (7F, 7S, 7C)
Swamp	:	Wetland and forest associations, including mangrove, Nipah, Gelam (8)
Unused Land	:	Unproductive areas, e.g. beaches, mudflats, exposed rocks, cliffs (9)
Roads in Flood Area (km)	:	Total length of all-weather roads (sealed/ unsealed) passing in flood plain. Length measured on 1:63,360 maps
Railway in Flood Area	:	Total length of railway passing through flood plain. Length measured on 1:63,360 maps
No. of People Affected by Flood	:	Estimated number of people in area vulnerable to floods. Assumed population density per ha of urban and rural areas - see Tables 70 to 72

Remarks; Figures in ( ) show land use categories as per Ref. 6.

Table 58 FLOOD AREA STATISTICS BY BASIN (1/11)

Basin No.	1	2	3	4
State(s)	Perlis	Kedah	Kedah	Kedah
River Basin(s)	Perlis	Pulau Langkawi	Kedah	Merbok
Land Use (10^3 ha)				
- Urban Area	0.2	-	0.1	-
- Mining	0.6	-	-	-
- Mixed Horticulture	0.3	-	0.4	-
- Rubber	-	-	0.1	-
- Oil Palm	-	-	-	-
- Coconuts	-	-	-	-
- Other Crops	-	-	-	-
- Padi	2.6	-	0.8	-
- Pasture/Grassland	-	-	-	-
- Forest Land	0.1	-	0.1	-
- Swamp	0.1	-	0.1	-
- Unused Land	-	-	-	-
- Total Flood Area	3.9	-	1.6	-
Roads in Flood Area (Km)	29	-	3	-
Railway in Flood Area (Km)	1	-	1	-
No. of People (10^3) Affected by Flood	27.9	-	14.5	-

Remarks: See Table 57 for definitions of items appeared in this table.

Table 59 FLOOD AREA STATISTICS BY BASIN (2/11)

Basin No.	5	6	7	8
State(s)	Kedah/ P. Pinang	P. Pinang	P. Pinang	Kedah/Perak
River Basin(s)	Muda, Tembus	Perai, Juru	Pinang	Kerian
Land Use (10^3 ha)				
- Urban Area	0.1	-	0.1	-
- Mining	-	-	-	-
- Mixed Horticulture	2.2	-	-	-
- Rubber	4.6	-	-	0.1
- Oil Palm	0.1	-	-	-
- Coconuts	0.1	0.2	-	-
- Other Crops	-	0.1	-	-
- Padi	6.0	-	-	-
- Pasture/Grassland	0.2	-	-	-
- Forest Land	0.4	-	-	-
- Swamp	0.5	1.4	-	1.6
- Unused Land	-	-	-	-
- Total Flood Area	14.2	1.7	0.1	1.7
Roads in Floor Area (Km)	45	1	4	-
Railway in Flood Area (Km)	1	-	-	-
No. of People (10^3) Affected by Flood	73.7	7.7	9.9	0.9

Remarks: See Table 57 for definitions of items appeared in this table.

Table 60 FLOOD AREA STATISTICS BY BASIN (3/11)

Basin No.	9	10	11	12
State(s)	Perak	Perak	Perak/ Selangor	Selangor
River Basin(s)	Kurau, Beruas	Perak	Bernam	Tengi, etc.
Land Use (10^3 ha)				
- Urban Area	-	0.7	-	-
- Mining	-	0.4	0.4	-
- Mixed Horticulture	0.3	9.3	0.1	0.1
- Rubber	1.0	14.3	1.0	-
- Oil Palm	-	4.3	0.2	0.2
- Coconuts	0.1	18.3	1.3	6.2
- Other Crops	1.3	0.2	-	-
- Padi	2.1	15.0	-	-
- Pasture/Grassland	0.1	1.5	0.1	-
- Forest Land	1.5	15.1	1.2	-
- Swamp	8.7	59.6	2.7	0.3
- Unused Land	-	-	-	-
- Total Flood Area	15.1	138.7	7.0	6.8
Roads in Flood Area (Km)	10	243	7	13
Railway in Flood Area (Km)	2	8	4	-
No. of People (10^3) Affected by Flood	13.6	375.0	12.9	3.1

Remarks: See Table 57 for definitions of items appeared in this table.

Table 61 FLOOD AREA STATISTICS BY BASIN (4/11)

Basin No.	13	14	15	16
State(s)	Selangor	Selangor	Selangor	Selangor/N. Sembilan
River Basin(s)	Selangor	Boloh, etc.	Klang	Langat
Land Use (10^3 ha)				
- Urban Area	0.2	-	1.5	0.4
- Mining	2.2	-	1.5	0.8
- Mixed Horticulture	0.2	0.4	0.5	0.9
- Rubber	4.8	3.6	1.9	4.1
- Oil Palm	2.6	2.4	2.0	5.4
- Coconuts	1.4	2.3	-	0.3
- Other Crops	0.6	0.2	0.3	0.7
- Padi	-	0.2	-	1.3
- Pasture/Grassland	0.8	0.3	0.5	0.9
- Forest Land	2.2	2.0	0.6	2.7
- Swamp	4.9	0.9	5.4	23.4
- Unused Land	-	-	-	-
- Total Flood Area	19.9	12.3	14.2	40.9
Roads in Flood Area (Km)	22	22	19	22
Railway in Flood Area (Km)	1	-	1	1
No. of People (10^3) Affected by Flood	22.8	23.7	177.5	114.7

Remarks: See Table 57 for definitions of items appeared in this table.

Table 62 FLOOD AREA STATISTICS BY BASIN (5/11)

Basin No.	17	18	19	20
State(s)	Selangor/N. Sembilan	Negeri Sembilan	Melaka	Melaka/ Johor
River Basin(s)	Sepang, etc.	Linggi, Bharu	Melaka, Duyong	Kesang
Land Use (10^3 ha)				
- Urban Area	-	0.5	0.6	-
- Mining	-	0.3	-	-
- Mixed Horticulture	0.1	0.9	0.7	0.8
- Rubber	0.8	1.3	1.4	3.4
- Oil Palm	1.6	-	-	-
- Coconuts	0.4	-	-	0.2
- Other Crops	-	-	-	0.1
- Padi	0.2	4.3	3.3	1.8
- Pasture/Grassland	0.1	-	-	0.1
- Forest Land	0.6	0.7	0.1	0.5
- Swamp	12.7	5.1	2.8	3.6
- Unused Land	-	-	-	-
- Total Flood Area	16.5	13.1	8.9	10.5
Roads in Flood Area (Km)	8	27	31	26
Railway in Flood Area (Km)	-	3	1	-
No. of People (10^3) Affected by Flood	-	60.9	61.3	35.0

Remarks: See Table 57 for definitions of items appeared in this table.

Table 63 FLOOD AREA STATISTICS BY BASIN (6/11)

Basin No.	21	22	23	24
State(s)	N. Sembilan /Johor	Johor	Johor	Johor
River Basin(s)	Muar	Batu Pahat, Senggarang	S.W. Johor Rivers, Scudai, Tebrau	Johor, incl. Tiram, Serai
Land Use (10^3 ha)				
- Urban Area	0.2	0.4	0.6	0.2
- Mining	-	0.1	-	0.5
- Mixed Horticulture	1.6	0.7	2.8	0.3
- Rubber	13.3	19.4	18.2	2.4
- Oil Palm	0.8	2.2	1.0	0.4
- Coconuts	-	2.2	12.0	-
- Other Crops	0.1	2.3	4.4	0.2
- Padi	3.3	0.6	1.2	0.2
- Pasture/Grassland	0.2	-	1.2	0.2
- Forest Land	12.3	4.4	16.1	4.1
- Swamp	3.5	10.7	13.8	0.6
- Unused Land	-	-	-	-
- Total Flood Area	35.3	43.0	71.3	9.1
Roads in Flood Area (Km)	43	31	110	24
Railway in Flood Area (Km)	5	-	3	-
No. of People (10^3) Affected by Flood	76.8	29.5	110.9	30.5

Remarks: See Table 57 for definitions of items appeared in this table.

Table 64 FLOOD AREA STATISTICS BY BASIN (7/11)

Basin No.	25	26	27	28
State(s)	Johor	Johor	Johor/ Pahang	Pahang
River Basin(s)	Sedili Besar & Kechil	Jamaring, Mersing, Tenglu, Mawar, Teriang Besar	Endau	Rompin, Pontian
Land Use (10^3 ha)				
- Urban Area	-	-	0.3	0.1
- Mining	-	0.4	0.1	0.2
- Mixed Horticulture	0.1	0.4	0.3	0.1
- Rubber	0.2	0.8	1.9	0.1
- Oil Palm	-	-	0.7	1.4
- Coconuts	--	0.9	-	0.1
- Other Crops	-	-	-	-
- Padi	-	0.1	0.7	0.4
- Pasture/Grassland	0.1	0.2	0.1	0.3
- Forest Land	4.1	3.3	18.7	42.0
- Swamp	24.9	6.1	52.8	43.0
- Unused Land	-	-	-	-
- Total Flood Area	29.4	12.2	75.6	87.7
Roads in Flood Area (Km)	32	17	27	8
Railway in Flood Area (Km)	-	-	2	-
No. of People (10^3) Affected by Flood	2.0	18.1	34.4	4.0

Remarks: See Table 57 for definitions of items appeared in this table.

Table 65 FLOOD AREA STATISTICS BY BASIN (8/11)

Basin No.	29	30	31	32
State(s)	Pahang	Pahang/N. Sembilan	Pahang	Trengganu
River Basin(s)	Merchang, Bebar	Pahang	Kuantan	Kemaman, Kemasik, Kertch
Land Use (10^3 ha)				
- Urban Area	-	2.0	0.3	0.1
- Mining	-	0.2	0.2	0.2
- Mixed Horticulture	0.2	14.6	1.1	1.4
- Rubber	-	73.4	1.2	1.6
- Oil Palm	-	11.2	0.2	0.2
- Coconuts	0.1	1.2	-	0.1
- Other Crops	-	-	-	-
- Padi	0.6	9.1	0.2	0.8
- Pasture/Grassland	0.9	5.0	0.4	0.2
- Forest Land	6.0	101.5	5.7	6.2
- Swamp	136.8	82.2	15.4	20.7
- Unused Land	-	-	-	-
- Total Flood Area	144.6	300.4	24.7	31.5
Roads in Flood Area (Km)	24	443	16	34
Railway in Flood Area (Km)	-	84	-	-
No. of People (10^3) Affected by Flood	2.0	299.9	29.1	26.8

Remarks: See Table 57 for definitions of items appeared in this table.

Table 66 FLOOD AREA STATISTICS BY BASIN (9/11)

Basin No.	33	34	35	36
State(s)	Trengganu	Trengganu	Trengganu	Trengganu
River Basin(s)	Paka	Dungun	Merchong, Merang	Trengganu, Ibai
Land Use (10^3 ha)				
- Urban Area	-	-	-	0.5
- Mining	-	-	0.2	0.3
- Mixed Horticulture	-	0.4	0.1	8.7
- Rubber	0.5	1.0	0.2	10.2
- Oil Palm	-	0.7	-	0.8
- Coconuts	0.1	-	0.1	1.2
- Other Crops	-	-	-	-
- Padi	0.1	1.3	0.4	15.5
- Pasture/Grassland	0.2	0.3	0.5	1.8
- Forest Land	1.6	10.0	3.4	17.2
- Swamp	4.2	7.8	11.0	4.8
- Unused Land	-	-	-	0.2
- Total Flood Area	6.7	21.5	15.9	61.2
Road in Flood Area (Km)	2	11	1	166
Railway in Flood Area (Km)	-	-	-	-
No. of People (10^3) Affected by Flood	0.5	7.9	2.6	96.8

Remarks: See Table 57 for definitons of items appeared in this table.

Table 67 FLOOD AREA STATISTICS BY BASIN (10/11)

Basin No.	37	38	39	40
State(s)	Trengganu	Trengganu	Kelantan	Kelantan
River Basin(s)	Setiu, Merang	Besut, Keluang	Kemasin, Semerak	Kelantan
Land Use (10^3 ha)				
- Urban Area	-	0.1	(included in Basin 40)	2.1
- Mining	-	-		-
- Mixed Horticulture	0.5	5.0		27.6
- Rubber	0.1	2.6		37.5
- Oil Palm	0.1	-		0.3
- Coconuts	0.2	0.6		8.1
- Other Crops	-	-		0.3
- Padi	1.7	8.8		67.6
- Pasture/Grassland	1.5	2.2		6.3
- Forest Land	4.9	2.1		6.0
- Swamp	27.3	3.5		17.2
- Unused Land	-	-		0.2
- Total Flood Area	36.3	24.9		173.2
Roads in Flood Area (Km)	16	70		353
Railway in Flood Area (Km)	-	-		90
No. of People (10^3) Affected by Flood	7.3	80.4		624.8

Remarks: See Table 57 for definitions of items appeared in this table.

Table 68 FLOOD AREA STATISTICS BY BASIN (11/11)

Basin No.	41	
State(s)	Kelantan	Peninsular
River Basin(s)	Golok	Total
Land Use (10^3 ha)	(included in Basin 40)	
- Urban Area		11.3
- Mining		8.6
- Mixed Horticulture		83.1
- Rubber		227.0
- Oil Palm		38.8
- Coconuts		57.7
- Other Crops		10.8
- Padi		150.2
- Pasture/Grassland		26.2
- Forest Land		297.4
- Swamp		620.1
- Unused Land		0.4
- Total Flood Area		1,531.6
Roads in Flood Area (Km)		1,960
Railway in Flood Area (Km)		208
No. of People (10^3) Affected by Flood		2,519.4

Remarks: See Table 57 for definitions of items appeared in this table.

