

TABLE

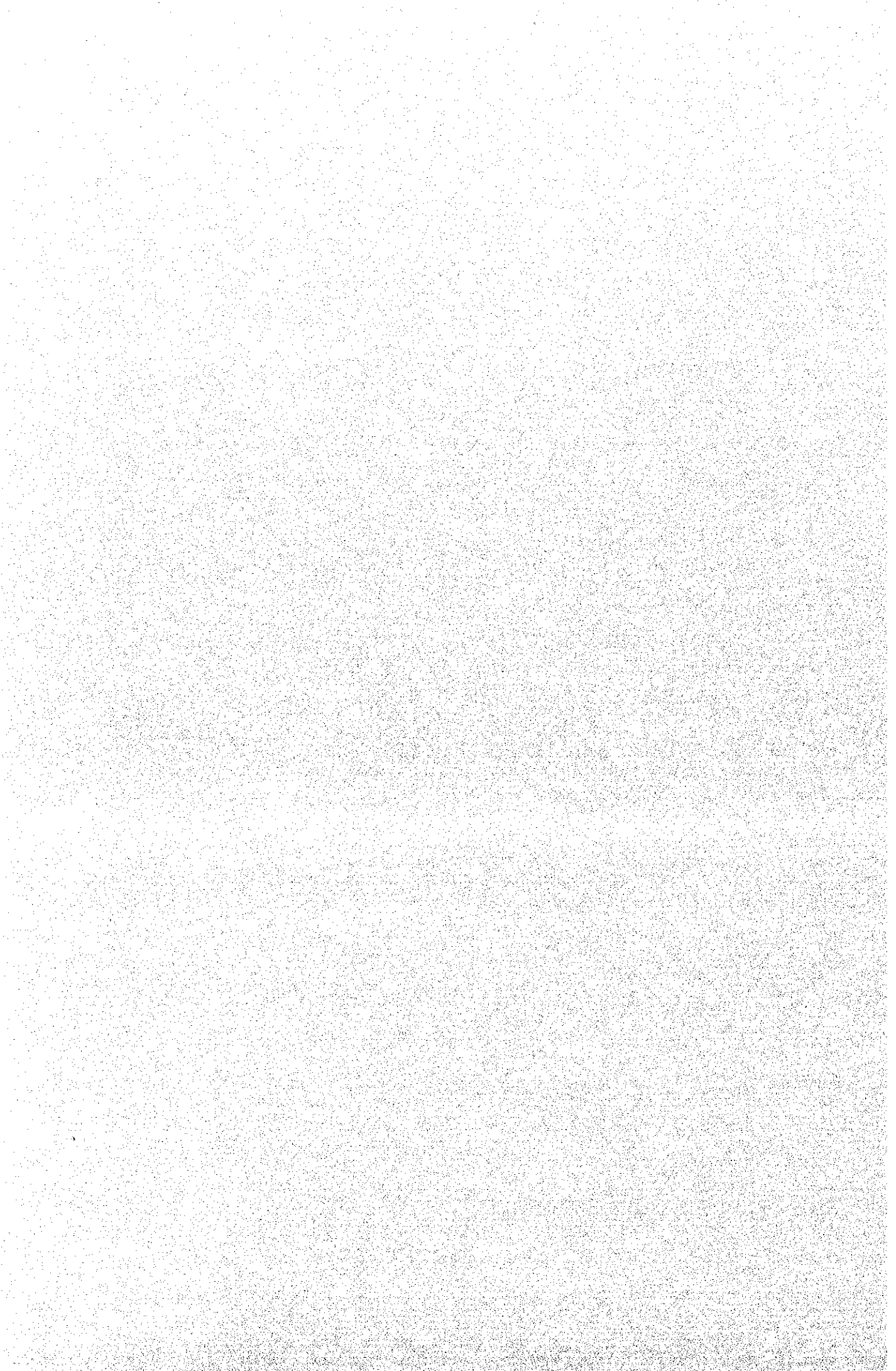


Table L.1.1 Annual Maximum Discharge Records

Year	Astana			Volgodonovka			Nilolaevka			Turgenevka			Year	Astana			Volgodonovka			Nilolaevka			Turgenevka		
	Discharge (m ³ /s)	Date		Discharge (m ³ /s)	Date		Discharge (m ³ /s)	Date		Discharge (m ³ /s)	Date			Discharge (m ³ /s)	Date		Discharge (m ³ /s)	Date		Discharge (m ³ /s)	Date		Discharge (m ³ /s)	Date	
1937	221	May	1	-	-	-	-	-	-	-	-	-	1969	27	Apr	11	-	-	-	-	-	-	-	-	-
1938	36	Apr	14	-	-	-	-	-	-	-	-	-	1970	78	Apr	3	-	-	-	-	-	-	-	-	-
1939	18	Apr	18	-	-	-	-	-	-	-	-	-	1971	235	Apr	19	-	-	-	-	-	-	-	-	-
1940	28	Apr	12	-	-	-	-	-	-	-	-	-	1972	502	Apr	25	-	-	-	-	-	-	-	-	-
1941	668	Apr	15	-	-	-	-	-	-	-	-	-	1973	430	Apr	15	-	-	-	54	Apr	12	-	-	-
1942	883	Apr	21	-	-	-	-	-	-	-	-	-	1974	124	Apr	18	-	-	-	53	Apr	11	-	-	-
1943	1,060	Apr	15	-	-	-	-	-	-	-	-	-	1975	40	Apr	11	-	-	-	20	Apr	12	19	Apr	9
1944	122	Apr	1	-	-	-	-	-	-	-	-	-	1976	214	Apr	23	-	-	-	91	Apr	17	271	Apr	19
1945	120	Apr	13	-	-	-	-	-	-	-	-	-	1977	82	Apr	13	-	-	-	39	Apr	11	244	Apr	10
1946	331	Apr	18	-	-	-	-	-	-	-	-	-	1978	-	-	-	8	Jul	27	33	Apr	1	69	Apr	3
1947	299	Apr	8	-	-	-	-	-	-	-	-	-	1979	486	Apr	25	830	Apr	23	55	Apr	24	345	Apr	21
1948	1,200	Apr	16	-	-	-	-	-	-	-	-	-	1980	-	-	-	83	-	-	-	-	-	-	-	-
1949	1,080	Apr	19	-	-	-	-	-	-	-	-	-	1981	3	Aug	8	4	Aug	11	1	Apr	1	79	Apr	4
1950	134	Apr	19	-	-	-	-	-	-	-	-	-	1982	3	Jul	4	9	Jul	15	58	Apr	11	107	Apr	14
1951	264	Apr	11	-	-	-	-	-	-	-	-	-	1983	270	Apr	13	356	Apr	12	8	Apr	11	328	Apr	5
1952	117	Apr	22	-	-	-	-	-	-	-	-	-	1984	130	Apr	25	-	-	-	40	Apr	20	179	Apr	6
1953	135	Apr	15	-	-	-	-	-	-	-	-	-	1985	196	Apr	17	239	Apr	15	92	Apr	13	287	Apr	9
1954	472	Apr	27	-	-	-	-	-	-	-	-	-	1986	294	Apr	20	394	Apr	18	202	Apr	17	507	Apr	16
1955	168	Apr	4	-	-	-	-	-	-	-	-	-	1987	44	May	12	75	May	2	118	May	21	363	Apr	21
1956	83	Apr	12	-	-	-	-	-	-	-	-	-	1988	224	Apr	17	215	Apr	14	32	Apr	16	341	Apr	13
1957	319	Apr	17	-	-	-	-	-	-	-	-	-	1989	16	Apr	10	7	Jun	27	30	Apr	24	113	Apr	8
1958	190	Apr	24	-	-	-	-	-	-	-	-	-	1990	181	Apr	15	272	Apr	13	45	Apr	4	409	Apr	9
1959	531	Apr	18	-	-	-	-	-	-	-	-	-	1991	204	Apr	20	269	Apr	19	83	Apr	18	480	Apr	16
1960	478	Apr	22	-	-	-	-	-	-	-	-	-	1992	-	-	-	-	-	-	-	-	-	-	-	-
1961	382	Apr	1	-	-	-	-	-	-	-	-	-	1993	750	Apr	18	974	Apr	18	130	Apr	17	473	Apr	21
1962	249	Apr	4	-	-	-	-	-	-	-	-	-	1994	5	Apr	16	-	-	-	18	Apr	16	53	Apr	16
1963	45	Apr	11	-	-	-	-	-	-	-	-	-	1995	-	-	-	-	-	-	63	Apr	6	250	Apr	7
1964	619	Apr	23	-	-	-	-	-	-	-	-	-	1996	111	Apr	20	-	-	-	104	Apr	18	277	Apr	17
1965	130	Apr	6	-	-	-	-	-	-	-	-	-	1997	114	Apr	13	148	Apr	10	39	Apr	8	213	Apr	6
1966	509	Apr	17	-	-	-	-	-	-	-	-	-	1998	9	Apr	15	-	-	-	12	Apr	27	12	Apr	29
1967	2	Apr	8	-	-	-	-	-	-	-	-	-	1999	3	Apr	16	6	Jun	24	5	Apr	21	5	Apr	16
1968	36	Apr	9	-	-	-	-	-	-	-	-	-													

Table L.1.2 Discharge Records of Vyacheslavsky Reservoir since 1970

Year	Initial Storage (MCM)	Prior Spillout		Storage before flooding (MCM)	Flood Inflow		Flood Spillout		Total			Daily Maximum Inflow		
		Period	Volume (MCM)		Period	Volume (MCM)	Period	Volume (MCM)	Inflow (MCM)	Spillout (MCM)	Reservoir Storage (MCM)	Date	Daily Inflow (MCM)	Per Second (m ³ /s)
1970	153	-	-	153	-	-	-	-	202	11	344	-	-	-
1971	229	-	-	229	-	-	-	-	262	80	411	-	-	-
1972	308	-	-	308	-	-	-	-	387	284	411	-	-	-
1973	317	28/3-6/4	38	279	8/4-15/4	294	8/4-15/4	206	403	308	412	8/4	58	671
1974	323	-	-	323	10/4-14/4	34	16/4-18/4	25	76	56	343	10/4	10	116
1975	272	-	-	272	-	-	-	-	40	12	300	-	-	-
1976	206	-	-	206	11/4-21/4	204	16/4-22/4	64	247	64	389	19/4	34	393
1977	303	-	-	303	9/4-14/4	112	9/4-10/4	8	113	22	394	10/4	30	347
1978	314	-	-	314	1/4-8/4	31	-	-	51	-	365	-	-	-
1979	278	1/4-10/4	5	273	16/4-30/4	322	10/4-30/4	187	327	192	413	21/4	76	880
1980	368	-	-	368	2/4-19/4	59	13/4-21/4	30	81	30	419	-	-	-
1981	358	-	-	358	1/4-9/4	38	-	-	52	-	410	-	-	-
1982	330	-	-	330	6/4-16/4	47	-	-	77	-	407	-	-	-
1983	315	20/3-31/3	49	266	30/3-20/4	251	6/4-21/4	109	269	158	426	4/4	39	451
1984	344	-	-	344	4/4-25/4	134	8/4-26/4	108	190	108	426	-	-	-
1985	340	19/3-28/3	47	293	5/4-23/4	300	8/4-24/4	176	311	223	428	8/4	42	486
1986	325	24/3-6/4	57	268	12/4-23/4	257	16/4-24/4	120	280	177	428	15/4	49	567
1987	320	9/3-18/4	82	238	18/4-30/4	176	26/4-20/5	46	237	128	429	21/4	33	382
1988	292	11/3-1/4	30	262	10/4-25/4	164	15/4-3/5	73	244	103	433	14/4	42	486
1989	317	-	-	317	1/4-21/4	66	-	-	102	-	419	-	-	-
1990	302	19/3-29/3	41	261	9/4-20/4	253	10/4-28/4	179	347	221	428	13/4	34	393
1991	319	6/3-9/4	37	282	12/4-22/4	216	17/4-23/4	84	278	172	425	18/4	31	359
1992	290	17/3-4/4	38	252	-	-	-	-	67	40	317	19/4	6	69
1993	253	-	-	253	13/4-19/4	357	15/4-20/4	212	534	350	437	17/4	84	972
1994	275	-	-	275	17/4-16/5	-	-	-	70	-	345	-	-	-
1995	252	-	-	252	28/3-11/4	-	-	-	152	-	404	17/3	17	197
1996	250	-	-	250	15/4-22/4	194	18/4-19/4	13.8	220	18	452	18/4	50	579
1997	289	-	-	289	6/4-11/4	130	10/4-12/4	28	246	94	441	9/4	27	312
1998	286	-	-	286	-	-	-	-	38	6	318	-	-	-
1999	225	-	-	225	-	-	-	-	-	-	247	-	-	-
2000	171	-	-	171	-	-	-	-	-	-	-	-	-	-

Source: Astana-Su

Table L.1.3 Maximum Discharge Estimation of Sub-catchment of Ishim (1/2)

Year	1975	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	1987	1988
Date													
1/4	0.85	0.00	0.00	20.98	0.00	23.52	0.00	54.14	45.48	0.00	0.00	0.00	0.00
2/4	1.26	0.00	0.00	86.15	0.00	25.79	0.00	68.67	36.49	0.00	0.00	0.00	0.00
3/4	0.98	0.00	0.00	89.05	0.00	15.48	0.00	159.70	58.35	0.53	0.00	0.00	0.00
4/4	4.08	0.00	0.00	70.28	0.00	102.57	0.00	426.40	96.25	1.15	0.00	0.00	0.00
5/4	10.83	0.00	0.00	48.45	0.00	61.45	0.00	420.01	172.41	1.76	0.00	0.00	0.00
6/4	17.55	0.00	0.00	41.97	0.00	58.87	0.00	277.88	232.70	75.30	0.00	0.00	0.00
7/4	24.31	0.00	22.05	35.48	0.00	45.37	0.27	212.40	120.58	263.57	0.00	0.00	0.00
8/4	24.70	0.00	44.10	35.48	0.00	14.72	0.52	143.41	88.14	352.56	13.26	0.00	0.00
9/4	24.96	0.00	169.27	35.48	0.00	12.31	0.79	110.83	110.36	373.10	48.15	0.00	4.18
10/4	21.84	0.00	317.20	14.77	0.00	9.88	21.89	156.03	200.97	205.38	37.89	0.00	157.52
11/4	20.80	3.56	243.23	21.32	0.00	9.00	37.39	274.68	112.47	145.13	41.44	0.00	253.71
12/4	19.89	41.78	142.24	22.18	0.00	8.19	82.92	210.80	104.01	148.73	49.14	0.00	338.75
13/4	21.32	157.86	108.67	20.30	0.00	7.84	119.92	99.33	105.77	193.40	97.48	0.67	443.30
14/4	17.42	139.19	79.51	14.77	0.00	7.13	139.10	71.39	65.23	297.80	592.01	1.35	362.45
15/4	13.78	127.83	52.35	12.91	0.00	6.07	37.97	52.70	57.65	142.39	485.44	2.02	224.44
16/4	9.98	165.95	43.81	11.05	4.09	5.01	29.06	47.11	51.65	90.19	659.10	2.70	167.28
17/4	7.98	342.67	34.85	10.13	20.77	4.73	27.12	40.40	47.07	75.65	515.05	3.37	127.69
18/4	6.73	346.52	29.73	10.13	81.99	4.73	24.22	39.45	57.65	59.90	372.96	21.87	101.49
19/4	4.71	352.30	20.06	10.13	156.42	4.48	18.52	33.06	110.18	46.55	228.91	269.66	75.97
20/4	4.24	205.99	17.78	9.21	162.09	4.48	16.89	27.79	79.15	40.39	85.05	432.44	42.38
21/4	3.77	75.66	13.29	9.21	448.50	4.20	16.89	26.83	142.79	33.20	74.59	471.90	35.41
22/4	3.09	53.13	9.19	7.80	431.19	3.95	15.42	25.87	81.09	23.45	64.13	471.90	31.64
23/4	3.09	48.51	7.67	6.40	376.11	3.95	15.42	22.36	45.31	16.94	53.68	264.72	26.49
24/4	3.43	41.78	6.13	5.70	210.87	3.95	14.10	18.37	37.55	14.77	47.36	143.38	23.28
25/4	3.09	32.15	5.36	5.00	146.82	3.67	13.45	18.37	25.91	10.42	41.05	149.30	14.22
26/4	2.76	26.57	4.74	4.28	68.30	3.40	12.79	16.93	14.63	7.17	34.73	133.51	11.15
27/4	2.43	24.83	4.74	3.58	42.17	3.40	12.11	15.40	9.70	6.09	28.42	121.67	9.06
28/4	2.43	21.18	4.74	3.58	23.76	2.87	11.45	14.64	8.64	2.82	22.10	82.21	7.26
29/4	2.09	18.00	4.13	2.88	9.08	2.61	9.47	12.62	8.64	1.75	15.87	56.56	6.16
30/4	1.76	18.00	3.84	2.88	5.27	2.61	7.50	11.34	8.64	1.71	9.57	44.72	5.20
1/5	1.76	20.41	3.84	2.76	4.94	2.61	6.20	12.94	7.30	1.64	8.88	43.41	5.20
2/5	1.76	21.18	3.84	2.63	5.60	2.61	5.33	12.62	6.63	1.63	8.21	44.72	5.20
3/5	2.43	21.18	3.56	2.49	5.60	2.61	4.88	13.26	6.03	1.61	8.21	39.46	5.62
4/5	3.09	21.18	3.56	2.37	5.60	2.34	4.46	12.62	5.71	1.61	7.52	29.10	4.78
5/5	3.77	21.18	3.27	2.25	5.27	2.61	4.09	11.34	4.87	1.61	6.83	24.50	5.20
6/5	4.71	19.44	3.56	2.12	4.94	2.34	4.09	10.06	4.62	1.59	6.83	25.49	5.20
7/5	3.43	16.00	3.27	1.98	4.60	2.34	3.74	10.06	4.37	1.57	5.47	31.08	5.20
8/5	3.43	12.76	2.99	1.86	4.60	1.94	3.02	9.42	3.88	1.57	4.78	64.13	5.62
9/5	3.43	12.76	2.76	1.74	4.26	1.94	3.02	8.78	3.65	1.57	4.78	46.04	4.78
10/5	3.09	11.53	2.53	1.60	3.93	1.76	3.02	7.51	3.40	1.57	4.46	28.28	3.93
11/5	2.76	7.85	2.53	1.47	4.26	1.76	2.65	5.72	3.40	1.57	4.46	31.90	3.21
12/5	2.76	7.05	2.30	1.35	5.27	1.56	2.36	3.94	3.40	1.57	4.46	27.29	2.90
13/5	2.43	6.64	2.08	1.21	5.93	1.56	1.80	2.24	2.93	1.56	6.14	22.69	2.90
14/5	1.76	6.64	2.08	1.09	6.61	1.21	0.00	2.24	2.70	1.54	5.47	19.90	3.21
15/5	1.53	6.24	1.85	0.96	6.61	1.21	0.00	3.50	2.49	1.54	5.47	18.09	3.21
16/5	1.53	5.04	1.66	0.82	5.93	1.21	0.00	3.50	2.06	1.51	4.78	15.24	3.21
17/5	1.33	3.83	1.66	0.70	5.93	1.21	0.00	2.24	2.06	1.51	5.47	13.78	3.21
18/5	1.33	3.83	1.66	0.56	5.27	1.06	0.00	2.24	1.85	1.51	5.47	12.71	2.90
19/5	1.33	3.18	1.48	0.44	5.27	1.06	0.00	2.24	1.85	1.49	4.78	11.12	3.21
20/5	1.33	3.18	1.48	0.31	5.27	1.06	0.00	3.05	1.85	1.49	4.46	9.52	3.21
21/5	0.95	2.85	1.48	0.34	4.94	1.06	0.00	3.50	1.85	1.40	4.14	8.99	3.21
22/5	0.95	2.52	1.48	0.38	4.60	1.06	0.29	3.50	1.64	1.33	3.83	8.47	3.21
23/5	0.95	2.52	1.29	0.43	4.60	0.90	0.29	3.05	1.64	1.33	3.20	6.87	3.21
24/5	0.95	2.19	1.29	0.46	4.26	0.90	0.29	3.05	1.48	1.33	2.57	6.35	3.21
25/5	0.95	2.19	1.29	0.49	3.93	0.90	0.00	3.50	1.64	1.27	2.57	5.28	2.90
26/5	0.95	1.91	1.48	0.53	3.93	0.90	0.00	4.95	1.64	1.27	1.93	3.80	2.90
27/5	0.95	1.91	1.66	0.56	3.93	0.74	0.00	2.16	1.64	1.27	1.93	2.93	2.90
28/5	0.95	1.91	1.66	0.61	3.93	0.74	0.00	1.72	1.85	1.18	1.78	2.93	2.59
29/5	0.79	1.91	1.48	0.65	3.93	0.59	0.00	1.52	1.85	1.18	1.64	3.80	2.29
30/5	0.64	1.91	1.29	0.68	3.49	1.41	0.00	1.52	1.85	1.18	1.48	4.23	2.09
31/5	0.64	2.19	1.29	0.72	3.49	0.59	0.00	1.52	1.85	1.18	1.48	4.75	2.09

