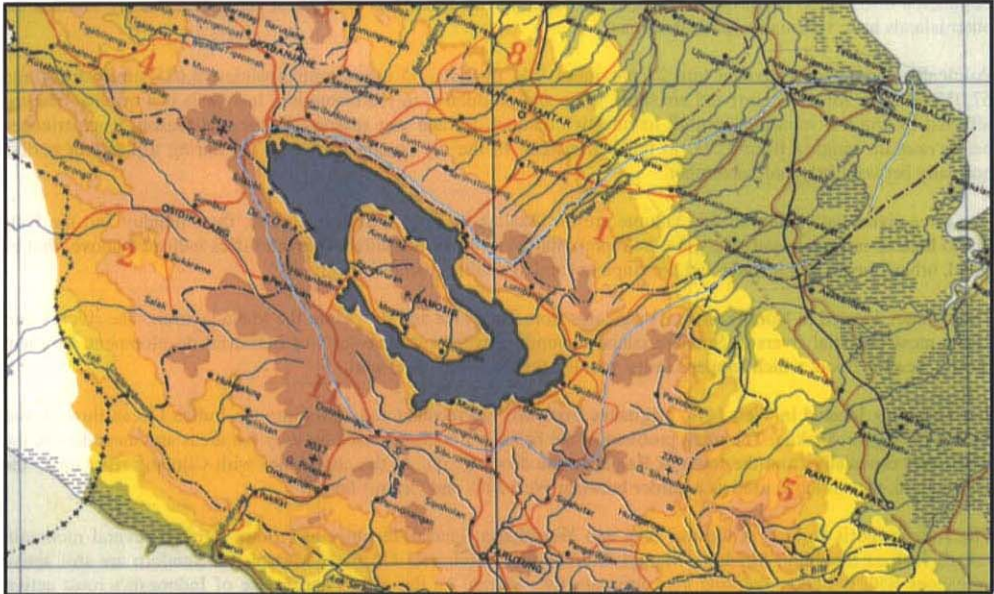


Sungai Asahan

Indonesia-4

Map of River




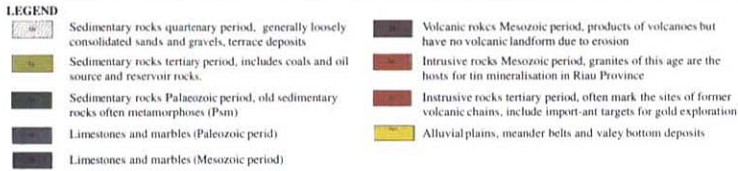
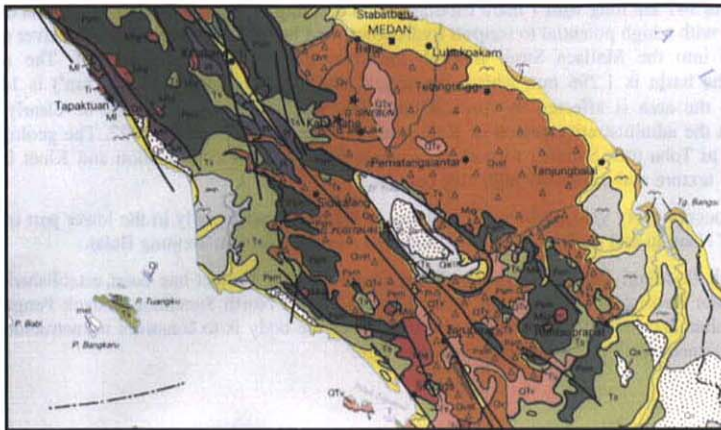
 Basin of Ashan River