Table 69 FLOOD AREA STATISTICS AND ESTIMATED DAMAGES BY STATE (1/3)

	PERLIS	KEDAH	P. PINANG	PERAK
Flood Area Statistics*:				
1. Land Use (10^3 ha)				
Urban Area	0.2	0.1	0.2	0.8
Mining	0.6	-	-	0.6
Mixed Horticulture	0.3	2.1	0.6	9.6
Rubber	-	3.0	1.8	16.0
Oil Palm	-	0.1	-	4.4
Coconuts	-	0.1	0.3	18.5
Other Crops	-	-	0.1	1.5
Paddy	2.6	3.5	3.3	17.0
Grassland	-	0.2	-	1.7
Forest Land	0.1	0.5	-	17.1
Swamp	0.1	1.5	1.4	70.3
Unused Land	-	-	-	-
Total Flood Area	3.9	11.1	7.7	157.5
2. Roads in Flood Area (km)	29	27	26	255
3. Railway in Flood Area (km)	1	1	1	13
4. Number of people affected (10^3 people)	28	62	44	393
Estimated Damages:				
1. Damages in Past Largest Flood* (M$$10^6$)	6.2	9.5	7.3	64.2
2. Annual Average Damage (M$$10^6$)	1.8	2.9	2.9	13.9

Remarks: * For largest recorded flood or equivalent flood occurred in each river basin.

1. Road and railway: Total lengths passing through flooding area. Not implied that whole length is submerged.

2. Above represents present (1980) damages. Future enhancement and affluent factors not considered.

Table 70 FLOOD AREA STATISTICS AND ESTIMATED DAMAGES BY STATE (2/3)

	SELANGOR	N. SEMBILAN	MELAKA	JOHOR
Flood Area Statistics*:				
1. Land Use (10^3 ha)				
Urban Area	2.2	0.5	0.7	1.6
Mining	4.9	0.3	-	1.0
Mixed Horticulture	2.1	2.1	1.6	5.3
Rubber	15.2	2.3	4.9	55.7
Oil Palm	14.0	0.2	-	5.2
Coconuts	11.9	-	0.1	15.2
Other Crops	1.8	-	0.1	7.0
Paddy	1.2	5.5	6.9	4.1
Grassland	2.4	0.1	0.1	2.0
Forest Land	8.6	4.4	0.6	56.0
Swamp	46.8	5.4	7.5	90.7
Unused Land	-	-	-	-
Total Flood Area	111.1	20.8	22.5	243.8
2. Roads in Flood Area (km)	106	38	65	277
3. Railway in Flood Area (km)	4	4	1	9
4. Number of people affected (10^3 people)	345	98	117	262
Estimated Damages:				
1. Damages in Past Largest Flood* (M$$10^6$)	57.0	18.5	21.2	38.2
2. Annual Average Damage (M$$10^6$)	8.9	3.9	3.4	10.8

Remarks: * For largest recorded flood or equivalent flood occurred in each river basin.

1. Road and railway: Total lengths passing through flooding area. Not implies that whole length is submerged.

2. Above represents present (1980) damages. Future enhancement and affluent factors not considered.

Table 71 FLOOD AREA STATISTICS AND ESTIMATED DAMAGES BY STATE (3/3)

	PAHANG	TRENGGANU	KELANTAN	PENINSULAR TOTAL
Flood Area Statistics*:				
1. Land Use (10^3 ha)				
Urban Area	2.2	0.7	2.1	11.3
Mining	0.6	0.6	-	8.6
Mixed Horticulture	15.8	16.0	27.6	83.1
Rubber	74.4	16.2	37.5	227.0
Oil Palm	12.8	1.8	0.3	38.8
Coconuts	1.4	2.2	8.0	57.7
Other Crops	-	-	0.3	10.8
Paddy	9.8	28.7	67.6	150.2
Grassland	6.8	6.6	6.3	26.2
Forest Land	158.7	45.4	6.0	297.4
Swamp	299.5	79.7	17.2	620.1
Unused Land	-	0.2	0.2	0.4
Total Flood Area	582.0	198.1	173.1	1,531.6
2. Roads in Flood Area (km)	484	300	353	1,960
3. Railway in Flood Area (km)	84	-	90	208
4. Number of people affected (10^3 people)	323	222	625	2,519
Estimated Damages:				
1. Damages in Past Largest Flood* (M$$10^6$)	90.8	38.9	114.8	466.6
2. Annual Average Damage (M$$10^6$)	16.1	6.9	16.4	87.9

Remarks: * For largest recorded flood or equivalent flood occurred in each river basin.

1. Road and railway: Total lengths passing through flooding area. Not implies that whole length is submerged.

2. Above represents present (1980) damages. Future enhancement and affluent factors not considered.

Table 72 ESTIMATED POPULATION DENSITY (1/3)

Item		Perlis	Kedah	Pulau Pinang	Perak
Total Population:	(1)	160	1,090	896	1,815
Residential Area (ha):					
Urban Area	(2)	700	6,540	8,364	19,203
- Selected Towns	(3)	241	2,778	6,793	10,632
(No. of Towns)		(1)	(3)	(5)	(10)
- Other Towns	(4)	459	3,762	1,571	8,571
Rural Areas	(5)	6,456	37,823	8,595	30,434
Population by Areas (10^3 person):					
- Selected Towns	(6)	11	154	479	586
- Other Urban	(7)	15	148	79	334
- Rural	(8)	134	788	338	895
Population Density (Person/ha):					
- Selected Towns	(9)	46	55	71	55
- Other Urban	(10)	32	39	50	39
- Urban Average	(11)	37	46	67	48
- Rural	(12)	21	21	39	29

Remarks: (1); Ref. Sectoral Report Vol.1 - 1975 population.

(2); Total urban area in State, Ref. 6 - 1974 land use.

(3); Major town where population is known.
Area measured on Land Use Maps (Ref. 6) - 1974.

(4); (2) - (3)

(5); Total mixed horticulture area in State (Ref. 6) - 1974.

(6); Ref. Sectoral Report Vol.3 - 1975 population.

(9); (6)/(3) (10); (9) x 0.7 except *

(7); (10) x (4) (8); (1) - (6) - (7)

(11); ((6) + (7))/2 (12); (8)/(5)

Table 73 ESTIMATED POPULATION DENSITY (2/3)

Item		Selangor: Selangor	Selangor: Wilayah Persekutuan	Negeri Sembilan	Melaka
Total Population:	(1)	1,250	744	570	475
Residential Area (ha):					
Urban Area	(2)	14,374	10,378	7,299	3,694
- Selected Towns	(3)	8,334	10,378	4,127	1,028
(No. of Towns)		(7)	(1)	(3)	(1)
- Other Towns	(4)	6,040	-	3,172	2,666
Rural Areas	(5)	12,109	402	14,941	9,375
Population by Areas (10^3 person):					
- Selected Towns	(6)	392	744	131	141
- Other Urban	(7)	284	-	76	75
- Rural	(8)	574	-	363	259
Population Density (Person/ha):					
- Selected Towns	(9)	47*	72	32	137
- Other Urban	(10)	47*	-	24*	28*
- Urban Average	(11)	47	-	28	58
- Rural	(12)	47*	-	24*	28*

Remarks: (1); Ref. Sectoral Report Vol. 1 - 1975 population.

(2); Total urban area in State, Ref. 6 - 1974 land use.

(3); Major Towns where population is known.
Area measured on Land Use Maps (Ref. 6) - 1974.

(4); (2) - (3)

(5); Total mixed horticulture area in State (Ref. 6) - 1974.

(6); Ref. Sectoral Report Vol. 3.

(9); (6)/(3) (10); (9) x 0.7 except *

(7); (10) x (4) (8); (1) - (6) - (7)

(11); ((6) + (7))/2 (12); (8)/(5)

Table 74 ESTIMATED POPULATION DENSITY (3/3)

Item		Johor	Pahang	Trengganu	Kelantan	Peninsular Total
Total Population:	(1)	1,518	635	486	795	10,434
Residential Area (ha):						
Urban Area	(2)	18,778	8,936	3,408	3,314	104,988
- Selected Towns	(3)	10,775	3,372	1,590	1,525	61,573
(No. of Towns)		(13)	(7)	(3)	(5)	
- Other Towns	(4)	8,003	5,564	1,818	1,789	43,415
Rural Areas	(5)	27,787	29,446	24,661	34,377	236,406
Population by Area (10^3 person):						
- Selected Towns	(6)	464	153	155	138	3,548
- Other Urban	(7)	240	178	24	32	1,485
- Rural	(8)	814	304	307	625	5,401
Population Density (person/ha):						
- Selected Towns	(9)	43	45	97	90	58
- Other Urban	(10)	30	32	13*	18*	41
- Urban Average	(11)	37	37	53	51	48
- Rural	(12)	29	10	13*	18*	23

Remarks: (1); Ref. Sectoral Report Vol. 1 - 1975 population.

(2); Total Urban Area in State, Ref. 6 - 1974 land use.

(3); Major towns where population is known.
Area measured on Land Use Maps (Ref. 6) - 1974.

(4); (2) - (3).

(5); Total mixed horticulture area in State (Ref. 6) - 1974.

(6); Ref. Sectoral Report Vol. 3.

(9); (6)/(3) (10); (9) x 0.7 except *

(7); (10) x (4) (8); (1) - (6) - (7)

(11); ((6) + (7))/2 (12); (8)/(5)

Table 75 POPULATION GROWTH 1975 - 1980

State	Population (10^3 person) 1975	1980	Growth 1975/80	Assumed Growth in Flood Area 1975/80*
Perlis/Kedah	1,250	1,374	1.10	1.05
P. Pinang	896	982	1.10	1.05
Perak	1,815	1,984	1.09	1.05
Selangor	1,250	1,529	1.22	1.11
Wilayah Persekutuan	744	921	1.24	1.12
N. Sembilan	570	641	1.12	1.06
Melaka	475	528	1.11	1.06
Johor	1,518	1,715	1.13	1.07
Pahang	635	758	1.19	1.10
Trangannu	486	549	1.13	1.07
Kelantan	795	868	1.09	1.05

Note : * a lower growth rate (50% of state average) assumed for flood prone area.

Source: Sectoral Report Vol. 1

Table 76 NUMBER OF PERSONS PER HOUSEHOLD

State	Households - 1970 (No.)	Population - 1970 (Person)	Average No. of Person per Household (Person/No.)	Remarks
Perlis	25,236	121,062	4.8	
Kedah	185,419	955,374	5.2	
Pulau Pinang	135,348	776,770	5.7	
Perak	278,934	1,562,566	5.6	
Selangor	284,698	1,629,386	5.7	
(Kuala Lumpur)	(157,880)	(875,772)	(5.5)	
(Others)	(126,818)	(753,614)	(5.9)	
N. Sembilan	36,314	479,312	5.6	
Melaka	68,593	403,722	5.9	
Johor	214,917	1,273,990	5.9	
Pahang	98,357	503,131	5.1	
Trengganu	85,638	405,751	4.7	
Kelantan	144,520	680,626	4.7	
Total/Average	1,608,064	8,801,399	5.5	

Source: Ref. 1

Table 77 FLOOD DAMAGEABILITY OF PADDY BY GROWING STAGE

Item		Booting Stage	Heading Stage	Ripening Stage
Relative growth	(%)	60-75	80-90	90-100
Flooding depth up to 50% plant height	1 - 2 days	37	8	2
	3 - 4 days	42	22	4
	5 - 6 days	45	25	6
	7 days over	50	28	6
Flooding depth up to 75% plant height	1 - 2 days	40	10	4
	3 - 4 days	46	23	15
	5 - 6 days	49	26	23
	7 days over	55*	30*	23
Complete submergence	1 - 2 days	70*	30*	5
	3 - 4 days	80*	80*	20
	5 - 6 days	85*	90*	30
	7 days over	95*	100*	30

Remarks: 1. Assumption of paddy varieties:

Short-stem varieties (e.g. Mehsmi, Mat Candu) planted in irrigated area. Long-stem varieties (e.g. Serendah Kuning) planted in non-irrigated area.

2. * Almost coincide with assumptions in Kelantan River Basin Study - Main Report, Annex 1, page 87.

Source : 36

Table 78 FLOOD DAMAGE FACTORS - PADI

Unit: %

Inundation Depth (m)	Duration (day)	Region A (Booting-Heading Period) Short-term/ irrigated	Region A (Booting-Heading Period) Long-term/ rainfed	Region B (Heading-Ripending Period) Short-term/ irrigated	Region B (Heading-Ripending Period) Long-term/ rainfed
Plant Height (cm)		80-100	90-110	100-120	110-130
Less than 0.5 m	1-2	30	27	3	3
	3-4	37	33	8	7
	5-6	40	36	11	10
	7 over	45	41	12	11
0.5-0.9 m	1-2	33	30	5	5
	3-4	40	36	17	15
	5-6	43	39	24	22
	7 over	49	44	25	23
1.0 m over	1-2	60	54	11	10
	3-4	80	72	35	32
	5-6	86	77	45	41
	7 over	96	86	48	43

Remarks:

1. Main flood season:

   Region A (West Coast states): Booting/heading period
   Region B (East Coast and Johor): Heading/ripening period

2. Above weighted average damage rates were calculated taking into account the duration and damageability at respective growing stages. Growing period is assumed as below.