Table L.1.3 Maximum Discharge Estimation of Sub-catchment of Ishim (2/2)

Year Date	1989	1990	1991	1993	1994	1995	1996	1997	1998	1999
1/4	1.35	2.99	0.22	0.00	0.00	158.21	0.00	4.45	0.00	0.00
2/4	9.86	18.82	0.44	0.00	0.00	108.39	0.00	54.45	0.00	0.00
3/4	17.40	48.99	0.67	0.00	0.00	83.04	0.00	78.09	0.00	0.00
4/4	20.42	57.35	0.71	0.00	0.16	81.43	0.00	101.74	0.00	0.00
5/4	47.20	58.40	0.75	0.00	0.32	142.50	0.00	163.34	0.00	0.00
6/4	77.01	63.62	0.79	0.00	0.49	291.07	0.00	276.90	0.00	0.67
7/4	133.74	75.27	0.84	0.00	0.65	325.00	0.00	230.23	0.00	1.09
8/4	146.90	383.84	0.87	0.00	0.81	221.43	0.00	217.79	0.00	1.52
9/4	86.39	531.70	0.92	0.00	3.04	150.36	0.00	185.12	0.00	1.94
10/4	56.88	492.87	2.65	0.00	5.25	108.39	0.00	126.63	0.00	2.36
11/4	37.82	368.90	10.70	0.00	7.48	76.25	2.33	71.25	0.00	2.78
12/4	33.28	315.14	108.60	0.00	9.71	52.50	4.17	65.65	0.00	3.22
13/4	15.89	262.86	179.42	0.88	25.12	45.36	5.34	60.05	0.00	3.64
14/4	11.80	209.10	301.68	1.76	40.52	36.07	8.35	54.60	0.31	4.06
15/4	16.94	126.35	315.97	2.64	55.92	31.96	33.61	49.00	0.47	4.97
16/4	18.91	106.94	624.00	3.51	69.16	24.11	130.56	42.47	2.21	6.31
17/4	14.52	105.44	406.47	4.39	59.43	19.11	360.10	37.65	3.95	6.29
18/4	14.07	90.36	519.21	28.50	52.41	15.96	330.55	35.47	5.69	6.28
19/4	17.55	66.01	355.66	351.37	44.71	13.93	174.88	37.65	7.44	6.26
20/4	15.89	51.38	279.45	563.48	37.96	13.52	97.87	36.56	9.18	6.25
21/4	11.80	38.83	252.46	614.90	27.15	13.13	100.83	35.47	7.49	3.80
22/4	11.15	26.88	187.36	614.90	24.72	12.71	85.50	32.51	6.89	2.90
23/4	10.82	22.25	151.63	344.94	22.29	12.30	48.01	28.93	6.31	2.17
24/4	10.82	22.25	141.31	186.83	19.72	11.91	36.75	26.60	7.83	2.17
25/4	10.82	20.76	126.86	194.54	17.29	11.50	29.18	24.58	9.36	1.38
26/4	10.17	20.76	118.77	173.97	14.86	11.09	25.11	22.71	10.88	1.19
27/4	13.80	19.57	111.30	158.55	12.37	10.68	24.38	22.25	12.42	1.01
28/4	12.41	19.57	92.41	107.13	9.91	10.29	23.08	21.78	13.91	0.88
29/4	11.04	18.22	65.10	73.70	9.58	9.88	21.79	20.85	15.47	1.01
30/4	9.68	17.62	56.84	58.28	9.25	9.05	19.21	19.76	14.43	1.01
1/5	9.08	17.03	39.38	56.56	8.92	8.21	18.65	19.76	13.52	1.01
2/5	8.47	16.43	34.93	58.28	8.58	7.39	18.13	19.45	12.45	1.01
3/5	8.02	14.59	27.95	51.42	8.25	6.57	17.58	19.13	11.45	1.01
4/5	7.87	12.44	22.71	37.92	7.92	5.75	17.01	18.98	10.45	0.88
5/5	8.47	11.52	21.28	31.92	7.59	4.91	16.45	18.67	5.82	0.88
6/5	8.47	11.05	19.05	33.21	7.25	4.09	15.88	18.51	4.10	0.88
7/5	8.47	10.59	14.97	40.49	6.92	3.27	15.33	18.36	3.65	0.77
8/5	8.47	9.66	12.96	83.56	6.52	2.43	14.77	18.36	4.10	0.77
9/5	7.87	9.66	10.94	59.99	6.25	1.61	14.20	18.36	4.60	0.77
10/5	8.47	9.20	9.92	36.85	6.19	1.55	13.65	18.20	5.17	0.77
11/5	8.47	7.65	9.29	41.56	6.11	1.52	12.98	17.11	5.82	0.77
12/5	7.87	5.81	8.65	35.57	6.04	1.46	12.30	15.87	5.17	0.68
13/5	6.13	5.81	8.02	29.57	5.96	1.41	11.62	14.78	5.17	0.68
14/5	6.66	5.45	7.38	25.92	5.88	1.38	10.95	13.63	4.60	0.61
15/5	6.13	4.79	6.10	23.57	5.81	1.32	10.29	12.49	3.65	0.55
16/5	6.66	3.94	4.19	19.86	5.73	1.27	9.60	11.36	2.94	0.51
17/5	5.60	3.66	4.19	17.95	5.66	1.21	8.92	10.20	2.16	0.51
18/5	5.07	2.81	3.86	16.56	5.58	1.18	8.25	9.07	1.96	0.48
19/5	4.54	2.52	3.86	14.48	4.98	1.13	7.59	7.92	1.78	0.48
20/5	3.78	2.52	3.52	12.41	4.39	1.13	6.91	6.78	1.64	0.45
21/5	3.40	2.24	3.86	11.72	4.34	1.13	6.39	6.25	1.38	0.45
22/5	3.03	2.00	3.52	11.03	4.28	1.11	5.87	5.72	1.26	0.45
23/5	3.03	2.00	2.86	8.96	4.21	1.11	5.36	5.20	1.26	0.43
24/5	2.71	2.00	2.86	8.27	4.16	1.11	4.84	4.67	1.17	0.45
25/5	2.71	2.00	2.52	6.88	4.11	1.11	4.32	4.12	1.17	0.43
26/5	2.39	1.76	2.19	4.95	4.05	1.11	3.80	3.59	1.17	0.43
27/5	2.39	1.55	2.19	3.81	4.00	1.09	3.29	3.06	1.07	0.43
28/5	2.07	1.36	1.95	3.81	3.93	1.09	2.77	2.54	1.07	0.42
29/5	2.07	1.36	1.70	4.95	3.88	1.09	2.25	2.01	1.07	0.42
30/5	1.75	1.36	1.46	5.51	3.82	1.09	1.74	1.48	1.07	0.41
31/5	1.75	1.36	1.46	6.19	3.03	1.09	1.75	1.48	0.99	0.41

Table L.1.4 Maximum Discharge Estimation of Sub-catchment of Moildy (1/2)

Year Date	1973	1974	1975	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986
1/4	0.00	0.27	0.00	0.00	0.00	55.42	0.00	2.43	0.00	0.00	0.00	0.00	0.00
2/4	0.00	0.38	0.00	0.00	0.00	45.20	0.00	2.16	0.00	0.00	0.00	0.00	0.00
3/4	0.00	0.51	2.91	0.00	0.00	27.07	0.00	2.19	1.85	3.89	7.48	0.00	0.00
4/4	0.00	0.65	5.85	0.00	0.00	17.80	0.00	1.75	3.67	7.76	10.97	9.44	0.00
5/4	0.00	0.89	8.76	0.00	3.53	15.14	0.00	1.55	5.52	11.68	28.22	14.76	0.00
6/4	0.00	5.37	7.06	0.00	7.75	18.64	0.00	1.43	7.36	14.09	19.72	47.21	0.00
7/4	0.00	9.71	15.06	1.27	2.82	9.96	0.00	1.29	9.18	12.47	19.72	68.33	0.10
8/4	0.00	21.63	14.63	2.55	3.53	8.40	0.00	1.16	11.03	26.96	19.72	80.14	0.34
9/4	0.00	19.73	13.81	3.82	21.17	7.74	0.00	1.09	11.03	34.70	30.43	77.86	1.26
10/4	0.00	41.83	13.81	5.09	37.10	6.44	0.00	0.90	24.89	58.14	20.57	88.01	2.18
11/4	0.00	89.25	25.03	6.39	66.64	5.41	0.00	0.83	97.75	98.94	19.38	98.98	2.18
12/4	90.95	63.53	33.83	7.66	47.54	8.68	0.00	0.77	69.78	48.77	16.12	122.80	7.06
13/4	80.92	28.18	27.77	8.93	48.43	4.34	0.00	0.68	49.52	20.35	14.89	155.72	7.65
14/4	65.28	19.15	22.68	10.21	39.76	1.79	0.00	0.61	32.33	13.62	10.85	133.56	27.88
15/4	37.91	13.42	15.21	13.14	23.32	1.48	0.00	0.58	23.60	10.64	4.45	102.29	36.89
16/4	24.14	11.74	11.60	46.51	16.10	1.58	0.00	0.58	23.60	7.83	7.36	82.21	78.71
17/4	33.66	11.74	9.00	154.70	5.62	1.58	0.00	0.53	22.83	7.39	28.05	75.79	108.12
18/4	43.18	9.75	6.26	123.86	5.86	1.58	0.00	0.53	16.45	6.94	33.15	88.42	85.17
19/4	41.14	10.16	5.14	127.28	5.40	1.53	2.88	0.34	11.80	6.73	30.94	73.93	47.77
20/4	32.64	10.56	4.32	95.95	3.82	1.48	5.77	0.41	10.26	6.54	43.52	72.06	17.68
21/4	28.56	10.16	4.03	75.64	2.91	1.48	7.97	0.36	8.85	4.99	68.51	69.58	13.26
22/4	24.48	9.75	4.03	58.99	2.78	1.48	40.33	0.24	8.85	4.45	0.00	63.16	8.31
23/4	16.73	5.99	1.96	45.77	2.51	1.28	90.05	0.20	5.70	4.27	33.49	63.78	5.10
24/4	11.83	4.61	1.64	42.35	1.98	1.02	92.65	0.20	3.59	4.10	16.05	54.25	5.81
25/4	13.67	3.85	1.43	29.86	1.98	0.92	86.46	0.19	2.57	3.94	6.63	49.70	5.46
26/4	17.34	3.40	1.43	19.34	1.98	0.92	52.51	0.17	1.87	3.75	5.83	42.45	7.24
27/4	9.45	3.24	1.54	13.00	1.62	0.89	45.53	0.14	1.77	3.56	5.83	22.16	6.89
28/4	5.13	3.09	1.84	13.71	1.62	0.79	38.74	0.13	1.77	3.40	0.00	19.36	6.17
29/4	4.13	2.93	1.96	13.00	1.51	0.97	31.95	0.11	1.64	3.24	0.00	13.77	5.10
30/4	3.81	2.77	1.96	11.90	1.51	1.07	24.96	0.10	1.54	3.24	0.00	10.04	4.83
1/5	4.13	2.64	1.96	13.00	1.51	0.97	15.57	0.10	1.41	2.88	0.00	10.04	5.81
2/5	4.79	2.48	1.84	12.63	1.27	0.97	12.08	0.09	1.21	2.72	0.00	5.63	5.10
3/5	4.79	2.33	2.33	11.55	1.18	0.97	10.82	0.08	1.08	2.72	0.00	5.24	4.83
4/5	5.47	2.17	2.52	10.11	1.11	0.92	11.58	0.07	1.08	2.39	0.00	5.24	4.28
5/5	6.14	2.01	2.52	9.18	1.18	0.92	9.68	0.07	0.97	2.09	0.00	4.04	3.20
6/5	5.47	1.86	5.71	7.34	1.51	0.79	8.17	0.09	0.97	1.95	0.00	4.04	3.20
7/5	5.47	1.70	7.43	5.19	1.51	0.79	6.67	0.09	0.85	1.78	0.00	4.04	2.98
8/5	5.47	1.54	7.04	4.60	1.38	0.79	6.11	0.09	0.74	1.64	0.00	3.23	2.35
9/5	6.17	1.39	2.72	4.01	1.11	0.72	4.99	0.07	0.67	1.50	0.00	2.86	2.16
10/5	4.13	1.23	1.54	4.28	1.11	0.72	4.79	0.07	0.56	1.38	0.00	2.51	2.16
11/5	6.14	1.12	1.13	4.28	0.93	0.72	4.79	0.07	0.56	1.24	0.00	2.51	1.97
12/5	3.47	1.12	0.96	4.28	0.93	0.66	4.57	0.06	0.51	1.24	0.00	2.51	1.79
13/5	2.79	1.03	1.13	4.28	1.02	0.64	4.37	0.06	0.44	1.03	0.00	1.78	2.16
14/5	2.13	0.83	1.13	7.96	1.11	0.59	4.37	0.05	0.38	1.03	0.00	1.78	2.53
15/5	1.79	0.74	0.96	4.01	1.11	0.59	4.15	0.04	0.38	1.03	0.00	1.78	1.60
16/5	1.68	0.74	0.96	3.52	0.93	0.54	3.09	0.04	0.38	1.13	0.00	1.41	1.46
17/5	1.58	0.65	0.80	4.60	0.67	0.54	2.44	0.04	0.31	1.13	0.00	1.41	1.46
18/5	1.68	0.65	0.80	1.71	0.67	0.54	2.32	0.04	0.31	1.13	0.00	1.10	1.46
19/5	1.79	0.58	0.72	1.71	0.62	0.54	2.32	0.04	0.31	1.13	0.00	1.10	1.34
20/5	1.58	0.51	0.72	1.30	0.58	0.54	2.32	0.04	0.31	1.13	0.00	1.10	1.46
21/5	1.58	0.51	0.66	1.13	0.58	0.54	2.32	0.04	0.26	1.95	0.00	1.10	1.34
22/5	1.29	0.51	0.53	1.03	0.53	0.54	2.20	0.03	0.26	3.40	0.00	1.10	1.21
23/5	1.19	0.51	0.53	2.50	0.53	0.54	2.06	0.03	0.21	4.45	1.29	0.83	1.21
24/5	1.09	0.36	0.53	0.93	0.53	0.54	1.80	0.03	0.21	4.81	0.87	0.56	1.09
25/5	1.09	0.36	0.53	0.93	0.49	0.59	1.72	0.03	0.21	5.18	0.87	0.56	0.95
26/5	0.99	0.36	0.53	0.86	0.49	0.59	1.62	0.03	0.21	4.81	0.48	0.56	1.34
27/5	0.88	0.36	0.45	0.86	0.47	0.59	1.36	0.03	0.18	3.75	0.48	0.56	1.46
28/5	0.99	0.36	0.39	0.78	0.47	0.66	1.52	0.03	0.18	2.39	0.37	0.33	1.21
29/5	0.78	0.29	0.39	0.54	0.42	0.89	2.06	0.03	0.18	1.78	0.37	0.33	0.87
30/5	0.78	0.29	0.33	0.54	0.36	0.92	1.80	0.03	0.15	1.24	0.37	0.33	0.68
31/5	0.78	0.25	0.33	0.54	0.31	0.74	1.62	0.03	0.15	1.03	0.37	0.33	0.60

Table L.1.4 Maximum Discharge Estimation of Sub-catchment of Moildy (2/2)

Year Date	1987	1988	1989	1990	1991	1993	1994	1995	1996	1997	1998	1999
1/4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.41	0.00	0.14	0.00	0.00
2/4	0.00	0.00	0.00	6.96	0.00	0.00	0.00	10.72	0.00	0.17	0.00	0.00
3/4	0.00	0.00	0.00	74.15	0.00	0.00	0.00	10.72	0.00	0.14	0.00	0.00
4/4	0.00	0.00	0.00	80.37	0.00	0.00	0.00	31.37	0.00	27.54	0.00	0.00
5/4	0.00	0.00	0.00	79.46	0.00	0.00	0.00	69.52	0.00	60.35	0.00	0.00
6/4	0.00	0.00	0.00	71.40	0.00	0.00	0.00	107.44	0.00	60.35	0.00	0.00
7/4	0.00	0.00	0.00	70.48	0.00	0.00	0.00	103.83	0.00	60.35	0.00	0.00
8/4	0.00	0.00	0.00	69.39	0.00	0.00	0.00	103.60	0.00	66.47	0.00	0.00
9/4	0.00	0.00	0.00	71.40	0.00	0.00	0.00	72.23	0.00	66.47	0.00	0.00
10/4	0.00	0.00	0.00	72.50	0.00	0.00	0.00	41.08	0.00	64.26	0.00	0.00
11/4	0.00	0.00	0.00	76.16	0.00	0.08	0.00	9.71	0.00	49.98	0.00	2.45
12/4	0.05	0.00	0.00	72.13	0.00	22.51	0.00	8.87	0.14	38.59	0.00	2.33
13/4	0.30	0.00	0.00	55.29	3.16	19.25	0.00	7.18	0.18	31.79	0.00	2.55
14/4	0.87	0.00	0.00	45.95	8.18	77.45	0.24	5.91	2.34	23.80	0.00	2.77
15/4	1.60	38.25	0.00	47.23	0.00	125.16	0.44	4.76	18.90	21.08	0.00	5.10
16/4	2.55	53.89	0.00	40.64	0.00	173.08	30.09	4.04	70.59	21.59	0.00	7.43
17/4	4.66	50.32	0.00	38.63	120.19	221.00	28.05	3.75	150.17	22.27	0.00	6.87
18/4	6.52	46.58	0.00	44.30	140.59	99.76	25.84	3.14	176.80	22.78	0.00	6.29
19/4	26.54	33.32	0.00	31.31	139.57	78.49	19.21	3.14	148.88	23.29	5.22	5.73
20/4	90.17	20.06	0.00	18.31	138.38	64.65	15.16	2.84	120.65	23.80	7.49	7.26
21/4	200.60	18.70	0.00	19.04	113.39	79.73	11.97	2.55	92.73	18.70	9.75	8.77
22/4	166.76	17.00	0.00	19.77	88.40	84.48	12.26	2.26	36.58	13.23	8.23	7.09
23/4	117.93	12.26	0.00	19.22	63.41	52.46	11.42	2.03	27.37	11.87	6.70	6.43
24/4	111.65	9.93	51.17	18.49	38.42	45.23	10.86	2.03	19.89	11.24	8.08	5.56
25/4	111.65	8.89	45.56	21.60	28.22	49.78	10.76	1.83	21.50	10.12	9.46	6.12
26/4	87.13	8.21	39.27	24.53	22.44	48.95	9.88	1.60	23.10	9.61	14.60	5.83
27/4	56.74	7.19	32.13	21.60	18.19	50.60	8.99	1.38	24.48	8.62	19.72	6.43
28/4	39.92	5.83	22.95	18.49	14.37	44.41	7.65	1.38	15.92	9.11	17.83	7.09
29/4	35.46	5.47	18.02	17.26	12.50	44.41	7.36	1.17	13.77	8.62	15.92	6.75
30/4	32.42	5.47	13.82	16.04	11.56	44.41	7.14	0.95	13.77	8.16	14.07	5.83
1/5	31.81	4.11	10.54	14.79	9.52	38.00	6.85	0.95	16.65	5.87	12.25	6.43
2/5	27.56	3.30	6.80	13.57	8.84	36.14	6.56	0.90	15.92	5.39	10.42	6.43
3/5	19.35	3.57	9.04	13.25	6.80	36.14	6.27	0.84	13.06	4.35	8.57	6.43
4/5	11.85	4.11	9.79	12.94	6.12	36.14	5.98	0.79	10.97	4.88	11.07	5.83
5/5	11.85	4.45	7.33	12.63	4.76	35.32	5.70	0.74	10.97	5.39	13.57	5.56
6/5	11.41	3.57	7.07	12.32	4.47	25.20	5.41	0.68	10.97	4.88	16.06	5.32
7/5	10.98	3.57	7.60	12.01	4.47	19.31	5.12	0.63	10.97	4.68	18.56	5.08
8/5	10.56	3.57	6.80	11.70	4.18	15.78	4.83	0.63	9.66	4.47	21.12	4.86
9/5	10.56	3.03	6.56	11.39	4.18	12.23	4.54	0.61	9.02	4.28	23.56	4.66
10/5	10.56	2.50	6.80	11.08	3.89	8.70	4.25	0.61	8.37	4.08	21.32	4.45
11/5	10.13	1.68	6.32	10.76	3.89	8.72	3.96	0.59	7.77	3.88	18.91	4.27
12/5	9.71	1.26	6.07	10.45	3.89	8.74	3.67	0.59	7.77	3.62	16.57	3.91
13/5	9.26	1.26	5.37	10.12	3.60	8.78	3.38	0.59	6.58	3.38	14.24	3.57
14/5	8.41	2.50	4.69	9.81	3.60	8.80	3.09	0.56	6.03	3.13	11.92	3.40
15/5	8.41	2.23	4.27	9.50	3.33	8.82	2.81	0.56	5.49	2.89	9.59	3.23
16/5	8.13	2.50	4.27	9.19	3.33	8.90	2.52	0.54	4.97	2.64	8.61	3.06
17/5	7.25	2.23	4.27	8.88	2.47	9.01	2.23	0.54	4.97	2.53	7.62	2.89
18/5	6.97	1.68	4.05	8.57	2.35	9.09	1.94	0.54	4.49	2.45	6.64	2.89
19/5	6.97	1.46	3.45	8.26	2.35	9.19	1.65	0.52	4.49	2.36	5.67	2.89
20/5	5.82	2.23	3.45	7.95	2.23	9.27	1.55	0.52	4.01	2.26	4.67	2.11
21/5	3.18	1.68	3.26	7.63	2.11	8.59	1.43	0.50	4.01	2.16	3.70	2.11
22/5	2.69	1.96	3.26	7.32	1.99	7.91	1.33	0.52	4.01	2.06	3.55	2.11
23/5	1.88	1.68	2.36	7.01	1.87	7.23	1.21	0.52	4.01	1.96	3.43	1.89
24/5	1.72	1.11	2.21	6.70	1.73	6.55	1.11	0.54	3.56	1.85	3.29	1.89
25/5	1.50	1.26	1.62	6.39	1.62	5.87	1.00	0.54	3.56	1.77	3.15	1.65
26/5	1.40	0.95	1.26	6.08	1.62	5.31	0.90	0.56	3.56	1.67	3.03	1.39
27/5	1.20	0.80	1.14	5.77	1.50	4.73	0.80	0.56	3.14	1.56	2.88	1.39
28/5	1.20	0.68	1.04	5.46	1.38	4.17	0.70	0.59	3.14	1.46	2.82	1.39
29/5	1.20	0.56	0.94	5.14	1.26	3.59	0.60	0.56	2.76	1.36	2.76	1.39
30/5	1.09	0.56	0.85	4.83	1.26	3.04	0.49	0.56	2.76	1.26	2.68	1.65
31/5	1.09	0.56	0.85	4.52	1.14	2.87	0.48	0.54	2.76	1.16	2.62	1.65

