Table 12.2.3 Number of Traders in Flood Prone Area
(Kebeles in the Study Area only)

Zone	Wereda	Kebele	Area (ha)	Number of Traders					
				1997			2020		
				Retailer	Service	Wholesaler	Retailer	Service	Wholesaler
01	03	30	16.9	110	28	10	192	49	17
		31	17.7	99	38	6	131	50	8
		32	13.9	165	80	12	182	88	13
		33	12.3	105	65	4	153	95	6
		34	12.2	43	6	3	59	8	4
		41	6.9	19	4	2	29	6	3
		42	10.5	32	11	4	44	15	6
		43	9.6	28	11	0	39	15	0
		44	17.7	94	44	4	107	50	5
		45	9.5	28	43	2	35	54	3
		47	15.0	32	29	4	48	43	6
		51	24.8	34	36	6	45	48	8
		52	11.2	68	71	9	92	96	12
		53	54.8	102	109	16	150	160	23
	Sub-total		233.0	959	575	82	1,306	778	114
01	04	26	24.0	157	26	20	239	40	30
		27	14.3	109	76	5	148	103	7
		28	13.3	47	24	3	47	24	3
		29	10.2	35	21	5	44	27	6
		35	15.2	23	15	1	30	20	1
		36	18.3	40	17	6	39	17	6
		37	26.8	27	19	2	36	26	3
		38	11.2	34	21	6	41	25	7
		39	14.7	29	19	7	36	23	9
		40	13.3	22	11	6	32	16	9
		49	13.8	66	74	4	79	88	5
		50	25.6	26	14	0	44	23	0
	Sub-total		200.7	615	337	65	816	432	86
01	05	5	9.7	184	120	10	258	168	14
		6	22.3	2,160	428	113	2,294	455	120
		7	15.9	304	203	68	330	220	74
		12	12.6	991	250	66	733	185	49
		15	9.2	83	10	4	113	14	5
		16	8.7	65	25	10	90	35	14
		17	9.3	384	92	23	531	127	32
		18	10.1	543	47	63	711	62	83
		19	20.0	927	146	163	854	135	150
		20	9.4	51	12	5	75	18	7
		21	9.7	88	32	6	115	42	8
		22	11.1	368	78	8	483	102	11
		23	9.1	77	30	9	112	44	13
	Sub-total		157.1	6,225	1,473	548	6,700	1,605	579
01	06	1	18.6	233	29	15	308	38	20
		2	13.0	48	62	8	57	74	10
		3	10.3	63	21	10	90	30	14
		4	7.9	71	56	1	83	65	1
		8	18.9	49	29	3	80	47	5
		9	8.9	35	24	2	49	33	3
		10	10.3	51	11	9	58	13	10
		11	7.5	81	31	5	107	41	7
		13	38.0	83	18	11	139	30	18
		14	29.2	72	15	20	103	21	29
		24	12.3	21	18	5	36	31	9
		25	11.8	47	14	3	63	19	4
	Sub-total		186.7	854	328	92	1,172	442	129
Total of Zone 01			777.5	8,653	2,713	787	9,995	3,259	908
02	20	28	20.4	34	11	4	44	14	5
		29	22.5	48	23	7	64	31	9
		38	22.1	13	8	1	23	14	2
		39	22.0	27	20	6	32	24	7

Table 12.2.3 Number of Traders in Flood Prone Area
(Kebeles in the Study Area only)

Zone	Wereda	Kebele	Area (ha)	Number of Traders					
				1997			2020		
				Retailer	Service	Wholesaler	Retailer	Service	Wholesaler
		40	51.5	58	44	11	82	62	16
		42	62.8	41	20	5	121	59	15
		43	36.6	102	59	8	240	139	19
		44	23.5	16	23	4	25	37	6
		45	42.1	61	44	5	109	78	9
		46	39.7	86	37	3	165	71	6
		51	52.9	15	10	3	74	49	15
		52	0.0	0	0	0	0	0	0
		53	71.8	35	24	10	284	195	81
	Sub-total		467.9	536	323	67	1,264	773	190
02	21	1	92.2	172	286	38	175	291	39
		4	53.5	110	91	21	127	105	24
		9	15.3	89	63	2	104	74	2
		10	10.3	15	10	2	16	11	2
		11	5.9	40	23	9	45	26	10
		12	11.9	9	4	1	15	7	2
		13	6.1	209	84	0	391	157	0
		14	16.4	22	18	1	26	22	1
		19	54.4	39	42	6	248	267	38
		20	8.7	61	36	3	84	50	4
		21	8.2	51	33	4	66	43	5
		22	11.5	20	9	0	19	9	0
		23	11.4	35	23	1	29	19	1
		24	15.4	26	18	0	28	20	0
		25	11.3	29	33	0	20	23	0
		30	14.2	3	8	2	3	8	2
		31	14.0	24	8	0	24	8	0
		32	9.7	27	26	0	27	26	0
	Sub-total		370.4	981	815	90	1,449	1,163	131
02	22	1	221.9	23	10	1	31	13	1
		2	20.1	40	36	3	48	41	4
		3	16.0	25	25	1	26	26	1
		4	19.1	34	25	1	44	33	1
		6	22.9	12	5	0	18	8	0
		7	58.3	36	45	10	50	63	14
	Sub-total		358.3	170	146	16	218	186	21
02	23	8	37.7	37	26	3	69	48	6
		9	17.9	18	7	1	26	10	1
		10	108.4	58	45	8	136	106	19
		11	33.6	34	36	2	34	36	2
		12	165.9	68	66	32	188	182	88
		13	148.3	57	51	23	262	234	106
		14	133.8	6	4	2	98	62	39
		15	147.9	26	25	11	64	61	27
		16	63.8	6	6	2	60	60	16
	Sub-total		857.3	310	266	84	935	799	304
02	24	9	165.9	45	25	18	85	47	34
		10	29.7	87	13	12	232	35	32
		11	89.7	99	24	32	262	63	85
		12	80.5	28	19	3	37	25	4
		13	212.4	113	58	29	211	108	54
		14	253.8	17	15	1	62	54	4
		15	449.8	27	32	4	283	327	44
		16	329.3	8	5	1	8	5	1
		17	1,190.3	19	28	3	177	261	28
		18	0.0	0	0	0	0	0	0
	Sub-total		2,801.4	444	219	103	1,357	927	285
Total of Zone 2			4,855.2	2,440	1,769	360	5,222	3,848	930
03	17	13	40.8	25	21	7	54	45	15
		14	33.2	30	45	10	53	80	18

Table 12.2.3 Number of Traders in Flood Prone Area
(Kebeles in the Study Area only)

Zone	Wereda	Kebele	Area (ha)	Number of Traders					
				1997			2020		
				Retailer	Service	Wholesaler	Retailer	Service	Wholesaler
		15	32.6	24	28	10	49	57	20
		16	41.1	40	47	6	103	121	15
		17	64.1	45	35	7	156	121	24
		18	79.7	22	37	8	71	118	27
		19	69.3	34	40	7	45	53	9
		20	224.6	30	30	8	169	169	45
		21	91.7	18	14	3	195	147	32
		23	85.0	11	21	4	33	63	13
		24	172.3	78	61	14	402	314	72
		25	88.7	14	18	4	14	18	4
	Sub-total		1,023.1	371	396	88	1,343	1,306	295
03	18	6	43.3	44	57	0	84	108	0
		7	23.3	21	19	2	25	23	2
		15	20.0	75	48	6	136	87	11
		16	18.1	11	8	2	17	12	3
		17	23.3	58	53	4	95	87	7
		18	29.5	25	34	5	50	67	10
		26	32.0	20	39	7	51	100	18
		27	64.6	27	52	12	43	82	19
		33	24.2	24	22	5	39	36	8
		34	23.8	22	20	12	34	31	18
		35	34.8	23	23	5	52	52	11
		36	42.3	29	36	7	71	88	17
		41	38.0	26	28	9	45	48	16
	Sub-total		417.2	405	439	76	741	822	140
03	19	47	122.7	23	11	3	59	28	8
		49	31.2	37	43	9	52	60	13
		50	102.3	46	52	12	96	108	25
		54	52.1	37	39	4	75	80	8
		55	0.0	0	0	0	0	0	0
		56	55.2	32	17	5	73	39	10
		57	0.0	0	0	0	0	0	0
		58	0.0	0	0	0	0	0	0
		59	0.0	0	0	0	0	0	0
		60	0.0	0	0	0	0	0	0
	Sub-total		363.5	174	162	33	355	316	64
03	28	1	0.0	0	0	0	0	0	0
		2	0.0	0	0	0	0	0	0
		3	0.0	0	0	0	0	0	0
		4	0.0	0	0	0	0	0	0
		5	0.0	0	0	0	0	0	0
	Sub-total		0.0	0	0	0	0	0	0
Total of Zone 03			1,803.8	950	997	197	2,439	2,444	499
04	01	1	19.8	68	34	14	92	46	19
		3	25.1	78	56	13	126	90	21
		4	32.1	77	71	4	117	108	6
		5	14.0	77	63	3	112	92	4
		6	15.6	81	53	23	111	72	31
		7	23.0	127	67	10	161	85	13
		8	24.2	132	82	7	193	120	10
	Sub-total		153.8	640	426	74	912	613	105
04	09	6	24.1	20	15	10	35	26	17
		7	43.6	54	21	9	77	30	13
		8	21.3	43	26	9	58	35	12
		9	17.3	58	56	2	140	135	5
		10	22.7	28	17	1	34	20	1
		11	18.8	79	61	14	112	87	20
		12	28.3	110	50	15	177	81	24
		20	43.4	25	22	2	45	40	4
		21	30.7	23	12	14	48	25	29

Table 12.2.3 Number of Traders in Flood Prone Area
(Kebeles in the Study Area only)

Zone	Wereda	Kebele	Area (ha)	Number of Traders					
				1997			2020		
				Retailer	Service	Wholesaler	Retailer	Service	Wholesaler
	Sub-total		250.2	410	280	76	725	478	125
04	11	1	75.1	101	36	5	225	80	11
		2	551.7	35	19	4	79	43	9
		3	7.2	19	16	2	31	26	3
		4	148.1	36	11	0	65	20	0
		5	22.8	24	27	3	45	51	6
		8	13.7	34	8	0	52	12	0
		9	14.0	14	17	1	21	26	2
		10	47.0	15	10	6	27	18	11
		13	12.9	17	18	2	34	36	4
		14	15.3	21	13	3	35	21	5
		15	7.7	9	15	2	18	29	4
		16	18.9	12	8	1	18	12	1
		17	121.2	59	49	4	61	51	4
		19	13.7	42	14	8	88	29	17
		23	320.7	255	51	26	921	184	94
	Sub-total		1,390.0	693	312	67	1,721	639	171
04	12	6	62.9	61	20	2	110	36	4
		7	263.3	24	19	9	57	45	21
		11	46.1	29	28	4	57	55	8
		12	560.7	25	20	9	84	67	30
		18	37.9	12	5	1	16	7	1
		19	263.1	9	4	1	15	7	2
		20	23.2	4	5	0	5	7	0
		21	86.7	13	9	2	20	14	3
		22	66.7	1	5	1	3	13	3
	Sub-total		1,410.6	178	115	29	368	251	72
04	13	1	28.9	31	17	4	46	25	6
		2	28.9	46	45	2	77	76	3
		3	98.0	74	93	6	129	162	10
		5	11.3	13	6	0	14	7	0
		6	27.9	19	8	0	26	11	0
		8	41.0	38	25	1	50	33	1
		9	25.0	21	31	2	36	53	3
		10	20.5	19	18	3	27	26	4
		11	24.0	26	30	0	44	51	0
		15	28.8	11	20	4	16	29	6
		16	23.7	9	8	2	15	13	3
	Sub-total		358.0	307	301	24	480	485	38
04	15	19	28.4	37	27	4	59	43	6
		20	26.5	18	13	1	21	15	1
		23	22.1	24	20	0	34	29	0
		26	29.8	63	68	2	112	121	4
		27	25.6	110	95	7	181	157	12
		28	23.0	12	11	2	22	20	4
		29	27.9	12	14	3	18	21	4
		30	41.4	38	53	4	34	47	4
		31	24.5	59	76	3	80	103	4
		32	23.5	88	48	3	161	88	5
		33	20.5	23	26	2	33	37	3
		34	20.4	50	36	2	75	54	3
		35	9.7	14	10	0	24	17	0
		36	36.7	13	9	4	25	17	8
	Sub-total		360.0	561	506	37	880	769	57
04	16	1	92.6	12	9	0	17	13	0
		2	34.3	22	20	2	47	42	4
		3	40.0	22	16	3	35	26	5
		4	41.8	59	43	9	144	105	22
		5	19.6	23	17	1	52	38	2
		6	282.4	15	7	1	37	17	2
		7	142.2	7	13	2	20	36	6

Table 12.2.3 Number of Traders in Flood Prone Area
(Kebeles in the Study Area only)

Zone	Wereda	Kebele	Area (ha)	Number of Traders					
				1997			2020		
				Retailer	Service	Wholesaler	Retailer	Service	Wholesaler
		8	32.9	29	42	8	51	74	14
		9	36.3	26	29	4	47	52	7
		10	22.1	16	18	3	33	38	6
		11	48.8	41	41	10	82	82	20
		12	36.6	30	59	5	59	116	10
		22	0.0	0	0	0	0	0	0
	Sub-total		829.6	302	314	48	624	639	99
Total of Zone 04			4,752.2	3,121	2,254	355	5,710	3,874	666
05	02	9	16.8	192	141	16	176	129	15
		10	11.9	130	52	7	187	75	10
		11	34.8	355	110	67	598	185	113
		12	24.6	237	203	17	295	253	21
		13	11.1	80	54	2	126	85	3
		14	29.1	91	37	16	229	93	40
		15	21.6	63	55	7	72	63	8
		16	16.4	46	35	9	62	47	12
		17	24.7	44	47	1	64	68	1
	Sub-total		191.0	1,238	734	142	1,809	998	224
05	07	17	30.1	35	18	10	57	29	16
		18	15.3	16	11	3	29	20	5
		19	14.9	32	15	3	54	25	5
		20	10.8	32	12	4	53	20	7
		21	10.0	32	16	4	40	20	5
		26	21.7	42	14	9	90	30	19
		27	16.7	78	26	9	110	37	13
		28	10.0	50	7	5	50	7	5
		29	11.3	75	46	5	103	63	7
		30	14.0	60	8	8	84	11	11
		31	14.8	61	12	1	92	18	2
		32	14.6	116	70	16	126	76	17
		33	14.6	48	21	6	58	26	7
		34	10.0	197	84	5	117	50	3
	Sub-total		209.0	874	360	88	1,063	432	123
05	08	1	30.6	33	10	10	113	34	34
		2	490.5	83	43	13	366	190	57
		3	24.0	41	2	3	116	6	9
		5	36.6	51	17	15	101	35	30
		6	43.9	44	35	9	84	67	17
		10	56.2	59	25	11	110	47	21
		11	24.2	42	12	7	69	20	12
		13	35.5	17	7	12	21	9	15
		14	37.1	43	19	8	88	39	16
		15	25.1	29	17	3	55	33	6
		22	9.2	23	10	5	39	17	9
		23	9.8	34	6	9	52	9	14
		24	8.0	25	12	3	41	19	5
		25	14.6	76	11	4	147	21	8
		35	531.0	66	31	26	420	197	165
	Sub-total		1,376.3	666	257	138	1,825	742	417
05	10	1	213.5	85	29	8	306	104	29
		2	35.3	71	23	23	151	49	49
		3	30.3	176	19	14	276	30	22
		4	36.9	38	21	12	71	39	22
		5	35.6	31	18	15	53	31	26
		13	35.4	266	10	19	495	19	35
		14	26.2	126	6	3	263	13	6
		15	15.1	300	21	22	407	28	30
		16	32.2	208	20	14	333	32	22
		17	51.7	159	9	10	279	16	18
		18	38.6	263	25	16	403	38	25