   - Booting stage : 30% of total growing period
   - Heading time : 10% of total growing period
   - Ripening stage : 30% of total growing period

3. Damage rates for long-term varieties assumed to be 90% of that for short-term varieties.

Table 79 PADDY AREA BY BASIN IN 1980 (1/2)

Basin No.	Name of Basin	Paddy Area (ha) Total	Irrigated	Rainfed	Proportion (%) Irrigated	Rainfed
1.	Perlis	15,374	6,815	8,559	45	55
2.	Langkawi	3,234	2,692	542	83	17
3.	Kedah	121,751	96,943	24,808	80	20
	(PS State)	(13,357)	(13,357)	(0)	(100)	(0)
	(KH State)	(108,394)	(83,586)	(24,808)	(77)	(23)
4.	Merbok	3,124	2,074	1,050	66	34
5.	Muda	27,856	15,670	12,186	56	44
	(KH State)	(19,244)	(7,058)	(12,186)	(37)	(63)
	(PG State)	(8,612)	(8,612)	(0)	(100)	(0)
6.	Perai	8,855	5,893	2,962	67	33
	(KH State)	(2,556)	(443)	(2,113)	(17)	(83)
	(PG State)	(6,299)	(5,450)	(849)	(87)	(13)
7.	Pinang	1,588	1,189	399	75	25
8.	Kerian	3,827	982	2,845	26	74
	(KH State)	(2,527)	(215)	(2,312)	(9)	(91)
	(PK State)	(1,300)	(767)	(535)	(59)	(41)
9.	Kurau	26,190	26,033	157	99	1
	(PG State)	(1,504)	(1,504)	(0)	(100)	(0)
	(PK State)	(24,686)	(24,529)	(157)	(99)	(1)
10.	Perek	26,340	23,218	3,122	88	12
11.	Bernam	19,970	19,263	707	96	4
12.	Tengi	1,270	0	1,270	0	100
13.	Selangor	151	0	151	0	100
14.	Buloh	83	0	83	0	100
15.	Kelang	223	0	223	0	100
16.	Langat	2,406	1,481	925	62	38
	(SL State)	(887)	(0)	(887)	(0)	(100)
	(NS State)	(1,519)	(1,481)	(38)	(97)	(3)
17.	Sepang	81	81	0	100	0
18.	Linggi	6,539	4,067	2,472	62	38
	(NS State)	(3,344)	(2,879)	(465)	(86)	(14)
	(MA State)	(3,195)	(1,188)	(2,007)	(37)	(63)
19.	Melaka	7,843	6,366	1,477	81	19
	(NS State)	(640)	(620)	(20)	(100)	(0)
	(MA State)	(7,203)	(5,746)	(1,457)	(80)	(20)

Remarks: PS = Perlis, KH = Kedah, PG = Pulau Pinang, PK = Perak, SL = Selangor, NS = Negeri Sembilan, MA = Melaka

Source : Sectoral Report Vol. 5

Table 80 PADDY AREA BY BASIN IN 1980 (2/2)

Basin No.	Name of Basin	Paddy Area (ha) Total	Irrigated	Rainfed	Proportion (%) Irrigated	Rainfed
20.	Kesang	2,665	2,339	326	88	12
	(MA State)	(1,836)	(1,618)	(218)	(88)	(12)
	(JR State)	(829)	(721)	(108)	(87)	(13)
21.	Muar	10,569	7,006	3,563	66	34
	(NS State)	(5,966)	(4,557)	(1,409)	(76)	(24)
	(JR State)	(4,603)	(2,449)	(2,154)	(53)	(47)
22.	Batu Pahat	461	142	319	31	69
23.	Pontian & Kechil	322	176	146	55	45
24.	Johor	286	109	177	38	62
25.	Sedili Besar	51	0	51	0	100
26.	Mersing	284	0	284	0	100
27.	Endau	1,790	1,150	640	64	36
	(JR State)	(1,150)	(1,150)	(0)	(100)	(0)
	(PH State)	(640)	(0)	(640)	(0)	(100)
28.	Rompin	1,130	0	1,130	0	100
29.	Bebar & Merchang	221	221	0	100	0
30.	Pahang	23,969	19,870	4,099	83	17
	(NS State)	(1,615)	(1,419)	(196)	(88)	(12)
	(PH State)	(22,354)	(18,451)	(3,903)	(83)	(17)
31.	Kuantan	511	511	0	100	0
32.	Kemaman	1,172	635	537	54	46
33.	Peka	289	162	127	56	44
34.	Dungun	1,602	66	1,536	4	96
35.	Marang	6,692	2,695	3,997	40	60
36.	Trengganu	11,826	7,195	4,631	61	39
37.	Setiu	4,349	1,841	2,508	47	58
38.	Besut	8,145	6,066	2,079	74	26
39.	Kemasin & Semarak	13,545	617	12,928	5	95
40.	Kelantan	54,329	39,784	14,545	73	27
41.	Golok	7,351	2,638	4,713	36	64
	Peninsular Total	428,264	305,990	122,274	71	29

Remarks: MA = Melaka, JR = Johor, NS = Negeri Sembilan, PH = Pahang

Source : Sectoral Report Vol. 5

Table 81 MORTALITY OF IMMATURE RUBBER TREES UP TO 3-YEAR OLD

Flood Duration (Days)	Flood Depth (cm)	Mortality (%)
7	25	5
14	25	15
21	25	60
28	25	100

Source: Ref. 19

Table 82 MORTALITY OF IMMATURE PALM TREES UP TO 3-YEAR OLD (OIL PALMS/COCONUTS PALMS)

Flood Duration (Days)	Flood Depth (cm)	Mortality (%)
7	25	10
14	25	20
21	25	70
28	25	100

Source: Ref. 19

Remarks: Mortality of oil palms assumed to be same as for coconuts palms. (Conservative assumption in terms of damageability)

Table 83 MORTALITY OF IMMATURE TREES UP TO 3-YEAR OLD UNDER CATEGORY OF OTHER PERMANENT CROPS

Flood Duration (Days)	Flood Depth (cm)	Mortality (%)
4	25	10
8	25	25
12	25	60
16	25	100

Source : Ref. 19

Remarks: Majorities included in this category are fruit trees, cocoa, sugarcane, coffee, pineapples.
Mortality rates represented by fruit crops.

Table 84 FLOOD DAMAGE FACTORS OF MIXED HORTICULTURES

Flood Duration (Days)	4	8	12	16	20
Damage Factor (%)	10	25	50	75	100

Source: Damage - flood duration relationship extracted from Fig. A.14 in Vol. 2 of Ref. 21.

Table 85 LOSS OF LIVESTOCKS IN PAST FLOOD EVENTS

Flood Event	Livestock Damage (M$10^3)	No. of People Affected	Estimated No. of Household Affected	Loss of Livestocks per Household (M$) 1974-79 Price Level	1980 Price Level
Pahang - Jan. 71	1,410	152,725	30,000	47 (1974)	63
Pahang - Dec. 71	80	43,482	8,700	9 (1974)	12
Pahang - Dec. 72	20	6,853	1,400	14 (1974)	19
Kelantan - Jan. 67	6,390	320,000	80,000	80 (1976)	100
Kuantan - Jan. 71	412	11,000	2,200	187 (1979)	200

Source : Ref. 21 (a), 19 (d) and 25 (b).

Remarks: No other statistical data made available from Veterinery Department.

Table 86 BUILDINGS/PROPERTIES DAMAGE FACTORS

Flood Depth (m)	Damage Factor
Below floor level	0.03
0.5 m above floor level	0.05
1.0 m above floor level	0.07
2.0 m above floor level	0.11
3.0 m above floor level	0.15
More than 3 m above floor level	0.22

Table 87 PRODUCTION VALUE OF PADDY DAMAGED BY FLOOD BY STATE (1980 PRICE LEVEL)

Unit: M$/ha

	State	Irrigated	Rainfed
1.	Perlis	1,270	1,000
2.	Kedah	1,110	910
3.	Pulau Pinang	1,180	1,010
4.	Perak	860	780
5.	Selangor	-	770
6.	Negeri Sembilan	1,070	790
7.	Melaka	1,060	790
8.	Johor	1,010	700
9.	Pahang	760	620
10.	Trengganu	800	620
11.	Kelantan	620	540

Remarks; The above value consists of net value of lost production and production cost required after flood.

Table 88 ESTIMATED FLOOD DAMAGES FOR SELECTED FLOOD EVENTS (1/2)

Basin No.	River Basin	State	Damage (10^6M$)	Average Depth (m)	Flood Duration (day)	Flood Event (Recurrence Interval)
1.	Perlis	Perlis	6.2	0.5/1.0	12	1976 (10)
2.	Langkawi	Kedah	-	-	-	-
3.	Kedah	Kedah	1.9*	0.5/1.0	3	1975 (10)
4.	Merbok, etc.	Kedah	-	-	-	-
5.	Muda	Kedah	7.4	1.0/1.5	3	1973 (10)
		P. Pinang	1.0	1.0/1.5	3	1973 (10)
	Tembus	P. Pinang	3.8	0.5/1.0	3	1971 (10)
6.	Perai	P. Pinang	0.9	0.5/1.0	2	1971 (5)
	Juru	P. Pinang	Nil	-	-	-
7.	Pinang	P. Pinang	1.6	0.5/1.0	2	1980 (5)
8.	Kerian	Kedah	0.2	-	-	-
		Perak	Nil	-	-	-
9.	Kurau	Perak	1.6	0.5/1.0	3	1980 (10)
	Beruas	Perak	0.7	0.5/1.0	3	1963 (-)
10.	Perak	Perak	60.8**	1.0/1.5	10	1967 (30)
11.	Bernam	Perak	1.1	1.0/1.5	3	1971 (20)
		Selangor	1.1	1.0/1.5	3	1971 (20)
12.	Tengi, etc.	Selangor	0.4	0.5/1.0	5	1971 (20)
13.	Selangor	Selangor	3.9	1.0/1.5	10	1971 (20)
14.	Buloh, etc.	Selangor	2.3	0.5/1.0	10	1971 (20)
15.	Klang	Selangor	5.3	1.0/1.5	2	1971 (80)
		W. Persekutuan	30.2	1.5/2.0	2	1971 (80)
16.	Langat	Selangor	13.8	1.0/1.5	4	1971 (30)
		N. Sembilan	1.0	1.0/1.5	4	1971 (30)
17.	Sepang	Selangor	Nil	0.5/1.0	2	1971 (20)
		N. Sembilan	Nil	0.5/1.0	1	1971 (20)
18.	Linggi	N. Sembilan	5.5	0.5/1.0	3	1971 (30)
		Melaka	1.7	0.5/1.0	3	1971 (30)
	Bharu	Melaka	1.7	0.5/1.0	2	1971 (20)
19.	Melaka	Melaka	9.5	0.5/1.0	2	1971 (20)
	Duyong	Melaka	0.3	0.5/1.0	2	1971 (20)
20.	Kesang	Melaka	8.0	0.5/1.0	4	1971 (20)
		Johor	1.5	0.5/1.0	4	1971 (20)
21.	Muar	Johor	5.1	1.0/1.5	7	1971 (15)
		N. Sembilan	9.4	1.0/1.5	2	1971 (15)
22.	Batu Pahat	Johor	10.8	1.0/1.5	10	1971 (15)

Remarks; * : Flood in Muda Irrigation area not included (no information from MADA)

**: Exclud. flood damage due to tide in Teluk Anson (to be estimated separately)

Table 89 ESTIMATED FLOOD DAMAGES FOR SELECTED FLOOD EVENTS (2/2)

Basin No.	River Basin	State	Damage (10^6M$)	Average Depth (m)	Flood Duration (day)	Flood Event (Recurrence Interval)
23.	Benut, S.W. Johor Rivers	Johor	8.7	0.5/1.0	5	1969 (10)
	Sekudai	Johor	1.8	0.5/1.0	2	1978 (10)
	Tebrau	Johor	1.1	0.5/1.0	2	1978 (10)
24.	Johor	Johor	3.0	0.5/1.0	5	1969 (10)
25.	Sedili Kechil Besar	Johor	0.1	1.0/1.5	3	1969 (10)
26.	Mersing	Johor	1.2	0.5/1.0	2	1971 (10)
	Tenglu	Johor	0.1	0.5/1.0	2	1971 (10)
	Teriang Kechil Besar	Johor	Nil	0.5/1.0	2	1971 (10)
27.	Endau	Johor	4.8	1.0/1.5	4	1969 (10)
		Pahang	0.2	1.0/1.5	4	1969 (10)
28.	Rompin	Pahang	0.7	1.5/2.0	14	1971 (10)
	Pontian	Pahang	0.4	1.5/2.0	14	1971 (10)
29.	Merchang/Bebar	Pahang	0.6	1.0/1.5	14	1971 (10)
30.	Pahang	Pahang	83.7	1.5/2.0	12	1971 (40)
		N. Sembilan	2.6	1.0/1.5	3	1971 (40)
31.	Kuantan	Pahang	5.2	1.5/2.0	7	1971 (20)
32.	Kemaman	Trengganu	3.7	1.0/1.5	8	1972 (20)
	Kerteh	Trengganu	0.1	0.5/1.0	5	1973 (10)
	Kemasik	Trengganu	0.1	0.5/1.0	5	1973 (10)
33.	Paka	Trengganu	0.1	0.5/1.0	5	1973 (10)
34.	Dungun	Trengganu	1.3	1.0/1.5	6	1973 (20)
35.	Marang	Trengganu	0.4	0.5/1.0	7	1976 (10)
	Merchang	Trengganu	Nil	-	-	-
36.	Trengganu	Trengganu	12.7	1.5/2.0	7	1967 (30)
	Ibai	Trengganu	3.1	1.5/2.0	7	1967 (30)
37.	Setiu	Trengganu	1.6	1.0/1.5	10	1967 (30)
	Merang	Trengganu	0.1	1.0/1.5	10	1967 (30)
38.	Besut	Trengganu	11.0	1.0/1.5	10	1967 (30)
	Keluang	Trengganu	4.7	1.0/1.5	10	1967 (30)
39.	Kemasin/Semerak	Kelantan				
40.	Kelantan	Kelantan	114.8	1.0/1.5	10	1967 (40)
41.	Golok	Kelantan				

Table 90 COMPARISON WITH DAMAGE ESTIMATE IN PREVIOUS STUDIES (1/2)

KELANTAN 1967 FLOOD

Unit: M$ 10^3

Damage Item	Estimate in* Previous Study (1976 Price)	Estimate in This Study 1976 Q'ty & Price	Estimate in This Study 1980 Q'ty & Price
1. RURAL INDUSTRIES			
a. Crops			
- Horticulture		3,820	6,840
- Rubber, mortality		290	430
, product loss		1,830	2,500
- Oil palm, mortality	Crop total	-	10
- Coconuts, mortality	24,850	20	260
- Other Crops		10	30
- Paddy, irrigated		11,610	9,220
, rainfed		6,280	8,940
b. Livestocks	6,390	6,400	6,710
Sub-total	31,240	30,260	34,940
2. STRUCTURES/PROPERTIES			
a. Utilities & Facilities	9,287	7,060	12,320
b. Public Building	1,368	5,950	8,750
c. Housing, Urban	16,340	7,970	14,460
, Rural		9,600	16,400
d. Industrial Facilities	-	-	1,450
Sub-total	26,995	30,580	53,380
3. INDIRECT DAMAGES	20,655	18,250	26,490
TOTAL DAMAGE:	78,890	79,090	114,810
		≒79,100	≒114,800