Table L.1.5 Maximum Discharge Estimation of Sub-catchment of Vyacheslavsky (1/2)

Year Date	1975	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	1987	1988
1/4	0.93	0.00	0.00	84.04	0.00	28.54	0.00	59.55	50.03	0.00	0.00	0.00	0.00
2/4	1.39	0.00	0.00	144.49	0.00	30.75	0.00	75.54	40.14	0.00	0.00	0.00	0.00
3/4	4.28	0.00	0.00	127.73	0.00	19.44	2.03	179.95	72.41	0.58	0.00	0.00	0.00
4/4	10.92	0.00	0.00	96.89	0.00	114.75	4.04	477.58	117.94	11.65	0.00	0.00	0.00
5/4	21.55	0.00	3.89	69.95	0.00	69.30	6.07	474.86	220.69	18.18	0.00	0.00	0.00
6/4	27.07	0.00	8.53	66.67	0.00	66.33	8.10	321.17	277.66	134.77	0.00	0.00	0.00
7/4	43.30	1.40	27.36	49.99	0.00	51.33	10.40	247.36	154.33	365.09	0.11	0.00	0.00
8/4	43.26	2.80	52.39	48.27	0.00	17.46	12.71	187.41	118.65	475.97	14.96	0.00	0.00
9/4	42.64	4.20	209.48	47.54	0.00	14.73	13.01	160.08	154.86	496.06	54.35	0.00	4.60
10/4	39.21	5.60	389.73	23.33	0.00	11.86	51.46	235.59	243.69	322.72	44.07	0.00	173.28
11/4	50.41	10.95	340.86	29.41	0.00	10.81	148.65	410.99	145.04	268.53	47.98	0.00	279.08
12/4	59.09	54.38	208.76	33.95	0.00	9.85	167.97	285.53	132.14	298.67	61.81	0.06	372.62
13/4	54.00	183.48	172.81	27.11	0.00	9.38	186.38	131.65	132.73	384.03	115.65	1.08	487.63
14/4	44.11	164.33	131.20	18.22	0.00	8.52	188.57	93.51	83.68	474.49	681.87	2.44	398.69
15/4	31.89	155.07	83.24	15.83	0.00	7.31	67.73	69.68	68.31	269.16	574.57	3.99	288.96
16/4	23.74	233.70	65.91	13.90	4.50	6.14	57.93	60.44	64.91	189.64	811.59	5.77	243.29
17/4	18.67	547.11	44.52	12.89	22.85	5.79	54.95	52.57	82.63	166.58	685.48	8.83	195.81
18/4	14.29	517.42	39.15	12.89	90.19	5.79	44.73	51.02	99.88	163.15	503.95	31.23	162.87
19/4	10.83	527.54	28.00	12.83	175.23	5.30	33.35	43.77	155.23	132.53	304.35	325.82	120.22
20/4	9.42	332.14	23.76	11.76	184.65	5.37	29.87	37.76	134.94	123.70	113.00	574.87	68.68
21/4	8.58	166.42	17.81	11.76	502.11	5.02	28.32	35.01	232.43	113.06	96.64	739.75	59.52
22/4	7.83	123.34	13.16	10.21	518.68	4.60	26.70	33.36	89.20	95.27	79.69	702.53	53.51
23/4	5.55	103.72	11.19	8.44	512.78	4.56	23.23	29.29	86.68	88.79	64.65	420.92	42.62
24/4	5.58	92.53	8.92	7.39	333.88	4.56	19.47	24.72	58.96	75.93	58.49	280.53	36.53
25/4	4.97	68.21	8.07	6.51	256.61	4.24	17.61	24.53	35.80	66.13	51.15	287.04	25.42
26/4	4.60	50.49	7.39	5.72	132.89	3.93	16.13	22.75	22.51	54.58	46.17	242.71	21.30
27/4	4.37	41.62	6.99	4.92	96.47	3.90	15.27	20.85	17.08	31.07	38.83	196.25	17.88
28/4	4.70	38.37	6.99	4.81	68.75	3.30	14.54	19.85	9.50	24.40	31.10	134.34	14.40
29/4	4.45	34.10	6.20	4.24	45.13	2.99	12.23	17.44	9.50	17.07	23.06	101.22	12.80
30/4	4.08	32.89	5.89	4.35	33.25	2.98	9.94	16.03	9.50	12.93	15.84	84.86	11.74
1/5	4.08	36.74	5.89	4.11	22.57	2.98	8.37	17.40	8.03	12.85	16.16	82.74	10.25
2/5	3.95	37.19	5.62	3.96	19.45	2.97	7.19	16.87	7.29	7.98	14.64	79.51	9.35
3/5	5.23	36.00	5.21	3.81	18.07	2.96	6.56	17.57	6.63	7.53	14.34	64.69	10.11
4/5	6.18	34.41	5.13	3.62	18.90	2.65	6.09	16.51	6.28	7.53	12.98	45.05	9.79
5/5	6.92	33.39	4.89	3.49	16.45	2.95	5.57	14.77	5.35	6.21	11.03	39.99	10.62
6/5	11.46	29.47	5.57	3.20	14.42	2.67	5.57	13.21	5.08	6.19	11.03	40.58	9.65
7/5	11.95	23.31	5.26	3.05	12.39	2.67	5.04	13.03	4.81	6.17	9.29	46.26	9.65
8/5	11.52	19.10	4.80	2.92	11.78	2.24	4.14	12.17	4.27	5.29	7.83	82.15	10.11
9/5	6.77	18.46	4.26	2.70	10.18	2.22	4.06	11.31	4.01	4.88	7.63	62.26	8.59
10/5	5.10	17.40	4.01	2.55	9.60	2.01	3.95	9.78	3.74	4.49	7.28	42.72	7.07
11/5	4.28	13.35	3.81	2.40	9.96	2.01	3.54	7.66	3.74	4.49	7.07	46.23	5.38
12/5	4.09	12.46	3.56	2.21	10.83	1.78	3.16	5.71	3.74	4.49	6.87	40.70	4.57
13/5	3.92	12.02	3.41	2.03	11.34	1.78	2.46	3.59	3.22	3.67	9.13	35.15	4.57
14/5	3.18	16.06	3.51	1.85	12.08	1.39	0.42	3.59	2.97	3.65	8.80	31.13	6.28
15/5	2.74	11.28	3.26	1.70	11.84	1.38	0.42	4.98	2.73	3.65	7.77	29.15	5.98
16/5	2.74	9.43	2.86	1.49	9.93	1.38	0.42	5.09	2.27	3.21	6.86	25.70	6.28
17/5	2.34	9.28	2.56	1.36	9.21	1.38	0.34	3.70	2.27	3.21	7.62	23.14	5.98
18/5	2.34	6.10	2.56	1.21	8.35	1.21	0.34	3.70	2.04	2.86	7.62	21.65	5.04
19/5	2.25	5.38	2.31	1.08	8.35	1.21	0.34	3.70	2.04	2.85	6.73	19.89	5.14
20/5	2.25	4.92	2.26	0.93	8.35	1.21	0.34	4.59	2.04	2.85	6.51	16.87	5.98
21/5	1.78	4.37	2.26	0.97	7.98	1.21	0.28	5.99	2.04	2.75	6.04	13.39	5.38
22/5	1.62	3.90	2.21	1.00	7.47	1.20	0.60	7.59	1.80	2.68	5.54	12.28	5.68
23/5	1.62	5.52	2.01	1.06	7.32	1.02	0.55	8.26	3.22	2.38	4.84	9.63	5.38
24/5	1.62	3.44	2.01	1.10	6.67	1.02	0.55	8.64	2.58	2.08	4.02	8.88	4.74
25/5	1.62	3.44	1.96	1.19	6.22	1.02	0.23	9.55	2.76	2.01	3.87	7.46	4.57
26/5	1.62	3.04	2.16	1.23	6.11	1.02	0.23	10.73	2.33	2.01	3.60	5.72	4.24
27/5	1.54	3.04	2.34	1.27	5.82	0.85	0.20	6.50	2.33	2.01	3.74	4.53	4.07
28/5	1.47	2.96	2.34	1.41	6.00	0.85	0.20	4.53	2.45	1.66	3.28	4.53	3.60
29/5	1.30	2.69	2.09	1.70	6.59	0.68	0.20	3.63	2.45	1.66	2.76	5.49	3.13
30/5	1.07	2.69	1.81	1.76	5.82	1.58	0.17	3.04	2.45	1.66	2.38	5.85	2.92
31/5	1.07	3.01	1.77	1.60	5.62	0.68	0.17	2.80	2.45	1.66	2.28	6.43	2.92
Max	59	550	390	150	520	120	190	410	280	500	820	740	490

Table L.1.5 Maximum Discharge Estimation of Sub-catchment of Vyacheslavsky (2/2)

1989	1990	1991	1993	1994	1995	1996	1997	1998	1999
1.48	3.29	0.24	0.00	0.00	203.09	0.00	5.05	0.00	0.00
10.85	28.35	0.49	0.00	0.00	131.03	0.00	60.08	0.00	0.00
19.14	135.45	0.73	0.00	0.00	103.13	0.00	86.05	0.00	0.00
22.47	151.49	0.79	0.00	0.18	124.08	0.00	142.21	0.00	0.00
51.92	151.64	0.82	0.00	0.36	233.22	0.00	246.06	0.00	0.00
84.71	148.53	0.87	0.00	0.53	438.36	0.00	370.98	0.00	0.73
147.11	160.33	0.93	0.00	0.71	471.71	0.00	319.64	0.00	1.20
161.59	498.55	0.96	0.00	0.89	357.53	0.00	312.68	0.00	1.67
95.02	663.41	1.01	0.00	3.34	244.84	0.00	276.75	0.00	2.14
62.57	621.90	2.92	0.00	5.78	164.42	0.00	209.98	0.00	2.60
41.60	489.57	11.77	0.09	8.23	94.55	2.56	133.35	0.00	5.75
36.61	426.00	119.47	24.76	10.68	67.51	4.74	114.66	0.00	6.10
17.47	349.97	200.84	22.14	27.64	57.79	6.06	101.02	0.00	6.81
12.98	280.55	340.84	87.13	44.84	46.18	11.76	86.24	0.34	7.51
18.64	190.95	347.57	140.58	62.00	40.40	57.76	77.09	0.51	11.08
20.80	162.34	686.40	194.26	109.18	30.96	221.27	70.46	2.43	15.11
15.98	158.48	579.33	247.93	96.23	25.14	561.29	65.91	4.35	14.47
15.48	148.13	725.78	141.08	86.08	21.01	558.09	64.07	6.26	13.82
19.30	107.05	544.76	472.84	70.31	18.77	356.14	67.03	13.92	13.19
17.47	76.65	459.61	690.94	58.43	18.00	240.37	66.39	18.34	14.86
12.98	63.66	402.43	764.09	43.03	17.24	212.92	59.58	18.96	13.83
12.26	51.32	303.33	769.31	40.67	16.47	134.29	50.31	16.63	10.99
11.90	45.62	236.55	437.15	37.08	15.77	82.92	44.88	14.31	9.46
68.19	44.82	197.71	255.27	33.64	15.34	62.31	41.62	17.50	8.51
62.01	46.60	170.59	268.75	30.86	14.66	55.74	38.16	20.71	8.25
54.38	49.82	155.33	245.21	27.21	13.96	53.04	35.55	28.03	7.72
50.52	45.29	142.44	230.06	23.50	13.26	53.74	33.95	35.35	8.18
38.89	41.86	117.45	166.69	19.32	12.83	42.90	33.98	34.92	8.77
31.97	39.03	85.35	129.92	18.63	12.15	39.11	32.41	34.53	8.54
25.85	37.03	75.24	112.95	18.03	11.00	36.27	30.71	31.35	7.53
21.58	35.00	53.79	104.02	17.34	10.08	38.84	28.18	28.34	8.18
16.80	32.99	48.15	103.86	16.65	9.13	37.45	27.32	25.16	8.18
18.77	30.63	38.22	96.32	15.98	8.15	33.70	25.83	22.03	8.18
19.42	27.92	31.71	81.47	15.29	7.19	30.78	26.24	23.67	7.39
17.38	26.56	28.64	73.97	14.62	6.22	30.17	26.46	21.33	7.09
17.10	25.71	25.88	64.25	13.93	5.24	29.54	25.73	22.18	6.83
17.68	24.86	21.39	65.79	13.24	4.29	28.93	25.33	24.44	6.44
16.80	23.50	18.85	109.27	12.49	3.37	26.87	25.11	27.74	6.19
15.87	23.16	16.63	79.44	11.87	2.44	25.54	24.90	30.98	5.97
16.80	22.30	15.20	50.10	11.48	2.38	24.22	24.51	29.15	5.74
16.28	20.25	14.50	55.31	11.07	2.32	22.82	23.09	27.20	5.54
15.33	17.89	13.80	48.73	10.68	2.26	22.07	21.44	23.92	5.05
12.65	17.53	12.78	42.18	10.27	2.20	20.01	19.98	21.35	4.68
12.48	16.79	12.09	38.20	9.87	2.13	18.68	18.43	18.18	4.41
11.43	15.73	10.37	35.63	9.47	2.07	17.35	16.92	14.56	4.16
12.02	14.45	8.28	31.64	9.07	1.99	16.03	15.39	12.70	3.92
10.85	13.79	7.32	29.66	8.68	1.93	15.28	14.01	10.75	3.74
10.03	12.51	6.82	28.21	8.27	1.89	14.02	12.67	9.46	3.71
8.79	11.86	6.82	26.04	7.30	1.81	13.29	11.31	8.19	3.71
7.96	11.52	6.33	23.85	6.53	1.81	12.01	9.95	6.94	2.81
7.33	10.86	6.56	22.34	6.34	1.78	11.44	9.25	5.58	2.81
6.92	10.26	6.07	20.84	6.17	1.79	10.87	8.56	5.30	2.81
5.93	9.91	5.20	17.80	5.96	1.79	10.30	7.87	5.16	2.55
5.41	9.57	5.05	16.30	5.79	1.81	9.24	7.17	4.91	2.57
4.76	9.23	4.55	14.02	5.62	1.81	8.67	6.48	4.75	2.29
4.01	8.62	4.19	11.28	5.45	1.84	8.10	5.79	4.62	2.01
3.88	8.05	4.06	9.40	5.28	1.82	7.07	5.09	4.34	2.01
3.42	7.50	3.66	8.78	5.09	1.84	6.51	4.40	4.28	2.00
3.31	7.15	3.25	9.40	4.92	1.82	5.51	3.70	4.21	2.00
2.87	6.81	2.99	9.40	4.75	1.82	4.94	3.01	4.12	2.26
2.87	6.47	2.86	9.97	3.85	1.79	4.97	2.90	3.97	2.26
170	670	690	770	110	480	560	370	35	15

Table L.1.6 Design High Water Level Estimation

Section	Partial Distance (m)	Accumulated Distance (m)	Existing Left Bank Elevation EL(m)	Existing Right Bank Elevation EL(m)	Estimated Riverbed EL(m)	Design Riverbed EL(m)	H.W.L. EL(m)	D.H.W.L. EL(m)	Crest of Dike EL(m)
S-1	0	0	337.0	337.0	335.5	335.5	338.50	338.87	339.87
S-2	1,000	1,000	338.0	338.0	336.0	336.0	339.25	339.38	340.38
S-3	1,500	2,500	339.0	339.0	336.8	336.8	340.15	340.15	341.15
S-4	1,500	4,000	341.0	341.0	337.5	337.5	340.96	340.92	341.92
S-5	2,000	6,000	342.4	344.4	338.5	338.5	341.97	341.95	342.95
S-6	2,000	8,000	343.6	343.4	339.5	339.5	342.97	342.97	343.97
S-7	2,000	10,000	344.0	344.0	340.3	340.3	343.74	343.74	344.74
S-8	1,000	11,000	345.6	347.4	341.0	341.0	345.57	346.41	347.41
S-9	500	11,500	345.8	347.4	341.3	341.3	345.87	346.54	347.54
S-10	500	12,000	345.4	348.1	341.5	341.5	346.67	346.67	347.67
S-11	1,000	13,000	348.1	348.1	342.0	340.0	346.74	346.92	347.92
S-12	600	13,600	348.1	348.1	342.3	342.0	346.94	347.07	348.07
S-13	2,000	15,600	347.0	347.0	343.3	342.9	347.26	347.58	348.58
S-14	2,000	17,600	347.0	347.3	344.3	343.3	347.84	348.08	349.08
S-15	1,200	18,800	350.0	350.0	344.9	343.8	349.70	349.70	350.70
S-16	800	19,600	348.0	348.0	345.3	342.6	349.82	350.00	351.00
S-17	2,000	21,600	350.0	350.0	346.3	344.6	350.08	350.77	351.77
S-18	2,000	23,600	351.0	350.0	347.3	345.0	350.52	351.53	352.53
S-19	2,000	25,600	353.0	353.0	348.3	348.3	351.42	352.29	353.29
S-20	2,000	27,600	354.1	354.1	349.3	349.3	352.70	353.06	354.06
S-21	2,000	29,600	354.0	354.0	350.3	350.3	353.75	353.82	354.82
S-22	500	30,100	354.0	354.0	350.6	350.6	354.01	354.01	355.01
Total	30,100								