Table 12.2.3 Number of Traders in Flood Prone Area
(Kebeles in the Study Area only)

Zone	Wereda	Kebele	Area (ha)	Number of Traders					
				1997			2020		
				Retailer	Service	Wholesaler	Retailer	Service	Wholesaler
		22	378.8	147	26	15	383	68	39
	Sub-total		929.6	1,870	227	171	3,419	466	323
05	14	7	32.0	64	70	5	90	98	7
		12	10.7	49	14	4	48	14	4
		13	27.3	108	79	5	127	93	6
		14	20.3	36	14	3	52	20	4
		17	12.0	70	63	2	82	74	2
		18	62.3	14	7	1	15	7	1
		21	18.9	61	23	2	95	36	3
		22	13.2	22	20	4	29	26	5
		24	21.4	9	16	0	1	2	0
		25	56.2	31	20	1	27	17	1
	Sub-total		274.3	464	326	27	565	388	34
05	25	1	125.5	47	23	15	166	81	53
		2	60.6	17	4	3	61	14	11
		3	107.8	42	10	14	311	74	104
		4	441.5	77	21	16	281	77	58
		5	33.7	31	21	14	75	51	34
		6	24.6	75	15	5	136	27	9
		7	31.4	60	21	3	133	47	7
		8	31.4	135	53	14	271	107	28
		16	315.5	32	28	8	110	96	27
	Sub-total		1,172.0	516	196	92	1,544	574	331
Total of Zone 05			4,152.2	5,628	2,100	658	10,225	3,600	1,451
06	26	1	0.0	0	0	0	0	0	0
		2	0.0	0	0	0	0	0	0
		4	0.0	0	0	0	0	0	0
		5	0.0	0	0	0	0	0	0
		6	0.0	0	0	0	0	0	0
		7	0.0	0	0	0	0	0	0
	Sub-total		0.0	0	0	0	0	0	0
06	27	3	0.0	0	0	0	0	0	0
		8	0.0	0	0	0	0	0	0
		9	0.0	0	0	0	0	0	0
		10	0.0	0	0	0	0	0	0
		11	0.0	0	0	0	0	0	0
	Sub-total		0.0	0	0	0	0	0	0
Total of Zone 06			0.0	0	0	0	0	0	0
Total Urban Area			16,340.9	20,792	9,832	2,357	33,590	17,024	4,455
Farmers Association									
	17		0.0	0	0	0	0	0	0
	19		0.0	0	0	0	0	0	0
	28		468.2	0	0	0	0	0	0
	26		0.0	0	0	0	0	0	0
	27		0.0	0	0	0	0	0	0
Total Rural Area			468.2	0	0	0	0	0	0
Total of Addis Ababa			16,809.0	20,792	9,833	2,357	33,590	17,024	4,455

Note: The numbers of traders in 1997 is based on registration at Trade, Industry and Tourism Bureau of Addis Ababa Administration and those in 2020 are projected figures.

Table 12.2.4 Estimation of Value of Property of Manufacturing Industry (As of 1997, Addis Ababa)

Equation: Vi = Vsg + Vsm + Vma

Where,
- Vi : value of property in manufacturing firm,
- Vsg : stock value of finished and part-finished goods,
- Vsm : stock value of raw materials, and
- Vma : value of plant and machinery.

1. Number of Manufacturing Establishment

	Numbers of factories	Average annual growth rate	Numbers of factories in 1997
1. Medium/Large scale	325 (in 1995)	2.0 %	338
2. Small scale	1,173 (in 1996)	2.0 %	1,196
3. Cottage/Handicraft	2,433 (in 1996)	2.0 %	2,482

Note: Applied annual growth rate is an average annual growth rate of number of persons engaged in the medium/large scale industry from 1992 to 1996 .

2. Stock Value of Products (Vsp)

(1) Gross Value of Production

Unit: 1000 Birr

	Gross Value of Production	Average annual growth rate	Gross Value of Production in 1997
1. Medium/Large scale	2,950,575 (in 1995)	22 %	4,391,636
2. Small scale	82,089 (in 1996)	22 %	100,149
3. Cottage/Handicraft	Data not available		

Note: Applied annual growth rate is an average annual growth rate of gross value of production in medium/large scale industry from 1992 to 1996.

(2) Gross Production of One Factory

Unit: Birr

	Gross Production of One Factory in 1997
1. Medium/Large scale	12,993,000
2. Small scale	83,737
3. Cottage/Handicraft	8,374

Note: Gross production of one cottage/handicraft factory is estimated on assumption that its production ability is one tenth of a small scale factory, since it does not use power-driven machines.

(3) Stock Value of finished and part-finished goods (Vsg)

Unit: Birr

	Gross output of one factory	Stock period of products	Stock value of finished and part-finished goods
1. Medium/Large scale	12,993,000	0.5 month = 1/24 year	541,375
2. Small scale	83,737	0.5 month = 1/24 year	3,489
3. Cottage/Handicraft	8,374	0.5 month = 1/24 year	349

Note: Stock value of finished and part-finished goods is estimated on assumption that it is equivalent to half of monthly gross output..

3. Stock Value of Raw Material (Vsm)

(1)Cost of Raw Material

Unit: 1000 Birr

	Gross Value of Production in 1997	Gross Value Added	Wage & Salaries	Raw Material Cost
1. Medium/Large scale	4,391,636	1,071,310	382,173	2,938,153
2. Small scale	100,149	36,318	4,470	59,361
3. Cottage/Handicraft	Data not available			

(2) Raw Material Cost per One Factory

Unit: Birr

	Raw Material Cost per One Factory
1. Medium/Large scale	8,692,760
2. Small scale	49,633
3. Cottage/Handicraft	4,963

Note: Raw material cost spent by one cottage/handicraft factory is estimated on assumption that its raw material cost is one tenth of a small scale factory.

(3) Stock Value of Raw Material (Vsm)

Unit: Birr

	Raw Material Cost per One Factory	Stock period of raw material	Stock value of raw material
1. Medium/Large scale	8,692,760	0.5 month = 1/24 year	362,198
2. Small scale	49,633	0.5 month = 1/24 year	2,068
3. Cottage/Handicraft	4,963	0.5 month = 1/24 year	206

Note: Stock value of raw material is estimated on assumption that factories stock raw materials for half a month operation.

4. Value of plant and machinery (Vma)

(1) Value of Fixed Assets

Unit: 1000 Birr

	Value of Fixed Assets	Average annual growth rate	Value of Fixed Assets in 1997
1. Medium/Large scale	785,968 (in 1995)	22 %	1,169,835
2. Small scale	34,431 (in 1996)	22 %	42,006
3. Cottage/Handicraft	Negligible small		

Note: Since no power driven machine is used for cottage/handicraft industries, fixed assets of the industry are assumed to be negligible small.

(2) Value of Fixed Assets per One Factory

Unit: Birr

	Value of Fixed Assets per One Factory
1. Medium/Large scale	3,461,050
2. Small scale	35,122
3. Cottage/Handicraft	Negligible small

Source: Results of the Survey of Manufacturing and Electricity Industries 1994/95, CSA
Report on Small Scale Manufacturing Industries Survey January 1997, CSA
Survey Report on the Identification and Solution on the Problems Facing the Service Giving Organizations and the Society, January 1997, Region 14 Administration

Table 12.6.1 Annual Flood Reduction Benefit

(for selection of optimum design scale) Unit: 1,000 Birr

River System	Design Scale	Annual Flood Reduction Benefit			
		1997		2020	
		after minor drainage improvement	before minor drainage improvement	after minor drainage improvement	before minor drainage improvement
Bantyiketu River System	1/20	9,897	9,402	15,980	15,181
Kurtume River	(1/10)				
Kechene River	(1/10)				
Bantyiketu River	(1/20)				
Bantyiketu River System	1/30	10,493	9,968	16,903	16,058
Kurtume River	(1/20)				
Kechene River	(1/20)				
Bantyiketu River	(1/30)				
Bantyiketu River System	1/40	10,821	10,280	17,405	16,535
Kurtume River	(1/30)				
Kechene River	(1/30)				
Bantyiketu River	(1/40)				

Note: It is assumed that 5 % of flood damage remains even after implementation of the flood control master plan until completion of minor drainage improvement.

Table 12.6.2 Financial and Economic Project Cost
(for selection of optimum design scale)

Bantyiketu River System

Cost Item	F.C. (1,000 Birr)		L.C. (1,000 Birr)		Total financial cost (1,000 Birr)	Total economic cost (1,000 Birr)
	Financial cost	Economic cost	Financial cost	Economic cost		
Bantyiketu (20) + Kechene (10) + Kurtume (10)						
1. Construction cost	24,676	22,208	45,642	39,709	70,318	61,917
2. Resettlement cost	0	0	6,931	6,030	6,931	6,030
3. Engineering services	9,493	9,493	1,055	1,055	10,548	10,548
4. Administration	0	0	7,032	6,118	7,032	6,118
Sub-total of (1.- 4.)	34,168	31,701	60,660	52,912	94,828	84,613
5. Physical contingency	6,834	6,340	12,132	10,582	18,966	16,922
Total of (1.- 5.)	41,002	38,041	72,792	63,494	113,794	101,535
Bantyiketu (30) + Kechene (20) + Kurtume (20)						
1. Construction cost	27,506	24,757	45,086	39,225	72,590	63,982
2. Resettlement cost	2	0	7,357	6,401	7,359	6,401
3. Engineering services	9,800	9,800	1,089	1,089	10,889	10,889
4. Administration	0	0	7,259	6,315	7,259	6,315
Sub-total of (1.- 4.)	37,306	34,557	60,791	53,030	98,097	87,587
5. Physical contingency	7,461	6,911	12,158	10,606	19,619	17,517
Total of (1.- 5.)	44,767	41,468	72,949	63,636	117,716	105,104
Bantyiketu (40) + Kechene (30) + Kurtume (30)						
1. Construction cost	33,685	30,317	50,532	43,963	84,217	74,280
2. Resettlement cost	0	0	8,683	7,554	8,683	7,554
3. Engineering services	11,370	11,369	1,263	1,263	12,633	12,632
4. Administration	0	0	8,422	7,327	8,422	7,327
Sub-total of (1.- 4.)	45,055	41,686	68,900	60,107	113,955	101,793
5. Physical contingency	9,011	8,337	13,780	12,021	22,791	20,358
Total of (1.- 5.)	54,066	50,023	82,680	72,128	136,746	122,151

Note: 1. Price level: as of June 1997, US$1.0 = 6.80 Birr, J. Yen1.0 = 0.0593 Birr

2. Engineering service fee is estimated as 15 % of total construction cost

3. Administration cost is estimated as 5 % of construction cost

4. Physical contingency is estimated as 20 % of total of (1.- 4.)

5. SCF (standard conversion factor) of 87 % has been applied for nontraded project cost (local currency portion).

6. 10 % of foreign currency portion of construction cost has been deducted for adjustment of import duties for traded project cost.

Table 12.6.3 Breakdown of Anuual Economic Cost
(for selection of optimum design scale)

Unit: 1,000 Birr

Bantyiketu River System

Item	Year in order												Total
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	
Bantyiketu (20) + Kechene (10) + Kurtume (10)													
1. Construction cost	0	24,767	18,575	18,575	-	-	-	-	-	-	-	-	61,917
2. Resettlement cost	3,015	3,015	0	0	-	-	-	-	-	-	-	-	6,030
3. Engineering services	4,219	2,110	2,110	2,110	-	-	-	-	-	-	-	-	10,548
4. Administration	564	2,330	1,612	1,612	-	-	-	-	-	-	-	-	6,118
Sub-total of (1.- 4.)	7,798	32,221	22,297	22,297	-	-	-	-	-	-	-	-	84,613
5. Physical contingency	1,560	6,444	4,459	4,459	-	-	-	-	-	-	-	-	16,922
Total of (1.- 5.)	9,358	38,665	26,756	26,756	-	-	-	-	-	-	-	-	101,535
Bantyiketu (30) + Kechene (20) + Kurtume (20)													
1. Construction cost	0	25,593	19,195	19,195	-	-	-	-	-	-	-	-	63,982
2. Resettlement cost	3,201	3,201	0	0	-	-	-	-	-	-	-	-	6,401
3. Engineering services	4,356	2,178	2,178	2,178	-	-	-	-	-	-	-	-	10,889
4. Administration	587	2,407	1,661	1,661	-	-	-	-	-	-	-	-	6,315
Sub-total of (1.- 4.)	8,143	33,378	23,033	23,033	-	-	-	-	-	-	-	-	87,587
5. Physical contingency	1,629	6,676	4,607	4,607	-	-	-	-	-	-	-	-	17,517
Total of (1.- 5.)	9,772	40,053	27,640	27,640	-	-	-	-	-	-	-	-	105,104
Bantyiketu (40) + Kechene (30) + Kurtume (30)													
1. Construction cost	0	29,712	22,284	14,856	7,428	-	-	-	-	-	-	-	74,280
2. Resettlement cost	3,777	3,777	0	0	0	-	-	-	-	-	-	-	7,554
3. Engineering services	5,053	2,526	2,526	1,263	1,263	-	-	-	-	-	-	-	12,632
4. Administration	685	2,793	1,924	1,250	674	-	-	-	-	-	-	-	7,327
Sub-total of (1.- 4.)	9,515	38,809	26,735	17,369	9,365	-	-	-	-	-	-	-	101,793
5. Physical contingency	1,903	7,762	5,347	3,474	1,873	-	-	-	-	-	-	-	20,359
Total of (1.- 5.)	11,418	46,571	32,082	20,843	11,237	-	-	-	-	-	-	-	122,151

Table 12.6.4 Cost-Benefit Analysis
(for selection of optimum design scale)

Bantyiketu River System (20-year)