Table of Basic Data

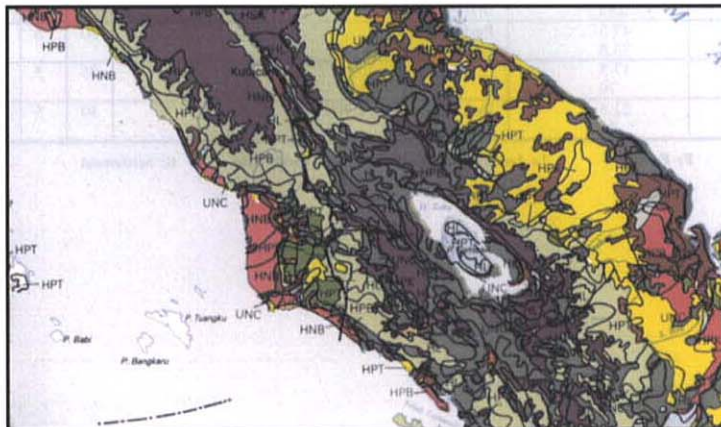
Name : Asahan River		Serial No. : Indonesia-4
Location : Sumatra Island, Indonesia	N 02° 15' 00" ~ 03° 03' 00"	E 98° 25' 10" ~ 99° 51' 30"
Area : 3,741 km ²	Length of main stream : 147 km	
Origin : Toba Lake	Highest point : Mt. Dolok Sibutan (2,457 m)	
Outlet : Mulla Strait	Lowest point : Tanjung Jumpul (0 m)	
Main geological features : Main basaltic rocks		
Main tributaries : Silang River (372 k m ²), Silau River (1,275 k m ²), Nantalu River (254 k m ²), Masihi River (133 k m ²), Lauran River (70 k m ²), Baru River (45 k m ²)		
Main reservoirs : Toba Lake		
Mean annual precipitation : 2,112 mm (basin average)		
Mean annual runoff : 155 m ³ /sec at Asahan-Puloraja (1,012 k m ²) (1978-1991)		
Population : 889,997 (1992)	Main cities : Parapat, Porsea, Balige, Kisaran, Tanjung Balai	
Land use : Forest (35%), Rice Paddy (10%), Other agriculture (50%), Urban (5 %) (1985)		

2. Geographical Information

2.1. Geological Map



2.2. Land Use Map



1. General Description

Asahan river, about 147 km long with 7 main tributaries and draining an area of about 3,741 km² is one of the rivers in Sumatra island with a high potential to support hydropower and industrial development. The river originates from Toba lake flows into the Mallaca Strait through the river mouth of Tanjung Jumpul. The average annual precipitation in the basin is 1,296 mm while the annual discharge at Puloraja (1,012 km²) is 140 m³/sec (138 litres/km²). Since the area is affected by tropical monsoon, wet and dry seasons can be clearly differentiated. Population within the administrative region of Kabupaten Asahan in 1992 was 889,997. The geological formation can be identified as Toba tuff, Samosir formation, younger formation, older formation and Kluet formation all of which have sandy texture with relatively high clay content.

Flooding, which occurs every year, is the main problem in the basin, particularly in the lower part of the catchment at the junctions of Nantalu and Asahan rivers and Silau and Asahan rivers, in Tanjung Balai.

To overcome such flooding, the lower Asahan River Flood Control Project has been established under the coordination of Water Resources Management Flood Control Project North Sumatera (Proyek Pengelolaan Sumber Air dan Pengendalian Banjir - PSAPB). The main function of the body is to construct infrastructure such as river bank, river improvement work etc, to mitigate flood damage.

2.3. Characteristics of River and Main Tributaries

No.	Names of River	Lenght [km] Catchment area [km ²]	Highest Peak [m] Lowest Point [m]	Cities (population in 1992)	Land use [%]				
					F	L	P	A	S
1.	Asahan (Main river)	147 3,741	Mt.D. Sanggul, 2,457 Tanjung Jumpal 0	Tanjung Balai (26,685)	35	10	10	40	5
2.	Silau (Tributary)	102 1,275	Mt.D. Pangulubao, 2.151 Tanjung Balai 30	Kisaran (105,943)	20	2	10	58	10
3.	Nantalu (Tributary)	38 254	Aek Kurasan, 50 Muara Nantalu 39		15	5	15	50	15
4.	Masihi (Tributary)	22 133	Pingol toba, 47 Masihi, 40		20	5	10	50	15
5.	Tarum (Tributary)	47.3 33,6	Pertijaan, 230 Ulak Medan, 45		30	5	15	40	10
6.	Lauran (Tributary)	17.5 70	- 1,300 - 150		35	5	15	30	15
7.	Baru (Tributary)	22.5 45	Dolok Surungan, 1,700 Tangga, 175		30	5	25	35	5