Table L.1.7 Flood Regulating Cimulation for Flood Regulating Basin

Orifice Size:		B= 60.0		d= 2.0		ill Elevation= 353.0	
Duration (days)	Inflow (m ³ /s)	Inflow Volume (MCM)	Beginning Volume (MCM)	Beginning WL EL (m)	Outflow (m ³ /s)	Outflow Volume (MCM)	Storage Volume (MCM)
			0				
1	0	0	0	353.0	0	0	0
2	9	0	0	353.0	0	0	0
3	46	2	2	353.5	225	10	0
4	77	3	3	354.0	319	12	0
5	197	8	8	354.5	390	17	0
6	325	14	14	355.0	451	19	0
7	457	20	20	355.0	451	19	0
8	529	23	25	355.5	504	22	4
9	501	22	23	355.5	504	22	1
10	894	39	50	356.0	552	23	27
11	1,065	46	92	357.0	638	27	65
12	1,178	51	137	357.5	676	28	108
13	1,254	54	186	358.0	713	30	156
14	1,263	55	235	358.5	748	32	203
15	914	39	260	358.5	748	32	228
16	725	31	261	358.5	748	32	229
17	633	27	253	358.5	748	32	221
18	562	24	239	358.5	748	32	207
19	440	19	214	358.0	713	32	183
20	348	15	184	358.0	713	31	153

Table L.2.1 Annual Maximum Precipitation

Year	24 hrs		60 min		10 min		Year	24 hrs		60 min		10 min	
	Precipitation (mm)	Date	Precipitation (mm)	Date	Precipitation (mm)	Date		Precipitation (mm)	Date	Precipitation (mm)	Date	Precipitation (mm)	Date
1936	28.7	Aug 23	-	- -	-	- -	1968	42.7	May 30	5.2	Jun 16	2.6	Jun 16
1937	14.8	Jun 26	-	- -	-	- -	1969	67.7	Jul 4	36.5	Jul 4	21.2	Jul 4
1938	15.5	Jun 10	-	- -	-	- -	1970	23.6	Sep 3	-	- -	-	- -
1939	34.0	Sep 9	-	- -	-	- -	1971	20.8	Aug 10	-	- -	-	- -
1940	23.8	Aug 16	-	- -	-	- -	1972	85.8	Jul 12	-	- -	-	- -
1941	32.1	Jul 26	-	- -	-	- -	1973	21.2	Jun 2	-	- -	-	- -
1942	24.5	Jul 29	-	- -	-	- -	1974	44.2	Jul 11	40.0	Jul 11	12.6	Jul 11
1943	9.1	Apr 16	-	- -	-	- -	1975	12.5	Jul 28	11.3	Jul 28	6.4	Jul 28
1944	32.0	Jul 9	-	- -	-	- -	1976	20.5	Apr 19	-	- -	-	- -
1945	16.1	May 6	-	- -	-	- -	1977	19.6	Aug 19	19.6	Aug 19	13.9	Aug 19
1946	27.0	Jul 31	-	- -	-	- -	1978	29.5	May 23	6.1	Jul 4	2.3	Jul 4
1947	35.8	Aug 8	-	- -	-	- -	1979	25.0	Jul 11	20.7	Jul 11	6.0	Jul 11
1948	18.0	Jun 2	-	- -	-	- -	1980	21.2	Aug 12	13.8	Jul 24	6.9	Jul 24
1949	19.7	Jun 15	-	- -	-	- -	1981	25.8	Jun 24	25.4	Jun 24	14.6	Jun 24
1950	13.8	May 7	-	- -	-	- -	1982	21.6	Aug 20	-	- -	-	- -
1951	12.2	Jun 12	-	- -	-	- -	1983	23.7	Jun 8	-	- -	-	- -
1952	49.6	Sep 4	-	- -	-	- -	1984	20.7	Oct 22	-	- -	-	- -
1953	27.0	Jul 27	-	- -	-	- -	1985	18.4	Jul 5	-	- -	-	- -
1954	30.7	Jun 22	-	- -	-	- -	1986	22.8	Jun 13	17.3	Jun 13	4.5	Jun 13
1955	10.7	Dec 1	-	- -	-	- -	1987	40.9	Jun 17	15.0	Jun 17	7.5	Jun 17
1956	28.8	Jun 8	-	- -	-	- -	1988	18.8	Jul 12	18.0	Jul 12	15.0	Jul 12
1957	19.6	Aug 1	-	- -	-	- -	1989	17.4	May 3	2.1	Jun 16	1.5	Jun 16
1958	23.9	Jul 30	-	- -	-	- -	1990	35.0	Jul 20	35.0	Jul 20	18.2	Jul 20
1959	18.2	Jun 8	-	- -	-	- -	1991	14.0	Jul 28	14.0	Jul 28	10.4	Jul 28
1960	27.0	- -	-	- -	-	- -	1992	22.2	Jul 24	7.7	Jul 24	2.3	Jul 1
1961	42.0	Jul 21	-	- -	-	- -	1993	21.2	Jul 25	20.9	Jul 25	11.5	Jul 25
1962	76.6	Aug 9	-	- -	-	- -	1994	16.2	Jul 27	12.6	Jul 27	9.3	Jul 27
1963	34.3	Sep 13	13.7	Jul 9	3.5	Jul 9	1995	40.7	Aug 23	-	- -	-	- -
1964	25.6	Aug 31	12.0	Aug 31	6.7	Aug 31	1996	32.1	Aug 28	-	- -	-	- -
1965	25.2	Sep 20	10.3	Jun 24	8.7	Jun 24	1997	13.7	May 20	-	- -	-	- -
1966	17.7	Aug 8	10.0	Jul 11	5.4	Jul 11	1998	38.5	Jul 17	-	- -	-	- -
1967	25.5	Aug 14	15.4	Jul 31	9.1	Jul 31	1999	24.6	Jun 25	-	- -	-	- -

Table L.2.2 Storm Water Run-off Coefficient Estimation

Planning Region	Sub-Zoning	Residential Area				Other Area (ha) (estimated as lawn)	Calculated Coefficient	Proposed Coefficient
		Low Density (ha)	Med Density (ha)	High density (ha)	Sub Total (ha)			
1. Central Planning	Residential District 3	23	277	0	300	85	0.18	0.20
	Residential District 4A	28	283	26	336	227	0.15	0.15
	Residential District 5	73	196	0	268	89	0.17	0.20
	Residential District 6	42	227	0	269	115	0.17	0.20
2. Northern Planning	Northern Industrial District	184	0	0	184	1,962	0.05	0.10
	Central Industrial District	118	0	0	118	3,235	0.04	0.10
3. Southeastern	Residential District 7	8	212	98	318	244	0.14	0.15
	Residential District 8	0	149	0	149	246	0.11	0.10
	Residential District 9	215	118	0	333	219	0.15	0.15
	Residential District 10	148	0	0	148	65	0.16	0.15
	Industrial District - Station 40	136	0	0	136	616	0.07	0.10
	Residential District 17	44	239	123	406	309	0.14	0.15
	Residential District 18	305	75	0	380	522	0.11	0.10
	Residential District 19	121	99	0	220	563	0.09	0.10
4. Southern Planning	Residential District 11	309	106	76	490	761	0.11	0.10
	Residential District 12	342	0	0	342	326	0.13	0.15
	Residential District 13	199	0	0	199	743	0.08	0.10
	Residential District 14	155	27	127	309	1,116	0.08	0.10
	Residential District 15	291	0	0	291	529	0.10	0.10
	Residential District 16	185	219	0	404	529	0.12	0.15
5. Northwest	Residential District 1	96	32	0	128	204	0.11	0.10
	Residential District 2	125	157	0	281	160	0.15	0.15
	West Industrial District	12	0	0	12	563	0.04	0.10
	Residential District 4B	214	156	52	422	263	0.15	0.15

Table L.2.3 Storm Water Chatchment

Storm Water Catchment No.		Storm Water Collection Area (Residential District)	Area (ha)	Run-off Coefficient	Estimated Storm Water Run-off (m ³ /s)	Unit Run-off (m ³ /s/ha)	Discharge Place
1	1	1	844	0.100	3.2	0.004	Existing Canal
2	2	2,4B	760	0.150	3.1	0.004	Ishim River
3	3	3	770	0.200	4.1	0.005	Ishim River
4	4A	4A	393	0.150	1.9	0.005	Ishim River
5	4B	4B	353	0.150	1.5	0.004	Ishim River
6	6	5,6	867	0.200	4.2	0.005	Akbulak River
7	7	7	563	0.150	2.3	0.004	Akbulak River
8	8	8,10	607	0.100	1.6	0.003	Akbulak River
9	9	9,13,17	890	0.150	2.6	0.003	Ishim River
10	11 a	11	301	0.100	1.1	0.004	New Pond
11	11 b	11	329	0.100	1.1	0.003	Ishim River
12	12	12	693	0.150	2.6	0.004	New Pond
13	13	13	407	0.100	1.3	0.003	New Pond
14	14	14	660	0.100	1.7	0.003	New Pond
15	15	15	400	0.100	1.2	0.003	Ishim River
16	16	16	680	0.150	3.0	0.004	Ishim River
17	17	13,17	659	0.150	2.2	0.003	Ishim River
18	18a	18	383	0.100	0.9	0.002	Ishim River
19	18b	17,18,Station 40	1,128	0.100	2.6	0.002	Existing Pond
20	19	19	380	0.100	1.0	0.003	Ishim River
21	Na	North Industry	351	0.100	1.2	0.003	Sarybulak River
22	Nb	North Industry	1,009	0.100	2.6	0.003	Sarybulak River
23	Nc	North Industry	601	0.100	1.7	0.003	Sarybulak River
24	Nd	North Industry	449	0.100	1.1	0.003	Sarybulak River
25	Ca	Central Industry	554	0.100	1.0	0.002	Akbulak River
26	Cb	Central Industry	739	0.100	2.1	0.003	Akbulak River
27	Cc	Central Industry	525	0.100	1.3	0.002	Akbulak River
28	Cd	Central Industry	1,445	0.100	2.8	0.002	Akbulak River