Bantyiketu (20), Kechene (10) & Kurtume (10) — Unit: 1,000 Birr

Year in order	Year	Benefit	Cost				Net Cash Flow
			Construction	O/M	Replacement	Total	
1	1997	0	9,358			9,358	-9,358
2	1998	0	38,665			38,665	-38,665
3	1999	3,469	26,756	103		26,860	-23,391
4	2000	6,938	26,756	206		26,963	-20,025
5	2001	10,407		310		310	10,097
6	2002	10,658		310		310	10,349
7	2003	10,910		310		310	10,600
8	2004	11,161		310		310	10,851
9	2005	11,412		310		310	11,102
10	2006	11,663		310		310	11,354
11	2007	11,915		310		310	11,605
12	2008	12,166		310		310	11,856
13	2009	12,417		310		310	12,108
14	2010	12,668		310		310	12,359
15	2011	12,920		310		310	12,610
16	2012	13,171		310		310	12,861
17	2013	13,422		310		310	13,113
18	2014	13,673		310		310	13,364
19	2015	13,925		310		310	13,615
20	2016	14,176		310		310	13,866
21	2017	14,427		310		310	14,118
22	2018	14,678		310		310	14,369
23	2019	14,930		310		310	14,620
24	2020	15,181		310		310	14,871
25	2021	15,181		310		310	14,871
26	2022	15,181		310		310	14,871
27	2023	15,181		310		310	14,871
28	2024	15,181		310	807	1,117	14,064
29	2025	15,181		310		310	14,871
30	2026	15,181		310		310	14,871
31	2027	15,181		310		310	14,871
32	2028	15,181		310		310	14,871
33	2029	15,181		310		310	14,871
34	2030	15,181		310		310	14,871
35	2031	15,181		310		310	14,871
36	2032	15,181		310		310	14,871
37	2033	15,181		310		310	14,871
38	2034	15,181		310		310	14,871
39	2035	15,181		310		310	14,871
40	2036	15,181		310		310	14,871
41	2037	15,181		310		310	14,871
42	2038	15,181		310		310	14,871
43	2039	15,181		310		310	14,871
44	2040	15,181		310		310	14,871
45	2041	15,181		310		310	14,871
46	2042	15,181		310		310	14,871
47	2043	15,181		310		310	14,871
48	2044	15,181		310		310	14,871
49	2045	15,181		310		310	14,871
50	2046	15,181		310		310	14,871

EIRR= 11.2%
B/C = 1.13 (at discount rate: 10 %)
NPV= 10,287 (at discount rate: 10 %)

Bantyiketu River System (30-year)

Bantyiketu (30), Kechene (20) & Kurtume (20) — Unit: 1,000 Birr

Year in order	Year	Benefit	Cost				Net Cash Flow
			Construction	O/M	Replacement	Total	
1	1997	0	9,772			9,772	-9,772
2	1998	0	40,053			40,053	-40,053
3	1999	3,675	27,640	107		27,747	-24,072
4	2000	7,351	27,640	213		27,853	-20,502
5	2001	11,027		320		320	10,707
6	2002	11,292		320		320	10,972
7	2003	11,557		320		320	11,237
8	2004	11,821		320		320	11,501
9	2005	12,086		320		320	11,766
10	2006	12,351		320		320	12,031
11	2007	12,616		320		320	12,296
12	2008	12,881		320		320	12,561
13	2009	13,145		320		320	12,825
14	2010	13,410		320		320	13,090
15	2011	13,675		320		320	13,355
16	2012	13,940		320		320	13,620
17	2013	14,205		320		320	13,885
18	2014	14,469		320		320	14,149
19	2015	14,734		320		320	14,414
20	2016	14,999		320		320	14,679
21	2017	15,264		320		320	14,944
22	2018	15,528		320		320	15,208
23	2019	15,793		320		320	15,473
24	2020	16,058		320		320	15,738
25	2021	16,058		320		320	15,738
26	2022	16,058		320		320	15,738
27	2023	16,058		320		320	15,738
28	2024	16,058		320	807	1,127	14,931
29	2025	16,058		320		320	15,738
30	2026	16,058		320		320	15,738
31	2027	16,058		320		320	15,738
32	2028	16,058		320		320	15,738
33	2029	16,058		320		320	15,738
34	2030	16,058		320		320	15,738
35	2031	16,058		320		320	15,738
36	2032	16,058		320		320	15,738
37	2033	16,058		320		320	15,738
38	2034	16,058		320		320	15,738
39	2035	16,058		320		320	15,738
40	2036	16,058		320		320	15,738
41	2037	16,058		320		320	15,738
42	2038	16,058		320		320	15,738
43	2039	16,058		320		320	15,738
44	2040	16,058		320		320	15,738
45	2041	16,058		320		320	15,738
46	2042	16,058		320		320	15,738
47	2043	16,058		320		320	15,738
48	2044	16,058		320		320	15,738
49	2045	16,058		320		320	15,738
50	2046	16,058		320		320	15,738

EIRR= 11.4%
B/C = 1.15 (at discount rate: 10 %)
NPV= 12,789 (at discount rate: 10 %)

Bantyiketu River System (40-year)

Bantyiketu (40), Kechene (30) & Kurtume (30) — Unit: 1,000 Birr

Year in order	Year	Benefit	Cost				Net Cash Flow
			Construction	O/M	Replacement	Total	
1	1997	0	11,418			11,418	-11,418
2	1998	0	46,571			46,571	-46,571
3	1999	2,910	32,082	95		32,177	-29,267
4	2000	5,820	20,843	187		21,030	-15,210
5	2001	8,730	11,237	279		11,516	-2,786
6	2002	11,640		371		371	11,269
7	2003	11,912		371		371	11,541
8	2004	12,184		371		371	11,813
9	2005	12,456		371		371	12,085
10	2006	12,728		371		371	12,357
11	2007	13,000		371		371	12,629
12	2008	13,272		371		371	12,901
13	2009	13,544		371		371	13,173
14	2010	13,815		371		371	13,444
15	2011	14,087		371		371	13,716
16	2012	14,359		371		371	13,988
17	2013	14,631		371		371	14,260
18	2014	14,903		371		371	14,532
19	2015	15,175		371		371	14,804
20	2016	15,447		371		371	15,076
21	2017	15,719		371		371	15,348
22	2018	15,991		371		371	15,620
23	2019	16,263		371		371	15,892
24	2020	16,535		371		371	16,164
25	2021	16,535		371		371	16,164
26	2022	16,535		371		371	16,164
27	2023	16,535		371		371	16,164
28	2024	16,535		371	807	1,176	15,357
29	2025	16,535		371		371	16,164
30	2026	16,535		371		371	16,164
31	2027	16,535		371		371	16,164
32	2028	16,535		371		371	16,164
33	2029	16,535		371		371	16,164
34	2030	16,535		371		371	16,164
35	2031	16,535		371		371	16,164
36	2032	16,535		371		371	16,164
37	2033	16,535		371		371	16,164
38	2034	16,535		371		371	16,164
39	2035	16,535		371		371	16,164
40	2036	16,535		371		371	16,164
41	2037	16,535		371		371	16,164
42	2038	16,535		371		371	16,164
43	2039	16,535		371		371	16,164
44	2040	16,535		371		371	16,164
45	2041	16,535		371		371	16,164
46	2042	16,535		371		371	16,164
47	2043	16,535		371		371	16,164
48	2044	16,535		371		371	16,164
49	2045	16,535		371		371	16,164
50	2046	16,535		371		371	16,164

EIRR= 9.9%
B/C = 0.99 (at discount rate: 10 %)
NPV= -580 (at discount rate: 10 %)

Table 12.6.5 Probable Flood Damage

(As of 1997)

Unit: 1,000 Birr

River System	Return Period (Year)	General Asset				Crops (Vegetable)	Total of Direct Damage	Indirect Damage	Infra structure	Other Damage	Total of Probable Damage
		Housing Asset		Commercial Sector	Factory						
		House	Household Effects								
Bantyiketu River System											
Kechene River	2	4	1	5	0	0	9	1	1	1	12
	5	58	13	65	1	0	137	19	14	17	187
	10	100	24	107	2	0	241	32	24	29	326
	20	342	79	316	6	0	742	104	74	92	1,013
	30	535	131	517	9	0	1,191	167	119	148	1,625
Kurtume River	2	-	-	-	-	-	0	0	0	0	0
	5	49	11	262	1	0	323	45	32	40	440
	10	96	25	581	2	0	703	98	70	87	959
	20	387	103	1,546	8	0	2,044	285	204	253	2,786
	30	552	159	1,974	11	0	2,697	376	269	333	3,675
Bantyiketu River	2	2,752	922	3,768	46	13	7,502	1,048	750	930	10,230
	5	4,846	1,637	6,077	81	23	12,665	1,770	1,267	1,570	17,272
	10	5,654	1,935	6,939	91	26	14,649	2,047	1,465	1,816	19,977
	20	7,156	2,418	9,564	117	27	19,313	2,700	1,931	2,394	26,339
	30	7,913	2,724	11,361	129	29	21,956	3,070	2,196	2,722	29,944
	40	8,077	2,783	11,396	132	29	22,328	3,122	2,233	2,768	30,451
Kebena River System	2	927	302	461	16	4	1,710	239	171	212	2,332
	5	2,720	913	1,762	46	16	5,455	761	545	676	7,438
	10	3,588	1,231	2,228	59	20	7,127	995	713	883	9,718
	20	4,498	1,551	3,111	74	23	9,257	1,293	926	1,148	12,623
	30	4,813	1,668	3,361	79	23	9,945	1,389	994	1,233	13,561
Little Akaki River System	2	3,374	1,134	2,391	69	12	6,981	976	698	865	9,520
	5	5,846	1,991	3,755	117	29	11,739	1,639	1,174	1,455	16,007
	10	7,062	2,415	4,431	141	31	14,113	1,971	1,411	1,750	19,245
	20	8,182	2,842	5,071	163	40	16,296	2,276	1,630	2,020	22,225
	30	8,937	3,120	5,502	178	44	17,781	2,483	1,778	2,204	24,247
Hanko River System	2	15	3	18	0	0	37	5	4	5	50
	5	32	7	34	1	0	73	10	7	9	100
	10	51	13	57	1	0	122	17	12	15	166
	20	63	15	68	1	0	148	21	15	18	202

(As of 2020)

Unit: 1,000 Birr

River System	Return Period (Year)	General Asset				Crops (Vegetable)	Total of Direct Damage	Indirect Damage	Infra structure	Other Damage	Total of Probable Damage
		Housing Asset		Commercial Sector	Factory						
		House	Household Effects								
Bantyiketu River System											
Kechene River	2	5	1	6	0	0	13	2	1	2	18
	5	152	37	114	2	0	305	43	31	38	416
	10	359	41	144	2	0	346	48	35	43	472
	20	544	140	418	7	0	1,109	155	111	137	1,512
	30	837	227	675	11	0	1,750	245	175	217	2,387
Kurtume River	2	-	-	-	-	-	0	0	0	0	0
	5	83	21	410	1	0	516	72	52	64	703
	10	168	48	918	3	0	1,136	159	114	141	1,550
	20	643	192	2,318	10	0	3,163	447	319	396	4,325
	30	969	276	2,968	14	0	4,167	583	417	517	5,684
Bantyiketu River	2	5,053	1,869	5,119	71	13	12,115	1,694	1,211	1,502	16,523
	5	8,818	3,305	8,192	122	23	20,490	2,865	2,049	2,540	27,944
	10	10,260	3,682	9,311	141	26	23,659	3,307	2,365	2,932	32,263
	20	12,830	4,648	12,359	174	27	30,239	4,230	3,024	3,749	41,242
	30	13,974	5,310	13,319	189	29	33,621	4,703	3,362	4,169	45,855
	40	14,277	5,430	14,312	193	29	34,242	4,790	3,424	4,246	46,701
Kebena River System	2	1,789	642	728	26	4	3,188	446	319	395	4,348
	5	5,414	1,959	2,888	76	16	10,383	1,451	1,038	1,287	14,159
	10	7,259	2,732	3,723	101	20	13,835	1,934	1,384	1,715	18,868
	20	8,915	3,375	5,100	124	23	17,537	2,456	1,757	2,178	23,927
	30	9,559	3,625	5,515	132	23	18,855	2,636	1,885	2,338	25,715
Little Akaki River System	2	7,213	2,685	4,081	121	12	14,112	1,974	1,411	1,750	19,247
	5	13,159	4,945	6,956	221	29	25,310	3,543	2,534	3,142	34,529
	10	16,042	6,123	8,506	272	34	30,978	4,332	3,098	3,841	42,249
	20	18,991	7,268	10,167	325	40	36,792	5,145	3,679	4,562	50,178
	30	21,124	8,135	11,413	364	41	41,080	5,745	4,108	5,093	56,027
Hanko River System	2	38	9	35	1	0	83	12	8	10	113
	5	97	23	77	2	0	198	28	20	25	270
	10	156	41	129	3	0	330	46	33	41	450
	20	202	53	160	4	0	419	59	42	52	573

Table 12.6.6 Annual Mean Flood Damage

(As of 1997)

River System	Return Period	Exceedance	Difference of Exceedance	Damage (1,000 Birr) Amount	Damage (1,000 Birr) Mean	Annual Damage (1,000 Birr) Segment	Annual Damage (1,000 Birr) Cumulative
Bantyiketu River System							
Kechene River	-	1.00					
	2	0.50	0.50	12	6	3	3
	5	0.20	0.30	187	100	30	33
	10	0.10	0.10	316	252	25	58
	20	0.05	0.05	1,013	664	33	91
	30	0.03	0.02	1,625	1,319	22	113
Kurtume River	-	1.00					
	2	0.50	0.50	-	-	-	-
	5	0.20	0.30	440	220	66	66
	10	0.10	0.10	959	700	70	136
	20	0.05	0.05	2,788	1,874	94	230
	30	0.03	0.02	3,665	3,227	54	283
Bantyiketu River	-	1.00					
	2	0.50	0.50	10,230	5,115	2,558	2,558
	5	0.20	0.30	17,272	13,751	4,125	6,683
	10	0.10	0.10	19,977	18,624	3,862	8,545
	20	0.05	0.05	26,339	23,158	1,158	9,703
	30	0.03	0.02	29,944	28,141	469	10,172
	40	0.025	0.01	30,451	30,198	252	10,424
Kebena River System	-	1.00					
	2	0.50	0.50	2,332	1,166	583	583
	5	0.20	0.30	7,438	4,885	1,465	2,048
	10	0.10	0.10	9,718	8,578	858	2,906
	20	0.05	0.05	12,623	11,170	559	3,465
	30	0.03	0.02	13,561	13,092	218	3,683
Little Akaki River System	-	1.00					
	2	0.50	0.50	9,520	4,760	2,380	2,380
	5	0.20	0.30	16,007	12,764	3,829	6,209
	10	0.10	0.10	19,245	17,626	1,763	7,972
	20	0.05	0.05	22,225	20,735	1,037	9,008
	30	0.03	0.02	24,247	23,236	387	9,396
Hanku River System	-	1.00					
	2	0.50	0.50	50	25	13	13
	5	0.20	0.30	100	75	23	35
	10	0.10	0.10	166	133	13	48
	20	0.05	0.05	201	184	9	58

(As of 2020)

River System	Return Period	Exceedance	Difference of Exceedance	Damage (1,000 Birr) Amount	Damage (1,000 Birr) Mean	Annual Damage (1,000 Birr) Segment	Annual Damage (1,000 Birr) Cumulative
Bantyiketu River System							
Kebene River	-	1.00					
	2	0.50	0.50	18	9	4	4
	5	0.20	0.30	416	217	65	69
	10	0.10	0.10	472	444	44	114
	20	0.05	0.05	1,512	992	50	163
	30	0.03	0.02	2,387	1,950	32	196
Kurtume River	-	1.00					
	2	0.50	0.50	-	-	-	-
	5	0.20	0.30	703	352	105	105
	10	0.10	0.10	1,550	1,127	113	218
	20	0.05	0.05	4,356	2,953	148	366
	30	0.03	0.02	5,684	5,020	84	449
Bantyiketu River	-	1.00					
	2	0.50	0.50	16,523	8,261	4,131	4,131
	5	0.20	0.30	27,944	22,233	6,670	10,801
	10	0.10	0.10	32,255	30,100	3,010	13,811
	20	0.05	0.05	41,242	36,749	1,837	15,648
	30	0.03	0.02	45,855	43,548	726	16,374
	40	0.025	0.01	46,701	46,278	386	16,760
Kebena River System	-	1.00					
	2	0.50	0.50	4,348	2,174	1,087	1,087
	5	0.20	0.30	14,159	9,254	2,776	3,863
	10	0.10	0.10	18,868	16,514	1,651	5,514
	20	0.05	0.05	23,957	21,413	1,071	6,585
	30	0.03	0.02	25,715	24,836	414	6,999
Little Akaki River System	-	1.00					
	2	0.50	0.50	19,247	9,624	4,812	4,812
	5	0.20	0.30	34,559	26,903	8,071	12,883
	10	0.10	0.10	42,249	38,404	3,840	16,723
	20	0.05	0.05	50,176	46,213	2,311	19,034
	30	0.03	0.02	56,027	53,102	885	19,919
Hanku River System	-	1.00					
	2	0.50	0.50	113	56	28	28
	5	0.20	0.30	270	191	57	86
	10	0.10	0.10	450	360	36	122
	20	0.05	0.05	571	510	26	147

Table 12.6.7 Summery of Annual Flood Reduction Benefit

(Flood Control Master Plan)

Unit: 1,000 Birr

River System	Design Scale	Annual Flood Reduction Benefit			
		1997		2020	
		after minor drainage improvement	before minor drainage improvement	after minor drainage improvement	before minor drainage improvement
Bantyiketu River System	1/30	10,493	9,968	16,903	16,058
Kurtume River	(1/20)				
Kechene River	(1/20)				
Bantyiketu River	(1/30)				
Kebena River System	1/30	3,683	3,499	6,999	6,649
Little Akaki River System	1/30	9,396	8,926	19,919	18,923
Hanku River System	1/20	58	55	147	140

Note: It is assumed that 5 % of flood damage remains even after implementation of the flood control master plan until completion of minor drainage improvement.