* Source; Ref. 19

Table 91 COMPARISON WITH DAMAGE ESTIMATE IN PREVIOUS STUDIES (2/2)

PAHANG 1971 FLOOD

Unit: M$10^3

Damage Item	Estimate in Previous Study* (1976 Price)	Estimate in This Study 1976 Q'ty & Price	Estimate in This Study 1980 Q'ty & Price
1. RURAL INDUSTRIES			
a. Crops			
- Horticulture		1,640	6,770
- Rubber, mortality		370	1,010
, product loss	Crop total	900	5,340
- Oil palm, mortality	6,060	30	430
- Coconuts, mortality		10	50
- Other crops		-	-
- Paddy, irrigated		2,750	5,050
, rainfed		350	790
b. Livestocks	200	660	2,860
Sub-total	6,260	6,710	17,300
2. STRUCTURES/PROPERTIES			
a. Utilities & Facilities	4,200	3,520	11,000
b. Public Building	2,200	2,470	6,820
c. Housing, Urban	2,800	6,340	19,050
, Rural	6,000	2,930	8,880
d. Industrial Facilities	380	-	1,910
Sub-total	15,580	15,260	47,660
3. INDIRECT DAMAGES	7,800	6,590	20,990
TOTAL DAMAGES:	29,640	28,560	85,950
		≒28,600	≒86,000

* Source; Ref. 21

Table 92 FLOOD DATA AT FLOOD ASSESSING STATIONS

Basin No.	River	Station (Station No.)	Non-flooding Discharge Q'ty (m^3/s)	Non-flooding Discharge R.P. (y)	Flood Event (for damage estimate) Q'ty (m^3/s)	Flood Event (for damage estimate) Year	Flood Event (for damage estimate) R.P. (y)
5.	Muda	Jeniang	250	2	680	1973	10
6.	Perai/Kulim	Ara Kuda	50	2	57	1971	5
9.	Kurau	Pondok Tanjong	90	3	110	1979	10
10.	Perak	Jembatan Iskandar	1,500	2	5,720	1967	30
11.	Bernam	Jam SKC	250	3	500	1971	20
13.	Selangor	Rantau Panjang	250	3	360	1971	20
		Rasa	-	-	180	1971	20
15.	Klang	Market Street*	160	4	540	1971	80
		Sentul	-	-	100	1971	30
18.	Linggi	Sua Betong	80	2	180	1971	30
19.	Melaka	Pantai Belimbing	50	3	90	1971	20
20.	Kesang	Chin Chin	30	5	70	1971	20
21.	Muar/ Segamat	Segamat	120	2	1,030	1971	15
22.	Batu Pahat/ Bakok	Bt. 8 Jam Yong Peng/Labis	40	2	80	1971	20
22.	Batu Pahat/ Sambrong	Bt. 2 Air Hitam	60	3	100	1971	15
24.	Johor	Rantau Panjang	180	2	320	1969	10
27.	Endau/ Lenggor	Bt. 42 Klung/ Mersing	180	2	300	1971	10
30.	Pahang	Temeroh	4,000	2	10,000	1971	40
31.	Kuantan	Bt. Kenau	-	2	310	1971	20
32.	Kemaman	Kg. Tayor	-	2	-	1972	20
36.	Trengganu	Kg. Tenggol	3,000	2	8,000	1967	30
40.	Kelantan	Guillemard	3,500	2	16,300	1967	40
41.	Golok	Rantau Panjang	250	2	390	1967	10

Source : * Ref. 12, 34 & Sectoral Report Vol. 13
Ref. 21, 25, 33, 32, 19 & Sectoral Report Vol. 13

Remarks: R.P. - Return Period

Table 93 ANNUAL AVERAGE FLOOD DAMAGE BY BASIN (1/3)

Basin No.	River Basin	State	Annual Average Damage (M$10^3)	No. of People Affected by Flood (10^3 person)	Remarks
1.	Perlis	Perlis	1,760	27.9	
2.	Langkawi	Kedah	-	-	
3.	Kedah	Kedah	540	14.5	
4.	Merbok, etc.	Kedah	-	-	
5.	Muda	Kedah	2,340	47.0	
		P. Pinang	330	6.1	
	Tembus	P. Pinang	1,200	20.6	
6.	Perai	P. Pinang	510	7.7	
	Juru	P. Pinang	Nil	-	
7.	Pinang	P. Pinang	860	9.9	
8.	Kerian	Kedah/Perak	Nil	0.9	
9.	Kurau	Perak	450	12.1	
	Beruas	Perak	*	1.5	*Not estimated (no flood reported since 1964).
10.	Perak	Perak	13,240	375.0	
11.	Bernam	Perak	190	4.5	
		Selangor	190	8.4	
12.	Tengi, etc.	Selangor	60	3.1	
13.	Selangor	Selangor	720	22.8	
14.	Buloh, etc.	Selangor	340	23.7	
15.	Klang	Selangor	2,650	46.8	
		W. Persekutuan	2,960	130.7	
16.	Langat	Selangor	2,040	109.2	
		N. Sembilan	140	5.5	
17.	Sepang	Selangor	Nil	-	
		N. Sembilan	Nil	-	

Table 94 ANNUAL AVERAGE FLOOD DAMAGE BY BASIN (2/3)

Basin No.	River Basin	State	Annual Average Damage (M$10^3)	No. of People Affected by Flood (10^3 person)	Remarks
18.	Linggi	N. Sembilan	980	36.0	
		Melaka	320	11.2	
	Bharu	Melaka	270	13.7	
19.	Melaka	Melaka	1,550	59.4	
	Duyong	Melaka	40	1.9	
20.	Kesang	Melaka	1,180	31.0	
		Johor	220	4.0	
21.	Muar	Johor	1,280	33.4	
		N. Sembilan	2,380	43.4	
22.	Batu Pahat	Johor	2,720	29.5	
23.	Benut, S.W. Johor Rivers	Johor	2,740	89.9	
	Sekudai	Johor	580	12.9	
	Tebrau	Johor	350	8.1	
24.	Johor	Johor	960	30.5	
25.	Sedili Besar	Johor	Nil	2.0	
26.	Mersing	Johor	380	15.9	
	Tenglu	Johor	40	2.2	
	Teriang Besar	Johor	Nil	Nil	
27.	Endau	Johor	1,510	33.7	
		Pahang	80	0.7	
28.	Rompin/ Pontian	Pahang	360	4.0	
29.	Merchang/ Bebar	Pahang	310	2.0	
30.	Pahang	Pahang	14,210	287.0	
		N. Sembilan	440	12.9	
31.	Kuantan	Pahang	1,150	29.1	

Table 95 ANNUAL AVERAGE FLOOD DAMAGE BY BASIN (3/3)

Basin No.	River Basin	State	Annual Average Damage (M$10^3)	No. of People Affected by Flood (10^3 person)	Remarks
32.	Kemaman	Trengganu	820	25.3	
	Kerteh	Trengganu	30	1.1	
	Kemasik	Trengganu	20	0.4	
33.	Paka	Trengganu	30	0.5	
34.	Dungun	Trengganu	290	7.9	
35.	Marang	Trengganu	140	2.6	
	Merchang	Trengganu	Nil	-	
36.	Trengganu	Trengganu	1,870	73.8	
	Ibai	Trengganu	450	23.0	
37.	Setiu	Trengganu	300	6.6	
	Merang	Trengganu	20	0.7	
38.	Besut	Trengganu	2,070	57.2	
	Keluang	Trengganu	880	23.2	
39.	Kemasin/ Semerak	Kelantan			
40.	Kelantan	Kelantan	16,410	624.8	
41.	Golok	Kelantan			
	Total:		87,900	2,519.4	

Table 96 WIDTH OF HIGH-WATER CHANNEL

Design Discharge (m^3/s)	Width (m)	Levees of Earth Embankment	
		Freeboard (m)	Width (m)
300	40 - 60	0.7	3
500	60 - 80	0.8	3
1,000	90 - 120	1.0	4
2,000	160 - 220	1.0	4
5,000	350 - 450	1.2	5

Table 97 CHANNEL IMPROVEMENT COST (PER KM)

Unit: $M\$10^6/km$

Design Flood (m^3/s)	Longitudinal Gradient						
	1/500	1/1000	1/2000	1/3000	1/5000	1/10,000	1/20,000
50	0.24	0.26	0.31	0.33	0.36	-	-
100	0.30	0.34	0.39	0.43	0.46	-	-
200	0.31	0.38	0.48	0.50	0.54	0.68	1.09
300	0.38	0.43	0.49	0.53	0.66	0.79	1.20
500	0.55	0.58	0.74	0.79	0.88	1.09	1.63
1,000	0.66	0.76	0.88	0.97	1.14	1.37	2.02
2,000	0.91	0.98	1.31	1.44	1.70	2.08	3.34
3,000	1.11	1.25	1.60	1.77	2.07	2.54	3.57
5,000	1.51	1.80	2.18	2.42	2.82	3.46	4.02
10,000	2.30	2.75	3.30	3.72	4.32	5.37	5.76
20,000	3.46	3.84	4.85	5.42	6.38	8.03	10.25

Remarks; (1) *Cost for other discharges/gradient to be interpolated.*

(2) Single cross section for discharges less than 200 m^3/s. Composite section for others.

(3) Basic unit prices used for the estimation above (contingencies and engineering cost not included):

- Clearing & Stripping (m^2) M$0.4
- Excavation-machine (m^3) M$3.0
- Embankment-excavated (m^3) M$2.0
- Embankment-borrowed (m^3) M$6.0
- Levee road pavement (m^2) M$8.0
- Revetment (m^2) M$25.0
- Sod facing (m^2) M$2.5

Table 98 CONSTRUCTION COST OF BYPASS FLOODWAY - PER KM

Unit: M$10^6/km

Design Capacity (m^3/s)	Longitudinal Gradient 1/500	1/1000	1/2000	1/3000	1/5000	1/10,000
300	0.62	0.69	0.80	0.87	1.09	1.27
500	0.76	0.89	1.24	1.26	1.40	1.76
1,000	1.08	1.27	1.47	1.65	1.95	2.37
2,000	1.51	1.73	2.25	2.99	2.99	3.57
3,000	1.85	2.20	2.78	3.43	3.71	4.43
5,000	2.54	3.13	3.84	4.31	5.04	6.14
10,000	3.86	4.85	5.90	6.72	7.77	9.79

Remarks; Single cross section for discharge of less than 200 m^3/s. Composite section for others.

Table 99 CONSTRUCTION COST OF POLDER

Unit: M$10^6

Item		Estimated Cost
Polder Dyke:		
- Height	1 m	0.19/km
- "	2 m	0.36/km
- "	3 m	0.46/km
- "	4 m	0.64/km
- "	5 m	0.86/km
Internal Drainage System:		
- Urban land		0.006/ha
- Paddy land		0.003/ha
Pumping Facilities:		
- Capacity	1 m^3/s	0.50/station
- "	2 m^3/s	0.70/station
- "	4 m^3/s	1.20/station
- "	6 m^3/s	1.60/station
- "	8 m^3/s	2.00/station
- "	10 m^3/s	2.40/station

Table 100 UNIT PRICES FOR ESTIMATION OF DAM CONSTRUCTION COST

Class of Dam (in Embankment Volume)	Unit Price ($M\$/m^3$)
Less than 500,000 m^3	67
500,000 - 2,000,000	56
More than 2,000,000	44

Remarks; Above represents prices for construction of rockfill dam.

Table 101 LAND PROCUREMENT AND RESETTLEMENT COSTS

Compensation on Land ($M\$10^6/km^2$)

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

Resettlement ($M\$10^3$/household)

Urban	30	Rural	10

Table 102 UNIT COST FOR NON-STRUCTURAL MEASURES

Unit: M$10^3

		Estimated Cost
1. Restriction of Development		
1) Management office expenditures (per 100 km^2 of flood area /1)		
- Personnel cost (per year)		
Engineer	0.5 persons x 36 =	18
Asst. engineer	1 person x 25 =	25
Overseer	1 person x 20 =	20
Assistant incl. clerks	6 persons x 30 =	180
Others	2 persons x 3 =	6
Sub-total	10.5 =	249
- Building, equipment and other expenditures		
100% of personnel cost		251
Total cost per year		500
2) Flood risk mapping (per 100 km^2 /2)		20
2. Land Use Change and Resettlement Plan		
1) Plantation development (per ha)		
- Conversion from paddy to rubber		3
- New plantation in resettled area		6
2) Resettlement cost (per family)		
- Resettlement		10
- Procurement of land in resettled area		10
3. Flood Proofing		
Subsidy to household (per household)		4

Remarks; /1: Only for lands presently in use, excl. unused lands such as swamp, forest

/2: For total flood area incl. swamp, forest, etc.