A: Agriculture

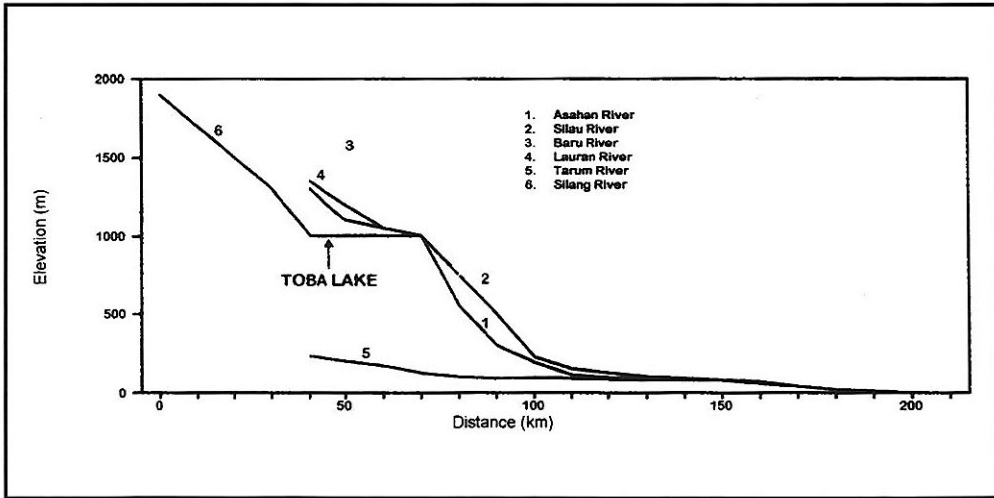
F: Forest

L: Lake, River, Marsh

P: Paddy field

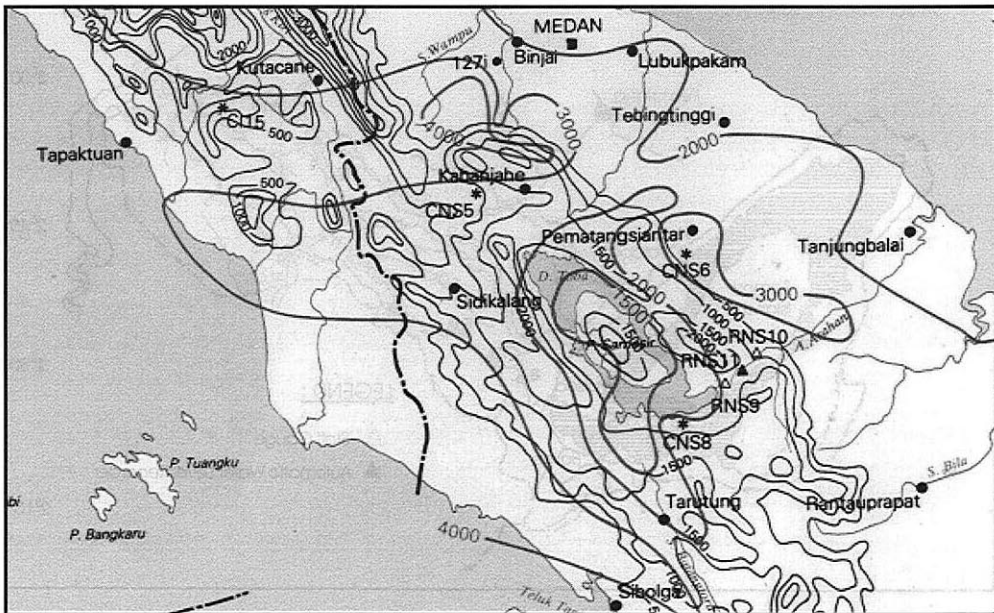
S: Settlement

2.4 Longitudinal Profiles



3. Climatological Information

3.1. Annual Isohyetal Map and Observation Stations



3.2 List of Meteorological Observation Stations

No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation [mm]	Mean annual evaporation [mm]	Observation items
1	Sitohang P	910	N 02° 45'	1983 ~ 1987	2,090	5.74	E,SR,DT,T
2	Haranggaol	-	E 98° 42'	1981~ 1987	1,524	3.98	E,SR,DS,T

E : Evaporation DS : Duration of Sunshine P : Precipitation SR : Solar Radiation T : Temperature

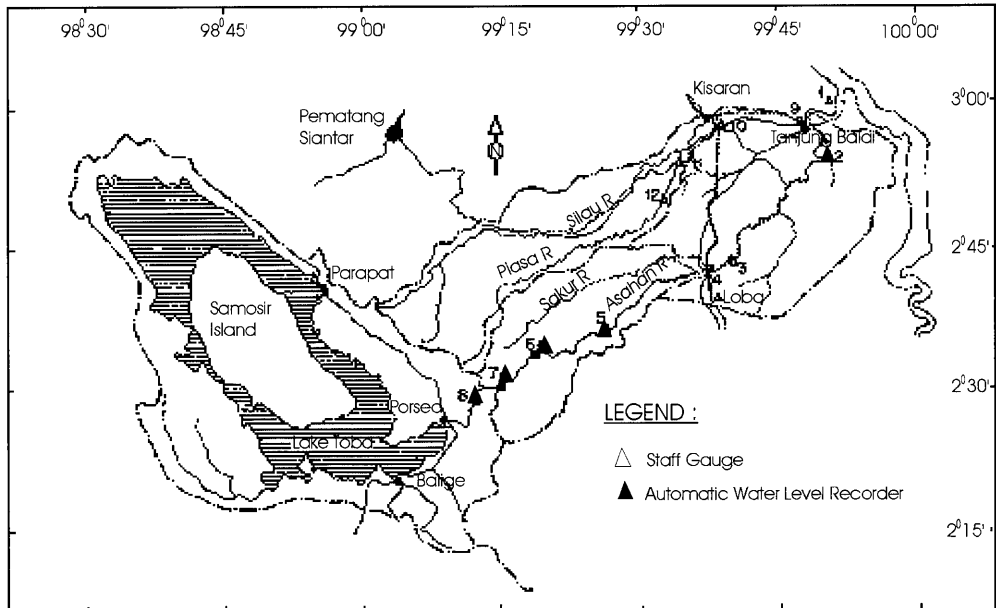
3.3 Monthly Climate Data

Station : Sitohang - Parhorasan

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	29	30	30.3	30.3	30.5	31.5	31	31	30	29.5	29.5	28.5	30.1	1983-87
Precipitation [mm]	342	166	305	207	282	41.8	88.2	41.1	167	115	139	196	2,090	1983-84
Evaporation [mm]	5.6	6.2	5.3	5.6	6.05	6.95	6.3	6.65	6.3	6.2	5.9	5.8	6.07	1983-87
Solar Radiation [MJ/m ² d]	204	195	180	214	243	331	316	289	253	266	260	242	249	1983-85
Duration of Sunshine [hr]	155.5	164.3	151	162	151	162	160	153	133	148.8	137	125	150.6	1983-87

4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Station

No.	Station	Location	Catchment area (A) [km ²]	Observation period	Observation items (frequency)
01-053-00-04	Asahan	Siruar	3,782	1916 - 1996	Q(d)
01-053-00-12	Silang	Marade	164	1982 - 1996	Q(d)
01-053-00-08	S. Silau	Kisaranaga	1011	1971 - 1996	Q(d)
01-053-00-04	Asahan	Puloraja	4,681	1977 - 1996	Q(d)

