Table E-3 Annual Sediment Runoff Volume at Pulau Raja

Sediment	Discharge Range	mean (m^3/s) Discharge	Rating Curve	Days	Sediment Volume($10^3 m^3$)
Wash Load	50 - 100m^3/s	87.50	$Qws = 2.5 \times 10^{-7} \times Q^2$	78.91	13.0
	100 - 150	127.74		139.16	49.0
	150 - 200	169.39		99.89	61.9
	200 - 250	221.46		21.41	22.7
	250 - 300	271.00		9.09	14.4
	300 - 350	322.95		13.16	29.6
	350 - 400	361.10		2.59	7.9
	400 - 450	432.03		0.48	1.9
	450 - 500	460.27		0.31	1.4
	<Total>	(149)	-	365	201.8
Suspended Load and Bed Load	50 - 100m^3/s	87.50	$Qs = 1.340 \times 10^{-6} \times Q^{1.685}$	78.91	17.1
	100 - 150	127.74		139.16	57.1
	150 - 200	169.39		99.89	65.9
	200 - 250	221.46		21.41	22.2
	250 - 300	271.00		9.09	13.2
	300 - 350	322.95		13.16	25.7
	350 - 400	361.10		2.59	6.2
	400 - 450	432.03		0.48	1.5
	450 - 500	460.27		0.31	1.1
	<Total>	(149)	-	365	210.0
<Ground Total>				365	411.8

Table E-4 Annual Sediment Outflow at Lower Reaches of Silau R. and Asahan R.

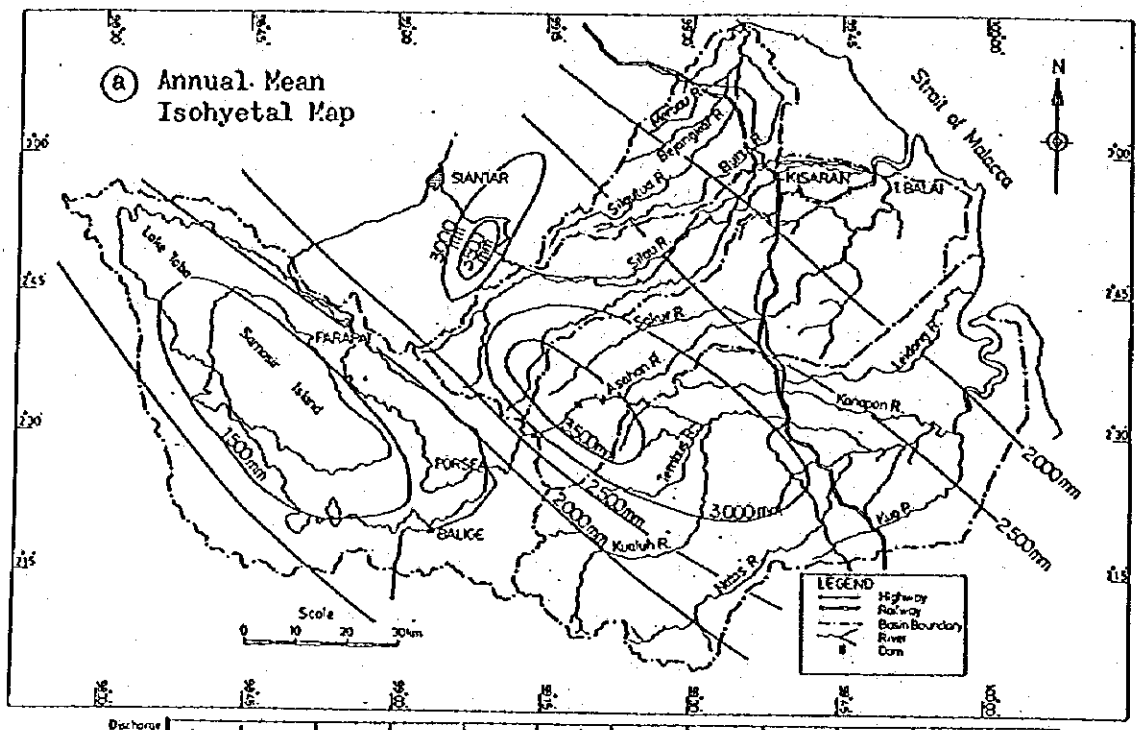
Section	Discharge *1 Range (m^3/s)	Mean *2	Rating Curve	Days	Sediment Volume($10^3 m^3$)
Silau R.	0 - 50m^3/s	39.53	$Qs = 3.519 \times 10^{-7} \times Q^{2.421}$	143.57	32.1
	50 - 100	67.45		181.25	147.6
	100 - 150	117.53		32.98	103.0
	150 - 200	166.28		4.89	27.6
	200 - 250	217.93	$Qs = 6.527 \times 10^{-2} m^3/s$	1.41	8.0
	250 - 300	280.47		0.58	3.3
	300 - 350	311.30		0.08	0.5
	350 - 400	381.60		0.08	0.5
	400 - 450	415.30		0.08	0.5
	450 - 500	457.40		0.08	0.5
	< Total>			365	323.6
Asahan R.	50 - 100m^3/s	105	$Qs = 5.373 \times 10^{-10} \times Q^{3.073}$	78.91	6.0
	100 - 150	153		139.16	33.4
	150 - 200	203		99.89	57.2
	200 - 250	266		21.41	28.1
	250 - 300	325		9.07	22.0
	300 - 350	-	$Qs = 3.533 \times 10^{-2} m^3/s$	13.16	40.1
	350 - 400	-		2.59	7.9
	400 - 450	-		0.48	1.5
	450 - 500	-		0.31	0.9
	< total>	-		365	197.1