Table 103 UNIT COST FOR TELEMETRIC FLOOD FORECASTING SYSTEM INSTALLATIONS

Item	Equipment Cost ($M\$10^3$/No.)	Cost including Installation * ($M\$10^3$/No.)
Rain-gauge station	32	40
Stream-gauge station	36	50
Repeater station	78	100
Receiving station	290	330

Remarks; (1) * Excluding contingencies (30%) and engineering cost (10%)

(2) In addition, cost for operation guidance to be assumed at approximately 20% of above

Table 104 COST OF EROSION CONTROL AND DREDGING WORKS

Description	Estimated Cost (M$)
Erosion control:	
- stone riprap embankment	$60/m^3$
Breakwater wall:	
- rock embankment	$60/m^3$
Dredging fleet (450,000 m^3/year class):	
- procurement of equipment	10×10^6/unit
- operating cost	0.7×10^6/year

Table 105 BUDGET TO BE ALLOTTED FOR MINOR PROJECTS AND ROUTINE MAINTENANCE WORKS

Unit: M$10^6

State	Budget Proposed in 4MP /1			Budget Preserved for 5MP Period Onward /2
	Minor /3 Project	River Clearing	Total	
Perlis	-	-	-	0.30
Kedah	1.80	-	1.80	2.60
P. Pinang	1.17	-	1.17	2.00
Perak	2.81	3.00	5.81	4.20
Selangor	2.00	3.00	5.00	5.00
N. Sembilan	0.72	-	0.72	1.40
Melaka	0.41	-	0.41	1.10
Johor	1.81	-	1.81	3.60
Pahang	1.61	-	1.61	1.70
Trengganu	-	-	-	1.30
Kelantan	3.00	0.90	3.90	1.80
Total	15.33	6.90	22.23	25.00

Remarks; /1: Source: Ref. 44

/2: Tentative distribution of total budget M$ 25 x 10^6, in consideration of population and present river condition

/3: Excluding some river improvement works carried out as a part of irrigation and drainage projects

Table 106 OPERATION AND MAINTENANCE COSTS

Work Item	O&M Cost (% to Initial Cost)	Service Life (year)
Channel/levee	2	50
Bypass floodway	2	50
Polder	2	-
- Civil works	-	50
- Pumps & equipment	-	20 /1
Flood control dam	0.5	50
Flood forecasting system	10	10 /2
Dredger	7	10 /1

Remarks; /1: Replacement at end of service life

/2: Ditto. Possibility of replacement due to system remodelling taken into account

Table 107 RIVER IMPROVEMENT PLAN (1/29)
WITHOUT DAM/FLOODWAY

State:Perlis

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 1 Perlis								
Perlis/Korok								
1	K.Perlis	3	340	1/10000	2.46	0.25	0.18	-0.07
2	Kg.Kota Keran	3	320	1/10000	10.79	1.10	0.71	-0.39
3	Kangar Kechor	17	170	1/2000	7.31	0.74	0.87	+0.12
K1	Kangar Gial	14	58	1/2000	4.09	0.42	0.60	+0.18
G1	Kg.Alor Ara	9	94	1/2000	3.00	0.31	0.17	-0.13

Remarks: * Stretches in other state

Table 108 RIVER IMPROVEMENT PLAN (2/29)
WITHOUT DAM/FLOODWAY

State:Kedah

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 3 Kedah								
Anak Bukit								
1	Alor Setar	15	700	1/10000	56.15	5.71	0.16	-5.55
	Pdg.Terap							
2	Kg.K.Pai	0.5	500	1/3000	0.47	0.05	0.11	+0.06
3	K.Nerang	15	270	1/3000	8.47	0.86	1.88	+1.02
	Pandang							
P1	Alor Setar	8	400	1/10000	7.18	0.73	0.03	-0.71
Basin 5 Muda (after Muda dam)								
Muda								
1	Kg.K.Muda	10	1160	1/10000	16.00	1.63	0.09	-1.54
2	Muda Barrage	12	1160	1/8000	17.06	1.74	1.06	-0.68
3	Kg.Pinang Ti	15	1160	1/3000	17.69	1.80	1.52	-0.28
4	Kg.Sidam Kiri	5	1110	1/3000	5.63	0.57	0.01	-0.57
5	Kg.K.Sedim	14	990	1/5000	17.15	1.74	0.26	-1.48
6	K.Kechil	40	960	1/2000	36.55	3.72	0.68	-3.04
	Kechil/Kupang							
K1	K.Kechil	35	440	1/1000	20.14	2.05	2.26	+0.21
K2	Kupang	10	130	1/500	2.64	0.27	1.53	+1.26

Remarks: * Stretches in other state

Table 109 RIVER IMPROVEMENT PLAN (3/29)
WITHOUT DAM/FLOODWAY

State:Kedah

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	A2n'l Cost	Da'g Red'n	B-C
Basin 8 Kerian								
Kerian								
1	Kg.Batang Se	13	480	1/8000	12.52	1.27	0.	-1.27
2	Kg.Labak	15	440	1/4000	11.15	1.13	0.10	-1.04
	Ijok							
I1	Kg.Labak	4	180	1/4000	1.88	0.19	0.	-0.19

Remarks: * Stretches in other state

Table 110 RIVER IMPROVEMENT PLAN (4/29)
WITHOUT DAM/FLOODWAY

State:P.Pinang

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 5 Tembus								
1	All area	3	58	1/10000	0.98	0.10	1.59	+1.49
Basin 6 Perai								
1	Butterworth	4	270	1/10000	5.35	0.54	0.61	+0.07
2	Perai Barrage	4	260	1/10000	2.82	0.29	0.47	+0.18
Basin 6 Juru								
1	Kg.BaganNyor	5	60	1/10000	5.52	0.56	0.00	-0.56
2	TitiPanjang	5	45	1/10000	22.84	2.32	0.	-2.32
Basin 7 Pinang								
Pinang								
1	River mouth	2.4	68	1/20000	1.47	0.11	0.11	0.00

Remarks: * Stretches in other state

Table 111 RIVER IMPROVEMENT PLAN (5/29)
WITHOUT DAM/FLOODWAY

State:Perak

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 9 Beruas								
1	All area	(Already improved)						
Basin 9 Kurau								
1	Kual Kuran	48	350	1/40000	No imp.	-	-	-
2	Kg.S.Gedong	13	245	1/40000	5.06	0.52	0.26	-0.26
3	Bt.Merah reser	7	240	1/2000	3.31	0.34	0.00	-0.34
4	Pondok Tonjon	10	165	1/1000	3.62	0.37	0.39	+0.02
Basin 10 Perak								
1	Bypass out let	50	7400	1/10000	136.25	13.86	1.90	-11.96
2	Teluk Ansor	10	7200	1/3000	18.54	1.89	1.98	+0.09
3	Sg.Kinta Conf	60	6800	1/3000	152.24	15.49	8.99	-6.50
4	Kubang tlaji	7	6100	1/3000	24.10	2.45	0.96	-1.49
5	Nordin Bridge	40	6000	1/3000	65.67	6.68	0.91	-5.77
6	Kuala Kangsor	20	5860	1/3000	65.01	6.61	5.01	-1.60
7	Sg.Plus Confl	12	4420	1/3000	16.84	1.71	0.07	-1.64
8	Chenderoh dam	21	13000	(Reservoir)	0.	0.	-	-
9	Kg.Bharu K.T.	25	13000	1/1600	30.77	3.13	0.60	-2.53
10	Kg.Kenering Bidor	-	12000	(Reservoir)	-	-	-	-
B1	Sg.Batang Pad Batang Padang	14	420	1/3000	9.57	0.97	0.02	-0.96
B2	Sg.Bidor Confl Sungkai	17	320	1/2000	8.93	0.91	0.19	-0.71
B3	Kg.Tanjang Kinta	13	220	1/700	7.60	0.77	0.14	-0.64
Ki	Sg.Parak Conf Plus	23	800	1/5000	39.63	4.03	0.40	-3.64
P1	Kg.Plus	22	600	1/1500	16.01	1.63	0.53	-1.10

Remarks: * Stretches in other state

Table 112 RIVER IMPROVEMENT PLAN (6/29)
WITHOUT DAM/FLOODWAY

State:Perak

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 11 Bernam								
Bernam								
1	River mouth	No impr.	780	1/55000	-	-	-	-
2	Tengi diversi	8	480	1/3000	6.04	No improvement		
3	Kg.Baloh Sern	8	450	1/3000	5.70	0.58	0.01	-0.57
4	Kg.K.Slim	11	250	1/1700	4.94	0.50	0.01	-0.50
5	Behalang Slim	11	165	1/1700	4.33	0.44	0.50	+0.06
S1	Kg.K.Slim	14	280	1/1000	11.38	1.16	0.20	-0.96

Remarks: * Stretches in other state

Table 113 RIVER IMPROVEMENT PLAN (7/29)
WITHOUT DAM/FLOODWAY

State:Selangor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 12 Tengi								
1	All streches	15 (No impro)			-	-	-	-
Basin 13 Sg.Selangor								
	Sg.Selangor							
1	River mouth	-	640	1/10000	0.	0.	0.	0.
2	Kg.Peng Ladan	18	530	1/10000	20.17	2.05	0.08	-1.98
3	Batang Berjunt	8	530	1/2000	6.17	0.63	0.	-0.63
4	Sg.Sembah con	15	420	1/2000	9.69	0.99	0.04	-0.94
5	Sg.Kerling	11	300	1/1000	4.98	0.51	0.06	-0.45
6	Rasa bridge	20	280	1/1000	2.27	0.23	0.11	-0.12
	Sg.Sembah							
S1	Sg.Selanger co	6	260	1/2000	2.86	0.29	0.02	-0.27
	Sg.Kundang							
K1	Sg.Sembah cofl	9	128	1/1000	2.72	0.28	0.02	-0.26
	Sg.Garirp							
G1	Sg.Sembah cofl	8	120	1/500	2.18	0.22	0.17	-0.06
Basin 14 Sg.Buloh								
	Sg.Buloh							
1	River mouth	5	230	1/2000	2.39	0.24	0.34	+0.10
2	Kg.Bt.Cheraka	11	180	1/5000	5.13	0.52	0.28	-0.24
3	Bt.Mayong	11	150	1/2000	4.19	0.43	-	-
4	Kg.Bharn	8	105	1/500	2.11	0.21	0.38	+0.17

Remarks: * Stretches in other state

Table 114 RIVER IMPROVEMENT PLAN (8/29)
WITHOUT DAM/FLOODWAY

State:Selangor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 15 Sg.Kelang								
Sg.Kelang								
1	River mouth	-	580	1/9000	0.	0.	0.	0.
2	Kelang town	12	580	1/9000	12.37	1.26	0.30	-0.96
3	Sg.Damansara c	6	520	1/5000	4.52	0.46	-	-
4	Bukit Kamuning	7	480	1/5000	6.05	0.62	0.42	-0.20
5	Puchong Drop	6	420	1/1000	3.46	0.35	0.31	-0.04
6	Petaling Jaya	15	400	1/1000	70.25	7.15	2.62	-4.53
7	Market Street	12	320	1/1000	2.49	0.25	1.13	+0.88
Sg.Batu								
B1	Market Street	2	215	1/800	0.62	0.06	0.28	+0.22
B2	Sg.Gombak conf	6	150	1/500	1.06	0.11	0.42	+0.32
Sg.Gombak								
G1	Sg.Batu Confl	6	125	1/100	0.51	0.05	0.32	+0.27
Sg.Damansara								
D1	Sg.Kelang Cof	18	130	1/1500	5.50	0.56	0.08	-0.25
Basin 16 Sg.Langat								
Sg.Langat								
1	River mouth	-	790	1/80000	0.	0.	No impro.	
2	Tg.Tanakan	11	760	1/20000	18.60	1.89	No impro.	
3	Bandar	11	740	1/20000	18.44	1.88	No impro.	
4	Tk.Datok	13	720	1/7000	14.14	1.44	0.79	-0.19
5	Kg.Labohan dag	8	670	1/5000	7.37	0.75	0.09	-0.20
6	Sg.Batang Labu	4	560	1/5000	3.81	0.39	0.12	+0.19
7	Dengkil	9	560	1/3000	6.78	0.69	0.06	-0.17
8	Sg.Semenyih	14	300	1/1000	14.81	1.51	0.28	-0.76
9	Kajang	20	250	1/1000	18.74	1.91	0.65	-0.80
Sg.Laku								
L1	Sg.Labu/Sg.Lan	7	160	1/5000	3.27	0.33	0.00	+0.13
L2	Kg.Ager tlitam	5	144	1/2000	1.98	0.20	0.02	+0.28
L3	Salak cbelongs	9	80	1/500	2.22	0.23	0.53	+0.30
Sg.Semengih								
S1	Sg.Semengih/Lan	8	290	1/1000	3.58	0.36	0.02	+0.12
S2	Sg.Beranang con	8	280	1/700	3.54	0.36	0.10	+0.20
S3	Semengih	6	148	1/1000	2.02	0.21	0.12	+0.38
Sg.Beranang								
B1	Sg.Beranang/sg.Se	5	210	1/500	1.43	0.15	0.01	+0.33
B1	Sg.Pajam confl	4	200	1/700	1.65	0.17	0.22	+0.51
Sg.Pajam								
P1	Sg.Pajam/Sg.Ber	10	91	1/800	2.67	0.27	0.55	+0.28

Remarks: * Stretches in other state

Table 115 RIVER IMPROVEMENT PLAN (9/29)
WITHOUT DAM/FLOODWAY

State:Selangor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 17 Sepang Kechil								
1	K.Sepang kech	2	50	1/5000	0.62	0.06	No impro.	
2	Road Bridage	5	42	1/2000	0.63	0.06	No impro.	
Basin 17 Sepang Besar								
1	K.Sepang B.	6	86	1/4000	2.22	0.23	No impro.	
2	Kg.Bt.Pelandok	7	42	1/1500	1.76	0.18	No impro.	

Remarks: * Stretches in other state

Table 116 RIVER IMPROVEMENT PLAN (10/29)
WITHOUT DAM/FLOODWAY

State:Negeri Sembilan

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 17 Sepang Besar								
1	K.Sepang	6	86	1/4000	0.	0.	No impro.	
2	Kg.Bt.Pelandok	7	42	1/1500	1.76	0.18	No impro.	
Basin 17 Lukut Besar								
Lukut Besar								
1	Kg.Lukut	1	120	1/3000	0.40	0.04	No impro.	
2	Sg.T.Merah Con	3	56	1/2000	0.85	0.09	No impro.	
3	Road Bridge	6	45	1/1000	1.31	0.13	No impro.	
Tanah Merah								
T1	K.Sg.T.Merah	5	92	1/5000	1.94	0.20	No impro.	
T2	Road Bridge	4	78	1/500	0.97	0.10	No impro.	
Basin 17 Menyara								
1	K.Menyara	1	50	1/2000	0.29	0.03	No impro.	
2	Coastal Road	5	42	1/2000	1.36	0.14	No impro.	