Table 12.6.8 Financial and Economic Project Cost of Structural Measures

Flood Control Master Plan

Cost Item	F.C. (1,000 Birr)		L.C. (1,000 Birr)		Total financial	Total economic
	Financial cost	Economic cost	Financial cost	Economic cost	cost (1,000 Birr)	cost (1,000 Birr)
Bantyiketu River System (30-year)						
1. Construction cost	27,938	25,144	44,588	38,792	72,526	63,936
2. Resettlement cost	0	0	7,359	6,402	7,359	6,402
3. Engineering services	9,791	9,791	1,088	1,088	10,879	10,879
4. Administration	0	0	7,253	6,310	7,253	6,310
Sub-total of (1.- 4.)	37,729	34,935	60,288	52,592	98,017	87,527
5. Physical contingency	7,546	6,987	12,058	10,518	19,604	17,505
Total of (1.- 5.)	45,275	41,922	72,346	63,110	117,621	105,032
Kebcon River System (30-year)						
1. Construction cost	14,585	13,127	72,625	63,184	87,210	76,311
2. Resettlement cost	0	0	4,297	3,738	4,297	3,738
3. Engineering services	11,774	11,774	1,308	1,308	13,082	13,082
4. Administration	0	0	8,721	7,587	8,721	7,587
Sub total of (1.- 4.)	26,359	24,901	86,951	75,817	113,310	100,718
5. Physical contingency	5,272	4,980	17,390	15,163	22,662	20,143
Total of (1.- 5.)	31,631	29,881	104,341	90,980	135,972	120,861
Little Akaki River System (30-year)						
1. Construction cost	46,994	42,295	36,249	31,537	83,243	73,832
2. Resettlement cost	0	0	2,946	2,563	2,946	2,563
3. Engineering services	11,237	11,237	1,249	1,249	12,486	12,486
4. Administration	0	0	8,324	7,242	8,324	7,242
Sub-total of (1.- 4.)	58,231	53,532	48,768	42,591	106,999	96,123
5. Physical contingency	11,646	10,706	9,754	8,518	21,400	19,224
Total of (1.- 5.)	69,877	64,238	58,522	51,109	128,399	115,347
Hanku River System (20-year)						
1. Construction cost	217	195	583	507	800	702
2. Resettlement cost	0	0	0	0	0	0
3. Engineering services	108	108	12	12	120	120
4. Administration	0	0	80	70	80	70
Sub-total of (1.- 4.)	325	303	675	589	1,000	892
5. Physical contingency	65	61	135	118	200	179
Total of (1.- 5.)	390	364	810	707	1,200	1,071

Note: 1. Price level: as of June 1997, US$1.0 = 6.80 Birr, J. Yen1.0 = 0.0593 Birr
2. Engineering service fee is estimated as 15 % of total construction cost
3. Administration cost is estimated as 5 % of construction cost
4. Physical contingency is estimated as 20 % of total of (1.- 4.)
5. SCF (standard conversion factor) of 87 % has been applied for nontraded project cost (local currency portion).
6. 10 % of foreign currency portion of construction cost has been deducted for adjustment of import duties for traded project cost.

Table 12.6.9 Financial and Economic Project Cost of Non-structural Measures

Flood Control Master Plan

Cost Item	F.C. (1,000 Birr)		L.C. (1,000 Birr)		Total financial	Total economic
	Financial cost	Economic cost	Financial cost	Economic cost	cost (1,000 Birr)	cost (1,000 Birr)
Bantyiketu River System						
1. River management	-	-	96	84	96	84
2. Watershed management	-	-	22	19	22	19
3. Flood risk management	-	-	3,417	2,973	3,417	2,973
Sub-total of (1.- 3.)	0	0	3,535	3,076	3,535	3,076
4. Physical contingency	-	-	707	615	707	615
Total of (1.- 4.)	0	0	4,242	3,691	4,242	3,691
Kebena River System						
1. River management	-	-	36	31	36	31
2. Watershed management	-	-	46	40	46	40
3. Flood risk management	-	-	1,346	1,171	1,346	1,171
Sub-total of (1.- 3.)	0	0	1,428	1,242	1,428	1,242
4. Physical contingency	-	-	286	248	286	248
Total of (1.- 4.)	0	0	1,714	1,490	1,714	1,490
Little Akaki River System						
1. River management	-	-	48	42	48	42
2. Watershed management	-	-	24	21	24	21
3. Flood risk management	-	-	1,780	1,549	1,780	1,549
Sub-total of (1.- 3.)	0	0	1,852	1,612	1,852	1,612
4. Physical contingency	-	-	370	322	370	322
Total of (1.- 4.)	0	0	2,222	1,934	2,222	1,934
Hanku River System						
1. River management	-	-	0	0	0	0
2. Watershed management	-	-	8	7	8	7
3. Flood risk management	-	-	156	136	156	136
Sub-total of (1.- 3.)	0	0	164	143	164	143
4. Physical contingency	-	-	33	29	33	29
Total of (1.- 4.)	0	0	197	172	197	172

Note: 1. Price level: as of June 1997, US$1.0 = 6.80 Birr, J. Yen1.0 = 0.0593 Birr

2. Physical contingency is estimated as 20 % of total of (1.- 3.)

3. SCF (standard conversion factor) of 87 % has been applied for nontraded project cost (local currency portion).

Table 12.6.10 Financial and Economic Cost of Operation and Maintenance

Structural Measures

Cost Item	F.C. (1,000 Birr)		L.C. (1,000 Birr)		Total financial cost (1,000 Birr)	Total economic cost (1,000 Birr)
	Financial cost	Economic cost	Financial cost	Economic cost		
Bantyiketu River System						
1. Annual cost	-	-	363	316	363	316
2. Annual reserve for replacement of facilities	41	37	4	3	45	40
Total of (1.- 2.)	41	37	367	319	408	356
Kebena River System						
1. Annual cost	-	-	437	380	437	380
2. Annual reserve for replacement of facilities	-	-	0	0	0	0
Total of (1.- 2.)	0	0	437	380	437	380
Little Akaki River System						
1. Annual cost	-	-	416	362	416	362
2. Annual reserve for replacement of facilities	7	6	1	1	8	7
Total of (1.- 2.)	7	6	417	363	424	369
Hanku River System						
1. Annual cost	-	-	4	3	4	3
2. Annual reserve for replacement of facilities	-	-	0	0	0	0
Total of (1.- 2.)	0	0	4	3	4	3

Non-structural Measures

Cost Item	F.C. (1,000 Birr)		L.C. (1,000 Birr)		Total financial cost (1,000 Birr)	Total economic cost (1,000 Birr)
	Financial cost	Economic cost	Financial cost	Economic cost		
Bantyiketu River System						
1. River management	-	-	1.0	0.8	1.0	0.8
2. Watershed measures (Reforestation)	-	-	27.8	24.2	27.8	24.2
Total of (1.- 2.)	0.0	0.0	28.8	25.0	28.8	25.0
Kebena River System						
1. River management	-	-	0.4	0.3	0.4	0.3
2. Watershed measures (Reforestation)	-	-	58.2	50.6	58.2	50.6
Total of (1.- 2.)	0.0	0.0	58.6	50.9	58.6	50.9
Little Akaki River System						
1. River management	-	-	0.5	0.4	0.5	0.4
2. Watershed measures (Reforestation)	-	-	30.4	26.4	30.4	26.4
Total of (1.- 2.)	0.0	0.0	30.8	26.8	30.8	26.8
Hanku River System						
1. River management	-	-	0.0	0.0	0.0	0.0
2. Watershed measures (Reforestation)	-	-	10.1	8.8	10.1	8.8
Total of (1.- 2.)	0.0	0.0	10.1	8.8	10.1	8.8

Note: 1. Price level: as of June 1997, US$1.0 = 6.80 Birr, J. Yen1.0 = 0.0593 Birr
2. SCF (standard conversion factor) of 87 % has been applied for nontraded project cost (local currency portion).

Table 12.6.11 Breakdown of Annual Economic Cost
(Flood Control Master Plan)

Unit: 1,000 Birr

Item	Year in order									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	Total
Bantyiketu River System (30-year)										
I. Structural measures										
1. Construction cost	-	12,787	12,787	12,787	12,787	12,788	-	-	-	63,936
2. Resettlement cost	1,601	1,601	0	1,601	1,599	-	-	-	-	6,402
3. Engineering services	1,813	1,813	1,813	1,813	1,813	1,814	-	-	-	10,879
4. Administration	1,052	1,052	1,052	1,052	1,052	1,050	-	-	-	6,310
Sub-total of (1.- 4.)	4,466	17,253	15,652	17,253	17,251	15,652	-	-	-	87,527
5. Physical contingency	893	3,451	3,130	3,451	3,450	3,130	-	-	-	17,505
Total of (1.- 5.)	5,359	20,704	18,782	20,704	20,701	18,782	-	-	-	105,032
II. Non-structural measures	-	1,846	1,845	-	-	-	-	-	-	3,691
Total of (I + II.)	5,359	22,550	20,627	20,704	20,701	18,782	-	-	-	108,723
Kebene River System (30-year)										
I. Structural measures										
1. Construction cost	-	10,902	10,902	10,902	10,902	10,902	10,902	10,899	-	76,311
2. Resettlement cost	935	935	0	0	935	933	-	-	-	3,738
3. Engineering services	1,635	1,635	1,635	1,635	1,635	1,635	1,635	1,637	-	13,082
4. Administration	948	948	948	948	948	948	948	951	-	7,587
Sub-total of (1.- 4.)	3,518	14,420	13,485	13,485	14,420	14,418	13,485	13,487	-	100,718
5. Physical contingency	704	2,884	2,697	2,697	2,884	2,884	2,697	2,696	-	20,143
Total of (1.- 5.)	4,222	17,304	16,182	16,182	17,304	17,302	16,182	16,183	-	120,861
II. Non-structural measures	-	745	745	-	-	-	-	-	-	1,490
Total of (I + II.)	4,222	18,049	16,927	16,182	17,304	17,302	16,182	16,183	-	122,351
Little Akaki River System (30-year)										
I. Structural measures										
1. Construction cost	-	14,766	14,766	14,766	14,766	14,768	-	-	-	73,832
2. Resettlement cost	641	641	0	641	640	-	-	-	-	2,563
3. Engineering services	2,081	2,081	2,081	2,081	2,081	2,081	-	-	-	12,486
4. Administration	1,207	1,207	1,207	1,207	1,207	1,207	-	-	-	7,242
Sub-total of (1.- 4.)	3,929	18,695	18,054	18,695	18,694	18,056	-	-	-	96,123
5. Physical contingency	786	3,739	3,611	3,739	3,739	3,610	-	-	-	19,224
Total of (1.- 5.)	4,715	22,434	21,665	22,434	22,433	21,666	-	-	-	115,347
II. Non-structural measures	-	967	967	-	-	-	-	-	-	1,934
Total of (I + II.)	4,715	23,401	22,632	22,434	22,433	21,666	-	-	-	117,281
Hanku River System (20-year)										
I. Structural measures										
1. Construction cost	-	702	-	-	-	-	-	-	-	702
2. Resettlement cost	0	0	-	-	-	-	-	-	-	0
3. Engineering services	60	60	-	-	-	-	-	-	-	120
4. Administration	35	35	-	-	-	-	-	-	-	70
Sub-total of (1.- 4.)	95	797	-	-	-	-	-	-	-	892
5. Physical contingency	19	160	-	-	-	-	-	-	-	179
Total of (1.- 5.)	114	957	-	-	-	-	-	-	-	1,071
II. Non-structural measures	-	172	-	-	-	-	-	-	-	172
Total of (I + II.)	114	1,129	-	-	-	-	-	-	-	1,243

Table 12.6.12 Cost-Benefit Analysis (1/2)
(Flood Control Master Plan)

Bantyiketu River System (30-year)

Bantyiketu (30), Kechene (20) & Kurtume (20)

Unit: 1,000 Birr

Year in order	Year	Benefit	Cost						Net Cash Flow
			Structural measures			Non-structural measures		Total Cost	
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total		
1	1997	0	0		0	0	0	0	0	0
2	1998	0	0		0	0	0	0	0	0
3	1999	0	5,359		5,359	0	0	5,359	5,359	-5,359
4	2000	0	20,704		20,704	1,846	1,846	22,550	22,550	-22,550
5	2001	2,418	18,782	72	18,854	1,845	13	1,858	20,712	-18,293
6	2002	4,835	20,704	143	20,847		25	25	20,872	-16,037
7	2003	7,252	20,701	214	20,915		25	25	20,940	-13,688
8	2004	9,669	18,782	285	19,067		25	25	19,092	-9,423
9	2005	12,086		356	356		25	25	381	11,705
10	2006	12,351		356	356		25	25	381	11,970
11	2007	12,616		356	356		25	25	381	12,235
12	2008	12,881		356	356		25	25	381	12,500
13	2009	13,145		356	356		25	25	381	12,764
14	2010	13,410		356	356		25	25	381	13,029
15	2011	13,675		356	356		25	25	381	13,294
16	2012	13,940		356	356		25	25	381	13,559
17	2013	14,205		356	356		25	25	381	13,824
18	2014	14,469		356	356		25	25	381	14,088
19	2015	14,734		356	356		25	25	381	14,353
20	2016	14,999		356	356		25	25	381	14,618
21	2017	15,264		356	356		25	25	381	14,883
22	2018	15,528		356	356		25	25	381	15,147
23	2019	15,793		356	356		25	25	381	15,412
24	2020	16,058		356	356		25	25	381	15,677
25	2021	16,058		356	356		25	25	381	15,677
26	2022	16,058		356	356		25	25	381	15,677
27	2023	16,058		356	356		25	25	381	15,677
28	2024	16,058		356	356		25	25	381	15,677
29	2025	16,058		356	356		25	25	381	15,677
30	2026	16,058		356	356		25	25	381	15,677
31	2027	16,058		356	356		25	25	381	15,677
32	2028	16,058		356	356		25	25	381	15,677
33	2029	16,058		356	356		25	25	381	15,677
34	2030	16,058		356	356		25	25	381	15,677
35	2031	16,058		356	356		25	25	381	15,677
36	2032	16,058		356	356		25	25	381	15,677
37	2033	16,058		356	356		25	25	381	15,677
38	2034	16,058		356	356		25	25	381	15,677
39	2035	16,058		356	356		25	25	381	15,677
40	2036	16,058		356	356		25	25	381	15,677
41	2037	16,058		356	356		25	25	381	15,677
42	2038	16,058		356	356		25	25	381	15,677
43	2039	16,058		356	356		25	25	381	15,677
44	2040	16,058		356	356		25	25	381	15,677
45	2041	16,058		356	356		25	25	381	15,677
46	2042	16,058		356	356		25	25	381	15,677
47	2043	16,058		356	356		25	25	381	15,677
48	2044	16,058		356	356		25	25	381	15,677
49	2045	16,058		356	356		25	25	381	15,677
50	2046	16,058		356	356		25	25	381	15,677

EIRR= 11.7%

B/C = 1.17 (at discount rate: 10 %)

NPV= 11,406 (at discount rate: 10 %)

Note: The O & M costs of the structural measures include annual reserve for replacement of gates.