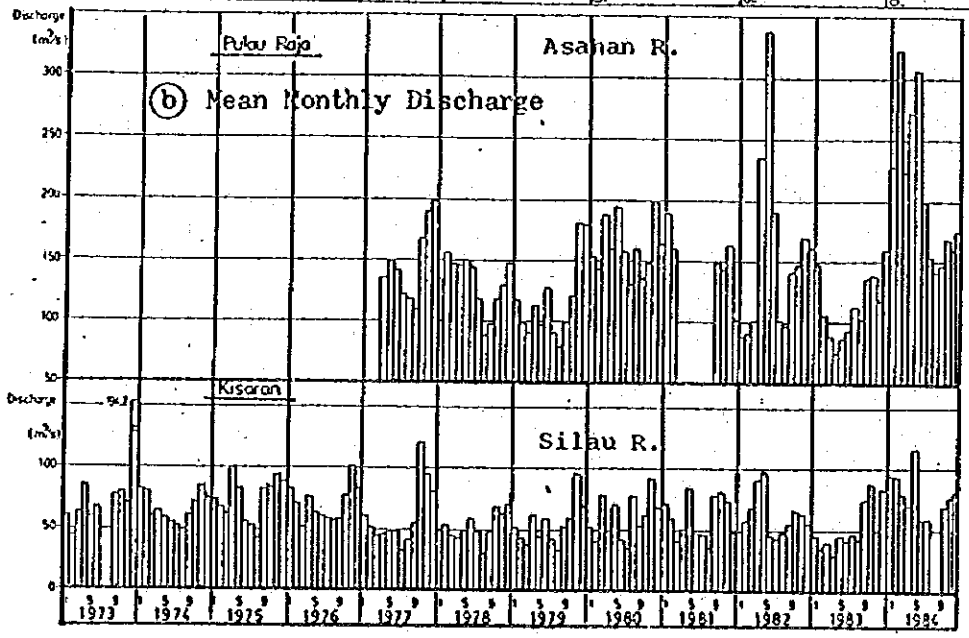
Note :

*1 : Discharge at Kisaran and Pulau Raja

*2 : For Asahan R., mean discharge is multiplied by 1.2 considering the downstream area of Pulau Raja.