Remarks: * Stretches in other state

Table 117 RIVER IMPROVEMENT PLAN (11/29)
WITHOUT DAM/FLOODWAY

State:Negeri Sembilan

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 18 Linggi								
	Linggi							
1	Kg.K.Linggi	8	500	1/4000	6.37	0.65	No impro.	
2	Sg.Rambai Conf	6	310	1/4000	3.91	0.40	0.22	-0.18
3	Linggi	17	300	1/1500	7.93	0.81	0.23	-0.58
4	Rantau	18	240	1/800	7.79	0.79	0.23	-0.56
5	Rasah	7	180	1/500	1.99	0.20	1.03	+0.83
6	Kg.Bharu	8	110	1/500	2.11	0.21	0.30	+0.09
	Rembau							
R1	Kg.Sg.Rembau	6	260	1/4000	3.36	0.34	0.03	-0.31
R2	Sg.Pedas Confl	3	220	1/1000	1.26	0.13	0.02	-0.11
R3	Kg.Bharu	7	150	1/1500	2.57	0.26	0.04	-0.22
R4	Kg.Istana Raja	6	53	1/1500	1.56	0.16	0.03	-0.13
	Pedas							
P1	K.Sg.Pedas	9	120	1/700	2.56	0.26	0.05	-0.21
P2	Kg.Paya Lebar	13	91	1/500	3.32	0.34	0.05	-0.28
	Siput/Lendu							
S1	Kg.Bharu	11	130	1/1200	3.46	0.35	0.30	-0.05
S2	Kg.Tengah	3	60	1/500	0.66	0.07	0.42	+0.35
S3	Kg.Tengah	6	45	1/1000	1.32	0.13	0.22	+0.09
	Penajis							
J1	Kg.Istana Raja	8	110	1/500	2.11	0.21	0.25	+0.04
J2	Kg.Peregi Jene	7	75	1/700	1.77	0.18	0.23	+0.05

Remarks: * Stretches in other state

Table 118 RIVER IMPROVEMENT PLAN (12/29)
WITHOUT DAM/FLOODWAY

State:Negeri Sembilan

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 21 Muar								
Muar								
1	State border	23	530	1/1500	15.88	1.62	0.10	-1.51
2	Rompin	20	480	1/1500	12.82	1.30	0.00	-1.30
3	Kg.K.Jelai	7	390	1/1000	3.66	0.37	0.12	-0.26
4	Kg.K.Jembol	14	320	1/1500	7.81	0.79	0.59	-0.21
5	Kg.Telok	6	270	1/800	3.04	0.31	0.34	+0.03
6	Tg.Ibok	8	170	1/800	2.49	0.25	0.21	-0.05
Gemas								
M1	K.Sg.Gemas	7	160	1/3000	2.99	0.30	0.	-0.30
Gemanche								
G1	K.Sg.Gemanche	20	300	1/2000	9.62	0.98	0.10	-0.88
G2	Kg.S.Dua	12	160	1/700	3.56	0.36	0.41	+0.05
G3	Gemanche	5	73	1/300	1.12	0.11	0.08	-0.03
Jelai								
J1	Kg.K.Jelai	15	220	1/700	9.24	0.94	0.01	-0.93
J2	Kg.AyerTalinp	9	160	1/1000	2.97	0.30	0.02	-0.28
J3	Kg.Chenggang	6	110	1/700	1.61	0.16	0.14	-0.03
Jambol								
B1	Kg.K.Jembol	10	120	1/700	2.86	0.29	0.61	+0.31
B2	Kg.Teletong	6	94	1/300	1.58	0.16	0.58	+0.41
Seri Menanti								
S1	Tg.Ibok	7	68	1/400	1.59	0.16	0.17	+0.00
Terachi								
T1	Tg.Ibok	8	73	1/400	1.87	0.19	0.11	-0.08
Basin 30 Pahang-Upper Reaches								
Terian								
T3	State border	13	880	1/1000	40.46	4.12	0.31	-3.81
T5	Kg.Pah	11	400	1/500	20.84	2.12	0.36	-1.76
Serting								
E1	Kg.Mahasan d/s	6	500	1/700	0.	0.	-	-
E2	Bahau	17	360	1/1000	0.	0.	-	-

Remarks: * Stretches in other state

Table 119 RIVER IMPROVEMENT PLAN (13/29)
WITHOUT DAM/FLOODWAY

State:Melaka

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 18 Bharu								
1	K.S.Bharu	6	92	1/2000	2.01	0.20	0.14	-0.06
2	Kg.Lbk Radah	6	74	1/1500	1.77	0.18	0.29	+0.11
Basin 19 Seri Melaka								
1	Kelebang Besar	4	60	1/5000	1.72	0.13	0.05	+0.02

Remarks: * Stretches in other state

Table 120 RIVER IMPROVEMENT PLAN (14/29)
WITHOUT DAM/FLOODWAY

State:Melaka

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 19 Melaka								
Meraka								
1	Meraka	5	340	1/10000	21.35	2.17	1.87	-0.30
2	TidalBarrage	2	330	1/10000	1.59	0.16	0.23	+0.07
3	Batu Berren dam	8	280	1/5000	5.05	0.51	0.09	-0.43
4	Kg.S.Badau	16	230	1/1500	7.64	0.78	0.14	-0.64
5	Kg.Gadek	14	150	1/700	4.11	0.42	0.02	-0.40
Tamping								
T1	Kg.Gadek	13	68	1/700	3.13	0.32	0.05	-0.27
Duriang Tunggal								
D1	Kg.S.Badan	3	94	1/2000	1.02	0.10	0.08	-0.03
Basin 19 Duyong								
1	K.Duyong	2	110	1/5000	0.82	0.08	0.01	-0.07
2	Kg.Peng Ranggam	3	110	1/5000	1.22	0.12	0.03	-0.10
3	Ayer Melok	6	90	1/3000	2.15	0.22	0.00	-0.22
4	Kg.Tg.Labok	5	55	1/1000	1.18	0.12	0.01	-0.11
Basin 20 Kesang								
Kesang								
1	K.Sg.Kesang	3	350	1/5000	2.15	0.22	0.31	+0.09
2	Kg.Sg.Rambai	12	340	1/7000	9.13	0.93	0.94	+0.01
3	Lusong Tempat	13	320	1/7000	8.54	0.87	0.03	-0.84
4	Sg.Chahang Co	10	140	1/900	3.15	0.32	0.81	+0.49
5	Jasin	7	88	1/700	1.91	0.19	0.58	+0.39
6	Kesang Pajah	13	58	1/500	2.83	0.29	0.59	+0.30
Chohong/Nyalas								
C1	K.Sg.Chohong	10	160	1/1000	3.17	0.32	0.37	+0.05
C2	Kg.Bekok	13	63	1/400	2.89	0.29	0.08	-0.22

Remarks: * Stretches in other state

Table 121 RIVER IMPROVEMENT PLAN (15/29)
WITHOUT DAM/FLOODWAY

State:Jhor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 21 Muar-lower Reaches								
Muar								
1	Muar	67	1700	1/25000	259.57	19.70	0.34	-19.36
2	Panchor	24	1500	1/40000	112.32	8.54	0.07	-8.47
3	Kg.Lenga	13	1500	1/15000	26.40	2.69	0.02	-2.67
4	Sg.Labis Confl	15	1300	1/5000	18.19	1.85	0.12	-1.73
5	Sg.Segmat Conf	27	1100	1/4000	32.56	3.31	0.28	-3.03
6	Sg.Palong Conf	14	720	1/1500	10.74	1.09	0.01	-1.09
Labis								
L1	K.Sg.Labis	31	180	1/1000	10.48	1.07	0.00	-1.07
L2	Labis	3	78	1/500	0.74	0.08	0.50	+0.42
Segmat								
S1	K.Sg.Segmat	5	380	1/2000	3.16	0.32	0.13	-0.19
S2	Segmat	13	290	1/2000	6.36	0.65	0.24	-0.41
S3	Sg.Juasseh Con	5	120	1/500	1.32	0.13	0.00	-0.13
Kapeh								
S4	Segmat	9	140	1/4000	3.71	0.38	0.18	-0.20
Juasseh								
S5	K.Sg.Juasseh	23	160	1/750	6.98	0.71	0.05	-0.66
Palong								
P1	K.Sg.Palong	8	280	1/2500	3.93	0.40	0.03	-0.37

Remarks: * Stretches in other state

Table 122 RIVER IMPROVEMENT PLAN (16/29)
WITHOUT DAM/FLOODWAY

State:Johor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 22 Batu Pahat								
Batu Pahat								
1	River Mouth	12	740	1/25000	0.	0.	0.48	+0.48
Simpang Kanan								
2	S.Kiri Confl	13	700	1/25000	0.	0.	0.45	+0.45
3	Proposed Bauag	6	500	1/25000	0.	0.	0.07	+0.07
Bekok								
4	Sg.Semberong	18	340	1/15000	18.20	1.85	0.61	-1.24
5	Yong Peng	16	260	1/4000	10.80	1.10	0.07	-1.03
6	Bekok Dam	16	200	1/500	4.86	0.49	0.01	-0.49
Simpang Kiri								
K1	S.Kanan Confl	14	380	1/1500	17.60	1.79	2.32	+0.53
K2	Proposed Barr	18	320	1/6000	11.63	1.18	1.32	+0.14
K3	Proposed Dam	12	250	1/4000	6.07	0.62	0.	-
K4	Kg.Bangka	16	210	1/3000	7.27	0.74	1.39	+0.65
Semberong								
S1	Sg.Bekok Conf	21	210	1/8000	12.95	1.32	0.05	-1.27
S2	Proposed Dam	9	111	1/1000	2.71	0.28	0.00	0.27
Basin 22 Senggarang / Proposed Floodway								
F1	Senggarang	19	420	1/16000	27.23	2.07	1.32	-0.75
Basin 23 S.W.Johor Rivers								
1	All areas	Not studied (Already improved)						-
Basin 23 Sekudai								
Sg.Sekudai								
1	River mouth	Impro.	440	1/3000	0.	0.	0.	0.
2	Kg.Telok Ser	Impro.	370	1/2500	0.	0.	0.	0.
3	Tidal Gate	15	400	1/1000	27.11	2.76	0.92	-1.84
4	Kulai	10	240	1/1000	11.30	1.15	0.45	-0.70
Basin 23 Sg.Tebrau								
1	River mouth	Impro.	450	-	0.	0.	0.	0.
2	Kg.Ubi Bharn	Impro.	346	-	0.	0.	0.	0.
3	Tidal Gate	5	320	1/1000	2.53	0.26	1.08	+0.82
4	Lembaga Tebrau	7	225	1/700	2.59	0.26	0.00	-0.26

Remarks: * Stretches in other state

Table 123 RIVER IMPROVEMENT PLAN (17/29)
WITHOUT DAM/FLOODWAY

State:Johor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 24 Johor								
Johor								
1	River mouth	No impro		-	0.	0.	-	-
2	Ladang Omar Sh	7	1170	1/5000	9.59	0.98	0.50	-0.48
3	PUB Intake	13	1150	1/3000	12.33	1.25	0.06	-1.20
4	Kg.Semangan	13	980	1/3000	13.15	1.34	0.34	-1.00
5	Sg.Linggiu Con	6	580	1/2500	4.87	0.50	-	-
6	Sg.Pengeli Con	19	520	1/2500	14.50	1.48	0.01	-1.47
7	Layang Layang	6	380	1/1000	3.33	0.34	0.43	+0.09
Tiram								
T1	River mouth	No impro		-	0.	0.	-	-
T2	Ladangs Tiram	10	300	1/750	4.51	0.46	0.48	+0.02
Panti								
P1	Sg.Johor Confl	8	230	1/1000	3.74	0.38	0.19	-0.19
Semangan								
M1	Sg.Johor Confl	7	295	1/2500	3.59	0.37	-	-
Linggiu								
L1	Sg.Linggiu/Joh	7	480	1/1500	4.52	0.46	-	-
Rengeli								
E1	Sg.Rengeli/Say	9	310	1/1500	4.21	0.43	-	-
Serai								
S1	Kg.Sg.Latoh	No impr	160	-	0.	0.	-	-
Basin 25 Sg.Sedili Kechil								
Sg.sedili Kechil								
1	Kg-Sedeli Kech	3	440	1/15000	3.68	0.37	0.	-0.37
2	Sg-Bahan Confl	15	390	1/15000	17.64	1.79	0.05	-1.74
3	Sg-Luboh Confl	8	310	1/15000	7.41	0.75	0.	-0.75
Sg.Bahan								
B1	Sg.Bahan Confl	6	170	1/15000	0.	0.	0.01	+0.01
Sg.Lukoh								
L1	Sg.Lukoh Confl	7	250	1/15000	6.32	0.64	0.	-0.64

Remarks: * Stretches in other state

Table 124 RIVER IMPROVEMENT PLAN (18/29)
WITHOUT DAM/FLOODWAY

State:Johor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 25 Sg.Sedili Besar								
Sg.Sedili Besar								
1	Kg-Sedili Besar	9	960	1/15000	15.71	1.60	0.	-1.60
2	Kg-Hutan Lesong	25	900	1/15000	42.33	4.31	0.	-4.31
3	Mawai	6	800	1/10000	7.21	0.73	0.	-0.73
4	Sg.Dohol Confl	22	720	1/15000	33.52	3.41	0.	-3.41
5	Sg.Ambol Confl	6	470	1/1500	3.77	0.38	0.	-0.38
6	Besar Damsite	6	360	1/1500	3.16	0.32	0.	-0.32
Kamban								
K1	Kuala Sg.Kamban	8	320	1/2000	4.01	0.41	0.00	-0.41
Mawai								
M1	Sg.Mawai	7	550	1/3000	3.45	0.35	0.00	-0.35
Dohol								
D1	Sg.Dohol	8	290	1/5000	5.01	0.51	0.	-0.51
Ambol								
A1	Sg.Ambol	10	440	1/2000	6.65	0.68	0.	-0.68
Basin 26 Sg.Jamaluang								
Sg.Jamaluang								
1	River mouth	8	290	1/4000	4.54	0.46	0.00	-0.46
2	Ladang Hoon Gin	10	220	1/1000	3.97	0.40	0.	-0.40
Basin 26 Sg.Mersing								
Sg-Mersing								
1	Mersing	6	480	1/7000	13.87	1.41	1.42	+0.01
2	Sg.Mayong Confl	9	280	1/2500	4.40	0.45	0.	-0.45
Sg.Mayong								
M1	Kuala Sg.Mayong	6	240	1/3000	2.94	0.30	0.	-0.30
Basin 26 Sg.Tenglu								
Sg.Tenglu								
1	River mouth	3	170	1/3000	1.34	0.14	0.48	+0.34
Basin 26 Sg.Mawar								
Sg.Mawar								
1	River mouth	4	155	1/10000	0.	0.	No impro.	