FIGURE

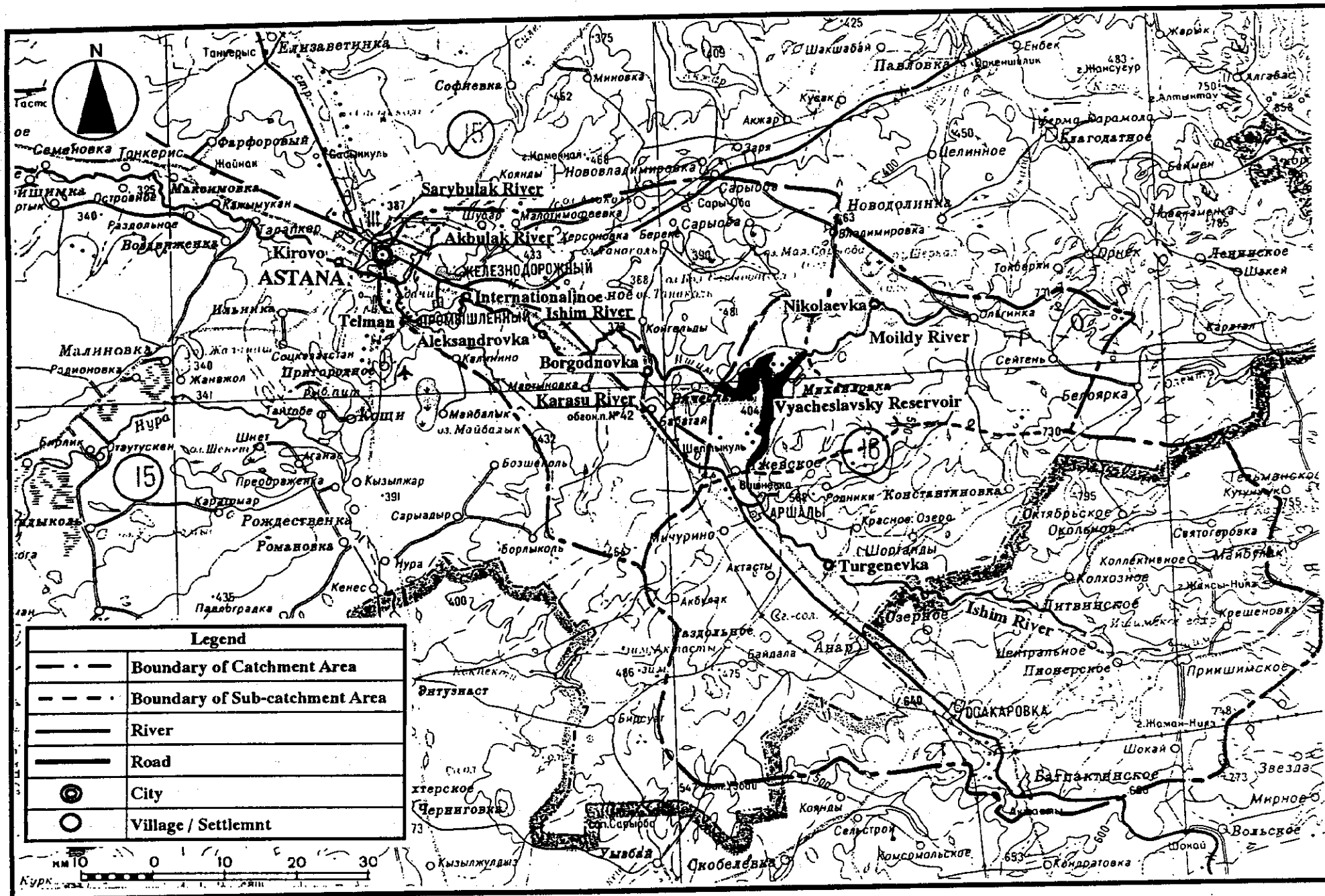


Figure L.1.1 General Location Map

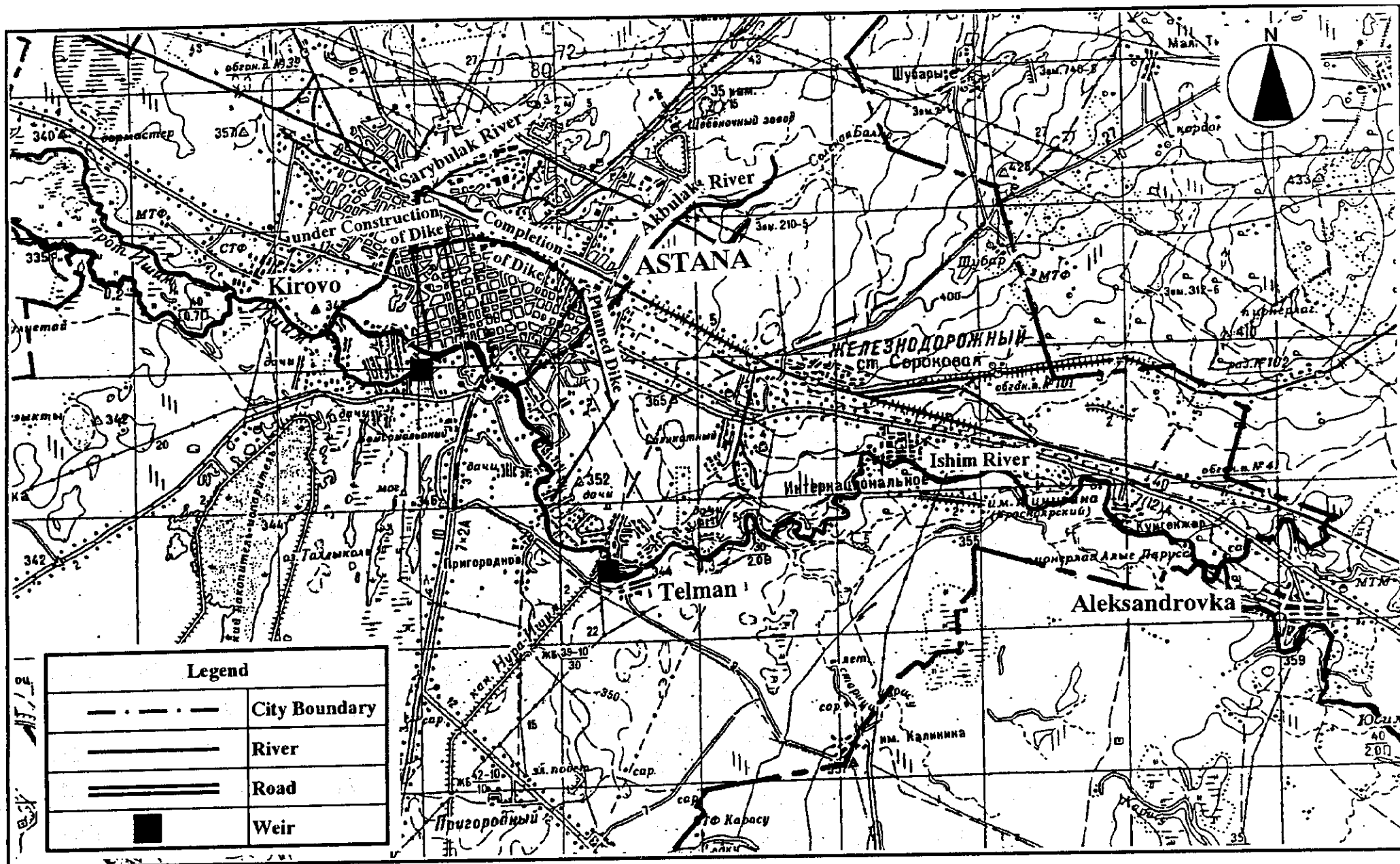


Figure F.1.2 River Structures around ASTANA

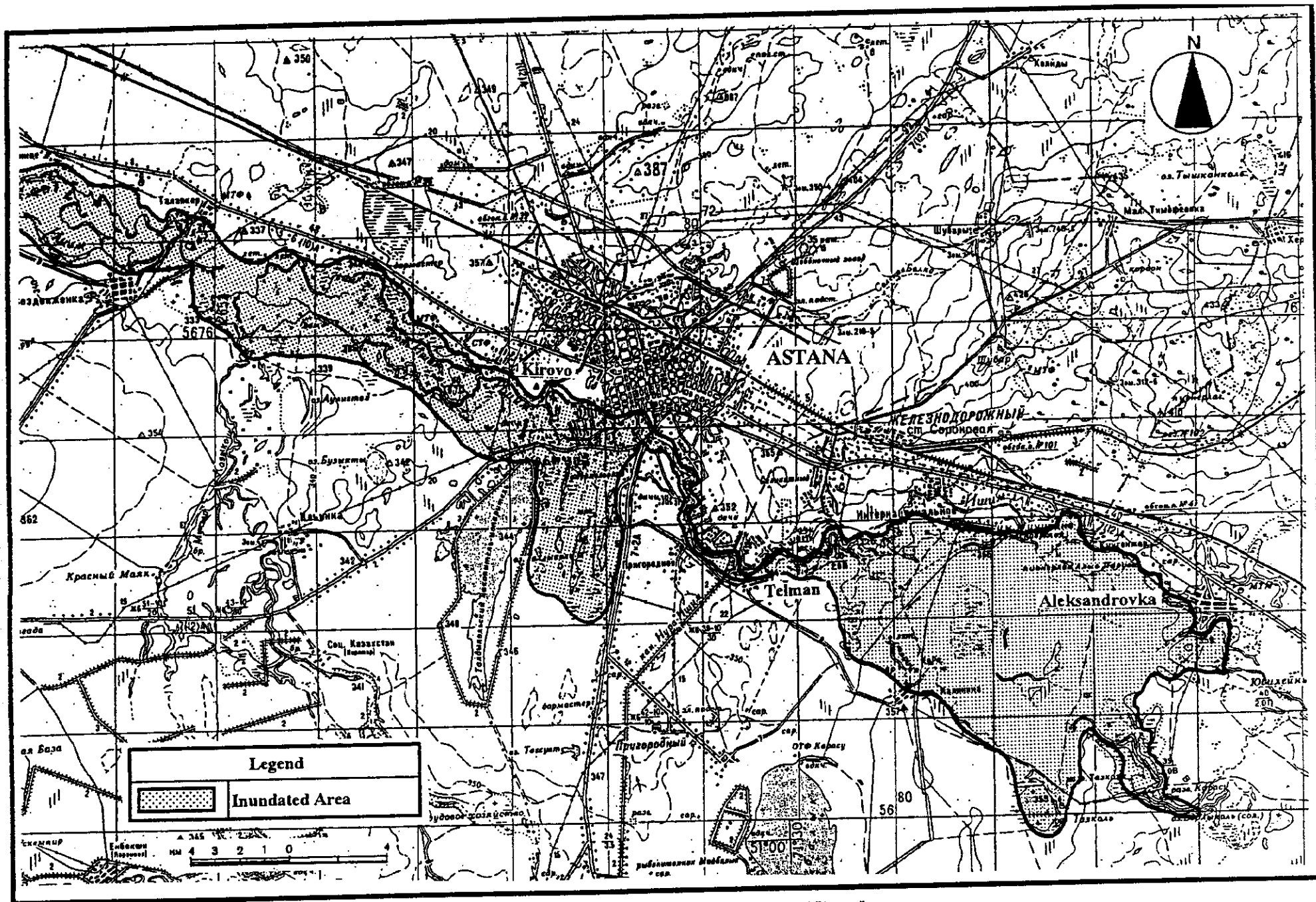


Figure L.1.3 Inundated Area of 1993 Flood

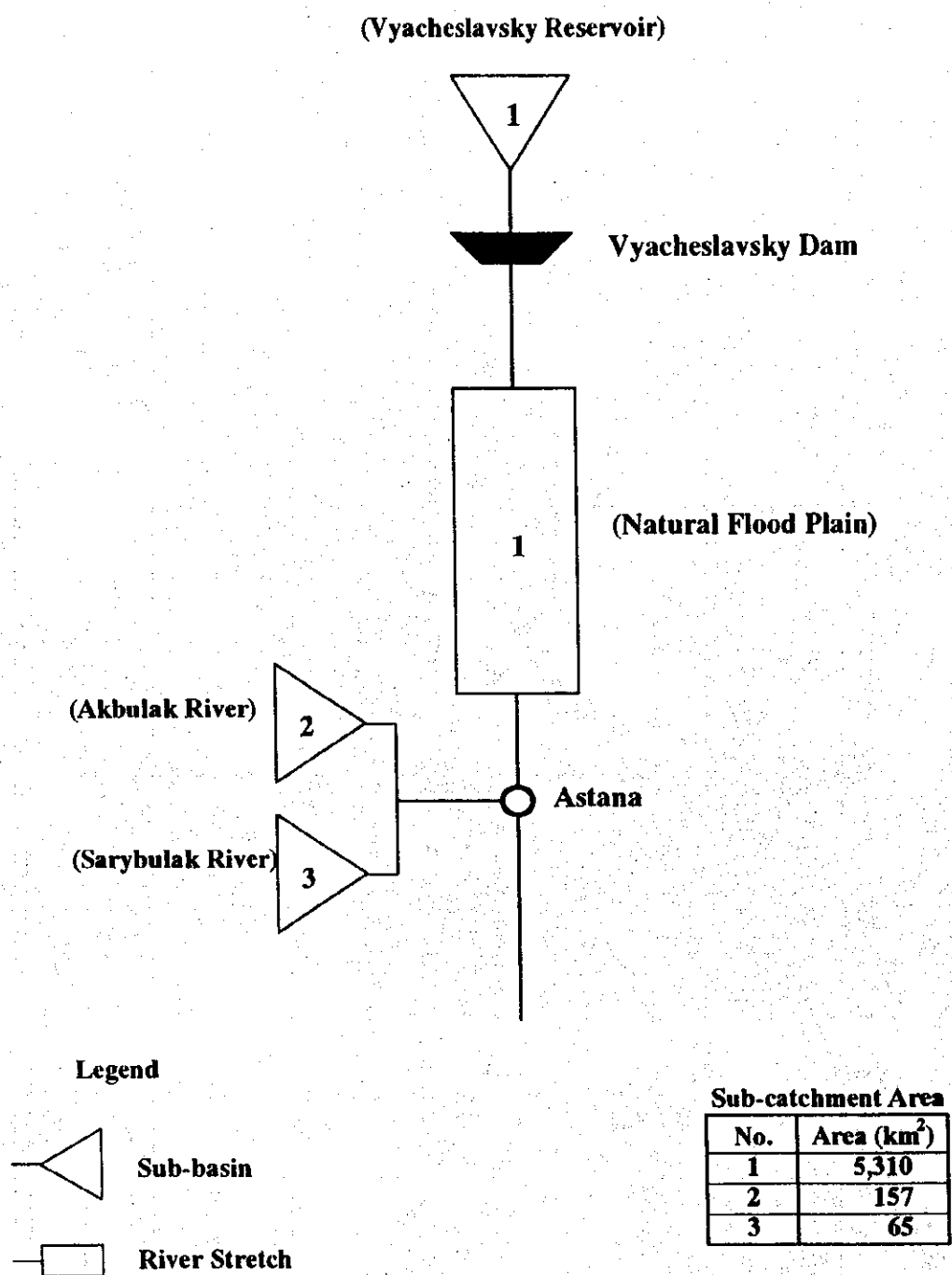


Figure L.1.4 Schematic Diagram of Flood Routing Model

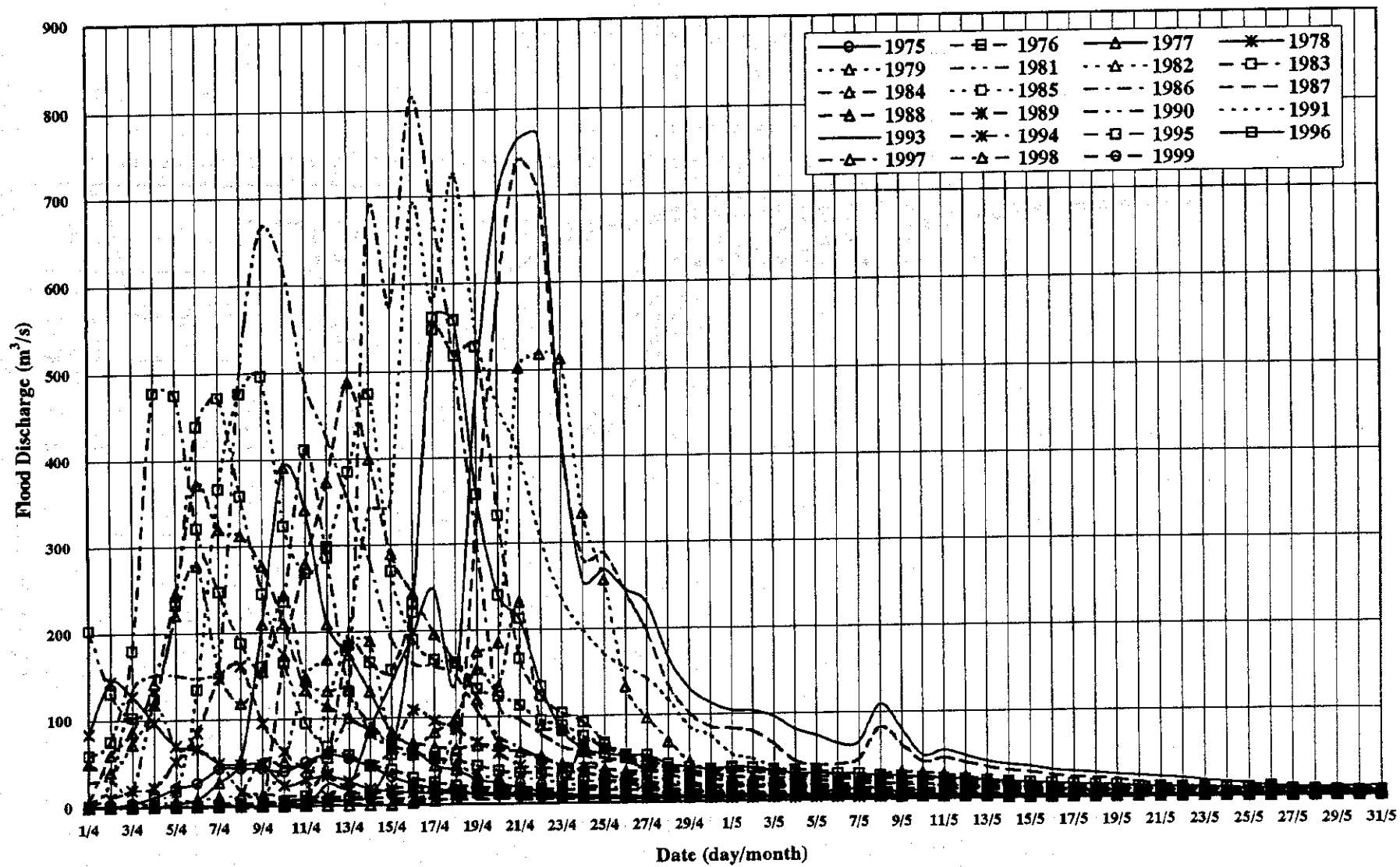


Figure L.1.5 Hydrographs of Past Flood from 1975 to 1999

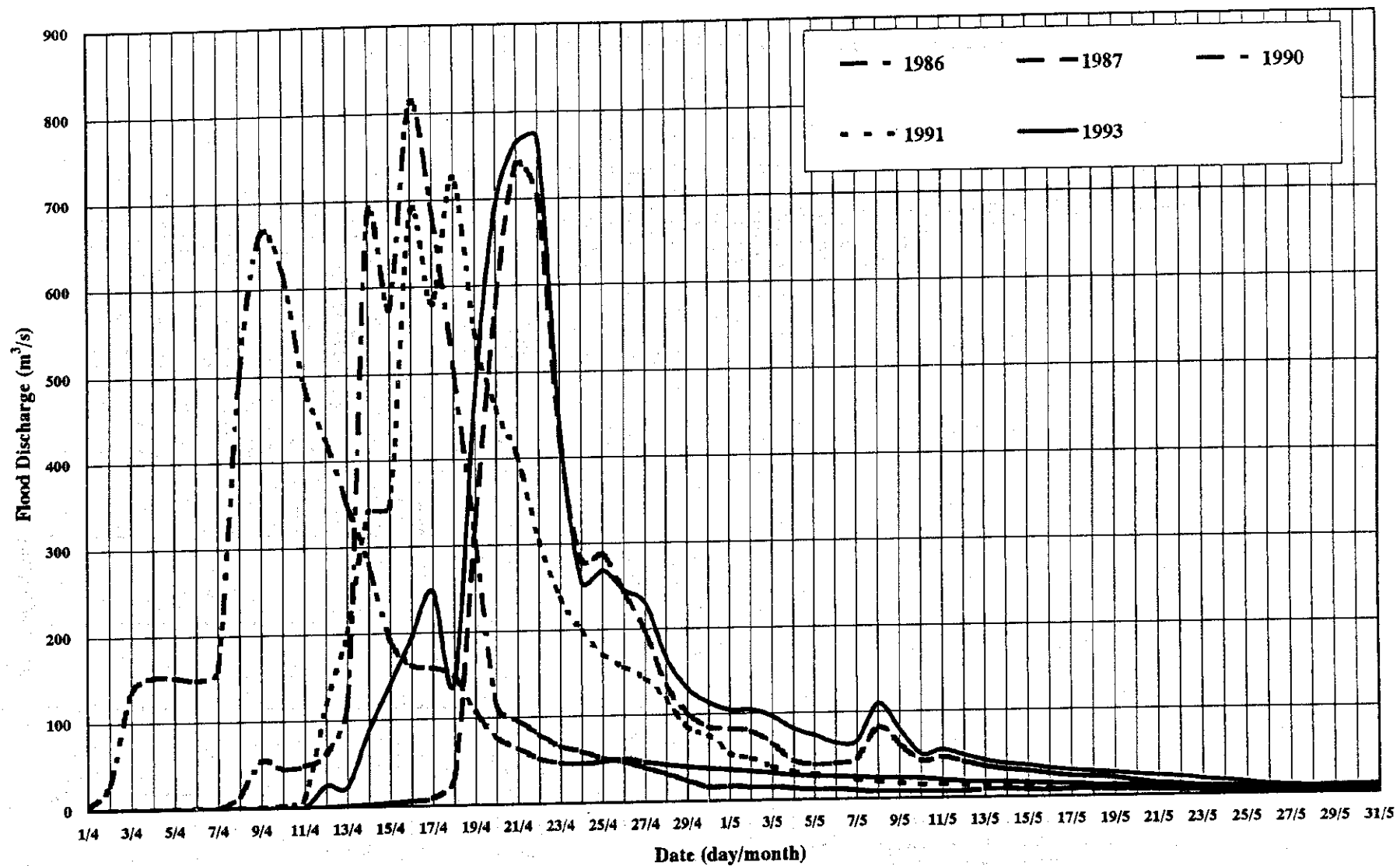


Figure L.1.6 Selected Past Flood Discharge Hydrographs

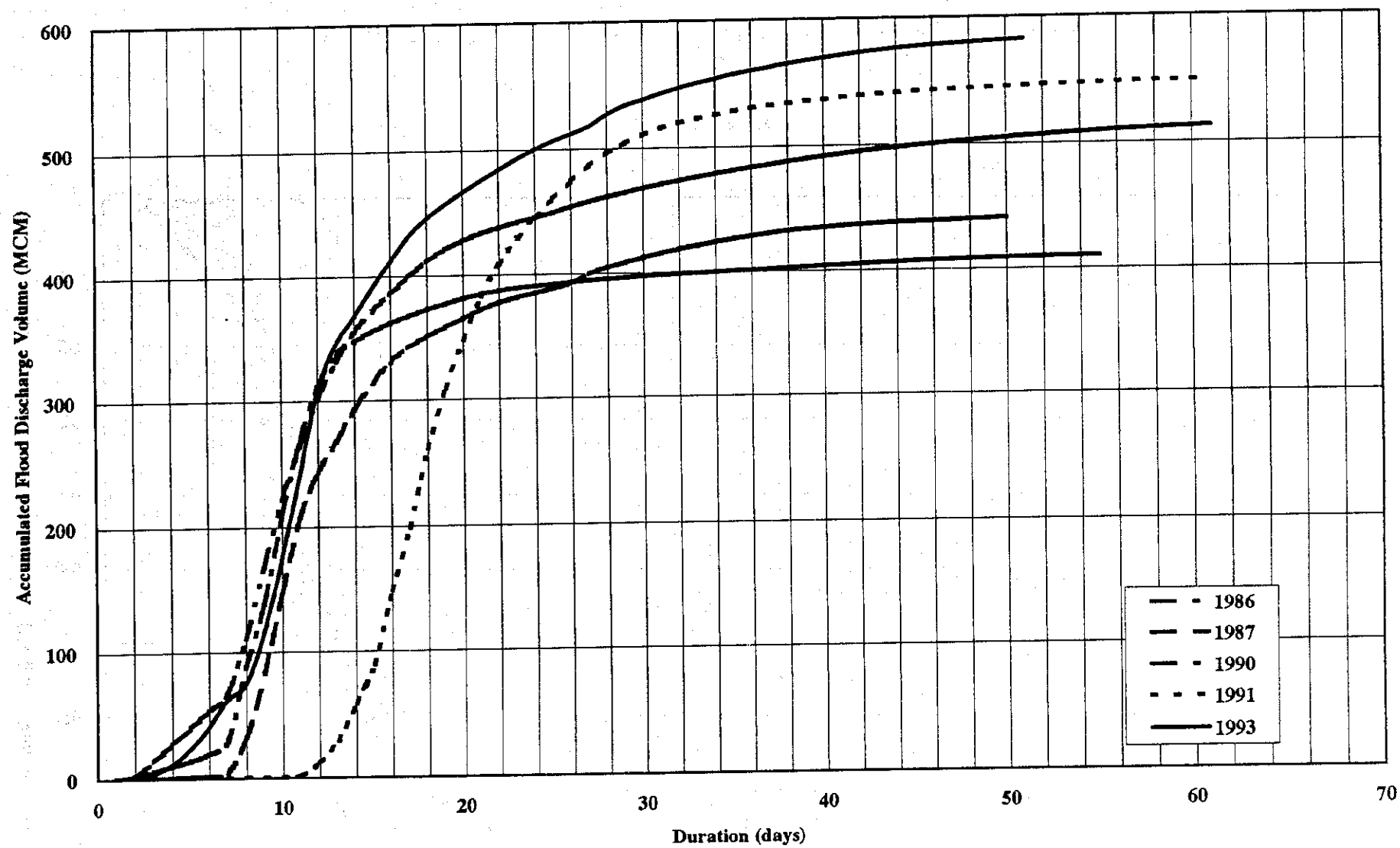


Figure L.1.7 Accumulated Flood Discharge Volume

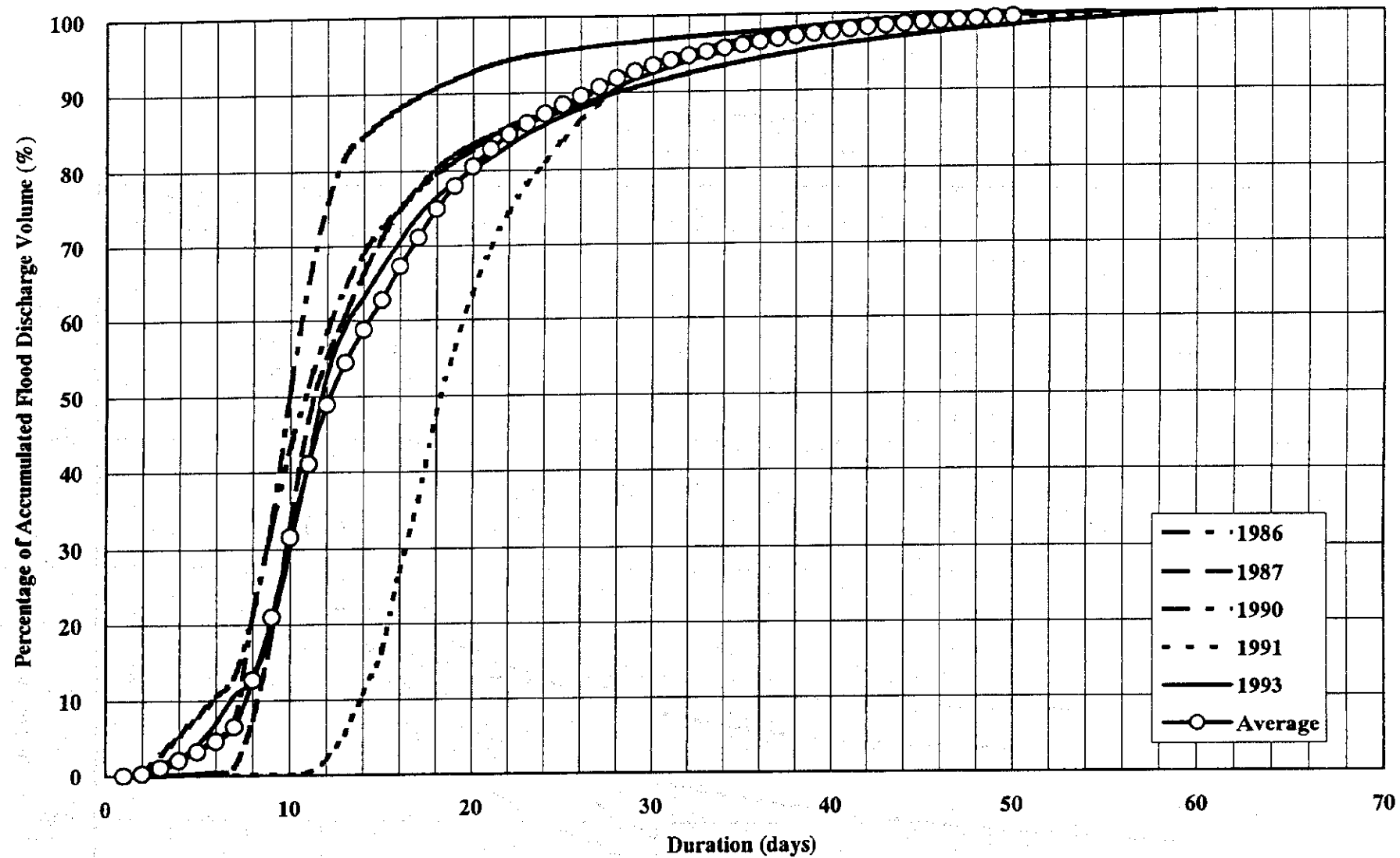


Figure L.1.8 Percentage of Accumulated Flood Discharge Volume

Flood Discharge with Duration of 20 days

Year	1993
Duration (days)	(Original)
1	0.09
2	24.76
3	22.14
4	87.13
5	140.58
6	194.26
7	247.93
8	141.08
9	472.84
10	690.94
11	764.09
12	769.31
13	437.15
14	255.27
15	268.75
16	245.21
17	230.06
18	166.69
19	129.92
20	112.95