Fig. E-1 Hydrology for Sdimentation Study





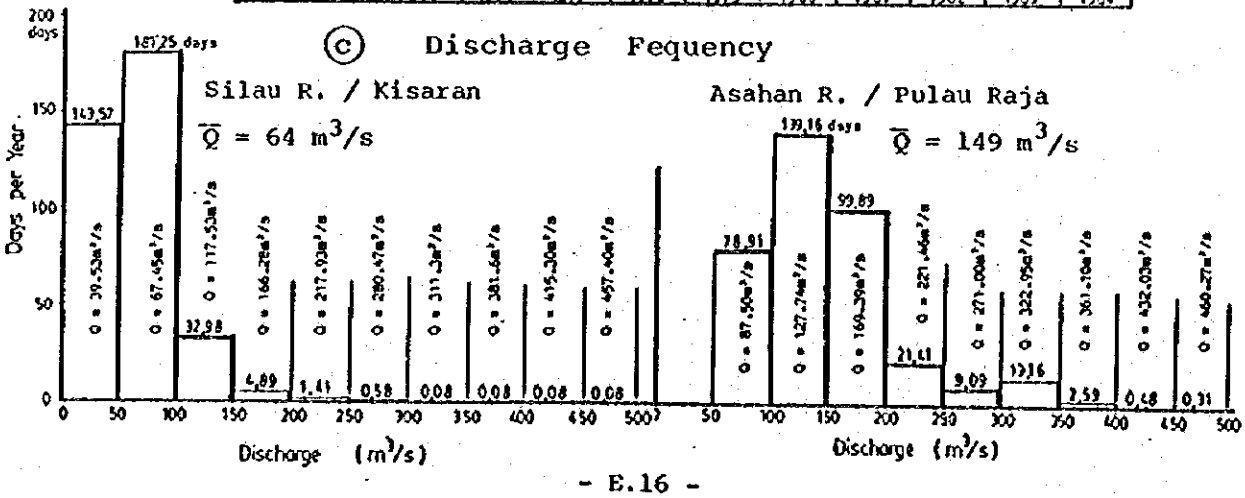


Fig. E-2 Topographical Basin Profile

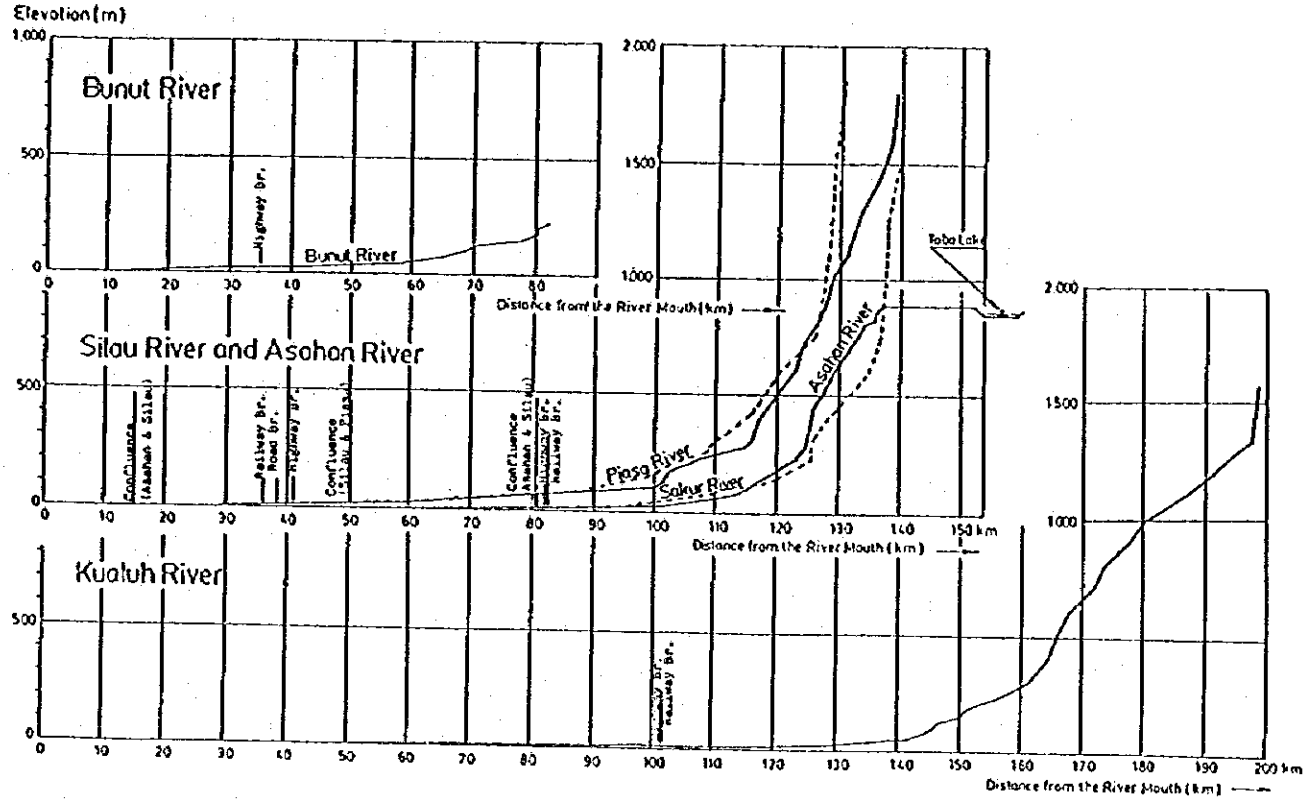