Remarks: * Stretches in other state

Table 125 RIVER IMPROVEMENT PLAN (19/29)
WITHOUT DAM/FLOODWAY

State:Johor

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 26 Sg.Sisek								
Sg.Sisek								
2	River mouth	4	125	1/10000	1378.83	140.28	No impro.	
Basin 26 Sg.Teriang Kechir								
Sg.T.Kechir								
1	River mouth	4	120	1/10000	18.00	1.83	No impro.	
Basin 26 Sg.Teriang Besar								
Sg.T.Besar								
2	River mouth	5	180	1/10000	1686.27	171.56	No impro.	

Remarks: * Stretches in other state

Table 126 RIVER IMPROVEMENT PLAN (20/29)
WITHOUT DAM/FLOODWAY

State:Johor/Pahang

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 27 Sg.Endau								
Sg.Endau								
1	River mouth	3	2050	1/10000	6.76	0.69	1.35	+0.66
2	Sg.Anak Endau	40	1580	1/15000	93.06	9.47	0.61	-8.86
Sg.Samberong								
3	Sg.Endau Confl	2.5	1300	1/8000	3.57	0.36	No impro.	
4	Sg.Lenggor Con	4	1180	1/15000	7.71	0.78	No impro.	
5	Sg.Lenga Confl	22	1150	1/20000	45.85	4.66	No impro.	
6	Sg.Kahang Conf	20	960	1/3000	19.11	1.94	No impro.	
7	Sg.Selai Conf	20	1790	1/3000	17.84	1.82	No impro.	
8	Sg.Poioh Confl	8	380	1/1500	4.54	0.46	No impro.	
Sg.Anak Endau								
A1	Kuala A Endau	31	410	1/7000	0.	0.	No impro.	
Endau								
E1	Kuala.Sg.Endau	16	760	1/9000	18.17	1.85	No impro.	
Lenggor								
L1	K.Sg.Lenggor	28	540	1/2500	21.48	2.19	No impro.	
Lenga								
G1	K.Sg.Lenga	20	300	1/1500	9.43	0.96	No impro.	
Kahang								
K1	K.Sg.Kahang	5	620	1/1500	3.52	0.36	0.12	-0.24
K2	Sg.Madek Conf	23	460	1/1500	14.56	1.48	1.30	-0.18
Sg.Madek								
M1	K.Sg.Madek	10	380	1/1500	5.36	0.55	No impro.	
Sg.Paloh								
P1	K.Sg.Paloh	8	420	1/2000	5.10	0.52	No impro.	
Sg.Mengkiboli								
M1	K.Sg.Mengkibol	5	340	1/1500	2.55	0.26	No impro.	
M2	Kg.Keluaung	11	285	1/1000	21.59	2.20	2.83	+0.63

Remarks: * Stretches in other state

Table 127 RIVER IMPROVEMENT PLAN (21/29)
WITHOUT DAM/FLOODWAY

State:Pahang

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 28 Sg.Pontian								
Sg.Pontian								
1	Kuala Potian	No imp	700	-	0.	0.	0.	-
2	Coastal Rd.Brid	8	680	1/7000	8.16	0.83	0.61	-0.22
3	Kg.Kepong	4	520	1/7000	3.75	0.38	0.	-
4	Kg.Lubuk Penak	8	460	1/9000	7.58	0.77	0.	-
Basin 28 Sg.Rompin								
Sg.Rompin								
1	Kuala Rompin	No imp	4200	-	0.	0.	0.	-
2	Kg.Pauh	12	4200	1/10000	35.16	3.58	0.	-
3	Kg.Pinanp	25	4200	1/10000	74.20	7.55	0.45	-7.09
4	Kg.Tinam	17	3800	1/8000	44.83	4.56	0.04	-4.52
5	Kg.Kong King	33	3400	1/9000	85.82	8.73	0.	-
Sg.Jeram								
6	Kg.Aur	4	2900	1/3000	7.25	0.74	0.00	-
7	Sg.Jeram/Kelat	1	1200	1/3000	1.06	0.11	0.	-
8	Sg.Jeram/Tepes	10	1100	1/5000	11.63	1.18	0.	-
Sg.Sekin								
S1	Kg.Kong King	13	500	1/6000	11.63	1.18	0.	-
Sg.Aur								
A1	Kg.Aur	25	700	1/4000	22.62	2.30	0.00	-
Sg.Keratong								
K1	Sg.Jeram/Kerato	19	2300	1/5000	34.24	3.48	0.00	-
K2	Kg.Paloh Rumeh	8	7700	1/1500	8.81	0.90	0.01	-0.89
K3	Kg.Bubit Seloh	10	1500	1/3000	12.01	1.22	0.00	-
K4	K.Sg.Rekam	24	1300	1/8000	34.23	3.48	0.00	-
Sg.Kepasing								
K5	Kg.Paloh Rumeh	14	580	1/3000	11.36	1.16	0.00	-
Sg.Tapesok								
T1	Sg.Jeram/Tapes	15	320	1/2000	7.27	0.74	0.	-

Remarks: * Stretches in other state

Table 128 RIVER IMPROVEMENT PLAN (22/29)
WITHOUT DAM/FLOODWAY

State:Pahang

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 29 Sg.Bebar								
Sg.Bebar								
1	Nenari	9	1900	1/10000	17.24	1.75	0.17	-1.59
2	Pmtg.Terong	19	1800	1/15000	48.12	4.90	0.37	-4.52
3	Kg.Sangka	11	920	1/10000	13.97	1.42	0.	-
4	Kg.Belangkak	12	660	1/4000	10.66	1.08	0.	-
Sg.Merba								
M1	Kg.Sangka	17	520	1/4000	13.81	1.41	0.	-
Sg.Serai								
S1	Kg.Belangkak	15	360	1/5000	10.30	1.05	0.	-
Basin 29 Sg.Merchong								
Sg.Merchong								
1	Merchong	13	1200	1/9000	18.15	1.85	0.	-
2	Kg.Padang	22	1100	1/5000	25.58	2.60	0.	-
3	Kg.Pulau Bayan	13	540	1/3000	10.20	1.04	0.	-
Basin 30 Sg.Phang								
Sg.Phang								
1	River mouth	105	15000	1/4500	677.30	49.94	9.26	-40.68
2	Kg.Luhuk Peku	13	15000	1/5000	86.85	6.40	0.36	-6.04
3	Kg.K.Jengka	24	14000	1/6000	94.50	9.61	1.50	-8.11
4	Kg.K.Bela	9	14000	1/6000	49.47	5.03	0.06	-4.97
5	K.Terlang	26	14000	1/5000	183.05	18.62	1.93	-16.69
6	Temerlok	104	12000	1/5000	662.12	67.36	5.63	-61.73
Sg.Jelai								
7	Kg.K.Tembeling	46	2700	1/400	104.67	10.65	0.58	-10.07
8	Kuala Lipis	19	2000	1/6000	70.85	7.21	2.32	-4.89
Sg.Jengka								
J1	Kg.K.Jengka	20	1100	1/1500	0.	0.	0.	-
Sg.Bela								
B1	Kg.Bela	21	2900	1/750	28.22	2.87	0.07	-2.80
E1	Kg.Mahasan	6	500	1/700	0.	0.	-	-
E2	Bahau	17	360	1/1000	0.	0.	-	-
Sg.Teriang								
T1	Kg.Teriang	47	1400	1/5000	174.62	17.77	2.03	-15.73
T2	Kg.Jawo2	13	1200	1/750	14.14	1.44	0.33	-1.11
T3	State border	13	880	1/1000	40.46	4.12	0.31	-3.81
T5	Kg.Pah	11	400	1/500	20.84	2.12	0.36	-1.76

Remarks: * Stretches in other state

Table 129 RIVER IMPROVEMENT PLAN (23/29)
WITHOUT DAM/FLOODWAY

State:Pahang

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 30 Sg.Pahang								
Sg.Semantan								
S1	Temerlok	72	1800	1/3000	401.39	40.84	5.60	-35.23
S2	Kanak	22	740	1/750	96.02	9.77	2.11	-7.66
Sg.Tembeling								
M1	Kg.K.Tembelin	16	4600	1/4000	48.00	4.88	0.15	-4.74
Sg.Lipis								
L1	Kuala Lipis	25	1100	1/3000	46.85	4.77	0.58	-4.19
Basin 31 Sg.Kuantan								
Sg.Kuantan								
1	Kuantan	6	3200	1/7000	14.26	1.45	1.02	-0.43
2	Sg.Belat Conf	11	2700	1/5000	21.73	2.21	0.56	-1.65
3	Kg.Kubang Ter	7	1820	1/5000	11.21	1.14	0.05	-1.09
4	Kg.Batu Sawar	15	1600	1/3000	23.43	2.38	0.69	-1.69
5	Kg.K.Reman	16	-	1/1000	16.80	1.71	0.	-1.71
6	Kg.K.Kenau	3	920	1/750	4.06	0.41	0.11	-0.31
Sg.Belat								
B1	Sg.Kauntan/Be	14	940	1/5000	34.24	3.48	1.39	-2.09
B2	Kg.Seri Damai	19	440	1/750	9.68	0.98	0.07	-0.91
Sg.Randan								
P1	Kg.Kuhang Ter	8	200	1/2500	3.82	0.39	0.04	-0.35
Sg.Riau								
R1	Kg.Batu Sawar	6	440	1/2000	4.00	0.41	0.02	-0.38
Sg.Reman								
M1	Kg.K.Reman	5	500	1/1500	3.54	0.36	0.15	-0.21
Sg.Kekau								
K1	Kg.K.Kekau	5	400	1/750	2.56	0.26	0.05	-0.21

Remarks: * Stretches in other state

Table 130 RIVER IMPROVEMENT PLAN (24/29)
WITHOUT DAM/FLOODWAY

State:Trengganu

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 32 Kemaman								
Kemaman								
1	Kg.R.Panjang	7	1300	1/1000	9.41	0.96	0.03	-0.93
2		3	6200	1/10000	7.62	0.78	0.81	0.03
3	Chukai Town	13	5200	1/10000	56.06	5.70	0.03	-5.68
4	Kg.Benjai	8	5000	1/3000	28.89	2.94	0.49	-2.45
5	Sg.Cherul Conf	13	2350	1/5000	19.43	1.98	0.18	-1.80
Chukai								
C1	Chukai Town	16	1500	1/5000	18.05	1.84	0.08	-1.76
Cherul								
H1	K.Sg.Cherul	24	3200	-	0.	0.	0.00	0.00
Tebak								
T1	Kg.R.Panjang	7	780	1/2000	3.95	0.40	0.06	-0.34
Basin 32 Kemasik								
1	Kemasik	6	340	1/5000	4.14	0.42	0.03	-0.39
Basin 32 Kerteh								
Kerteh								
1	Kerteh	2	900	1/10000	2.50	0.25	0.	-
2	Kerteh Bridge	10	800	1/5000	9.83	1.00	0.03	-0.97
3	Kg.Batu puteh	5	420	-	3.11	0.32	0.	-
Chabang								
C1	Kg.Gelugo	7	200	1/3000	3.30	0.34	0.03	-0.30
Basin 33 Paka								
1	River muoth	11	1850	1/5000	17.84	1.82	0.00	-
2	Kg.Ayertlitam	12	1750	1/4000	18.83	1.92	0.02	-1.89
3	Kg.K.Rasau	20	1860	1/3000	23.68	2.41	0.	-

Remarks: * Stretches in other state

Table 131 RIVER IMPROVEMENT PLAN (25/29)
WITHOUT DAM/FLOODWAY

State:Trengganu

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 34 Dungun								
Dungun								
1	Dungun	7	3600	1/3000	15.38	1.56	0.12	-1.45
2	Kg.Binjai	5	3400	1/3000	10.46	1.06	0.	-
3	Kg.Serdang	20	3400	1/3000	43.72	4.45	0.18	-4.27
4	Kg.Jerangau	23	3000	1/3000	46.50	4.73	0.14	-4.59
5	Kg.Kalmin Con	8	2400	1/3000	13.55	1.38	0.01	-1.37
6	Kg.K.Loh	23	1300	1/1500	23.37	2.38	0.06	-2.32
Telemboh								
T1	Kg.Jerangau	10	290	-	-	-	-	-
Kalmin								
K1	K.Sg.Kalmin	6	550	1/1500	4.05	0.41	0.	-
Jengai								
J1	Kg.K.Jengai	10	940	1/3000	9.86	1.00	0.01	-1.00
Loh								
L1	Kg.K.Loh	7	840	1/2000	5.74	0.58	0.	-0.58
Basin 35 Merchang								
1	River mouth	9	870	-	-	-	-	-
2	Kg.Kolam	15	800	-	-	-	-	-
Basin 35 Marang								
Marang								
1	Marang	16	1300	1/10000	26.28	2.67	0.08	-2.59
2	Sg.Asing Con	13	820	1/10000	15.84	1.61	0.01	-1.60
3	Sg.Chador Co	10	520	1/10000	10.49	1.07	0.10	-0.97
Asing								
A1	K.Sg.Asing	7	380	1/10000	5.88	0.60	0.04	-0.56
Basin 36 Ibai								
I1	River mouth	12	460	1/10000	12.78	1.30	0.79	-0.51
I2	Kg.Titlam Bh	10	280	1/4000	6.75	0.69	0.39	-0.29