No.	\bar{Q} ¹⁾ [m ³ /s]	Q max ²⁾ [m ³ /s]	Q max ³⁾ [m ³ /s]	Q min ⁴⁾ [m ³ /s]	\bar{Q}/A [m ³ /s/100 km ²]	Q max/A [m ³ /s/100 km ²]	Period of statistics
01-053-00-04	96.6	250.8	133.1	42.1	2.56	7	1957 ~ 1995
01-053-00-12	6.36	63.2	54.64	2.3	3.88	39	1984 ~ 1988
01-053-00-08	75.6	412	320	32.73	7.48	41	1984 ~ 1988
01-053-00-04	180	481	404.03	101.13	3.85	10	1984 ~ 1988

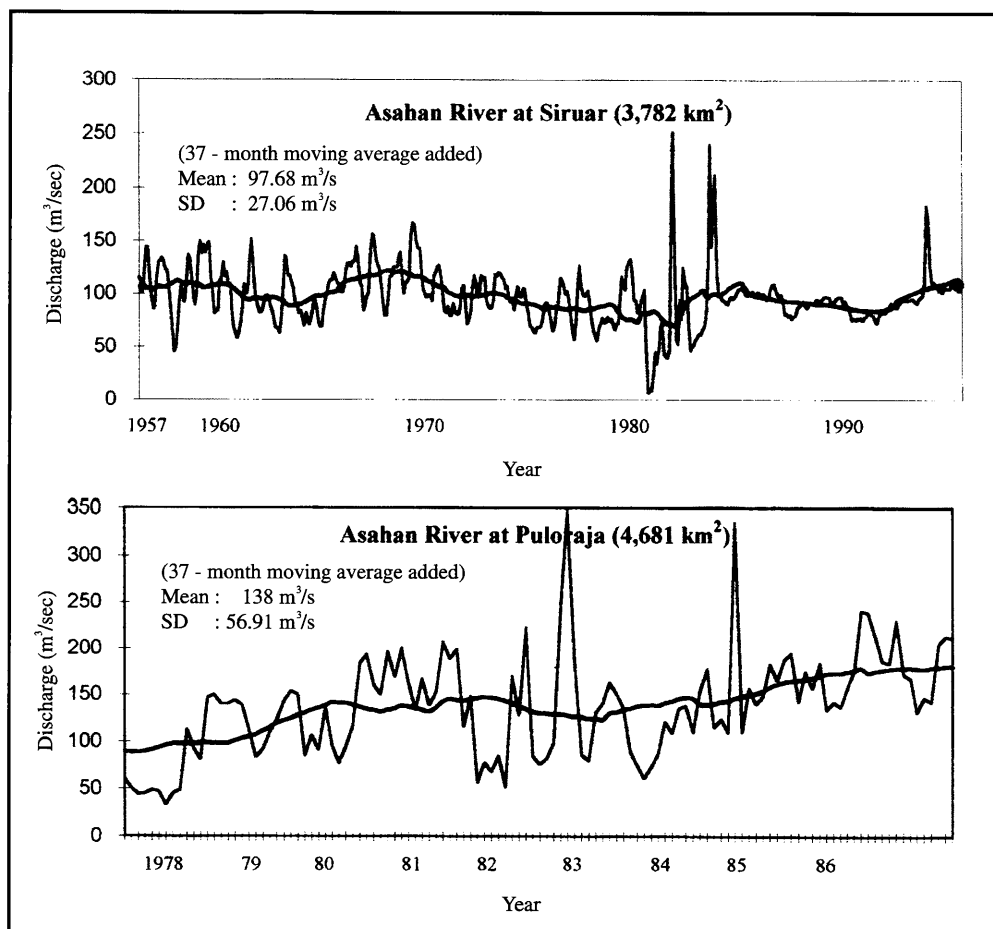
Q: Discharge
d: daily

¹⁾ mean annual discharge
²⁾ maximum discharge
³⁾ mean maximum discharge
⁴⁾ mean minimum discharge