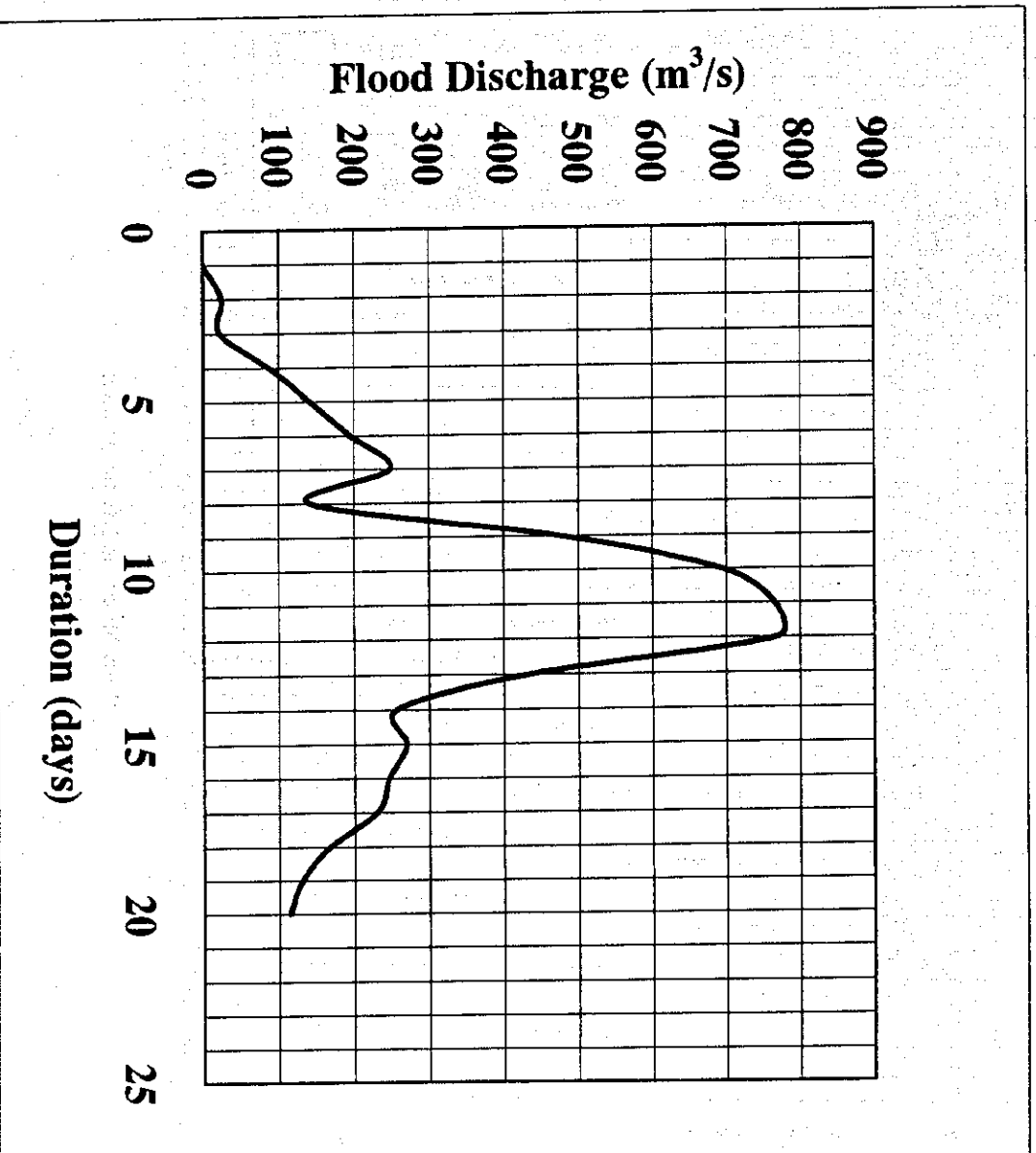


Figure L.1.9 1993 Flood Hydrograph with Duration of 20days

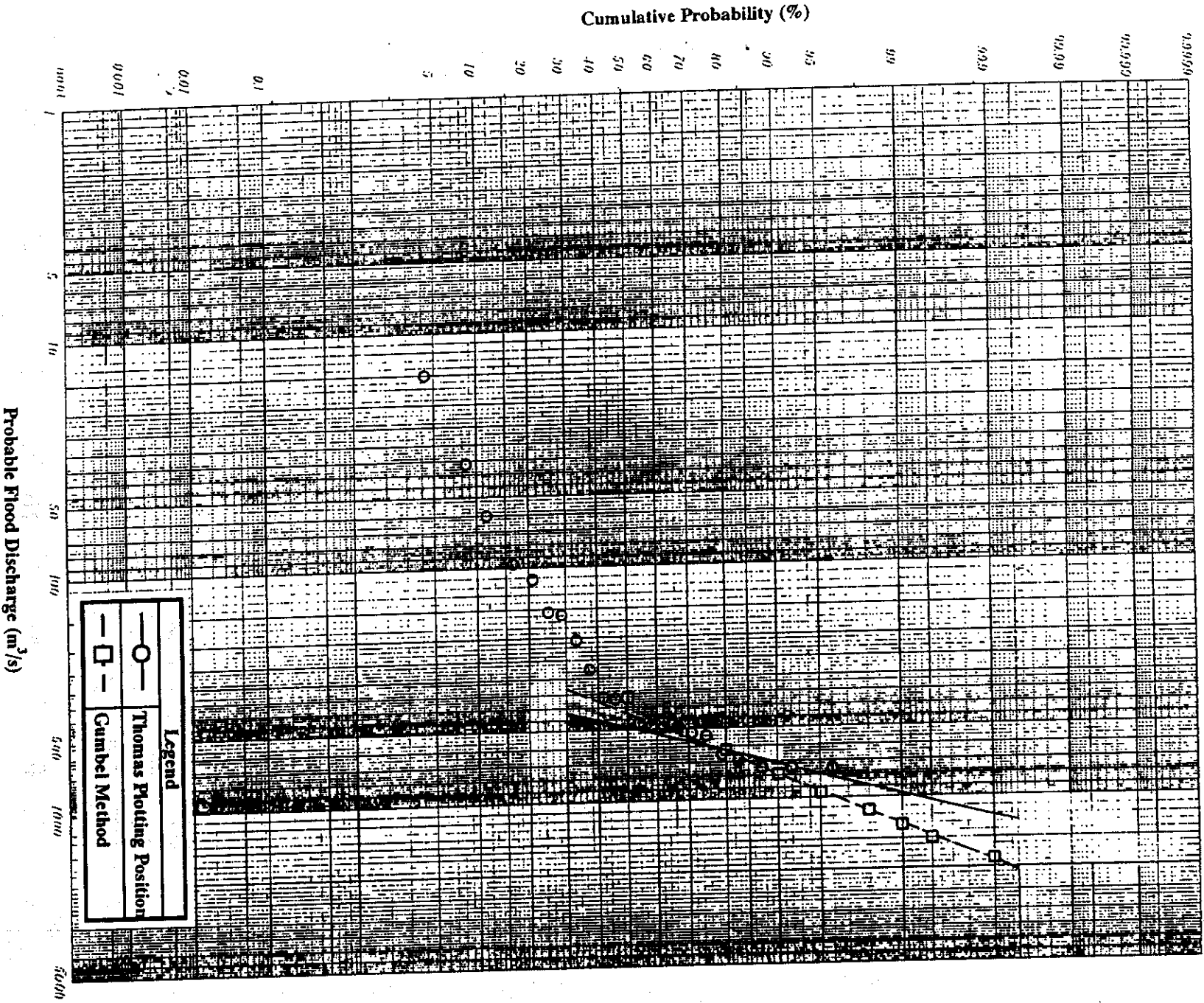


Figure L.1.10 Probable Flood Discharge Estimation

Design Hydrograph with Various Return Period

Year Duration(days)	1993 (Original)	1000-year (Return Period)	100-year (Return Period)	10-year (Return Period)
1	0	0	0	0
2	25	61	45	25
3	22	55	40	23
4	87	215	159	89
5	141	347	256	144
6	194	480	354	199
7	248	612	451	255
8	141	348	257	145
9	473	1,168	860	486
10	691	1,706	1,257	710
11	764	1,887	1,390	785
12	769	1,900	1,400	790
13	437	1,080	796	449
14	255	630	465	262
15	269	664	489	276
16	245	606	446	252
17	230	568	419	236
18	167	412	303	171
19	130	321	236	133
20	113	279	206	116
Max Dis	769	1,900	1,400	790

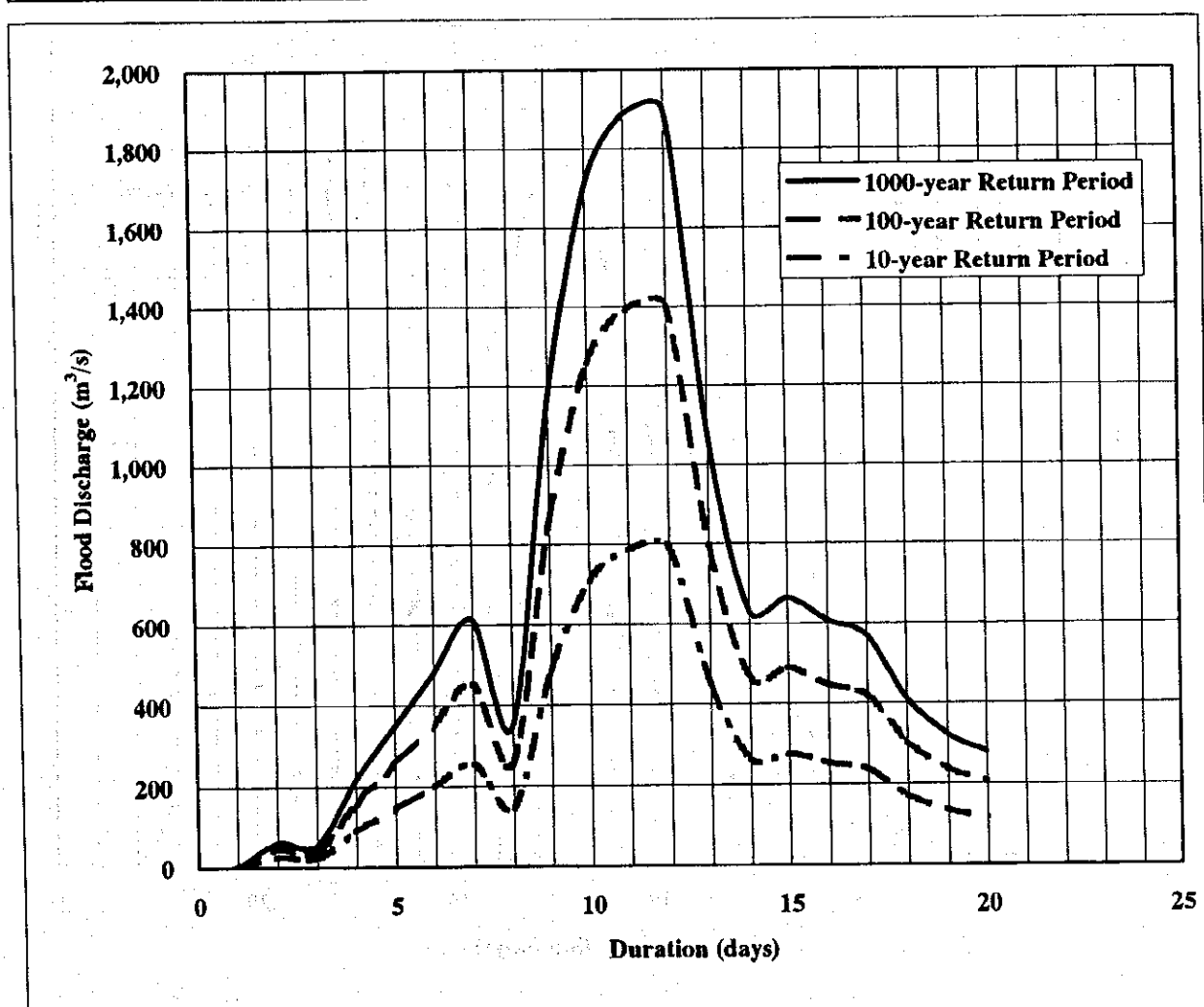


Figure L.1.11 Design Hydrograph with Various Return Period

Design Hydrograph with Different Return Period

Year Duration(days)	Vyacheslavsky Reservoir			Astana		
	1000-year (Return Period)	100-year (Return Period)	10-year (Return Period)	1000-year (Return Period)	100-year (Return Period)	10-year (Return Period)
1	0	0	0	0	0	0
2	61	45	25	9	7	4
3	55	40	23	33	24	14
4	215	159	89	68	50	28
5	347	256	144	157	116	65
6	480	354	199	267	197	111
7	612	451	255	388	286	161
8	348	257	145	454	335	189
9	1,168	860	486	529	389	220
10	1,706	1,257	710	913	673	380
11	1,887	1,390	785	1,316	969	547
12	1,900	1,400	790	1,588	1,170	660
13	1,080	796	449	1,611	1,187	670
14	630	465	262	1,291	951	537
15	664	489	276	984	725	409
16	606	446	252	824	607	342
17	568	419	236	715	527	297
18	412	303	171	622	458	258
19	321	236	133	509	375	211
20	279	206	116	413	305	172
Max Dis	1,900	1,400	790	1,700	1,200	700

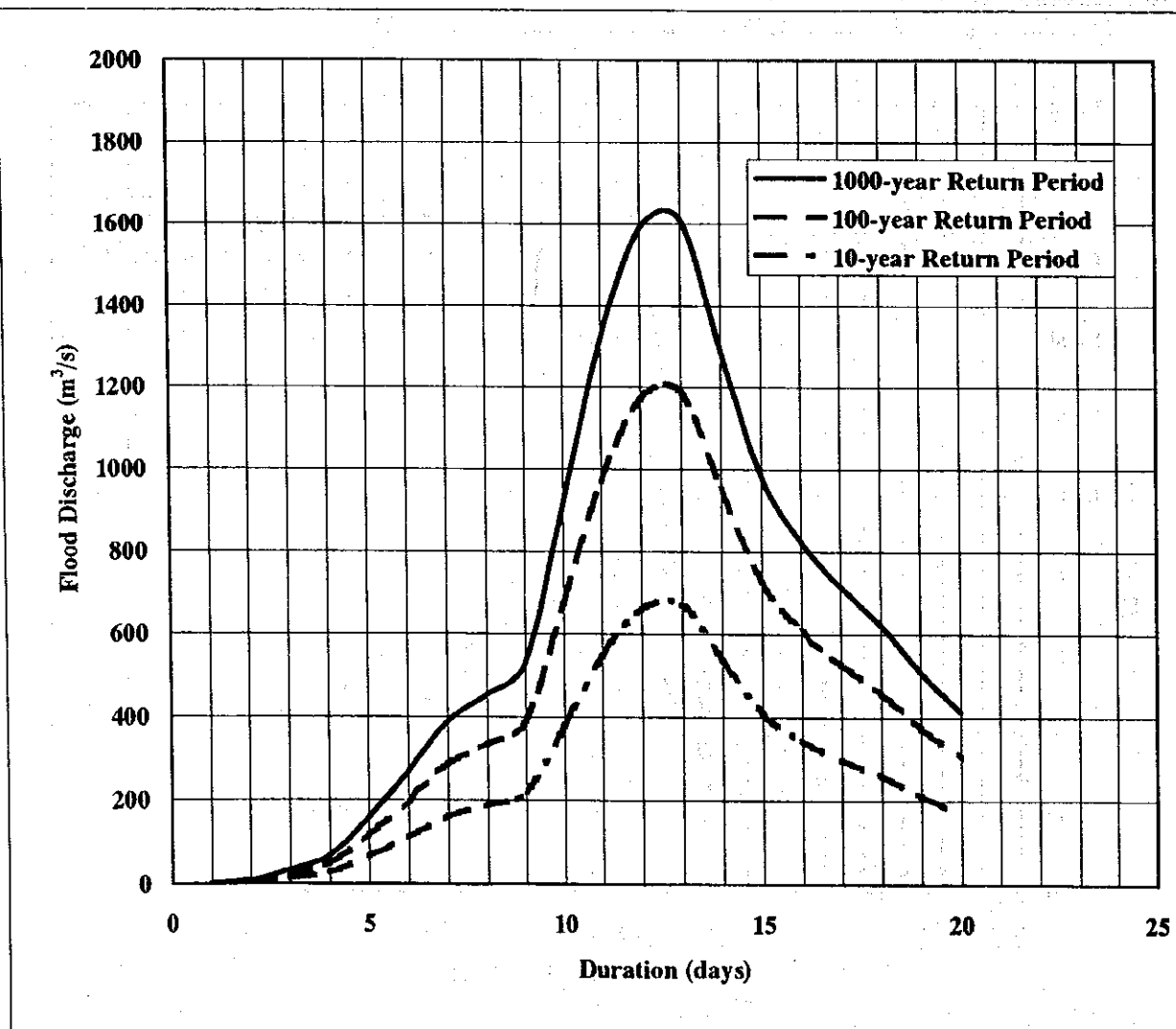


Figure L.1.12 Hydrograph Estimation of Astana

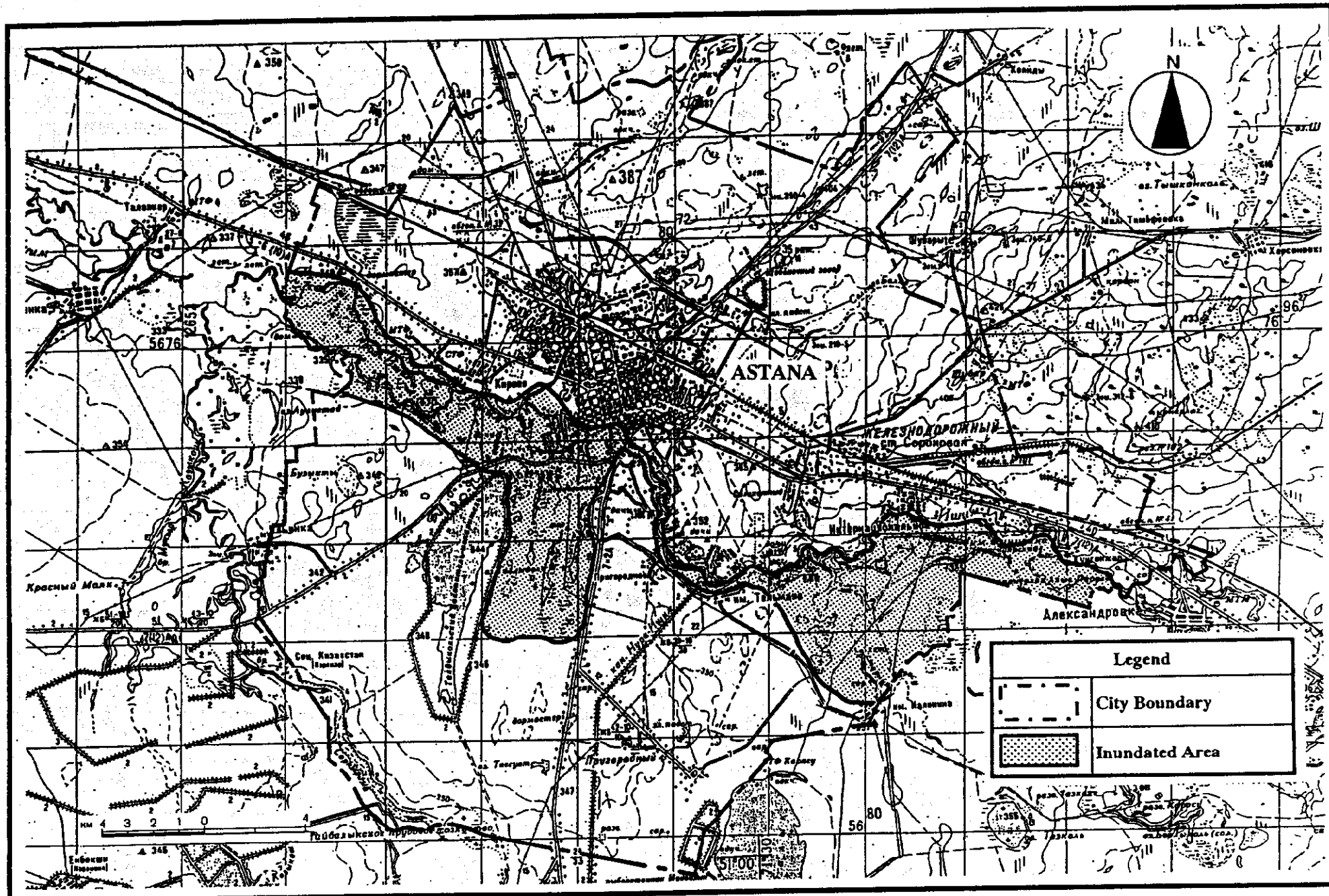


Figure L.1.13 Probable Inundation Area (10-year Return Period)