Remarks: * Stretches in other state

Table 132 RIVER IMPROVEMENT PLAN (26/29)
WITHOUT DAM/FLOODWAY

State:Trengganu

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 36 Trengganu								
Trengganu								
1	K.Trengganu	5	6300	1/4000	143.87	14.64	15.71	+1.07
2	K.Nerus	12	6200	1/4000	123.29	12.54	0.26	-12.28
3	Kg.Pulau Babi	8	3900	1/4000	34.30	3.49	0.09	-3.40
4	Kg.Telemong	19	2600	1/4000	79.16	8.05	0.14	-7.92
Nerus								
N1	K.Nerus	12	2300	1/16000	44.45	4.52	0.59	-3.93
N2	Kg.Belara	23	2100	1/4000	31.86	3.24	0.01	-3.23
N3	Kg.Berok	21	1500	1/2000	21.41	2.18	0.18	-1.99
Telemong								
T1	Kg.K.Telemong	13	940	1/4500	16.06	1.63	0.18	-1.45
T2	Kg.Nibong	17	840	1/1500	17.58	1.79	0.38	-1.41
Brang								
B1	Kuala Brang	20	900	1/2000	17.90	1.82	0.21	-1.62
Tersat								
B2	Kuala Brang	13	600	1/1000	10.12	1.03	0.14	-0.89
Basin 37 Merang								
1	Kg.Merang	8	840	1/10000	0.	0.	0.	-
2	Sg.Bali Conf	10	520	-	0.	0.	0.	-
Basin 37 Setiu								
Setiu								
1	River mouth	7	1800	1/10000	13.33	1.36	0.	-
2	Telok Labok	10	1100	1/4000	11.65	1.19	0.03	-1.15
3	Kg.Permaisuri	9	840	1/1200	9.50	0.97	0.11	-0.85
4	Kg.Buloh	6	580	1/1200	4.30	0.44	0.05	-0.39
Guntong								
G1	Kg.K.Guntong	8	410	1/3000	5.14	0.52	0.04	-0.49
Klong								
K1	Kg.Permaisuri	5	120	1/1500	1.70	0.17	0.03	-0.14
Taram								
T1	Kg.Tasek	4	300	1/1500	1.98	0.20	0.04	-0.17
Chalok								
C1	Telok Laboh	18	670	1/10000	20.36	2.07	0.04	-2.03
Ular								
U1	K.Sg.Ular	7	420	1/10000	6.34	0.65	0.05	-0.59

Remarks: * Stretches in other state

Table 133 RIVER IMPROVEMENT PLAN (27/29)
WITHOUT DAM/FLOODWAY

State:Trengganu

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 38 Keluang Besar								
Keluang Besar								
1	Kg.Peng Batang	9	760	1/5000	9.14	0.93	0.63	-0.30
2	Kg.Tembila	8	350	1/5000	7.12	0.72	0.03	-0.70
3	Kg.Batu Tansh	9	325	1/3000	5.24	0.53	0.47	-0.06
Kerondong								
9 Kl	Kg.Tembila	12	380	1/2000	7.97	0.81	1.22	+0.41
Kelung Kechil								
Ll	Kg.Peng Batang	5	60	1/10000	56.02	5.70	0.03	-5.67
Basin 38 Besut								
Besut								
1	Kg.K.Besut	17	3000	1/5000	45.83	4.66	3.70	-0.96
2	Jerteh	4	2500	1/3000	7.33	0.75	2.29	+1.54
3	R.Panjang	15	1700	1/3000	21.10	2.15	1.59	-0.56
4	Kg.Angga	10	1550	1/3000	13.27	1.35	0.02	-1.33

Remarks: * Stretches in other state

Table 134 RIVER IMPROVEMENT PLAN (28/29)
WITHOUT DAM/FLOODWAY

State:Kelantan

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 39 Peng Datu								
Sg.Peng Datu								
1	River mouth	14	680	1/7000	17.90	1.82	6.24	+4.42
2	Machang Diver	18	270	1/5000	12.73	1.30	2.32	+1.02
Basin 39 Kemasin								
Sg.Kemasin								
1	Kg.Kemasin	6	1200	1/60000	0.	0.	0.74	+0.74
2	Mentuan outlet	13	1100	1/60000	0.	0.	0.77	+0.77
3	Kg.Bator	9	420	1/45000	0.	0.	0.71	+0.71
4	Mentuan inlet	8	320	1/7000	3.41	0.35	0.61	+0.26
5	Mechang Dam	16	No impr.	1/3000	0.	0.	0.	-
Basin 39 Semerak								
Sg.Semerak								
1	Kg.Cherang Pu	20	1900	1/20000	61.96	6.30	1.22	-5.09
2	Sg.Gali Confl	15	1500	1/20000	40.80	4.15	1.58	-2.57
3	Sg.Tasik Conf	5.7	120	1/7500	5.54	0.56	0.69	+0.13
Sg.Gali								
G1	Kuala Sg.Gali	4	220	1/2500	2.22	0.23	0.22	-0.01
Sg.Rasau								
R1	Kuala Sg.Rasau	2.15	500	1/3500	2.00	0.20	0.91	+0.71
Sg.Jereneh								
J1	Kuala Sg.Jeren	1.8	220	1/3000	0.97	0.10	0.31	+0.21
Sg.Merkang								
J2	Kuala Sg.Merka	3.5	220	1/4500	2.22	0.17	0.17	-
Sg.A.Pasir								
J3	Kuala Sg.A.Pas	2	220	1/3300	1.19	0.09	0.09	-
Sg.Tasik								
T1	Kuala Sg.Tasik	7.3	440	1/8000	7.58	0.77	0.60	-0.17
Sg.Pauh								
T2	Kuala Sg.Pauh	1.5	440	1/4000	1.33	0.10	0.10	-
Basin 40 Sg.Kelantan								
Sg.Kelantan								
1	River mouth	65	19000	1/4000	579.32	58.94	29.53	-29.41
2	Giullemard ba	25	18000	1/3500	296.56	30.17	3.93	-26.24
Sg.Lebir								
L1	Kuala Kerai	7	9000	1/4000	26.46	2.69	0.10	-2.59
Sg.Pergau								
P1	Sg.Galas/Perg	25	4200	1/1700	39.71	4.04	0.39	-3.65

Remarks: * Stretches in other state

Table 135 RIVER IMPROVEMENT PLAN (29/29)
WITHOUT DAM/FLOODWAY

State:Kelantan

Unit: Million M$ for cost

St'h No.	Location	Impr. Le'th (km)	Des'n Flood (cms)	Lon'l Grad.	Con' Cost	Ann'l Cost	Da'g Red'n	B-C
Basin 41 Sg.Golok								
Sg.Golog								
1	Kg.K.Golog	10	4600	1/5000	34.21	3.48	3.68	+0.20
2	Kg.K.Jambu	13	3400	1/5000	26.85	2.73	0.31	-2.42
3	Kg.Guntong	9	2800	1/2500	17.04	1.73	0.34	-1.39
4	Pantau Pajang	13	2600	1/3300	25.41	2.59	0.16	-2.43
5	Kg.Lubuk Setol	9	2200	1/2500	13.29	1.35	0.31	-1.04
Sg.Lachong								
L1	Kg.Guntong	9	800	1/6000	10.03	1.02	0.71	-0.31

Remarks: * Stretches in other state

Table 136 BYPASS FLOODWAY PLAN (1/3)

Unit:Mil. M. Dollar

St'h No.	Name/ Lacation of Floodway	Len'h	Design Flood (cms)	Long' Grad.	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 1.	9 Kurau Short-cut Channel to Terusan Gula	Conceived, but not required at present.						
Basin 1-3	10 Perak From Kg.Kubang Haji (inlet) to river mouth	50	5000	1/3000	250	22.75	24.12	+1.37
Basin 4.	16 Langat Kg.Labohang Bagan to T. Sepat	16	510	1/5000	24.1	2.19	2.0	-0.19
Basin 1. 2. 1*.	19 Melaka Melaka Floodway (from Malim to sea)	5.0	320 +60 *	1/5000	8.50	0.77	3.23	+2.46

Remarks: * Seri Malaka river

Table 137 BYPASS FLOODWAY PLAN (2/3)

Unit:Mil. M. Dollar

St'h No.	Name/ Lacation of Floodway	Len'h	Design Flood (cms)	Long' Grad.	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 20 Kesang								
1-3	Short-cut in lower reach	Conceived as future measure, but not required at present.						
Basin 22 Batu Pahat								
(Alt.2 : With upstream dams - Bekok & Semberong)								
F1	Sq.Semberong/ Bekok Confl. to K.Senggarang	19	130	1/16000	20.0	1.82	2.57	-0.75
Basin 30 Sg. Parang (Jengka Diversion)								
6	11 km upstream of Temerloh to Sg.Jengka	Conceived, but not recommendable as revealed in Ref.21 (Pahang River Basin Study)						
Basin 35 Merchang								
1	Merchang short-cut outlet, at river bend near coastal road	0.5	870	1/5000	0.99	0.09	Nil	Nil

Table 138 BYPASS FLOODWAY PLAN (3/3)

Unit:Mil. M. Dollar

St'h No.	Name/ Lacation of Floodway	Len'h	Design Flood (cms)	Long' Grad.	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 39	Kemasin							
4	Machang diversion Upstream of proposed Machang Dam to Sg.Peng.Datu	2.6	240	1/7000	3.5	0.32	*	*
3	Mentuan canal from Kg.Tasak to Kg.Tok Desoh	3.7	45	1/10000	3.5	0.32	*	*
1	Tidal gate	-	-	-	9.0	0.82	*	*
	Breakwater at estuary	-	-	-	9.0	0.82	*	*
	TOTAL					2.28	2.99	+0.71
Basin 39	Sg. Semerak							
3	Gunong diversion from Sg.Melar to Sg.Semerak, incl. structures.	1.8	120	1/7500	3.0	0.27	*	*
Sg. Semerak								
1	Spillway channel from Spillway inlet to the sea	7.5	1600	1/7500	22.7	2.06	*	*
1	Rivermoth improvement	-	-	-	10.0	0.91	*	*
2	Storage Reservoir	-	-	-	12.0	1.09		
	TOTAL					4.33	5.02	-0.69

Table 139 FLOOD PROTECTION BY POLDER (1/6)

State: Perlis

Unit:Mil. M. Dollars

St'h No.	Name/ Lacation of Floodway	Area Bunded	Population Protected (2000)	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 1 Perlis							
3	Kangar town	350	12157	5.80	0.53	1.12	+0.59

Table 140 FLOOD PROTECTION BY POLDER (2/6)

4 State: Perak

Unit:Mil. M. Dollars

St'h No.	Name/ Lacation of Floodway	Area Bunded	Population Protected (2000)	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 10 Perak							
1	Telok Auson town - polder (flood due to high spring tide) -Bank protection	1000	45600	65.00 (17.00) (48.00)	6.18 (1.39) (4.99)	6.50	+0.32

Table 141 FLOOD PROTECTION BY POLDER (3/6)

State: Johor

Unit:Mil. M. Dollars

St'h No.	Name/ Lacation of Floodway	Area Bunded	Population Protected (2000)	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 21 Muar							
S2	Segamat town Left bank area	130	6000	3.60	0.32	0.67	+0.35
Basin 24 Johor							
2	Kota Tinggi town	200	4700	8.00	0.73	0.61	-0.12
Basin 27 Endau							
2	Endau south area (Kg. Londang Bharu padi area)	820	4500	7.10	0.64	0.30	-0.34

Table 142 FLOOD PROTECTION BY POLDER (4/6)

State: Pahang

Unit:Mil. M. Dollars

St'h No.	Name/ Lacation of Floodway	Area Bunded	Population Protected (2000)	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 30 Pahang							
1	Pekan town (project under implementation)	1680	26100	19.00	1.73	2.52	+0.79
5	Temerloh town	280	12600	21.00	1.91	1.93	+0.02
S1	Mentekab town	260	8600	9.00	0.82	1.90	+1.08
8	Kuala Lipis town	630	15600	20.00	1.82	2.38	+0.56
Basin 31 Kuantan							
2	Batu Tiga/Paya	2210	18400	16.5	1.50	1.52	+0.02
B1	Besar area						

Table 143 FLOOD PROTECTION BY POLDER (5/6)

State: Trengganu

Unit:Mil. M. Dollars

St'h No.	Name/ Lacation of Floodway	Area Bunded	Population Protected (2000)	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 32 Kemaman							
2	Chukai town Kg. Binjai	2000	14000	9.75	0.88	0.92	+0.04
Basin 36 Trengganu							
B1	Kuala Brang town east area	720	3900	2.31	0.21	0.33	+0.12
Basin 36 Trengganu							
4	Kuala Telemong village area	860	3300	5.16	0.47	0.14	-0.33

Table 144 FLOOD PROTECTION BY POLDER (6/6)

State: Kelantan

Unit:Mil. M. Dollars

St'h No.	Name/ Lacation of Floodway	Area Bunded	Population Protected (2000)	Const. Cost	Ann'l Cost	Damage Red'n	B-C
Basin 39 Semerak							
2	Pasir Puteh town	370	8960	3.1	0.28	0.52	+0.24
Basin 40 Kelantan							
1	Kota Bharu town	2050	59783	17.5	1.59	5.34	+3.75
1	Pasir Mas Town	660	17962	7.4	0.67	1.37	+0.70
L1	Kuala Kerai area	4640	19269	9.5	0.86	1.68	+0.82

Table 145 FLOOD CONTROL DAMS (1/7)

Name of Dam	Design Flood (X-year Flood)	Flow Reduction Ratio at Damsite	Flood Control Storage (10^6 m^3)	Cost of Dam/1 (M$$10^6$)
Perlis				
Timah-Tassoh	50	0.53	28.0	4.40
Kedah				
Drian	50	0.25	14.1	16.5
Aning	50	0.25	24.6	28.7
Pedu	50	0.15	37.9	(existing)
Muda	50	0.75	154.0	(existing)
P. Pinang				
Muda	50	0.75	154.0	(existing)

Table 146 FLOOD CONTROL DAMS (2/7)

Name of Dam	Design Flood (X-year Flood)	Flow Reduction Ratio at Damsite	Flood Control Storage (10^6 m^3)	Cost of Dam/1 (M$$10^6$)
Perak				
Pelus	50	0.25	143.7	92.31
Slim	100	0.25	19.0	319.22

Remarks; /1: Financial cost excl. price escalation.
Only cost to be allocated to flood control.