Fig. E-3 Geological Basin Profile

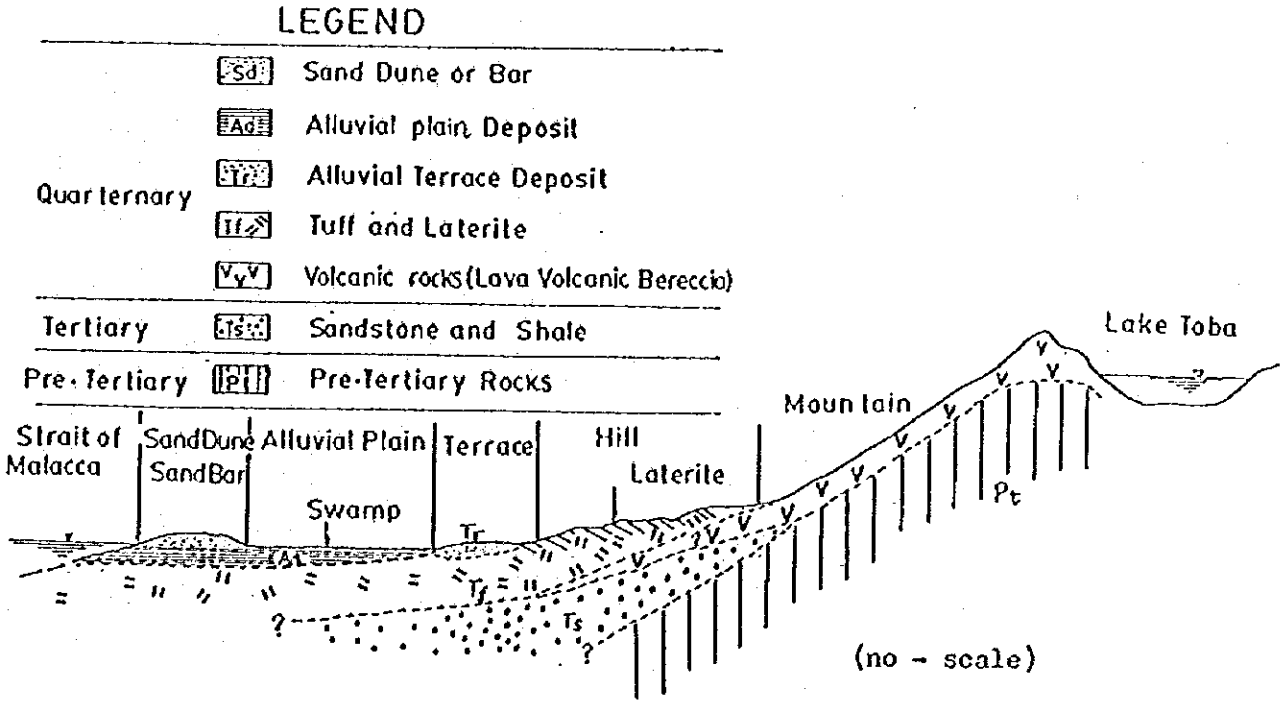
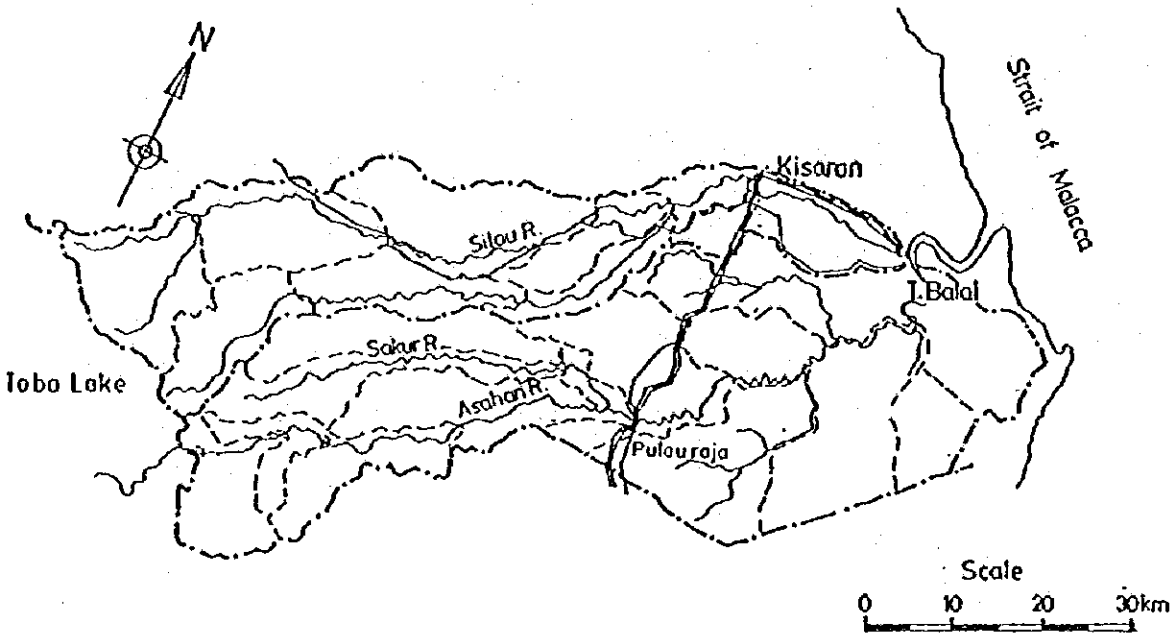
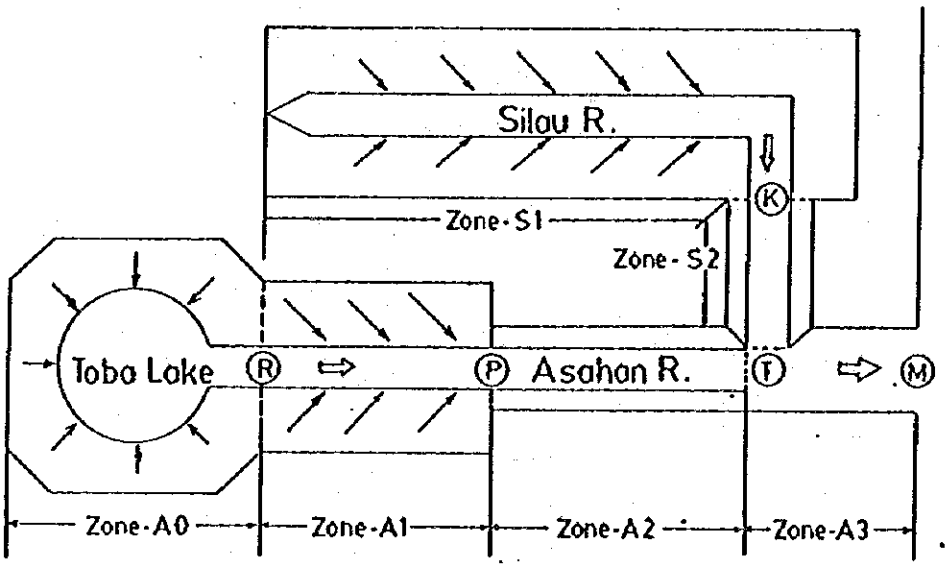