Kehena River System (30-year)

Unit: 1,000 Birr

Year in order	Year	Benefit	Cost						Net Cash Flow
			Structural measures			Non-structural measures		Total Cost	
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total		
1	1997	0	0		0	0	0	0	0	0
2	1998	0	0		0	0	0	0	0	0
3	1999	0	4,222		4,222	0	0	4,222	4,222	-4,222
4	2000	0	17,304		17,304	745	745	18,049	18,049	-18,049
5	2001	699	16,182	56	16,238	745	25	770	17,008	-16,309
6	2002	1,394	16,182	110	16,292		51	51	16,343	-14,949
7	2003	2,089	17,304	164	17,468		51	51	17,519	-15,430
8	2004	2,784	17,302	218	17,520		51	51	17,571	-14,787
9	2005	3,479	16,182	272	16,454		51	51	16,505	-13,026
10	2006	4,174	16,183	326	16,509		51	51	16,560	-12,386
11	2007	4,869		380	380		51	51	431	4,438
12	2008	5,006		380	380		51	51	431	4,575
13	2009	5,142		380	380		51	51	431	4,711
14	2010	5,279		380	380		51	51	431	4,848
15	2011	5,416		380	380		51	51	431	4,985
16	2012	5,553		380	380		51	51	431	5,122
17	2013	5,690		380	380		51	51	431	5,259
18	2014	5,827		380	380		51	51	431	5,396
19	2015	5,964		380	380		51	51	431	5,533
20	2016	6,101		380	380		51	51	431	5,670
21	2017	6,238		380	380		51	51	431	5,807
22	2018	6,375		380	380		51	51	431	5,944
23	2019	6,512		380	380		51	51	431	6,081
24	2020	6,649		380	380		51	51	431	6,218
25	2021	6,649		380	380		51	51	431	6,218
26	2022	6,649		380	380		51	51	431	6,218
27	2023	6,649		380	380		51	51	431	6,218
28	2024	6,649		380	380		51	51	431	6,218
29	2025	6,649		380	380		51	51	431	6,218
30	2026	6,649		380	380		51	51	431	6,218
31	2027	6,649		380	380		51	51	431	6,218
32	2028	6,649		380	380		51	51	431	6,218
33	2029	6,649		380	380		51	51	431	6,218
34	2030	6,649		380	380		51	51	431	6,218
35	2031	6,649		380	380		51	51	431	6,218
36	2032	6,649		380	380		51	51	431	6,218
37	2033	6,649		380	380		51	51	431	6,218
38	2034	6,649		380	380		51	51	431	6,218
39	2035	6,649		380	380		51	51	431	6,218
40	2036	6,649		380	380		51	51	431	6,218
41	2037	6,649		380	380		51	51	431	6,218
42	2038	6,649		380	380		51	51	431	6,218
43	2039	6,649		380	380		51	51	431	6,218
44	2040	6,649		380	380		51	51	431	6,218
45	2041	6,649		380	380		51	51	431	6,218
46	2042	6,649		380	380		51	51	431	6,218
47	2043	6,649		380	380		51	51	431	6,218
48	2044	6,649		380	380		51	51	431	6,218
49	2045	6,649		380	380		51	51	431	6,218
50	2046	6,649		380	380		51	51	431	6,218

EIRR= 3.5%

B/C = 0.42 (at discount rate: 10 %)

NPV= -38,852 (at discount rate: 10 %)

Table 12.6.12 Cost-Benefit Analysis (2/2)
(Flood Control Master Plan)

Little Akaki River System (30-year) — Unit: 1,000 Birr

Year in order	Year	Benefit	Cost: Structural measures Initial cost	Structural measures O&M	Structural measures Sub-total	Non-structural measures Initial cost	Non-structural measures O&M	Non-structural measures Sub-total	Total Cost	Net Cash Flow
1	1997	0	0		0	0		0	0	0
2	1998	0	0		0	0		0	0	0
3	1999	0	4,715		4,715	0		0	4,715	-4,715
4	2000	0	22,434		22,434	967		967	23,401	-23,401
5	2001	0	21,665		21,665	967	14	981	22,646	-22,646
6	2002	0	22,434		22,434		27	27	22,461	-22,461
7	2003	0	22,433		22,433		27	27	22,460	-22,460
8	2004	6,202	21,666	185	21,851		27	27	21,878	-15,676
9	2005	12,403		369	369		27	27	396	12,007
10	2006	12,838		369	369		27	27	396	12,442
11	2007	13,272		369	369		27	27	396	12,876
12	2008	13,707		369	369		27	27	396	13,311
13	2009	14,142		369	369		27	27	396	13,746
14	2010	14,576		369	369		27	27	396	14,180
15	2011	15,011		369	369		27	27	396	14,615
16	2012	15,446		369	369		27	27	396	15,050
17	2013	15,880		369	369		27	27	396	15,484
18	2014	16,315		369	369		27	27	396	15,919
19	2015	16,749		369	369		27	27	396	16,353
20	2016	17,184		369	369		27	27	396	16,788
21	2017	17,619		369	369		27	27	396	17,223
22	2018	18,053		369	369		27	27	396	17,657
23	2019	18,488		369	369		27	27	396	18,092
24	2020	18,923		369	369		27	27	396	18,527
25	2021	18,923		369	369		27	27	396	18,527
26	2022	18,923		369	369		27	27	396	18,527
27	2023	18,923		369	369		27	27	396	18,527
28	2024	18,923		369	369		27	27	396	18,527
29	2025	18,923		369	369		27	27	396	18,527
30	2026	18,923		369	369		27	27	396	18,527
31	2027	18,923		369	369		27	27	396	18,527
32	2028	18,923		369	369		27	27	396	18,527
33	2029	18,923		369	369		27	27	396	18,527
34	2030	18,923		369	369		27	27	396	18,527
35	2031	18,923		369	369		27	27	396	18,527
36	2032	18,923		369	369		27	27	396	18,527
37	2033	18,923		369	369		27	27	396	18,527
38	2034	18,923		369	369		27	27	396	18,527
39	2035	18,923		369	369		27	27	396	18,527
40	2036	18,923		369	369		27	27	396	18,527
41	2037	18,923		369	369		27	27	396	18,527
42	2038	18,923		369	369		27	27	396	18,527
43	2039	18,923		369	369		27	27	396	18,527
44	2040	18,923		369	369		27	27	396	18,527
45	2041	18,923		369	369		27	27	396	18,527
46	2042	18,923		369	369		27	27	396	18,527
47	2043	18,923		369	369		27	27	396	18,527
48	2044	18,923		369	369		27	27	396	18,527
49	2045	18,923		369	369		27	27	396	18,527
50	2046	18,923		369	369		27	27	396	18,527

EIRR= 10.6%
B/C = 1.07 (at discount rate: 10 %)
NPV= 4,754 (at discount rate: 10 %)

Note: The O & M costs of the structural measures include annual reserve for replacement of gates.

Hanku River System (20-year) — Unit: 1,000 Birr

Year in order	Year	Benefit	Cost: Structural measures Initial cost	Structural measures O&M	Structural measures Sub-total	Non-structural measures Initial cost	Non-structural measures O&M	Non-structural measures Sub-total	Total Cost	Net Cash Flow
1	1997	0	0		0	0		0	0	0
2	1998	0	0		0	0		0	0	0
3	1999	0	114		114	0		0	114	-114
4	2000	0	957		957	172		172	1,129	-1,129
5	2001	69		3	3		9	9	12	57
6	2002	73		3	3		9	9	12	61
7	2003	77		3	3		9	9	12	65
8	2004	81		3	3		9	9	12	69
9	2005	84		3	3		9	9	12	72
10	2006	88		3	3		9	9	12	76
11	2007	92		3	3		9	9	12	80
12	2008	95		3	3		9	9	12	83
13	2009	99		3	3		9	9	12	87
14	2010	103		3	3		9	9	12	91
15	2011	106		3	3		9	9	12	94
16	2012	110		3	3		9	9	12	98
17	2013	114		3	3		9	9	12	102
18	2014	118		3	3		9	9	12	106
19	2015	121		3	3		9	9	12	109
20	2016	125		3	3		9	9	12	113
21	2017	129		3	3		9	9	12	117
22	2018	132		3	3		9	9	12	120
23	2019	136		3	3		9	9	12	124
24	2020	140		3	3		9	9	12	128
25	2021	140		3	3		9	9	12	128
26	2022	140		3	3		9	9	12	128
27	2023	140		3	3		9	9	12	128
28	2024	140		3	3		9	9	12	128
29	2025	140		3	3		9	9	12	128
30	2026	140		3	3		9	9	12	128
31	2027	140		3	3		9	9	12	128
32	2028	140		3	3		9	9	12	128
33	2029	140		3	3		9	9	12	128
34	2030	140		3	3		9	9	12	128
35	2031	140		3	3		9	9	12	128
36	2032	140		3	3		9	9	12	128
37	2033	140		3	3		9	9	12	128
38	2034	140		3	3		9	9	12	128
39	2035	140		3	3		9	9	12	128
40	2036	140		3	3		9	9	12	128
41	2037	140		3	3		9	9	12	128
42	2038	140		3	3		9	9	12	128
43	2039	140		3	3		9	9	12	128
44	2040	140		3	3		9	9	12	128
45	2041	140		3	3		9	9	12	128
46	2042	140		3	3		9	9	12	128
47	2043	140		3	3		9	9	12	128
48	2044	140		3	3		9	9	12	128
49	2045	140		3	3		9	9	12	128
50	2046	140		3	3		9	9	12	128

EIRR= 7.2%
B/C = 0.72 (at discount rate: 10 %)
NPV= -264 (at discount rate: 10 %)

Table 12.6.13 Cost-Benefit Analysis

Whole Master Plan

Unit: 1,000 Birr

Year in order	Year	Benefit					Cost											Total	Net Cash Flow
							Bantyiketu			Little Akaki			Hanku			Kebena			
		Bantyiketu	Little Akaki	Hanku	Kebena	Total	Structural	Non-structural	Sub-total	Structural	Non-structural	Sub-total	Structural	Non-structural	Sub-total	Structural	Non-structural	Sub-total	
1	1997	-	-	-	-	0												0	0
2	1998	-	-	-	-	0												0	0
3	1999	-	-	-	-	0	5,359		5,359									5,359	-5,359
4	2000	-	-	-	-	0	20,704	1,846	22,550									22,550	-22,550
5	2001	2,418	-	-	-	2,418	18,854	1,858	20,712									20,712	-18,293
6	2002	4,835	-	-	-	4,835	20,847	25	20,872									20,872	-16,037
7	2003	7,252	-	-	-	7,252	20,915	25	20,940									20,940	-13,688
8	2004	9,669	-	-	-	9,669	19,067	25	19,092									19,092	-9,423
9	2005	12,086	-	-	-	12,086	356	25	381	4,715		4,715						5,096	6,990
10	2006	12,351	-	-	-	12,351	356	25	381	22,434	967	23,401						23,782	-11,431
11	2007	12,616	-	-	-	12,616	356	25	381	21,665	981	22,646						23,027	-10,411
12	2008	12,881	-	-	-	12,881	356	25	381	22,434	27	22,461						22,842	-9,961
13	2009	13,145	-	-	-	13,145	356	25	381	22,433	27	22,460						22,841	-9,696
14	2010	13,410	7,505	-	-	20,916	356	25	381	21,851	27	21,878						22,259	-1,343
15	2011	13,675	15,011	-	-	28,686	356	25	381	369	27	396	114		114			891	27,795
16	2012	13,940	15,446	-	-	29,385	356	25	381	369	27	396	957	172	1,129			1,906	27,479
17	2013	14,205	15,880	114	-	30,199	356	25	381	369	27	396	3	9	12	4,222	-	4,222	5,011	25,188
18	2014	14,469	16,315	118	-	30,902	356	25	381	369	27	396	3	9	12	17,304	745	18,049	18,838	12,064
19	2015	14,734	16,749	121	949	32,554	356	25	381	369	27	396	3	9	12	16,238	770	17,008	17,797	14,757
20	2016	14,999	17,184	125	1,899	34,207	356	25	381	369	27	396	3	9	12	16,292	51	16,343	17,132	17,075
21	2017	15,264	17,619	129	2,849	35,860	356	25	381	369	27	396	3	9	12	17,468	51	17,519	18,308	17,552
22	2018	15,528	18,053	132	3,799	37,513	356	25	381	369	27	396	3	9	12	17,520	51	17,571	18,360	19,153
23	2019	15,793	18,488	136	4,749	39,166	356	25	381	369	27	396	3	9	12	16,454	51	16,505	17,294	21,872
24	2020	16,058	18,923	140	5,699	40,819	356	25	381	369	27	396	3	9	12	16,509	51	16,560	17,349	23,470
25	2021	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
26	2022	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
27	2023	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
28	2024	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
29	2025	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
30	2026	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
31	2027	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
32	2028	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
33	2029	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
34	2030	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
35	2031	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
36	2032	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
37	2033	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
38	2034	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
39	2035	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
40	2036	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
41	2037	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
42	2038	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
43	2039	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
44	2040	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
45	2041	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
46	2042	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
47	2043	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
48	2044	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
49	2045	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549
50	2046	16,058	18,923	140	6,649	41,769	356	25	381	369	27	396	3	9	12	380	51	431	1,220	40,549

EIRR= 10.8%

B/C = 1.08 (at discount rate: 10 %)

NPV= 9,315 (at discount rate: 10 %)

Table 12.6.14 Summery of Annual Flood Reduction Benefit

(for selection of Priority Projects)

Unit: 1,000 Birr

Priority Projects	Annual Flood Reduction Benefit			
	1997		2020	
	drainage improvement (a)	drainage improvement (b) = (a) x 95 %	drainage improvement (c)	drainage improvement (d) = (c) x 95 %
Case-1 (same as Master Plan) - Kurtume River (4 regulating ponds & channel improvement) - Kechene River (Kechene weir, Kostre regulating pond, and channel improvement) - Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch) - Non-structural measures (River management, watershed management, and flood risk management)	10,493	9,968	16,903	16,058
Case-2 - Kechene River (Kechene weir, Kostre regulating pond, and channel improvement) - Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch) - Non-structural measures (River management, watershed management, and flood risk management)	8,903	8,458	14,342	13,625
Case-3 - Kurtume River (4 regulating ponds & channel improvement) - Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch) - Non-structural measures (River management, watershed management, and flood risk management)	7,375	7,006	11,859	11,266
Case-4 - Kechene River (Kechene weir and Kostre regulating pond) - Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch) - Non-structural measures (River management, watershed management, and flood risk management)	8,878	8,434	14,291	13,576
Case-5 - Kechene River (Kechene weir and Kostre regulating pond) - Bantyiketu River (Bantyiketu regulating pond and road side-ditch) - Non-structural measures (River management, watershed management, and flood risk management)	6,772	6,433	10,914	10,368

Note: It is assumed that 5 % of flood damage remains even after implementation of the flood control master plan until completion of minor drainage improvement.