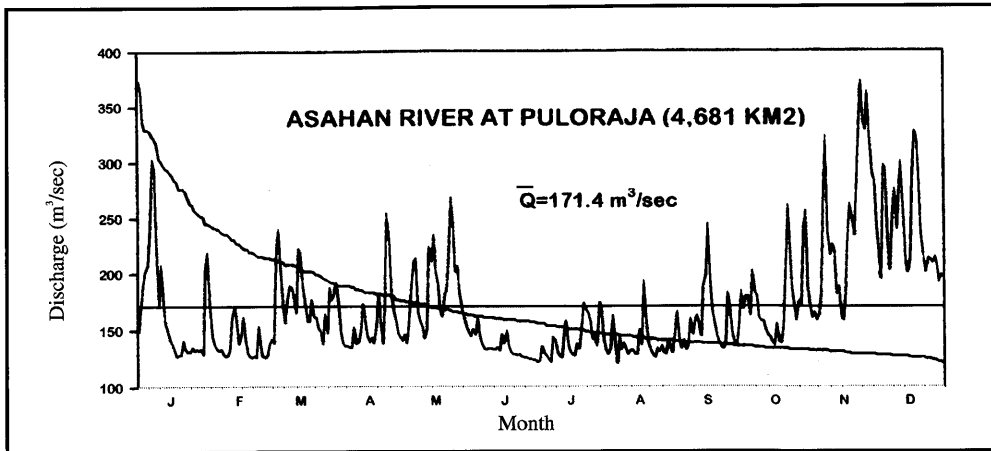
01-053-00-04 Asahan - Siruar
01 - Island number (Sumatera)
053 - Catchment number (Asahan R.)

00 - Sub Catchment number
04 - Station number in that catchment

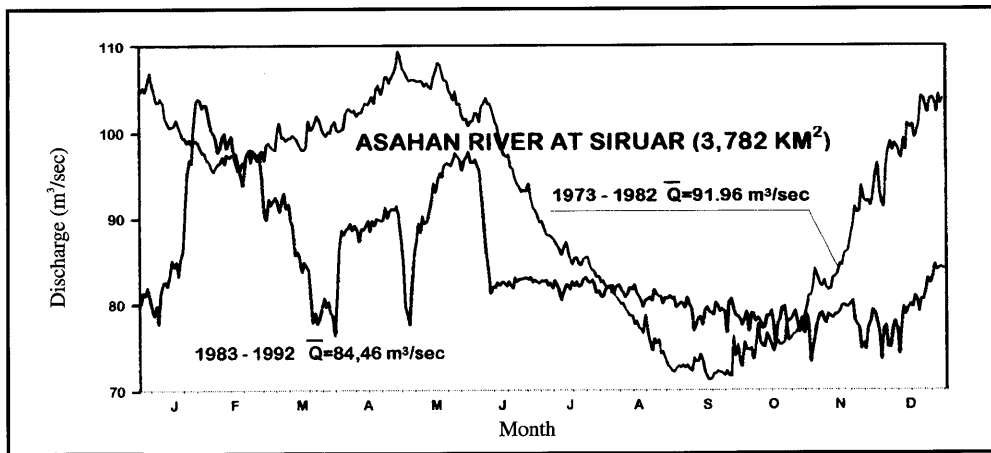
4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge



4.5 Unique Hydrological Features

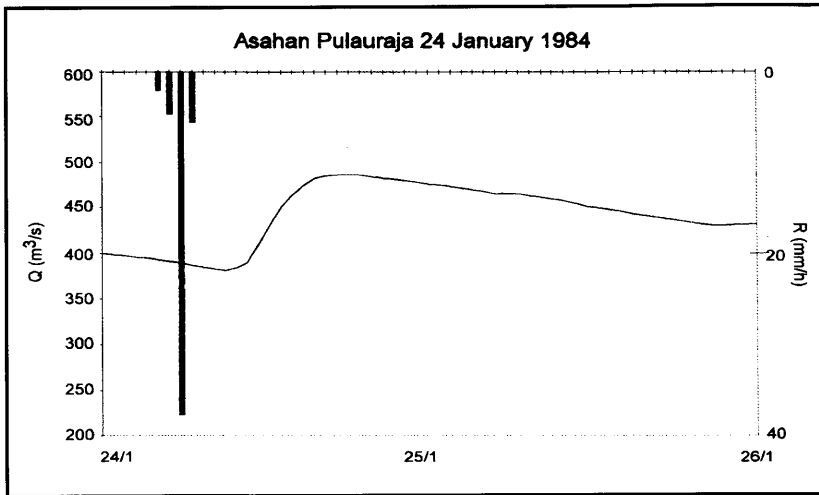


4.6 Annual Maximum and Minimum Discharges

At Asahan Siruar [3,782 km²]

Year	Maximum		Minimum		Year	Maximum		Minimum	
	Date	[m ³ /s]	Month	[m ³ /s]		Date	[m ³ /s]	Month	[m ³ /s]
1977	9. 22	373	9	80	1986	12.06	459	8	113
1978	12.22	324	8	74.6	1987	12.11	411	7	
1979	12.13	278	8	68	1990	2.02	402	8	93
1980	11.0	333	9	119	1991	12.03	526	7	85
1981	11.17	317	10	107	1992	2.08	353.6	1	95.9
1982	5.23	491	11	59	1993	4.19	310	2	73.6
1983	9.13	295	3	54.9	1994	4.22	351	8	61.1
1984	1.25	521	1	63	1995				
1985	11.24	397	7	121.5	1996				

4.7 Hyetographs and Hydrographs of Major Floods



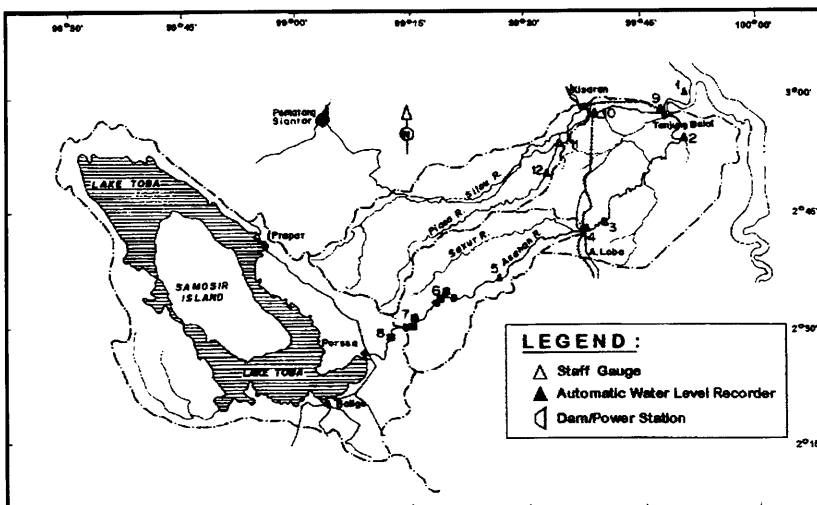
5. Water Resources

5.1 General Description

Asahan River with its 7 tributaries and catchment area of 3,741 km² is situated in the central part of North Sumatera Province. The downstream regions of the catchment which is often subjected to flooding has had the most severe flood at Pulou Raja station in 1984 with a discharge of 486 m³/sec. To overcome such floods, embankments and canals have been constructed.

Until recently, the waters of Asahan river have not been used optimally - it has just been used for hydropower generation (e.g. Siguragura hydropower plant with 286 MW and Tangga hydropower plant with 317 MW which have been built in 1984). The potency of water could be further developed for agriculture, fisheries, industrial etc., since the discharge at Siguragura and Tangga hydropower plants is always in the region of 80 - 100 m³/sec. Considering the topography, population density and infrastructure facility, the downstream parts have potential for development.