Fig. E-4 Sedimentation Modeling for Silau and Asahan River

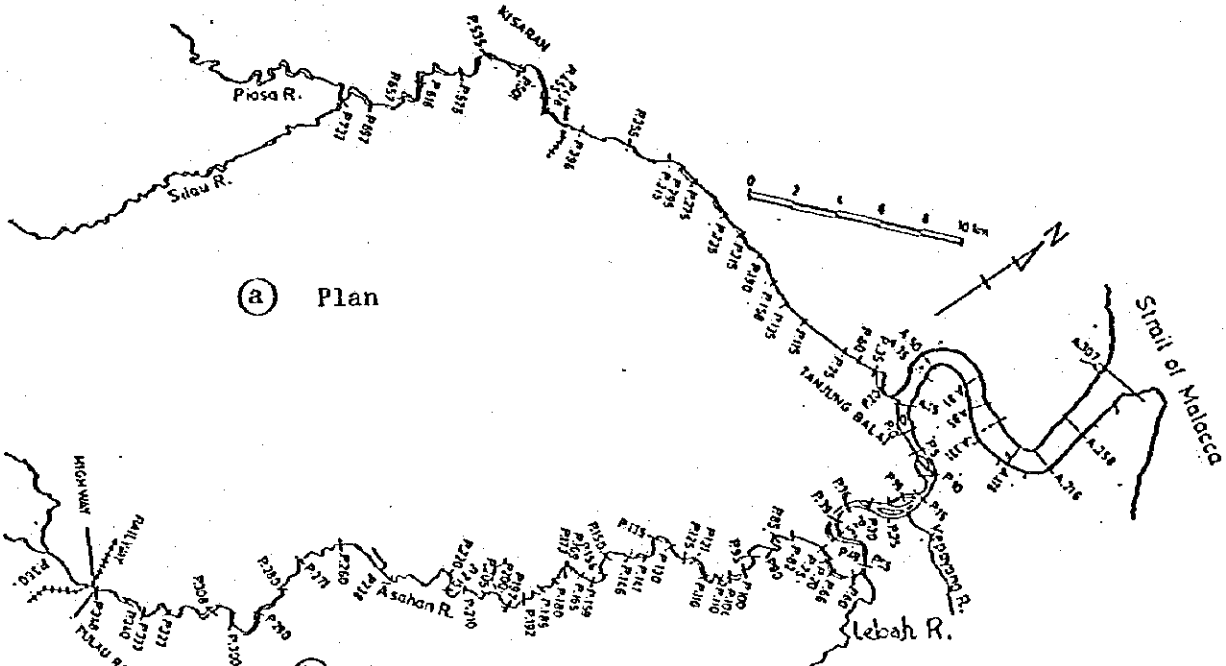




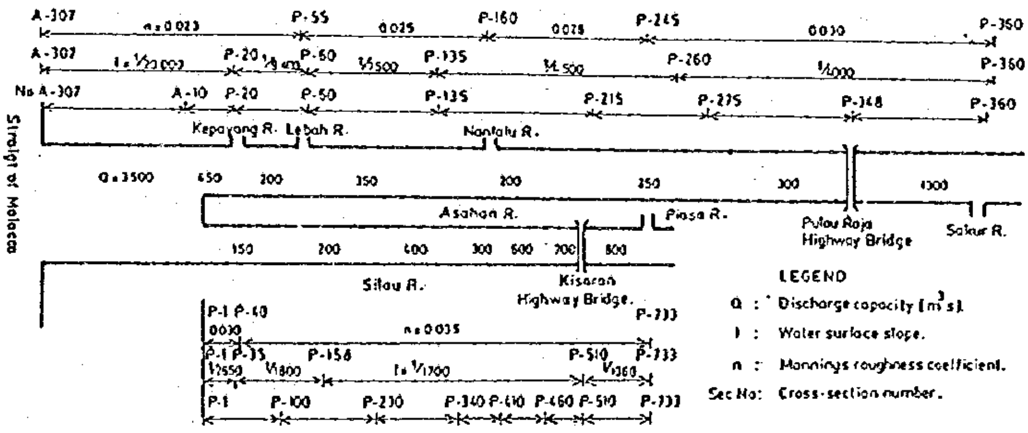
Zone and Reference Point	Area (km²)	Annual Rainfall (mm)	Basin Slope	Topography	Surface Geology	Land Use
Zone - S1	1,050.2	3,000	1/43	Mountain	Weathering Volcanic	Forest
(K), Kisaran	1,050.2	-	-	and Hill	Rocks and Laterite	
Zone - S2	151.2	2,000	1/1,000	Hill and	Laterite and	Rubber Tree and
(T), T. Balai	1,201.4	-	-	Alluvial Plain	Alluvial-Deposits	Paddy Field
Zone - A0	3,674.0	-	-	Mountain	Volcanic Ash and	Forest and