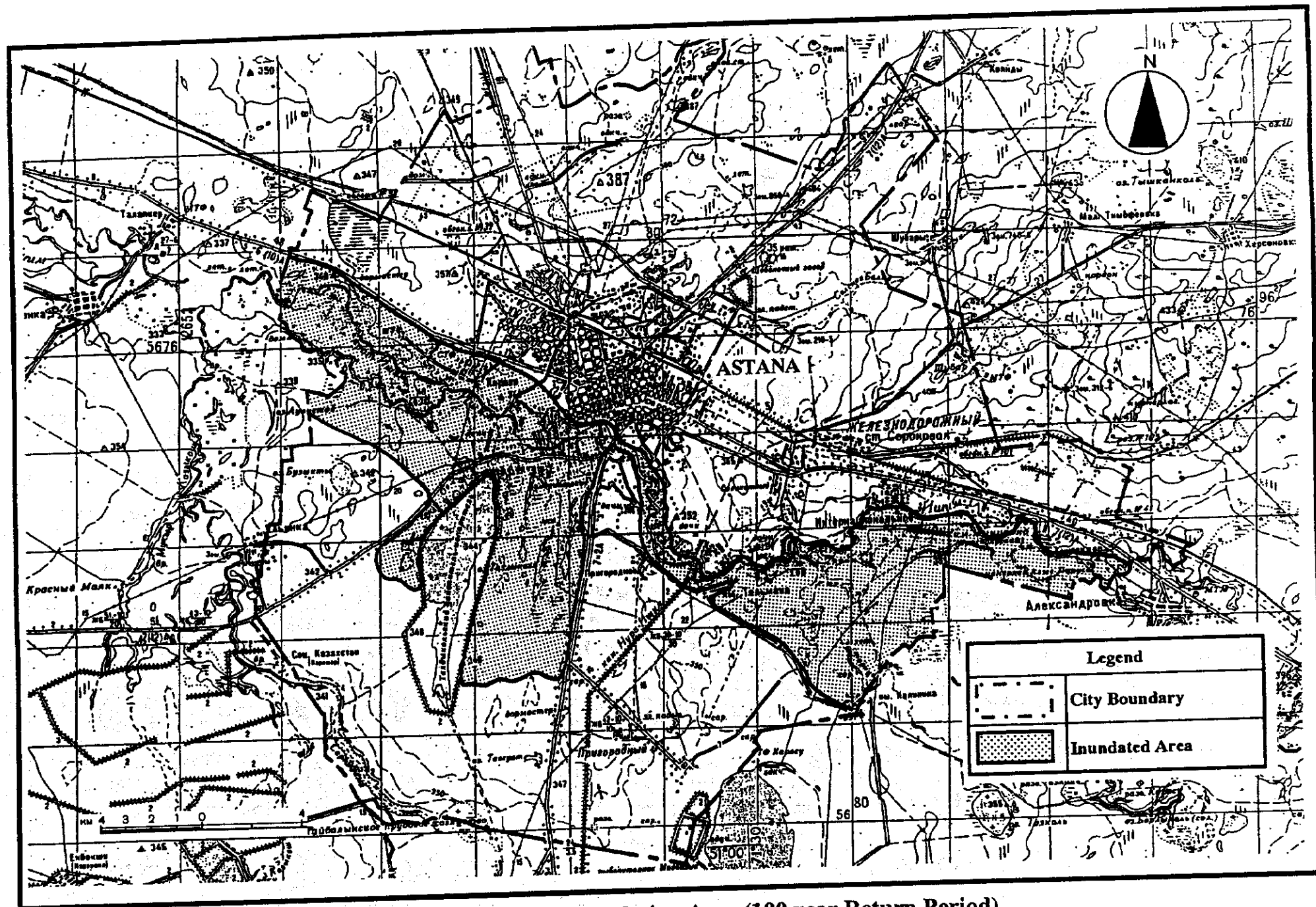


Figure L.1.14 Probable Inundation Area (100-year Return Period)

Design Discharge of the Municipality

Duration (days)	1000-year Return period
1	5
2	10
3	15
4	25
5	45
6	500
7	1,000
8	2,100
9	2,000
10	1,500
11	1,100
12	650
13	480
14	380
15	300
16	250
17	220
18	
19	
20	

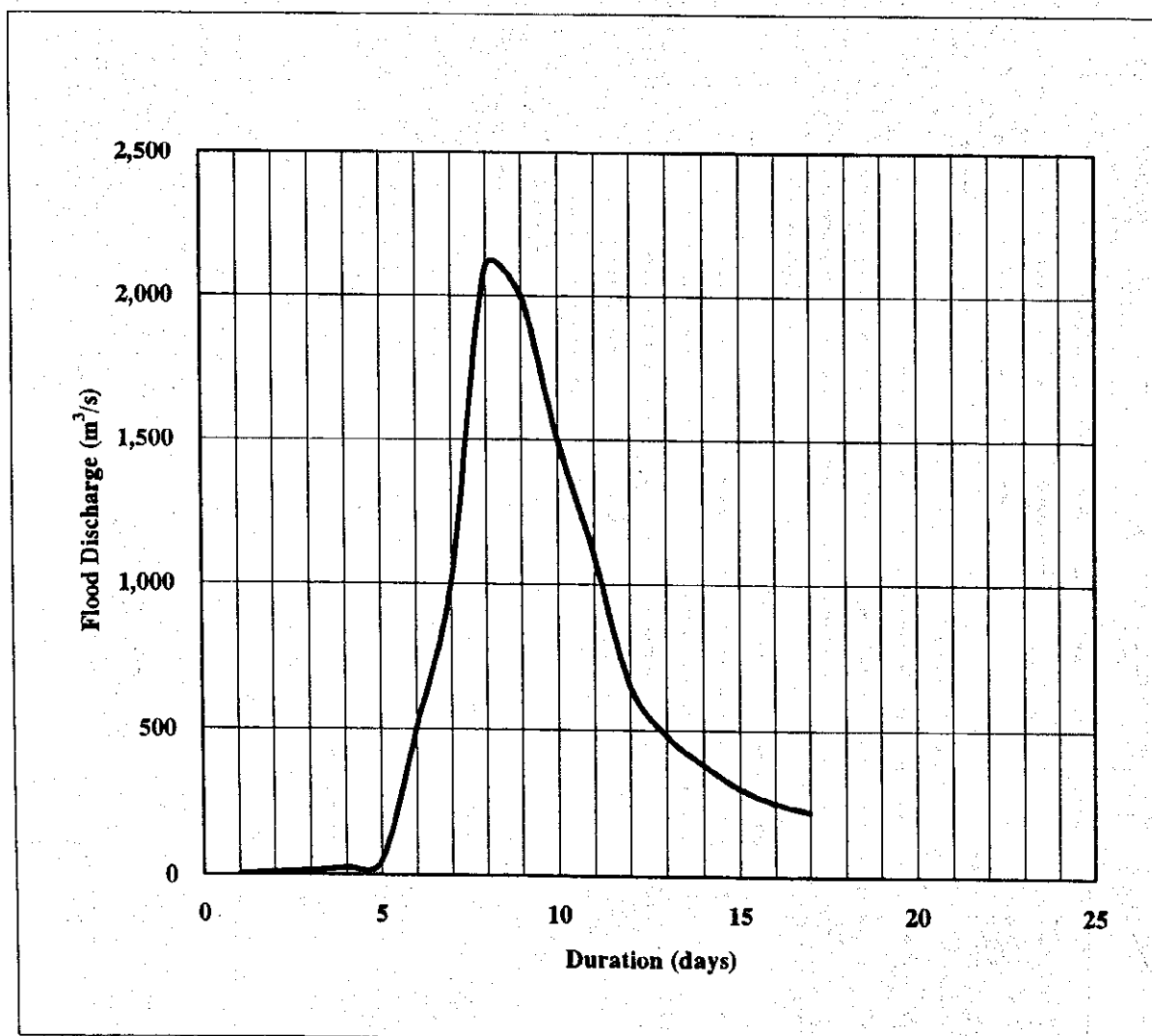
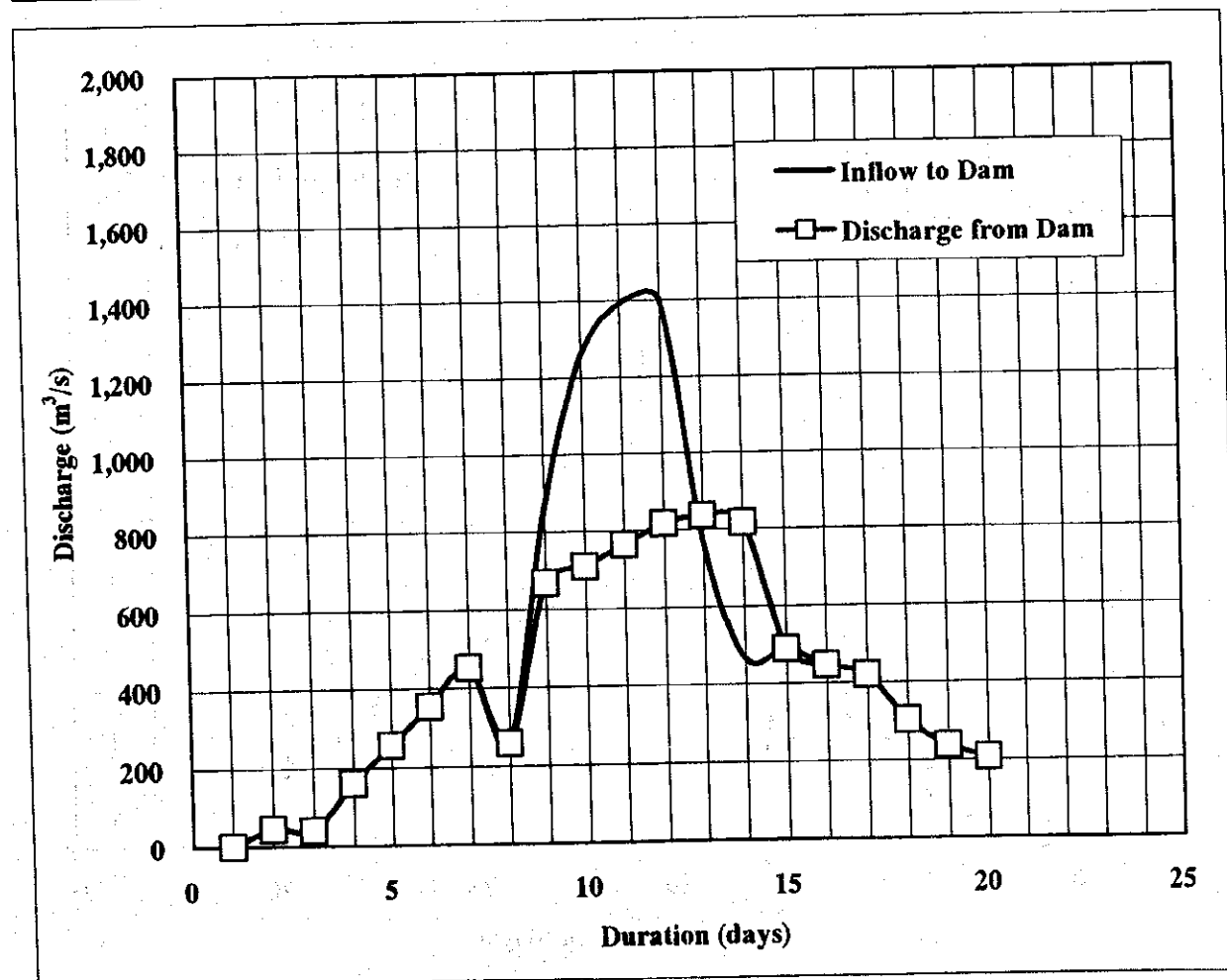


Figure L.1.16 Design Hydrograph of Astana Municipality

Dam discharge Calculation

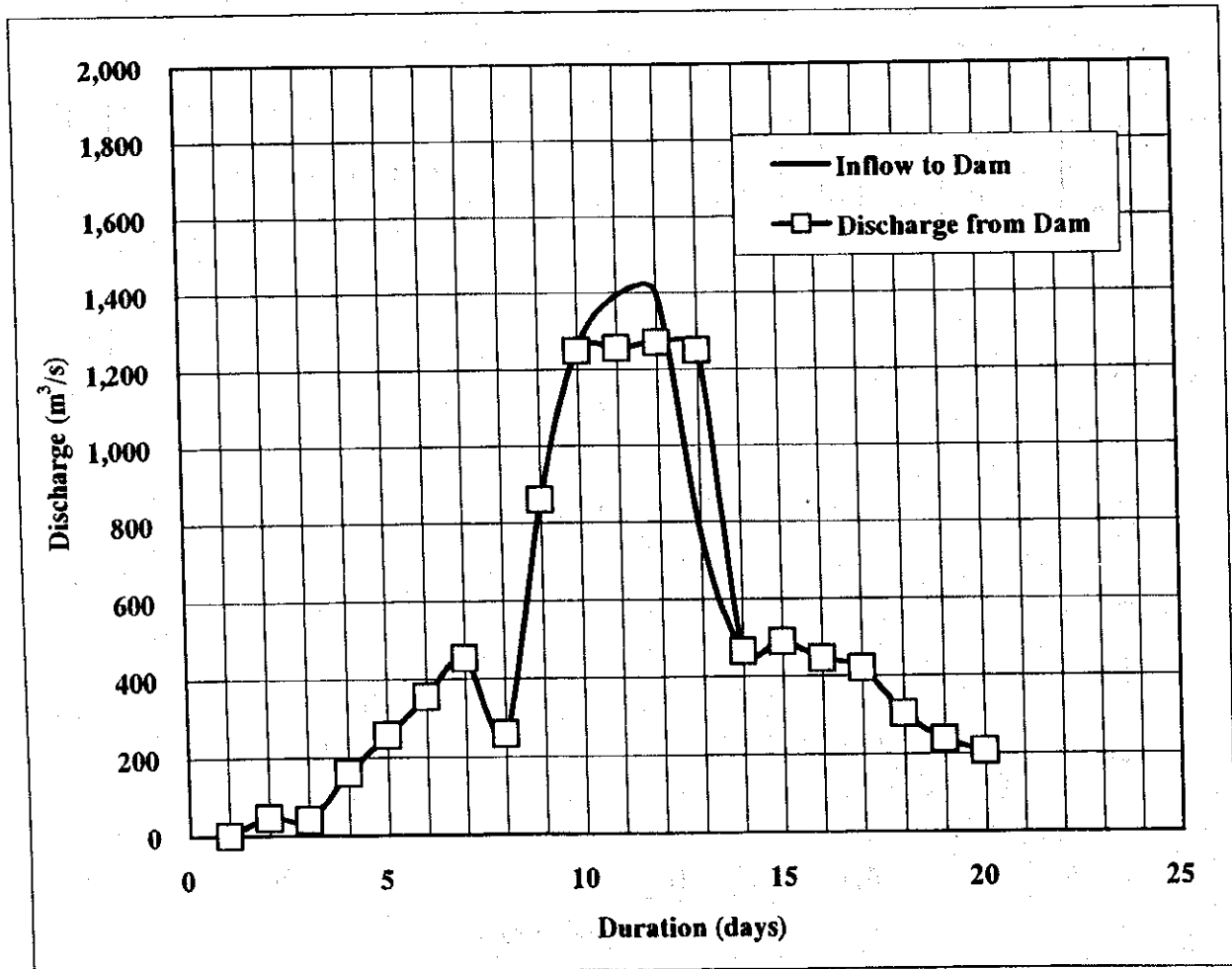
Duration (day)	Inflow (m ³ /s)	Inflow Volume (MCM)	Storage Volume (MCM)	Beginning Volume (MCM)	Dam Water Level (m)	Dam Discharge per 1Gate (m ³ /s)	Dam Discharge (m ³ /s)	Discharge Volume (MCM)	Dam Volume (MCM)
1	0	0.0	250.0	250.0	400.0	0.0	0.0	0.0	250.0
2	45	1.9	250.0	251.9	400.1	15.0	45.0	1.9	250.0
3	40	1.7	250.0	251.7	400.1	13.3	40.0	1.7	250.0
4	159	6.9	250.0	256.9	400.2	53.0	159.0	6.9	250.0
5	256	11.1	250.0	261.1	400.3	85.3	256.0	11.1	250.0
6	354	15.3	250.0	265.3	400.4	118.0	354.0	15.3	250.0
7	451	19.5	250.0	269.5	400.5	150.3	451.0	19.5	250.0
8	257	11.1	250.0	261.1	400.3	85.7	257.0	11.1	250.0
9	860	37.2	250.0	287.2	400.9	222.2	666.7	28.8	258.4
10	1,257	54.3	266.2	320.5	401.6	236.2	708.5	30.6	289.9
11	1,390	60.0	312.3	372.4	402.6	254.8	764.4	33.0	339.4
12	1,400	60.5	365.2	425.7	403.6	272.2	816.5	35.3	390.4
13	769	33.2	414.8	448.0	404.0	278.8	836.4	36.1	411.9
14	465	20.1	409.2	429.3	403.6	272.2	816.5	35.3	394.0
15	489	21.1	379.3	400.4	403.1	163.0	489.0	21.1	379.3
16	446	19.3	379.3	398.5	403.1	148.7	446.0	19.3	379.3
17	419	18.1	379.3	397.4	403.1	139.7	419.0	18.1	379.3
18	303	13.1	379.3	392.3	403.0	101.0	303.0	13.1	379.3
19	236	10.2	379.3	389.5	402.9	78.7	236.0	10.2	379.3
20	206	8.9	379.3	388.2	402.9	68.7	206.0	8.9	379.3