5.2 Map of Water Resource Systems



5.3. List of Major Water Resources Facilities

Major Reservoirs

Name of river	Name of dam (reservoir)	Catchment area [km ²]	Gross capacity [10 ⁶ m ³]	Effective capacity [10 ⁶ m ³]	Purpose ¹⁾	Year of completion
Asahan	Sigura-gura	3,730	-	0.752	P	1983
Asahan	Tangga	3,820	-	0.713	P	1983
Toba Lake	Siruar *)	3,674	-	2,860 **)	P	1983

*) Regulating Dam

**) Natural Lake

Floodways

Name of transfer line	Names of rivers connected		Length [km]	Maximum capacity [m ³ /s]	Purpose ¹⁾	Year of completion
	From	To				
Kanal Jepang	Pantai Burung	Silau	1.5	8.0	F	-

Retarding Basin

Name of river	Name of retarding basin	Area [km ²]	Volume [10 ⁶ m ³]	Purpose ¹⁾
Asahan	Padang Mahondang	95	92	F

1) F: Flood control, P: Hydro-power

Others

Name of river	Facility	Purpose ¹⁾	Capacity [km]	Year of completion
Asahan	Dike Embankment	F	17.16	1984
Lebah	Dike Embankment	F	15.231	Proposed
Silau	Dike Embankment	F	19.989	1983

1) F: Flood control

5.4. Major Floods and Droughts

Major Floods

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
1987.12	332	-	Heavy Rain	-	Puloraja
1987.12	223	-	Heavy Rain	-	Kisaran
1984.1.25	521	50 15 - 19	Heavy Rain	-	Puloraja

5.5 Groundwater and Water Quality

River Quality at Asahan ¹⁾, 1993-1994

Date	1993						1994
	Apr, 27	May, 28	Jun, 26	Jul, 28	Aug, 26	Sep, 23	Sep, 16
pH	8.1	8.2	7.0	7.4	7.7	7.6	7.5
DO [mg/l]	7.6	6.9	7.2	6.8	6.7	6.7	6.6
COD [mg/l]	4.8	-	3.2	-	7.8	6.5	2.6
SS [mg/l]	10	8.0	12	6.0	8.0	6.0	5.3
E. Coli ($\times 10^5$) ²⁾	600	-	-	-	-	-	-
Discharge [m ³ /s] ³⁾							

¹⁾ Located at Porsea

²⁾ Membrane filter method, coloni/100 ml

³⁾ Discharge on the observation date

5.6 Other Notable Features of Water Resources

Water uses at Major Reservoirs

Name of dam	Hydro-power capacity [MW]	Agricultural use [10 ⁶ m ³]	Industrial use [10 ⁶ m ³]	Fisheries use [10 ⁶ m ³]	Municipal water supply [10 ⁶ m ³]
Sigura-gura	286	-	-	-	-
Tangga	317	-	-	-	-

6. Socio-Cultural Characteristics

Generally, a river begins from springs on the mountains. But Asahan river begins from Toba Lake which has an area of about 1,300 km². Lake Toba is possibly the largest lake in Southeast Asia and the Pacific. It had been formed by eruption of the volcanoes and tectonic power of the earth millions of years ago. In the centre of the lake lies an island called Samosir island. Many locations around the lake such as Balige and Parapat had shown beautiful panorama making it one of the main domestic and foreign tourist destinations in Indonesia.

The Batakese who live in the Asahan river basin adhere to a culture with patriarchal system, meaning that the man's position is more powerful than that of woman. Cottage industries produce high quality and specific design items such as the long wide shawl called "ulos" which is used for special celebration, 'tor - tor' dancing, and also as souvenirs for tourism.

7. References, Databooks and Bibliography

- Lower Asahan River Flood Central (Civil and Building Works) Nippon Koei, Nikken Consultant, Inc & PT. Baru Madri Engineering Consultant, June 1989.
 Lower Asahan River Flood Central Main Report (Executive Summary) (1989).
 PT. Indonesia Asahan Aluminium (INALUM) (1990).
 PT. Baru Madri Engineering Consultant, June 1989.