Table 12.6.15 Financial and Economic Project Cost
(for selection of Priority Projects)

Bantyiketu River System (Structural and Non-structural Measures)

Cost Item	F.C. (1,000 Birr)		L.C. (1,000 Birr)		Total financial	Total economic
	Financial cost	Economic cost	Financial cost	Economic cost	cost (1,000 Birr)	cost (1,000 Birr)
Case-1 (same as Master Plan)						
- Kurtume River (4 regulating ponds & channel improvement)						
- Kechene River (Kechene weir, Kostre regulating pond, and channel improvement)						
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)						
- Non structural measures (River management, watershed management, and flood risk management)						
I. Structural measures						
1. Construction cost	27,938	25,144	44,588	38,792	72,526	63,936
2. Resettlement cost	0	0	7,359	6,402	7,359	6,402
3. Engineering services	9,791	9,791	1,088	1,088	10,879	10,879
4. Administration	0	0	7,253	6,310	7,253	6,310
Sub-total of (1.- 4.)	37,729	34,935	60,288	52,592	98,017	87,527
5. Physical contingency	7,546	6,987	12,058	10,518	19,604	17,505
Total of (1.- 5.)	45,275	41,922	72,346	63,110	117,621	105,032
II. Non-structural measures	-	-	4,242	3,691	4,242	3,691
Total of (I.+ II.)	45,275	41,922	76,588	66,801	121,863	108,723
Case-2						
- Kechene River (Kechene weir, Kostre regulating pond, and channel improvement)						
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)						
- Non structural measures (River management, watershed management, and flood risk management)						
I. Structural measures						
1. Construction cost	20,648	18,583	35,266	30,681	55,914	49,264
2. Resettlement cost	0	0	4,373	3,805	4,373	3,805
3. Engineering services	7,548	7,548	839	839	8,387	8,387
4. Administration	0	0	5,591	4,864	5,591	4,864
Sub-total of (1.- 4.)	28,197	26,131	46,069	40,189	74,266	66,320
5. Physical contingency	5,639	5,226	9,214	8,038	14,853	13,264
Total of (1.- 5.)	33,836	31,357	55,283	48,227	89,119	79,584
II. Non-structural measures	-	-	4,242	3,691	4,242	3,691
Total of (I.+ II.)	33,836	31,357	59,525	51,918	93,361	83,275
Case-3						
- Kurtume River (4 regulating ponds & channel improvement)						
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)						
- Non structural measures (River management, watershed management, and flood risk management)						
I. Structural measures						
1. Construction cost	20,352	18,317	25,883	22,518	46,235	40,835
2. Resettlement cost	0	0	5,470	4,759	5,470	4,759
3. Engineering services	6,241	6,241	694	694	6,935	6,935
4. Administration	0	0	4,624	4,023	4,624	4,023
Sub-total of (1.- 4.)	26,593	24,558	36,671	31,994	63,264	56,552
5. Physical contingency	5,319	4,912	7,334	6,399	12,653	11,311
Total of (1.- 5.)	31,912	29,470	44,005	38,393	75,917	67,863
II. Non-structural measures	-	-	4,242	3,691	4,242	3,691
Total of (I.+ II.)	31,912	29,470	48,247	42,084	80,159	71,554
Case-4						
- Kechene River (Kechene weir and Kostre regulating pond)						
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)						
- Non structural measures (River management, watershed management, and flood risk management)						
I. Structural measures						
1. Construction cost	21,077	18,969	31,973	27,817	53,050	46,786
2. Resettlement cost	0	0	3,124	2,718	3,124	2,718
3. Engineering services	7,162	7,162	796	796	7,958	7,958
4. Administration	0	0	5,305	4,615	5,305	4,615
Sub-total of (1.- 4.)	28,239	26,131	41,198	35,946	69,437	62,077
5. Physical contingency	5,648	5,226	8,240	7,189	13,888	12,415
Total of (1.- 5.)	33,887	31,357	49,438	43,135	83,325	74,492
II. Non-structural measures	-	-	4,242	3,691	4,242	3,691
Total of (I.+ II.)	33,887	31,357	53,680	46,826	87,567	78,183
Case-5						
- Kechene River (Kechene weir and Kostre regulating pond)						
- Bantyiketu River (Bantyiketu regulating pond and road side-ditch)						
- Non structural measures (River management, watershed management, and flood risk management)						
I. Structural measures						
1. Construction cost	18,822	16,940	28,077	24,427	46,899	41,367
2. Resettlement cost	0	0	638	555	638	555
3. Engineering services	6,332	6,332	703	703	7,035	7,035
4. Administration	0	0	4,690	4,080	4,690	4,080
Sub-total of (1.- 4.)	25,153	23,272	34,108	29,765	59,261	53,037
5. Physical contingency	5,030	4,654	6,822	5,953	11,852	10,607
Total of (1.- 5.)	30,183	27,926	40,930	35,718	71,113	63,644
II. Non-structural measures	-	-	4,242	3,691	4,242	3,691
Total of (I.+ II.)	30,183	27,926	45,172	39,409	75,355	67,335

Note: 1. Price level: as of June 1997, US$1.0 = 6.80 Birr, J. Yen1.0 = 0.0593 Birr
2. Engineering service fee is estimated as 15 % of total construction cost
3. Administration cost is estimated as 5 % of construction cost
4. Physical contingency is estimated as 20 % of total of (1.- 4.)
5. SCF (standard conversion factor) of 87 % has been applied for nontraded project cost (local currency portion).
6. 10 % of foreign currency portion of construction cost has been deducted for adjustment of import duties for traded project cost.

Table 12.6.16 Breakdown of Annual Economic Cost
(for selection of Priority Projects)

Bantyiketu River System (Structural and Non-structural Measures) Unit: 1,000 Birr

Item	Year in order						
	1st	2nd	3rd	4th	5th	6th	Total
Case-1 (same as Master Plan)							
- Kurfume River (4 regulating ponds & channel improvement)							
- Kechene River (Kechene weir, Kostre regulating pond, and channel improvement)							
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)							
- Non-structural measures (River management, watershed management, and flood risk management)							
I. Structural measures							
1. Construction cost	-	12,787	12,787	12,787	12,787	12,788	63,936
2. Resettlement cost	1,601	1,601	0	1,601	1,599	-	6,402
3. Engineering services	1,813	1,813	1,813	1,813	1,813	1,814	10,879
4. Administration	1,052	1,052	1,052	1,052	1,052	1,050	6,310
Sub-total of (1.- 4.)	4,466	17,253	15,652	17,253	17,251	15,652	87,527
5. Physical contingency	893	3,451	3,130	3,451	3,450	3,130	17,505
Total of (1.- 5.)	5,359	20,704	18,782	20,704	20,701	18,782	105,032
II. Non-structural measures	-	1,846	1,845	-	-	-	3,691
Total of (I.+ II.)	5,359	22,550	20,627	20,704	20,701	18,782	108,723
Case-2							
- Kechene River (Kechene weir, Kostre regulating pond, and channel improvement)							
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)							
- Non-structural measures (River management, watershed management, and flood risk management)							
I. Structural measures							
1. Construction cost	-	24,632	24,632	-	-	-	49,264
2. Resettlement cost	1,903	1,902	-	-	-	-	3,805
3. Engineering services	3,355	2,516	2,516	-	-	-	8,387
4. Administration	1,621	1,621	1,622	-	-	-	4,864
Sub-total of (1.- 4.)	6,879	30,671	28,770	-	-	-	66,320
5. Physical contingency	1,376	6,134	5,754	-	-	-	13,264
Total of (1.- 5.)	8,255	36,805	34,524	-	-	-	79,584
II. Non-structural measures	-	1,846	1,845	-	-	-	3,691
Total of (I.+ II.)	8,255	38,651	36,369	-	-	-	83,275
Case-3							
- Kurfume River (4 regulating ponds & channel improvement)							
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)							
- Non-structural measures (River management, watershed management, and flood risk management)							
I. Structural measures							
1. Construction cost	-	20,418	20,417	-	-	-	40,835
2. Resettlement cost	2,380	2,379	-	-	-	-	4,759
3. Engineering services	2,774	2,081	2,080	-	-	-	6,935
4. Administration	1,341	1,341	1,341	-	-	-	4,023
Sub-total of (1.- 4.)	6,495	26,219	23,838	-	-	-	56,552
5. Physical contingency	1,299	5,244	4,768	-	-	-	11,311
Total of (1.- 5.)	7,794	31,463	28,606	-	-	-	67,863
II. Non-structural measures	-	1,846	1,845				3,691
Total of (I.+ II.)	7,794	33,309	30,451				71,554
Case-4							
- Kechene River (Kechene weir and Kostre regulating pond)							
- Bantyiketu River (Bantyiketu regulating pond, channel improvement, and road side-ditch)							
- Non-structural measures (River management, watershed management, and flood risk management)							
I. Structural measures							
1. Construction cost	-	23,393	23,393	-	-	-	46,786
2. Resettlement cost	1,359	1,359	-	-	-	-	2,718
3. Engineering services	3,183	2,387	2,388	-	-	-	7,958
4. Administration	1,538	1,538	1,539	-	-	-	4,615
Sub-total of (1.- 4.)	6,080	28,677	27,320	-	-	-	62,077
5. Physical contingency	1,216	5,735	5,464	-	-	-	12,415
Total of (1.- 5.)	7,296	34,412	32,784	-	-	-	74,492
II. Non-structural measures	-	1,846	1,845				3,691
Total of (I.+ II.)	7,296	36,258	34,629				78,183
Case-5							
- Kechene River (Kechene weir and Kostre regulating pond)							
- Bantyiketu River (Bantyiketu regulating pond and road side-ditch)							
- Non-structural measures (River management, watershed management, and flood risk management)							
I. Structural measures							
1. Construction cost	-	20,684	20,683	-	-	-	41,367
2. Resettlement cost	278	277	-	-	-	-	555
3. Engineering services	2,814	2,111	2,110	-	-	-	7,035
4. Administration	1,360	1,360	1,360	-	-	-	4,080
Sub-total of (1.- 4.)	4,452	24,432	24,153	-	-	-	53,037
5. Physical contingency	890	4,886	4,831	-	-	-	10,607
Total of (1.- 5.)	5,342	29,318	28,984	-	-	-	63,644
II. Non-structural measures	-	1,846	1,845				3,691
Total of (I.+ II.)	5,342	31,164	30,829				67,335

Table 12.6.17 Cost-Benefit Analysis (1/3)
(for selection of priority projects)

Case-1 (same as master plan)

- Kintume River (4 regulating ponds & channel improvement)
- Kechene River (Kechene weir, Kositre regulating pond, and channel improvement)
- Bantyketu River (Bantyketu regulating pond, channel improvement, and road side-ditch)
- Non-structural measures (River management, watershed management, and flood risk management)

Unit: 1,000 Birr

Year in order	Year	Benefit	Cost							Total Cost	Net Cash Flow
			Structural measures			Non-structural measures					
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total			
1	1997	0	0		0	0		0	0	0	0
2	1998	0	0		0	0		0	0	0	0
3	1999	0	5,359		5,359	0		0	5,359	5,359	-5,359
4	2000	0	20,704		20,704	1,846		1,846	22,550	22,550	-22,550
5	2001	2,418	18,782	72	18,854	1,845	13	1,858	20,712	18,294	-18,294
6	2002	4,835	20,704	143	20,847		25	25	20,872	16,037	-16,037
7	2003	7,252	20,701	214	20,915		25	25	20,940	13,688	-13,688
8	2004	9,669	18,782	285	19,067		25	25	19,092	9,423	-9,423
9	2005	12,086		356	356		25	25	381	11,705	11,705
10	2006	12,351		356	356		25	25	381	11,970	11,970
11	2007	12,616		356	356		25	25	381	12,235	12,235
12	2008	12,881		356	356		25	25	381	12,500	12,500
13	2009	13,145		356	356		25	25	381	12,764	12,764
14	2010	13,410		356	356		25	25	381	13,029	13,029
15	2011	13,675		356	356		25	25	381	13,294	13,294
16	2012	13,940		356	356		25	25	381	13,559	13,559
17	2013	14,205		356	356		25	25	381	13,824	13,824
18	2014	14,469		356	356		25	25	381	14,088	14,088
19	2015	14,734		356	356		25	25	381	14,353	14,353
20	2016	14,999		356	356		25	25	381	14,618	14,618
21	2017	15,264		356	356		25	25	381	14,883	14,883
22	2018	15,528		356	356		25	25	381	15,147	15,147
23	2019	15,793		356	356		25	25	381	15,412	15,412
24	2020	16,058		356	356		25	25	381	15,677	15,677
25	2021	16,058		356	356		25	25	381	15,677	15,677
26	2022	16,058		356	356		25	25	381	15,677	15,677
27	2023	16,058		356	356		25	25	381	15,677	15,677
28	2024	16,058		356	356		25	25	381	15,677	15,677
29	2025	16,058		356	356		25	25	381	15,677	15,677
30	2026	16,058		356	356		25	25	381	15,677	15,677
31	2027	16,058		356	356		25	25	381	15,677	15,677
32	2028	16,058		356	356		25	25	381	15,677	15,677
33	2029	16,058		356	356		25	25	381	15,677	15,677
34	2030	16,058		356	356		25	25	381	15,677	15,677
35	2031	16,058		356	356		25	25	381	15,677	15,677
36	2032	16,058		356	356		25	25	381	15,677	15,677
37	2033	16,058		356	356		25	25	381	15,677	15,677
38	2034	16,058		356	356		25	25	381	15,677	15,677
39	2035	16,058		356	356		25	25	381	15,677	15,677
40	2036	16,058		356	356		25	25	381	15,677	15,677
41	2037	16,058		356	356		25	25	381	15,677	15,677
42	2038	16,058		356	356		25	25	381	15,677	15,677
43	2039	16,058		356	356		25	25	381	15,677	15,677
44	2040	16,058		356	356		25	25	381	15,677	15,677
45	2041	16,058		356	356		25	25	381	15,677	15,677
46	2042	16,058		356	356		25	25	381	15,677	15,677
47	2043	16,058		356	356		25	25	381	15,677	15,677
48	2044	16,058		356	356		25	25	381	15,677	15,677
49	2045	16,058		356	356		25	25	381	15,677	15,677
50	2046	16,058		356	356		25	25	381	15,677	15,677

EIRR= 11.7%
B/C = 1.17 (at discount rate: 10 %)
NPV= 11,406 (at discount rate: 10 %)

Note: The O & M costs of the structural measures include annual reserve for replacement of gates.