**Figure L.1.17 Calculation of Discharge from Vyacheslavsky Reservoir
(100-year return Period)**

Dam discharge Calculation

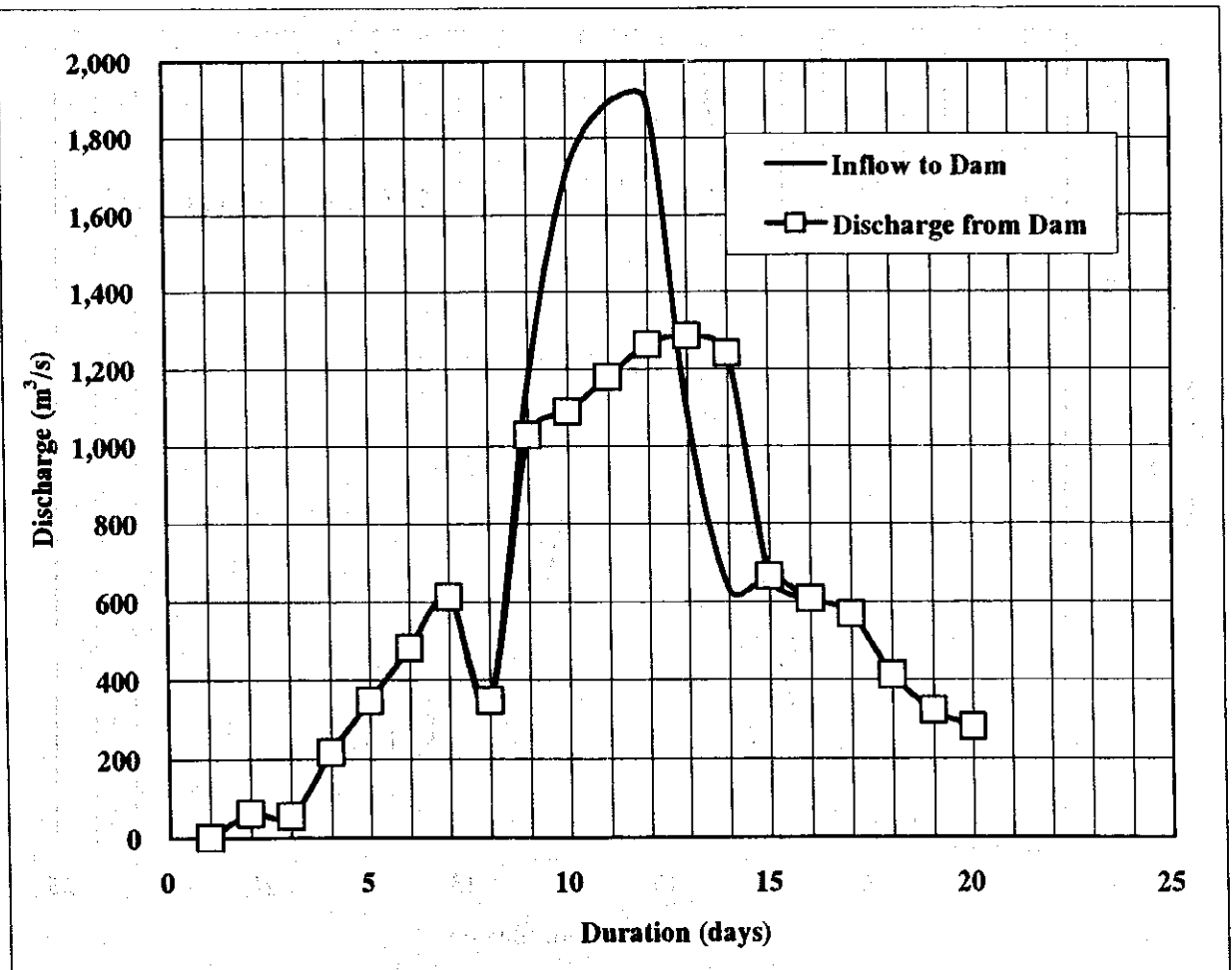
Duration (day)	Inflow (m ³ /s)	Inflow Volume (MCM)	Storage Volume (MCM)	Beginning Volume (MCM)	Dam Water Level (m)	Dam Discharge per 1 Gate (m ³ /s)	Dam Discharge (m ³ /s)	Discharge Volume (MCM)	Dam Volume (MCM)
1	0	0.0	390.0	390.0	403.0	0.0	0.0	0.0	390.0
2	45	1.9	390.0	391.9	403.0	15.0	45.0	1.9	390.0
3	40	1.7	390.0	391.7	403.0	13.3	40.0	1.7	390.0
4	159	6.9	390.0	396.9	403.1	53.0	159.0	6.9	390.0
5	256	11.1	390.0	401.1	403.1	85.3	256.0	11.1	390.0
6	354	15.3	390.0	405.3	403.2	118.0	354.0	15.3	390.0
7	451	19.5	390.0	409.5	403.3	150.3	451.0	19.5	390.0
8	257	11.1	390.0	401.1	403.1	85.7	257.0	11.1	390.0
9	860	37.2	390.0	427.2	403.6	286.7	860.0	37.2	390.0
10	1,257	54.3	390.0	444.3	403.9	415.7	1,247.2	53.9	390.4
11	1,390	60.0	390.8	450.9	404.0	418.2	1,254.6	54.2	396.7
12	1,400	60.5	402.2	462.7	404.2	423.1	1,269.3	54.8	407.9
13	769	33.2	413.2	446.4	403.9	415.7	1,247.2	53.9	392.6
14	465	20.1	372.9	393.0	403.0	155.0	465.0	20.1	372.9
15	489	21.1	372.9	394.0	403.0	163.0	489.0	21.1	372.9
16	446	19.3	372.9	392.1	403.0	148.7	446.0	19.3	372.9
17	419	18.1	372.9	391.0	403.0	139.7	419.0	18.1	372.9
18	303	13.1	372.9	386.0	402.9	101.0	303.0	13.1	372.9
19	236	10.2	372.9	383.1	402.8	78.7	236.0	10.2	372.9
20	206	8.9	372.9	381.8	402.8	68.7	206.0	8.9	372.9



**Figure L.1.18 Calculation of Discharge from Vyacheslavsky Reservoir
(100-year Return Period with Full Storage Volume)**

Dam discharge Calculation

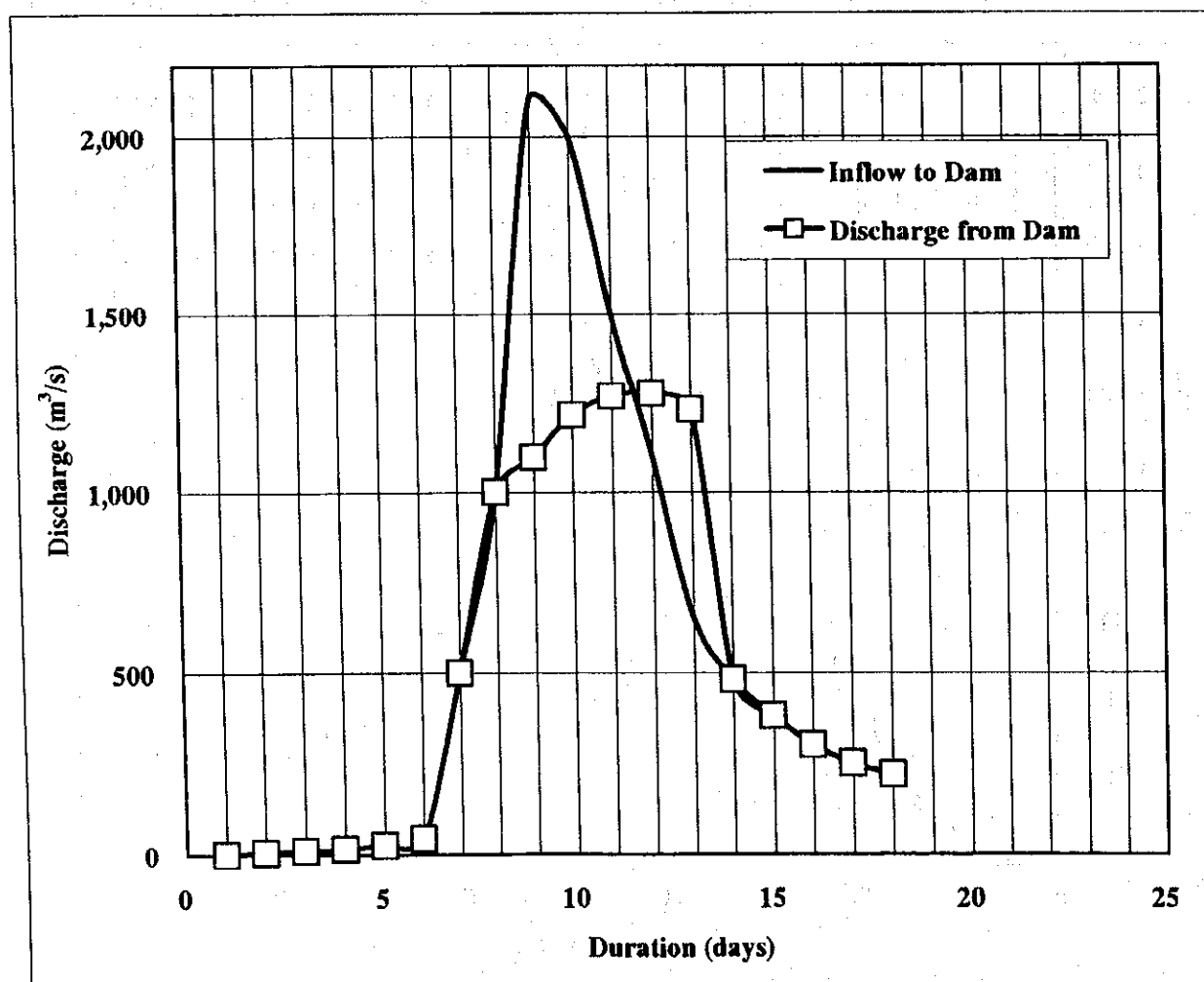
Duration (day)	Inflow (m ³ /s)	Inflow Volume (MCM)	Storage Volume (MCM)	Beginning Volume (MCM)	Dam Water Level (m)	Dam Discharge per 1 Gate (m ³ /s)	Dam Discharge (m ³ /s)	Discharge Volume (MCM)	Dam Volume (MCM)
1	0	0.0	250.0	250.0	400.0	0.0	0.0	0.0	250.0
2	61	2.6	250.0	252.6	400.1	20.3	61.0	2.6	250.0
3	55	2.4	250.0	252.4	400.1	18.3	55.0	2.4	250.0
4	215	9.3	250.0	259.3	400.2	71.7	215.0	9.3	250.0
5	347	15.0	250.0	265.0	400.4	115.7	347.0	15.0	250.0
6	480	20.7	250.0	270.7	400.5	160.0	480.0	20.7	250.0
7	612	26.4	250.0	276.4	400.6	204.0	612.0	26.4	250.0
8	348	15.0	250.0	265.0	400.4	116.0	348.0	15.0	250.0
9	1,168	50.5	250.0	300.5	401.2	342.5	1,027.4	44.4	256.1
10	1,706	73.7	261.8	335.5	401.9	362.9	1,088.6	47.0	288.4
11	1,887	81.5	313.3	394.8	403.0	392.8	1,178.5	50.9	343.9
12	1,900	82.1	372.5	454.6	404.1	420.7	1,262.0	54.5	400.1
13	1,080	46.7	426.4	473.0	404.4	427.9	1,283.8	55.5	417.6
14	630	27.2	409.4	436.6	403.8	413.2	1,239.7	53.6	383.1
15	664	28.7	383.1	411.8	403.3	221.3	664.0	28.7	383.1
16	606	26.2	383.1	409.2	403.3	202.0	606.0	26.2	383.1
17	568	24.5	383.1	407.6	403.3	189.3	568.0	24.5	383.1
18	412	17.8	383.1	400.9	403.1	137.3	412.0	17.8	383.1
19	321	13.9	383.1	396.9	403.1	107.0	321.0	13.9	383.1
20	279	12.1	383.1	395.1	403.0	93.0	279.0	12.1	383.1



**Figure L.1.19 Calculation of Discharge from Vyacheslavsky Reservoir
(1000-year Return Period)**

Dam discharge Calculation

Duration (day)	Inflow (m ³ /s)	Inflow Volume (MCM)	Storage Volume (MCM)	Beginning Volume (MCM)	Dam Water Level (m)	Dam Discharge per 1 Gate (m ³ /s)	Dam Discharge (m ³ /s)	Discharge Volume (MCM)	Dam Volume (MCM)
1	0	0.0	250.0	250.0	400.0	0.0	0.0	0.0	250.0
2	5	0.2	250.0	250.2	400.0	1.7	5.0	0.2	250.0
3	10	0.4	250.0	250.4	400.0	3.3	10.0	0.4	250.0
4	15	0.6	250.0	250.6	400.0	5.0	15.0	0.6	250.0
5	25	1.1	250.0	251.1	400.1	8.3	25.0	1.1	250.0
6	45	1.9	250.0	251.9	400.1	15.0	45.0	1.9	250.0
7	500	21.6	250.0	271.6	400.5	166.7	500.0	21.6	250.0
8	1,000	43.2	250.0	293.2	401.0	333.3	1,000.0	43.2	250.0
9	2,100	90.7	250.0	340.7	402.0	365.7	1,097.1	47.4	293.3
10	2,000	86.4	333.8	420.2	403.5	405.7	1,217.1	52.6	367.6
11	1,500	64.8	399.5	464.3	404.2	423.1	1,269.3	54.8	409.5
12	1,100	47.5	418.8	466.3	404.3	425.5	1,276.5	55.1	411.2
13	650	28.1	404.2	432.3	403.7	410.8	1,232.3	53.2	379.1
14	480	20.7	379.1	399.8	403.1	160.0	480.0	20.7	379.1
15	380	16.4	379.1	395.5	403.0	126.7	380.0	16.4	379.1
16	300	13.0	379.1	392.0	403.0	100.0	300.0	13.0	379.1
17	250	10.8	379.1	389.9	403.0	83.3	250.0	10.8	379.1
18	220	9.5	379.1	388.6	402.9	73.3	220.0	9.5	379.1



**Figure L.1.20 Calculation of Discharge from Vyacheslavsky Reservoir
(Flood with 1000-year Return Period by Astana Municipality)**

Flood Discharge Calculation

Duration (day)	Dam Discharge (m ³ /s)	Astana Inflow (m ³ /s)	Storage Volume (MCM)
1	0	0	0
2	61	9	4
3	55	46	1
4	215	77	12
5	347	197	13
6	480	325	13
7	612	457	13
8	348	529	0
9	1,027	501	45
10	1,089	894	17
11	1,178	1,065	10
12	1,262	1,178	7
13	1,284	1,254	3
14	1,240	1,263	0
15	664	914	0
16	606	725	0
17	568	633	0
18	412	562	0
19	321	440	0
20	279	348	0
Total			220

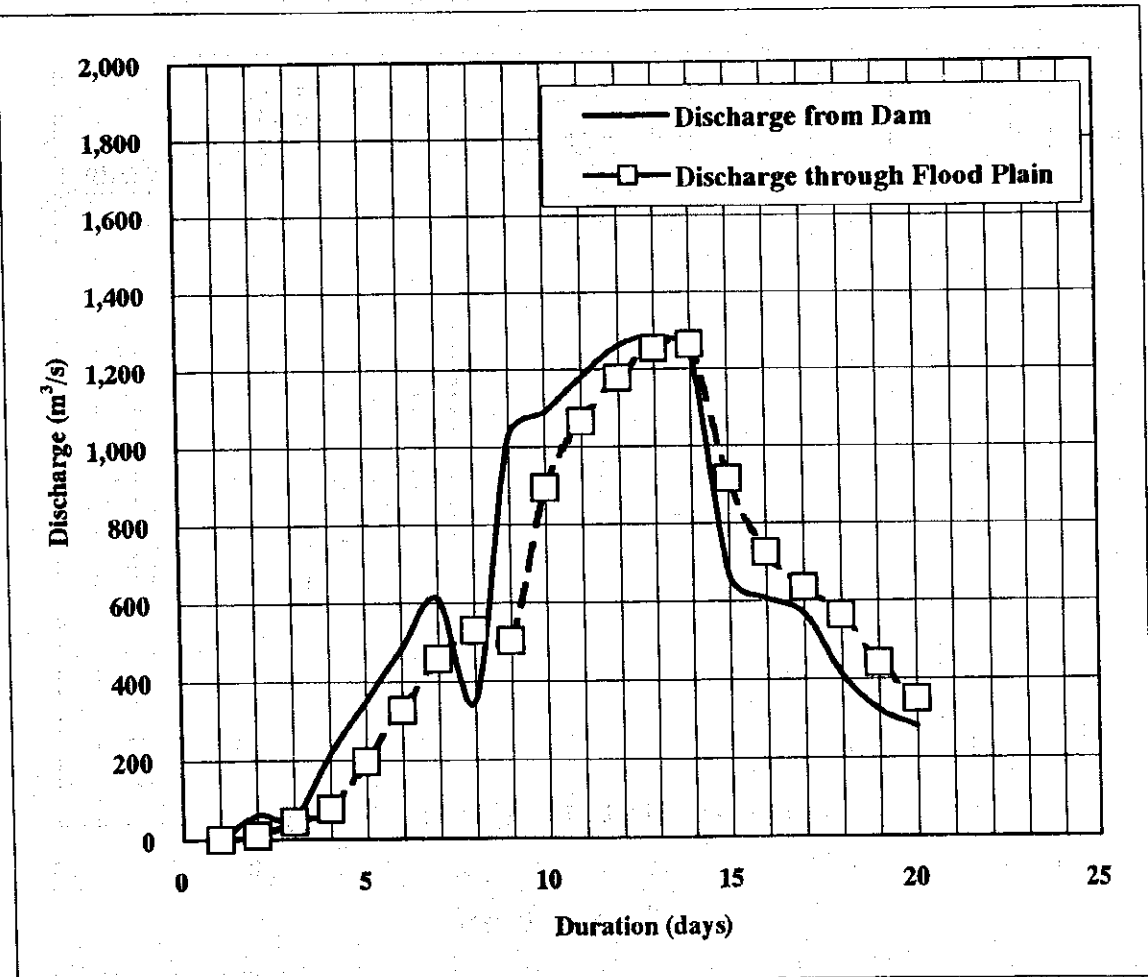


Figure L.1.21 Flood Discharge Estimation at Astana by Muskingum Method

Dam discharge Calculation

Duration (day)	Ishim Flow (m ³ /s)	Akbulak Flow (m ³ /s)	Combined Flow with Akbulak (m ³ /s)	Sarybulak Flow (m ³ /s)	Combined Flow with Sarybulak (m ³ /s)
1	0	0	0	0	0
2	9	2	11	1	12
3	33	2	34	1	35
4	68	6	74	3	76
5	157	10	167	4	172
6	267	14	281	6	287
7	388	17	405	7	413
8	454	10	464	4	468
9	529	33	562	14	576
10	913	49	961	20	982
11	1,316	54	1,369	23	1,392
12	1,588	54	1,642	23	1,665
13	1,611	31	1,642	13	1,655
14	1,291	18	1,309	8	1,317
15	984	19	1,003	8	1,011
16	824	17	841	7	848
17	715	16	731	7	738
18	622	12	633	5	638
19	509	9	518	4	522
20	413	8	421	3	425

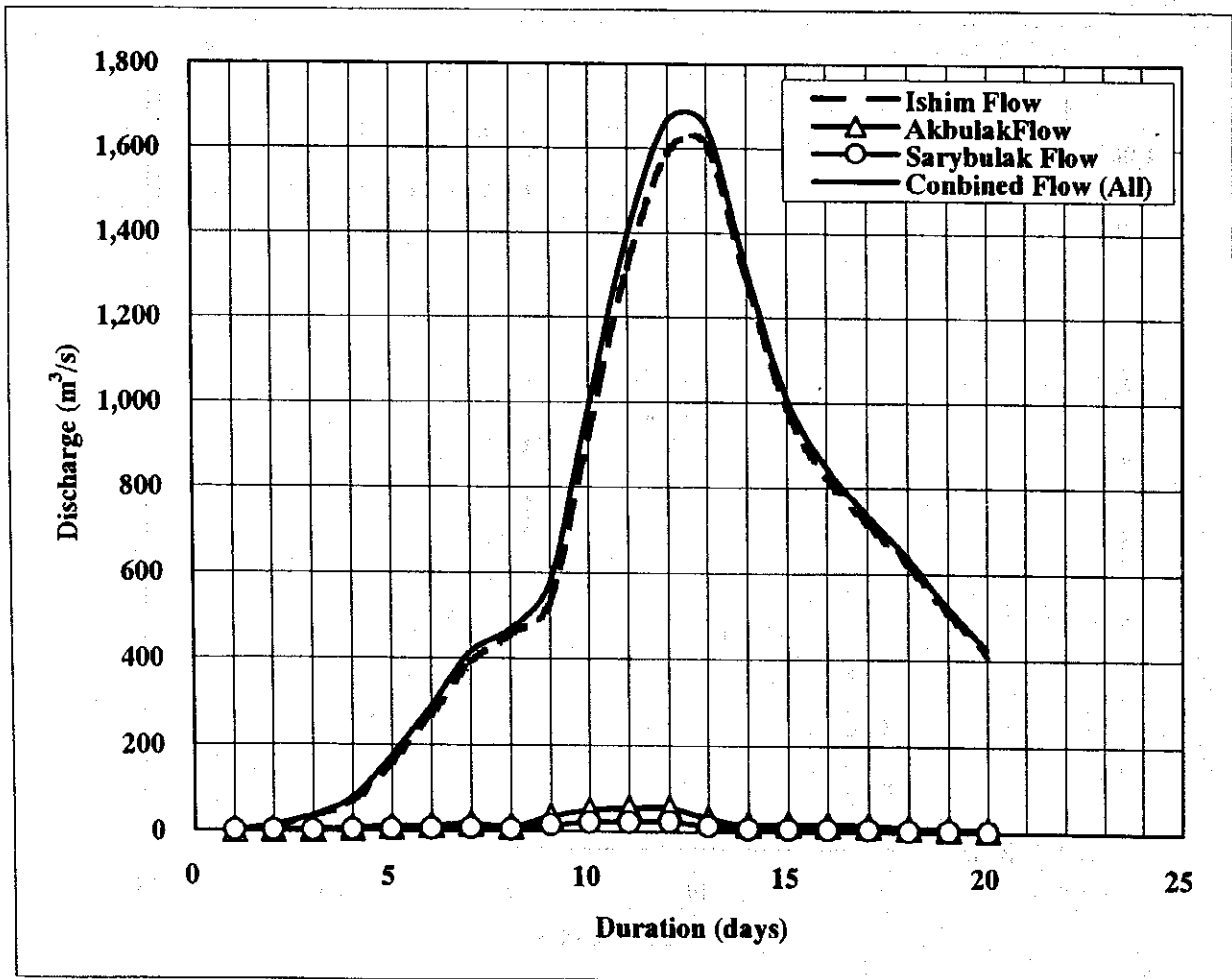


Figure L.1.22 Hydrograph Combined with Tributaries