(R) Regulating Dam	3,674.0	1,800	-	and Lake	Weathering Rocks	Paddy Field
Zone - A1	812.3	3,000	1/40	Mountain	Weathering Volcanic	Forest
(P), Pulau Raja	4,486.3	-	-	and Hill	Rocks and Laterite	
Zone - A2	1,215.8	2,000	1/4,000	Hill, Alluvial	Laterite and	Oil Palm and
(T)A, T. Balai	5,702.1	-	-	Plain and Swamp	Alluvial Deposits	Bush
(T), T. Balai	6,903.5	-	-	-	-	-
Zone - A3	-	-	-	Estuary	-	-
(M), River Mouth	-	-	-	-	-	-

Fig. E-5 Flow and Sediment Discharge Capacity of Silau and Asahan River

(a) Plan



(b) Discharge Capacity



(c) Sediment Discharge

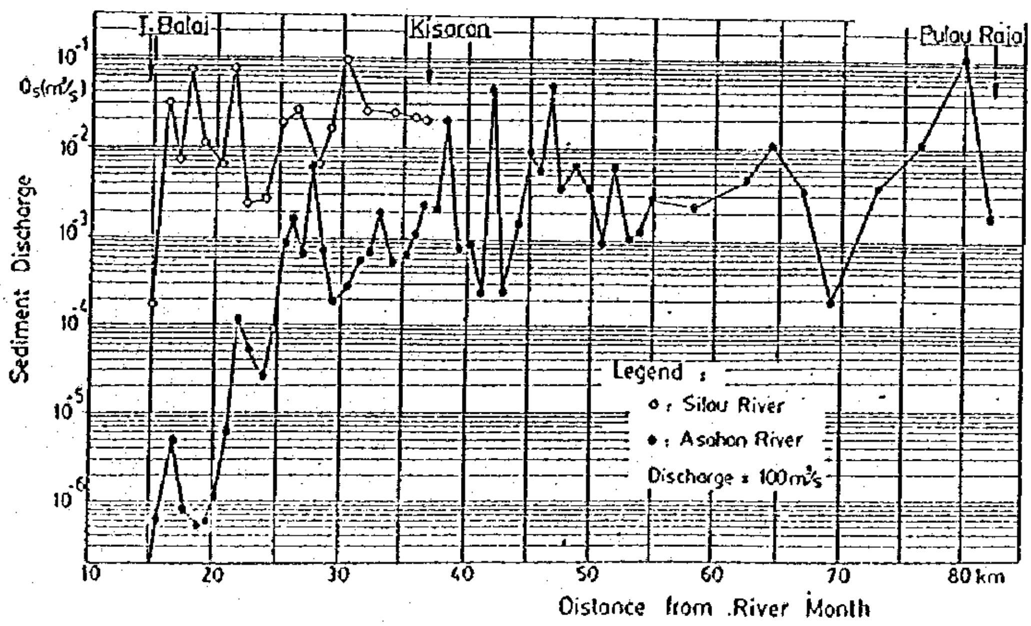
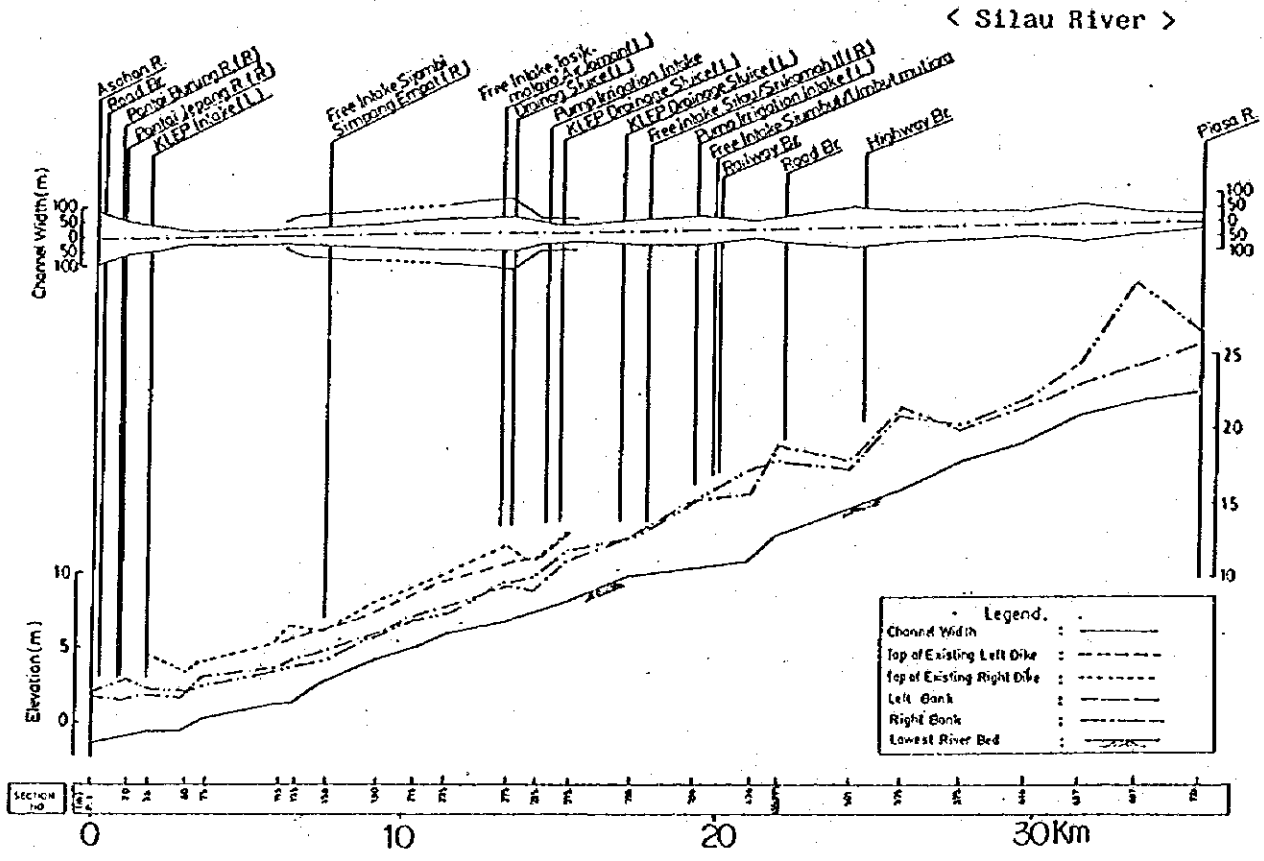