Case-2

- Kechene River (Kechene weir, Kositre regulating pond, and channel improvement)
- Bantyketu River (Bantyketu regulating pond, channel improvement, and road side-ditch)
- Non-structural measures (River management, watershed management, and flood risk management)

Unit: 1,000 Birr

Year in order	Year	Benefit	Cost							Total Cost	Net Cash Flow
			Structural measures			Non-structural measures					
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total			
1	1997	0	0		0	0		0	0	0	0
2	1998	0	0		0	0		0	0	0	0
3	1999	0	8,255		8,255	0		0	8,255	8,255	-8,255
4	2000	0	36,805		36,805	1,846		1,846	38,651	38,651	-38,651
5	2001	4,791	34,524	138	34,662	1,845	13	1,858	36,520	31,729	-31,729
6	2002	9,581		276	276		25	25	301	9,280	9,280
7	2003	9,806		276	276		25	25	301	9,505	9,505
8	2004	10,030		276	276		25	25	301	9,729	9,729
9	2005	10,255		276	276		25	25	301	9,954	9,954
10	2006	10,480		276	276		25	25	301	10,179	10,179
11	2007	10,704		276	276		25	25	301	10,403	10,403
12	2008	10,929		276	276		25	25	301	10,628	10,628
13	2009	11,154		276	276		25	25	301	10,853	10,853
14	2010	11,378		276	276		25	25	301	11,077	11,077
15	2011	11,603		276	276		25	25	301	11,302	11,302
16	2012	11,828		276	276		25	25	301	11,527	11,527
17	2013	12,052		276	276		25	25	301	11,751	11,751
18	2014	12,277		276	276		25	25	301	11,976	11,976
19	2015	12,502		276	276		25	25	301	12,201	12,201
20	2016	12,726		276	276		25	25	301	12,425	12,425
21	2017	12,951		276	276		25	25	301	12,650	12,650
22	2018	13,176		276	276		25	25	301	12,875	12,875
23	2019	13,400		276	276		25	25	301	13,099	13,099
24	2020	13,625		276	276		25	25	301	13,324	13,324
25	2021	13,625		276	276		25	25	301	13,324	13,324
26	2022	13,625		276	276		25	25	301	13,324	13,324
27	2023	13,625		276	276		25	25	301	13,324	13,324
28	2024	13,625		276	276		25	25	301	13,324	13,324
29	2025	13,625		276	276		25	25	301	13,324	13,324
30	2026	13,625		276	276		25	25	301	13,324	13,324
31	2027	13,625		276	276		25	25	301	13,324	13,324
32	2028	13,625		276	276		25	25	301	13,324	13,324
33	2029	13,625		276	276		25	25	301	13,324	13,324
34	2030	13,625		276	276		25	25	301	13,324	13,324
35	2031	13,625		276	276		25	25	301	13,324	13,324
36	2032	13,625		276	276		25	25	301	13,324	13,324
37	2033	13,625		276	276		25	25	301	13,324	13,324
38	2034	13,625		276	276		25	25	301	13,324	13,324
39	2035	13,625		276	276		25	25	301	13,324	13,324
40	2036	13,625		276	276		25	25	301	13,324	13,324
41	2037	13,625		276	276		25	25	301	13,324	13,324
42	2038	13,625		276	276		25	25	301	13,324	13,324
43	2039	13,625		276	276		25	25	301	13,324	13,324
44	2040	13,625		276	276		25	25	301	13,324	13,324
45	2041	13,625		276	276		25	25	301	13,324	13,324
46	2042	13,625		276	276		25	25	301	13,324	13,324
47	2043	13,625		276	276		25	25	301	13,324	13,324
48	2044	13,625		276	276		25	25	301	13,324	13,324
49	2045	13,625		276	276		25	25	301	13,324	13,324
50	2046	13,625		276	276		25	25	301	13,324	13,324

EIRR= 12.6%
B/C = 1.27 (at discount rate: 10 %)
NPV= 15,625 (at discount rate: 10 %)

Note: The O & M costs of the structural measures include annual reserve for replacement of gates.

Table 12.6.17 Cost-Benefit Analysis (2/3)
(for selection of priority projects)

Case-3

- Kurtune River (4 regulating ponds & channel improvement)
- Bantyketo River (Bantyketo regulating pond, channel improvement, and road side-ditch)
- Non-structural measures (River management, watershed management, and flood risk management)

Unit: 1,000 Birr

Year in order	Year	Benefit	Cost						Total Cost	Net Cash Flow
			Structural measures			Non-structural measures				
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total		
1	1997	0	0		0	0		0	0	0
2	1998	0	0		0	0		0	0	0
3	1999	0	7,794		7,794	0		0	7,794	-7,794
4	2000	0	31,463		31,463	1,846		1,846	33,309	-33,309
5	2001	3,966	28,606	115	28,721	1,845	13	1,858	30,579	-26,612
6	2002	7,932		229	229		25	25	254	7,678
7	2003	8,117		229	229		25	25	254	7,863
8	2004	8,303		229	229		25	25	254	8,049
9	2005	8,488		229	229		25	25	254	8,234
10	2006	8,673		229	229		25	25	254	8,419
11	2007	8,858		229	229		25	25	254	8,604
12	2008	9,043		229	229		25	25	254	8,789
13	2009	9,229		229	229		25	25	254	8,975
14	2010	9,414		229	229		25	25	254	9,160
15	2011	9,599		229	229		25	25	254	9,345
16	2012	9,784		229	229		25	25	254	9,530
17	2013	9,970		229	229		25	25	254	9,716
18	2014	10,155		229	229		25	25	254	9,901
19	2015	10,340		229	229		25	25	254	10,086
20	2016	10,525		229	229		25	25	254	10,271
21	2017	10,711		229	229		25	25	254	10,457
22	2018	10,896		229	229		25	25	254	10,642
23	2019	11,081		229	229		25	25	254	10,827
24	2020	11,266		229	229		25	25	254	11,012
25	2021	11,266		229	229		25	25	254	11,012
26	2022	11,266		229	229		25	25	254	11,012
27	2023	11,266		229	229		25	25	254	11,012
28	2024	11,266		229	229		25	25	254	11,012
29	2025	11,266		229	229		25	25	254	11,012
30	2026	11,266		229	229		25	25	254	11,012
31	2027	11,266		229	229		25	25	254	11,012
32	2028	11,266		229	229		25	25	254	11,012
33	2029	11,266		229	229		25	25	254	11,012
34	2030	11,266		229	229		25	25	254	11,012
35	2031	11,266		229	229		25	25	254	11,012
36	2032	11,266		229	229		25	25	254	11,012
37	2033	11,266		229	229		25	25	254	11,012
38	2034	11,266		229	229		25	25	254	11,012
39	2035	11,266		229	229		25	25	254	11,012
40	2036	11,266		229	229		25	25	254	11,012
41	2037	11,266		229	229		25	25	254	11,012
42	2038	11,266		229	229		25	25	254	11,012
43	2039	11,266		229	229		25	25	254	11,012
44	2040	11,266		229	229		25	25	254	11,012
45	2041	11,266		229	229		25	25	254	11,012
46	2042	11,266		229	229		25	25	254	11,012
47	2043	11,266		229	229		25	25	254	11,012
48	2044	11,266		229	229		25	25	254	11,012
49	2045	11,266		229	229		25	25	254	11,012
50	2046	11,266		229	229		25	25	254	11,012
EIRR=		12.1%								
B/C =		1.22 (at discount rate: 10 %)								
NPV=		11,039 (at discount rate: 10 %)								

Note: The O & M costs of the structural measures include annual reserve for replacement of gates.

Case-4

- Kechene River (Kechene weir and Kestre regulating pond)
- Bantyketo River (Bantyketo regulating pond, channel improvement, and road side-ditch)
- Non-structural measures (River management, watershed management, and flood risk management)

Unit: 1,000 Birr

Year in order	Year	Benefit	Cost						Total Cost	Net Cash Flow
			Structural measures			Non-structural measures				
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total		
1	1997	0	0		0	0		0	0	0
2	1998	0	0		0	0		0	0	0
3	1999	0	7,296		7,296	0		0	7,296	-7,296
4	2000	0	34,412		34,412	1,846		1,846	36,258	-36,258
5	2001	4,776	32,784	131	32,915	1,845	13	1,858	34,773	-29,997
6	2002	9,552		262	262		25	25	287	9,265
7	2003	9,776		262	262		25	25	287	9,489
8	2004	9,999		262	262		25	25	287	9,712
9	2005	10,223		262	262		25	25	287	9,936
10	2006	10,446		262	262		25	25	287	10,159
11	2007	10,670		262	262		25	25	287	10,383
12	2008	10,893		262	262		25	25	287	10,606
13	2009	11,117		262	262		25	25	287	10,830
14	2010	11,341		262	262		25	25	287	11,054
15	2011	11,564		262	262		25	25	287	11,277
16	2012	11,788		262	262		25	25	287	11,501
17	2013	12,011		262	262		25	25	287	11,724
18	2014	12,235		262	262		25	25	287	11,948
19	2015	12,459		262	262		25	25	287	12,172
20	2016	12,682		262	262		25	25	287	12,395
21	2017	12,906		262	262		25	25	287	12,619
22	2018	13,129		262	262		25	25	287	12,842
23	2019	13,353		262	262		25	25	287	13,066
24	2020	13,576		262	262		25	25	287	13,289
25	2021	13,576		262	262		25	25	287	13,289
26	2022	13,576		262	262		25	25	287	13,289
27	2023	13,576		262	262		25	25	287	13,289
28	2024	13,576		262	262		25	25	287	13,289
29	2025	13,576		262	262		25	25	287	13,289
30	2026	13,576		262	262		25	25	287	13,289
31	2027	13,576		262	262		25	25	287	13,289
32	2028	13,576		262	262		25	25	287	13,289
33	2029	13,576		262	262		25	25	287	13,289
34	2030	13,576		262	262		25	25	287	13,289
35	2031	13,576		262	262		25	25	287	13,289
36	2032	13,576		262	262		25	25	287	13,289
37	2033	13,576		262	262		25	25	287	13,289
38	2034	13,576		262	262		25	25	287	13,289
39	2035	13,576		262	262		25	25	287	13,289
40	2036	13,576		262	262		25	25	287	13,289
41	2037	13,576		262	262		25	25	287	13,289
42	2038	13,576		262	262		25	25	287	13,289
43	2039	13,576		262	262		25	25	287	13,289
44	2040	13,576		262	262		25	25	287	13,289
45	2041	13,576		262	262		25	25	287	13,289
46	2042	13,576		262	262		25	25	287	13,289
47	2043	13,576		262	262		25	25	287	13,289
48	2044	13,576		262	262		25	25	287	13,289
49	2045	13,576		262	262		25	25	287	13,289
50	2046	13,576		262	262		25	25	287	13,289
EIRR=		13.3%								
B/C =		1.35 (at discount rate: 10 %)								
NPV=		18,910 (at discount rate: 10 %)								

Note: The O & M costs of the structural measures include annual reserve for replacement of gates.

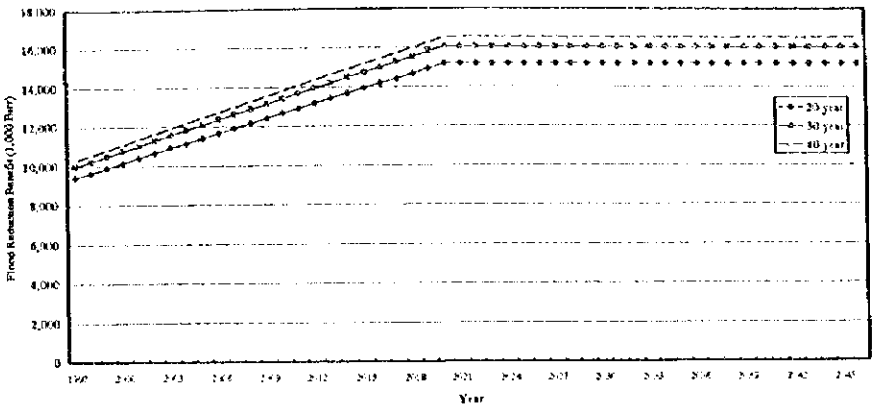
Table 12.6.17 Cost-Benefit Analysis (3/3)
(for selection of priority projects)

Case-5
- Kechene River (Kechene weir and Kentre regulating pond)
- Bantyiketu River (Bantyiketu regulating pond and road side-ditch)
- Non-structural measures (River management, watershed management, and flood risk management)

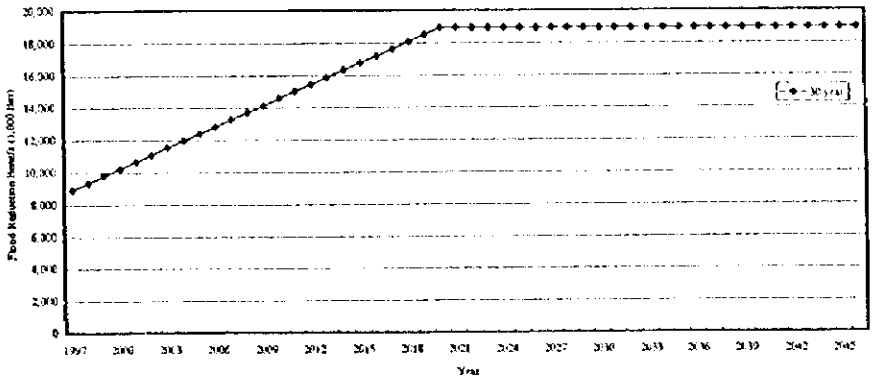
Unit: 1,000 Birr

Year in order	Year	Benefit	Cost							Net Cash Flow
			Structural measures			Non-structural measures			Total Cost	
			Initial cost	O&M	Sub-total	Initial cost	O&M	Sub-total		
1	1997	0	0		0	0		0	0	0
2	1998	0	0		0	0		0	0	0
3	1999	0	5,342		5,342	0		0	5,342	-5,342
4	2000	0	29,318		29,318	1,846		1,846	31,164	-31,164
5	2001	3,644	28,984	116	29,100	1,845	13	1,858	30,958	-27,314
6	2002	7,289		232	232		25	25	257	7,032
7	2003	7,460		232	232		25	25	257	7,203
8	2004	7,631		232	232		25	25	257	7,374
9	2005	7,802		232	232		25	25	257	7,545
10	2006	7,973		232	232		25	25	257	7,716
11	2007	8,144		232	232		25	25	257	7,887
12	2008	8,315		232	232		25	25	257	8,058
13	2009	8,486		232	232		25	25	257	8,229
14	2010	8,657		232	232		25	25	257	8,400
15	2011	8,829		232	232		25	25	257	8,572
16	2012	9,000		232	232		25	25	257	8,743
17	2013	9,171		232	232		25	25	257	8,914
18	2014	9,342		232	232		25	25	257	9,085
19	2015	9,513		232	232		25	25	257	9,256
20	2016	9,684		232	232		25	25	257	9,427
21	2017	9,855		232	232		25	25	257	9,598
22	2018	10,026		232	232		25	25	257	9,769
23	2019	10,197		232	232		25	25	257	9,940
24	2020	10,368		232	232		25	25	257	10,111
25	2021	10,368		232	232		25	25	257	10,111
26	2022	10,368		232	232		25	25	257	10,111
27	2023	10,368		232	232		25	25	257	10,111
28	2024	10,368		232	232		25	25	257	10,111
29	2025	10,368		232	232		25	25	257	10,111
30	2026	10,368		232	232		25	25	257	10,111
31	2027	10,368		232	232		25	25	257	10,111
32	2028	10,368		232	232		25	25	257	10,111
33	2029	10,368		232	232		25	25	257	10,111
34	2030	10,368		232	232		25	25	257	10,111
35	2031	10,368		232	232		25	25	257	10,111
36	2032	10,368		232	232		25	25	257	10,111
37	2033	10,368		232	232		25	25	257	10,111
38	2034	10,368		232	232		25	25	257	10,111
39	2035	10,368		232	232		25	25	257	10,111
40	2036	10,368		232	232		25	25	257	10,111
41	2037	10,368		232	232		25	25	257	10,111
42	2038	10,368		232	232		25	25	257	10,111
43	2039	10,368		232	232		25	25	257	10,111
44	2040	10,368		232	232		25	25	257	10,111
45	2041	10,368		232	232		25	25	257	10,111
46	2042	10,368		232	232		25	25	257	10,111
47	2043	10,368		232	232		25	25	257	10,111
48	2044	10,368		232	232		25	25	257	10,111
49	2045	10,368		232	232		25	25	257	10,111
50	2046	10,368		232	232		25	25	257	10,111
EIRR=		11.9%								
B/C =		1.20 (at discount rate: 10 %)								
NPV=		9,254 (at discount rate: 10 %)								

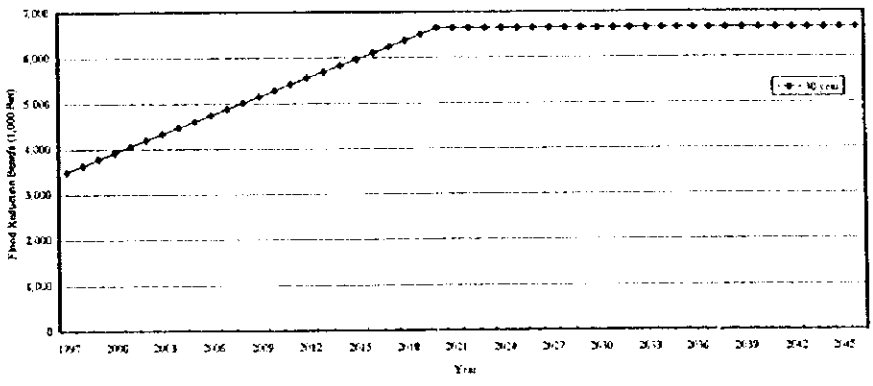
Note: The O & M costs of the structural measures include annual reserve for replacement of gates.



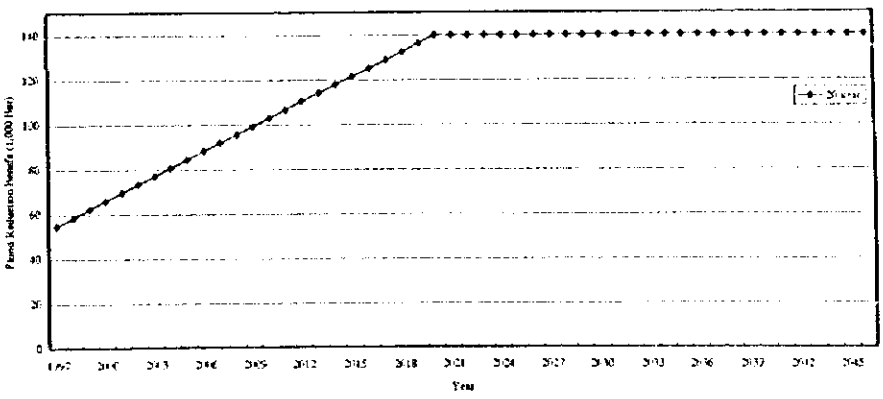
Bantjiketu River System



Little Akaki River System



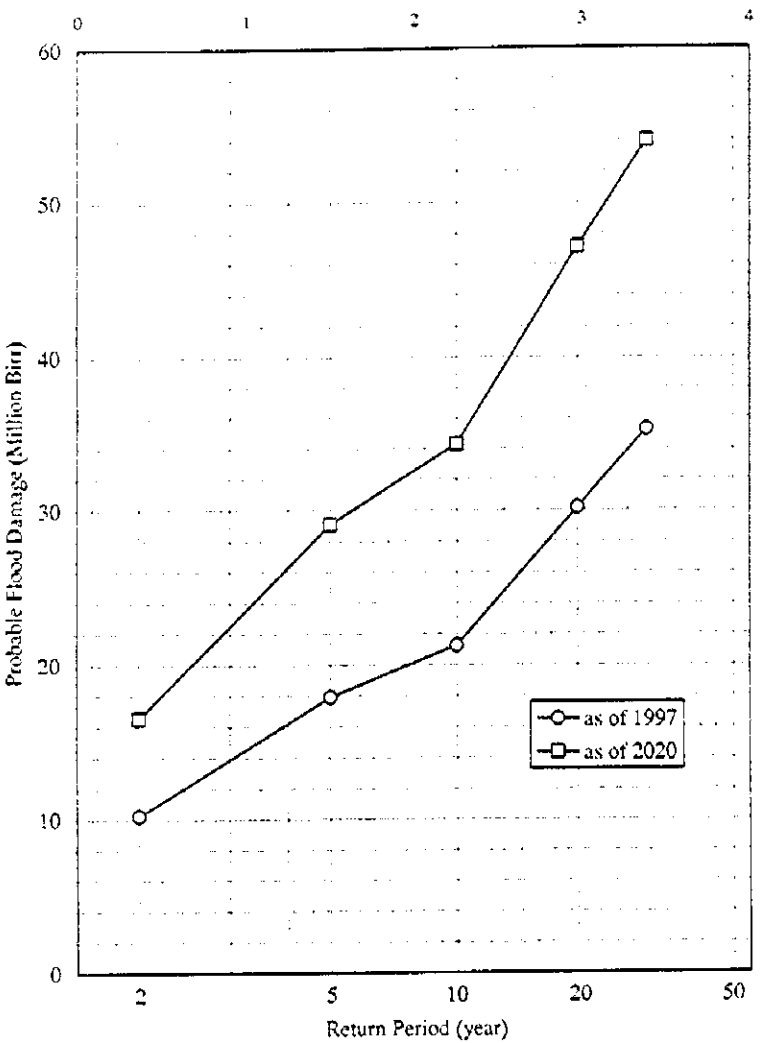
Kebena River System



Hanku River System

Figure 12.4.1 Annual Flood Reduction Benefit

Bantyiketu River System



Kebena River System

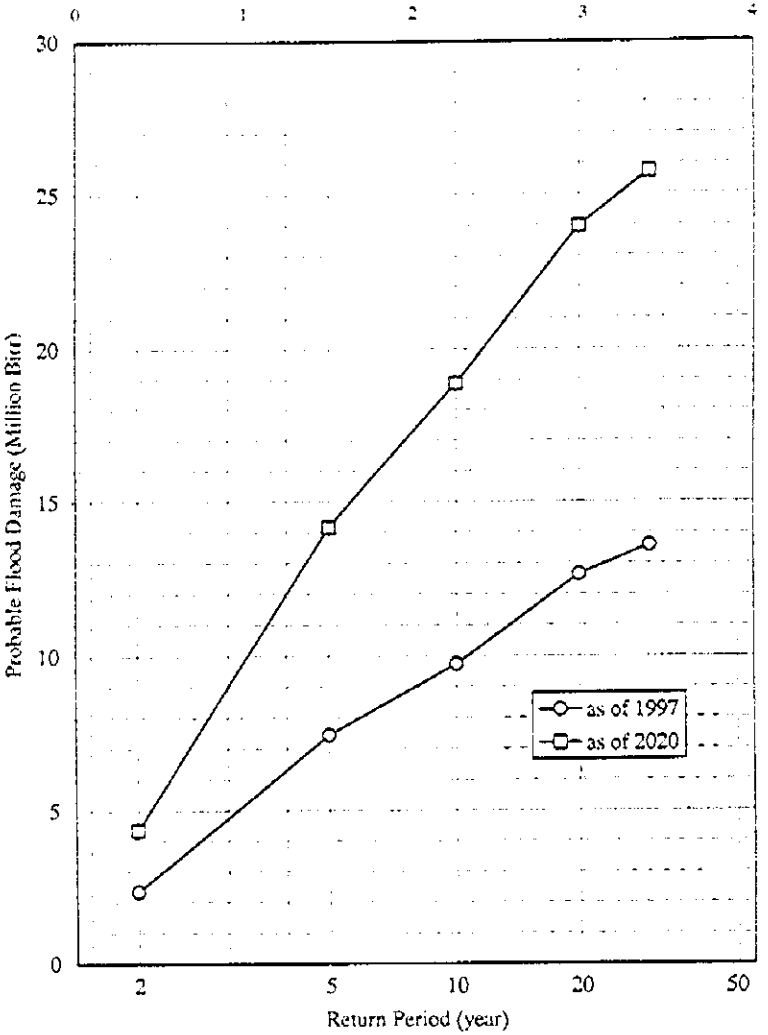
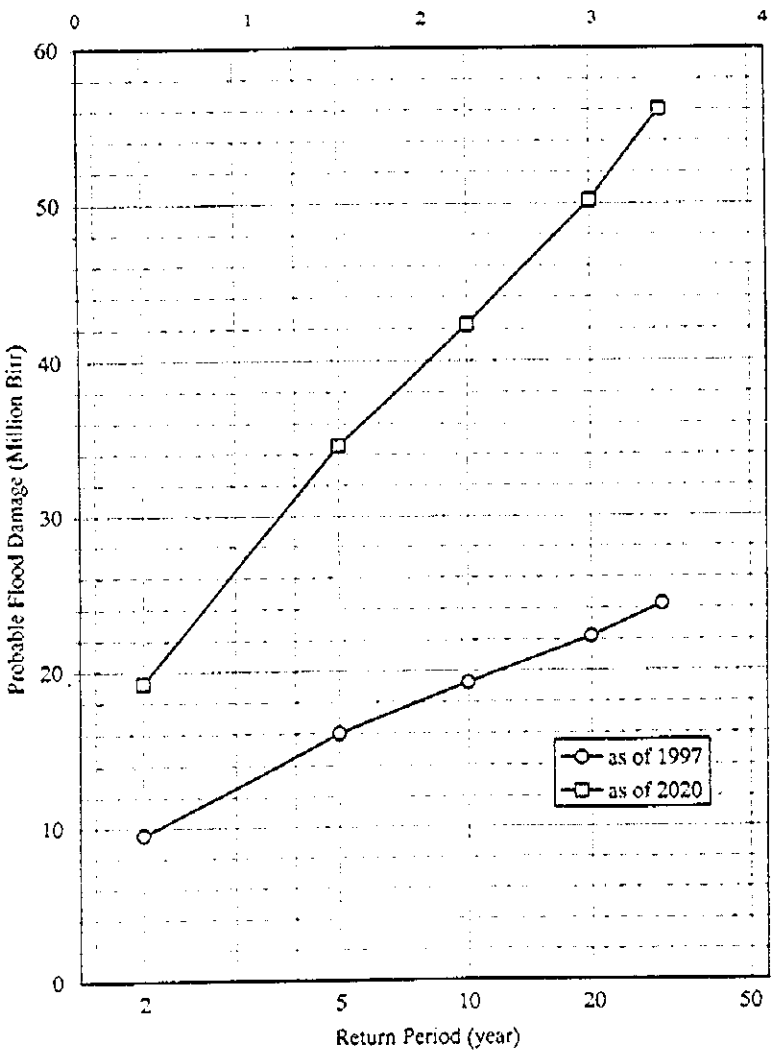


Figure 12.6.1 Relation between Flood Magnitude and Probable Flood Damages (1/2)

Little Akaki River System



Hanku River System

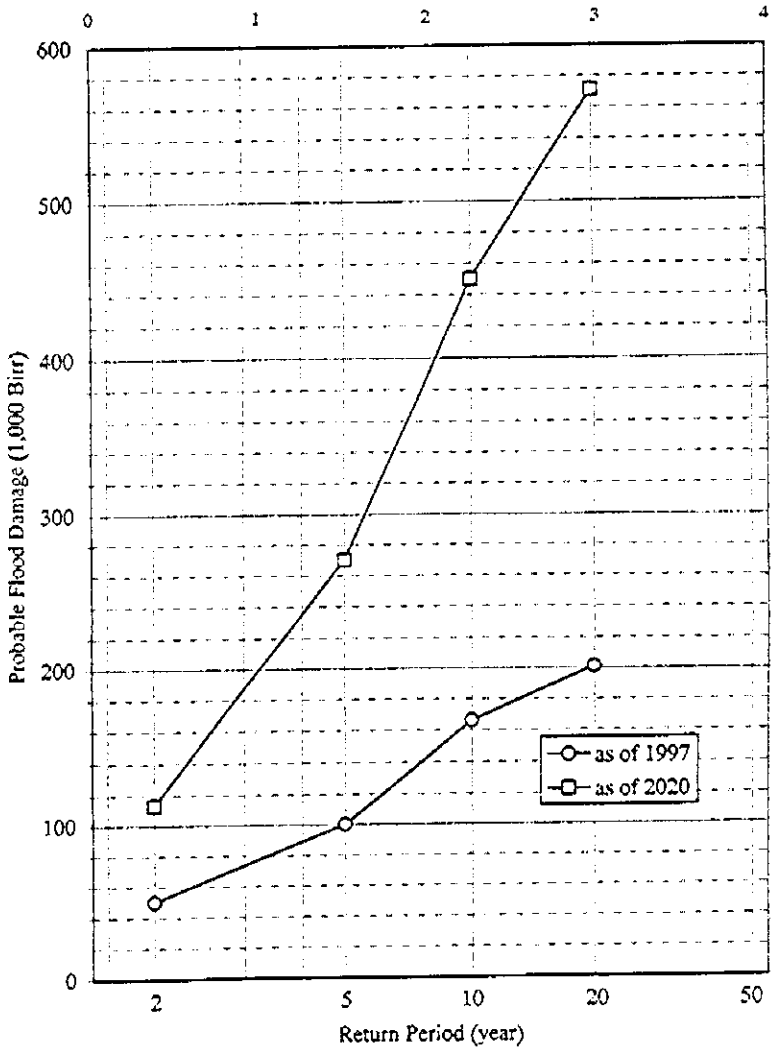


Figure 12.6.1 Relation between Flood Magnitude and Probable Flood Damages (2/2)