Fig. E-6 Longitudinal Profile of Silau and Asahan River

< Silau River >



< Asahan River >

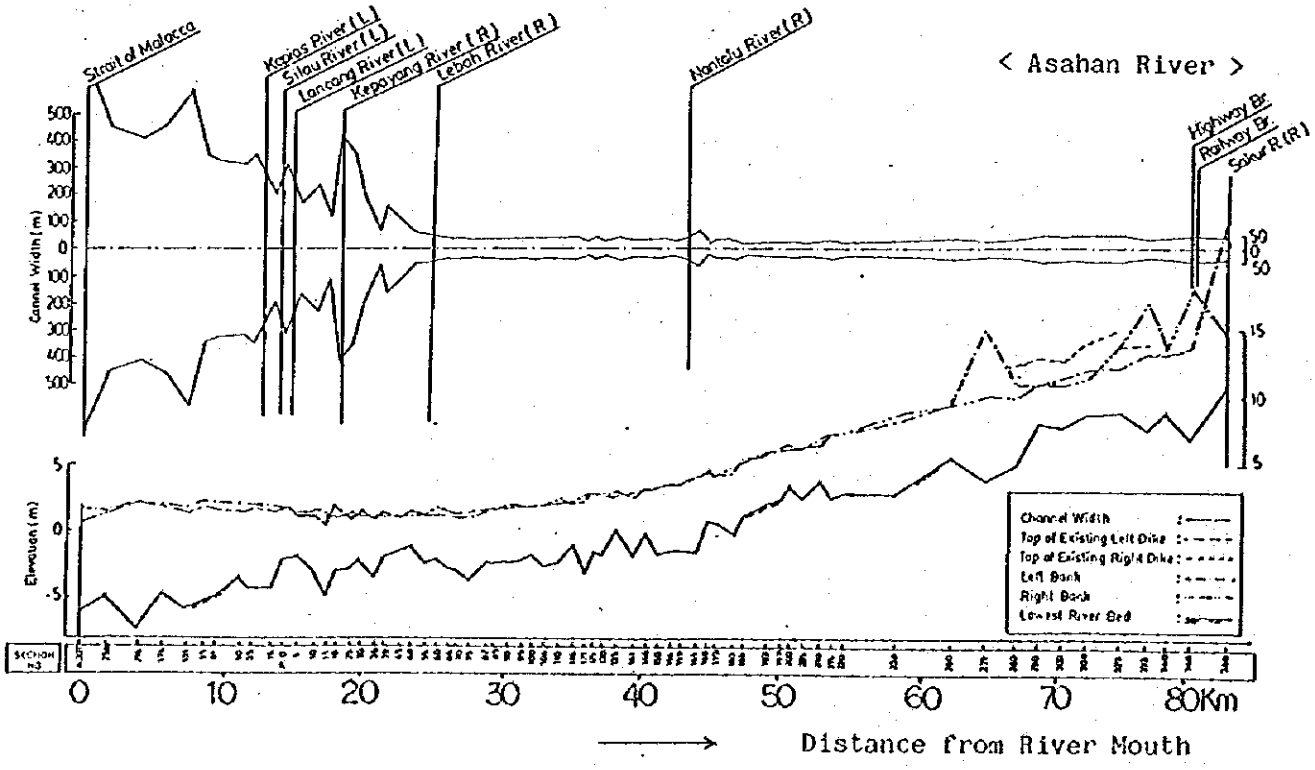


Fig. E-7 Grain Size Distribution of River Bed Materials

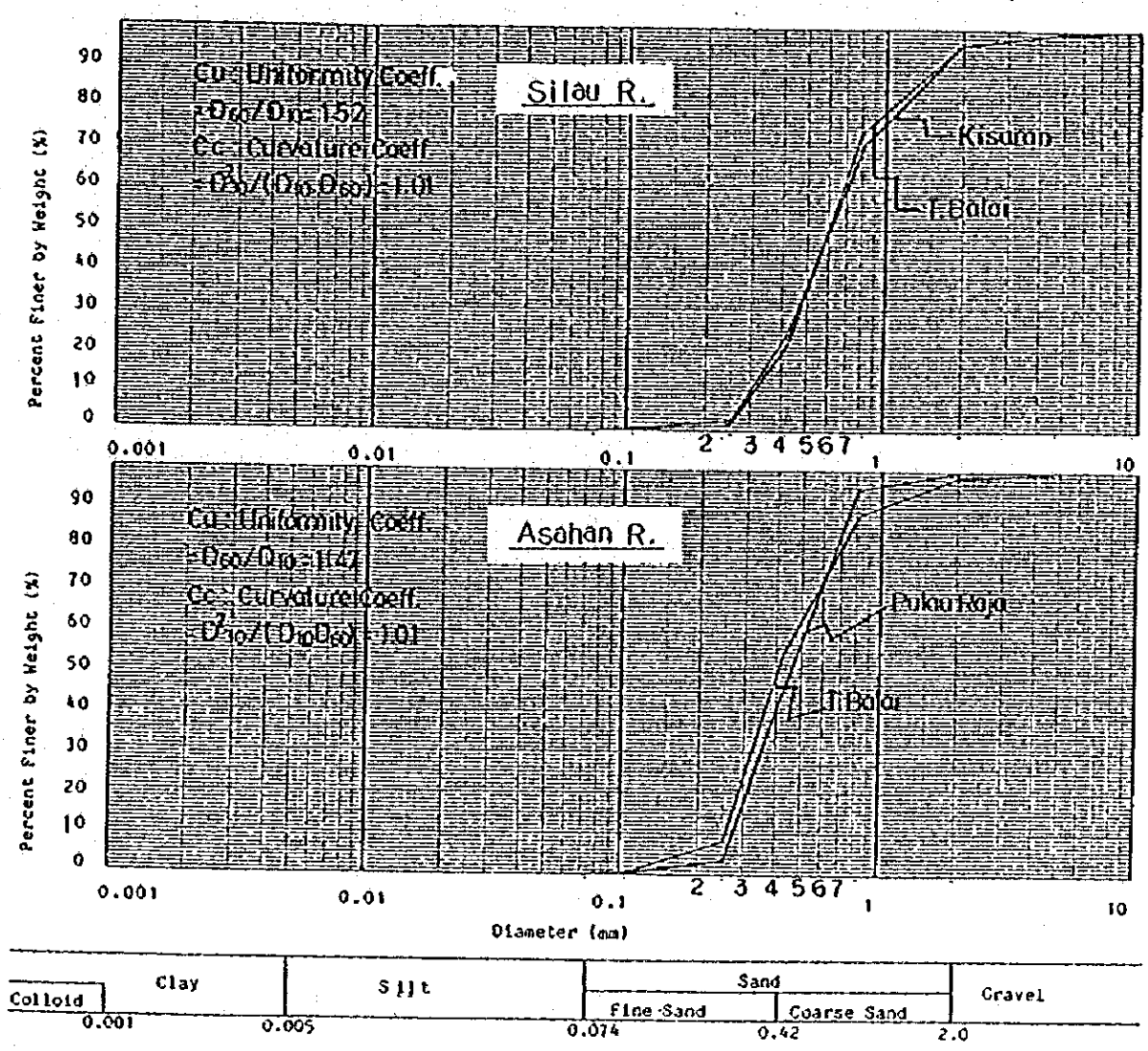


Fig. E-8 River Bed Regime

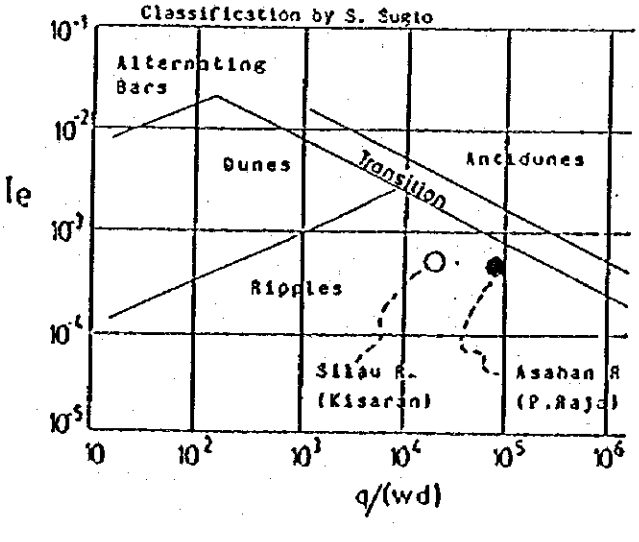


Fig. E-9 Sediment Transportation Regime

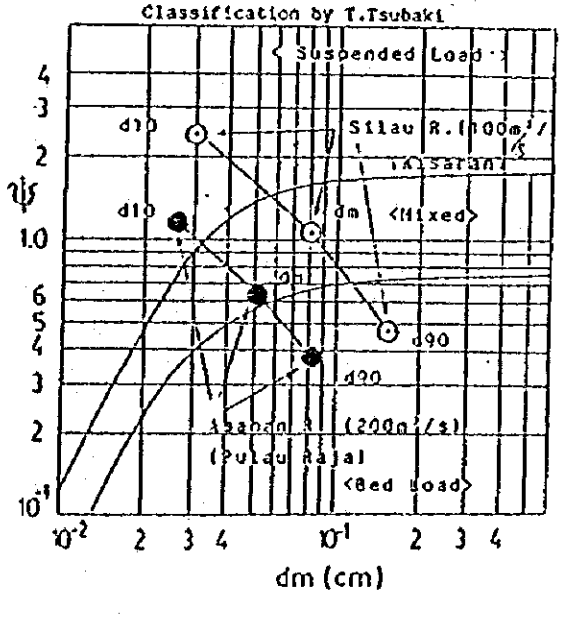
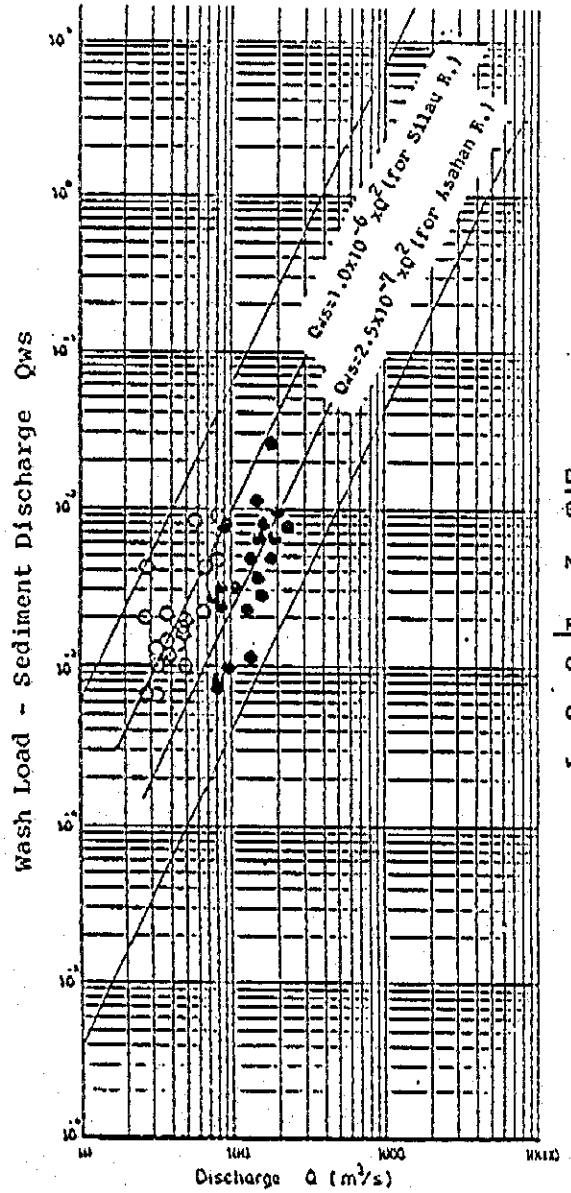


Fig. E-10 Rating Curve for Wash Load



Legend :
- ○ Silau R. (Kisaran)
- ● Asahan R. (Pulau Raja)
- X Kualuh R. (pulo Dogom)

Data used :

Existing : 1978 - 80

Measured by JICA : Dec, 1984

Reference :

Observation Data in Japan

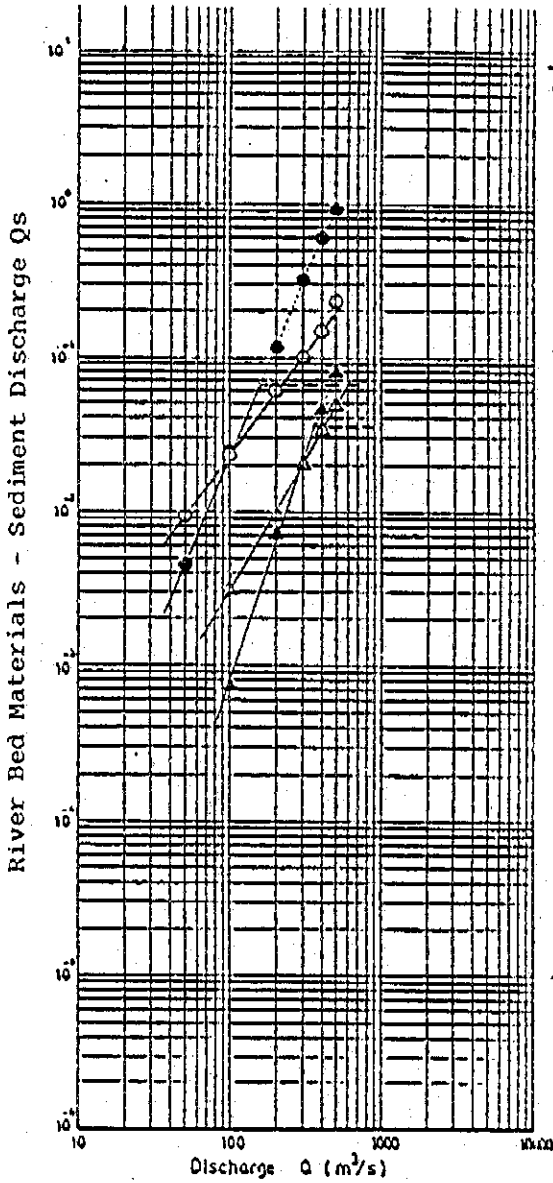
$Qws = (4\times10^{-8} \sim 6\times10^{-6})Q^2$

where,

Qws : Sediment Discharge of Wash Load (m^3/s)

Q : Flow Discharge (m^3/s)

Fig. E-11 Rating Curve for River Bed Materials



Legend :
- ○ Silau R. (P455-P550) sediment inflow
- ● Silau R. (P10-P35) sediment outflow
- △ Asahan R. (P335-P360) sediment inflow
- ▲ Asahan R. (P60-P90) sediment outflow

Rating Curve :

(Silau R.)

- sediment inflow -

$Qs = 4.867\times10^{-5}xQ^{1.343}$

- sediment outflow -

$Q \leq 150\ m^3/s$:

$Qs = 3.519\times10^{-7}xQ^{2.421}$

$Q > 150\ m^3/s$:

$Qs = 6.527\times10^{-2}\ m^3/s$

(Asahan R.)

- sediment inflow -

$Qs = 1.340\times10^{-6}xQ^{1.685}$

- sediment outflow -

$Q \leq 350\ m^3/s$:

$Qs = 5.373\times10^{-10}xQ^{3.073}$

$Q > 350\ m^3/s$:

$Qs = 3.533\times10^{-2}\ m^3/s$

Remarks:

Each sediment outflow rating curve is applicable to the present river.