Table G-8 PRELIMINARY COST ESTIMATE OF ALTERNATIVE PLANS

Unit: TSh. 10^6

Scheme/Alternative	Foreign Currency Portion	Local Currency Portion	Total	(Economic Cost)
1. Kisiwani scheme				
- Case 1 and 2	18.4	6.9	25.3	(27)
Irrigation and drainage	18.4	6.9	25.3	
2. Gonja scheme				
- Case 1	157.5	60.2	217.7	(230)
Irrigation and drainage	42.3	19.3	61.6	
Hingilili dam	115.2	40.9	156.1	
- Case 2	32.1	12.4	44.5	(47)
Irrigation and drainage	32.1	12.4	44.5	
3. Ndungu scheme				
- Case 1	153.6	61.5	215.1	(227)
Irrigation and drainage	59.0	28.0	87.0	
Yongoma dam	94.6	33.5	128.1	
- Case 2	30.9	12.5	43.4	(46)
Irrigation and drainage	30.9	12.5	43.4	
4. Kihurio scheme				
- Case 1	193.7	95.0	288.7	(302)
Irrigation and drainage	108.0	53.8	161.8	
Mkuyu dam	85.7	41.2	126.9	
- Case 2	74.5	29.0	103.5	(109)
Irrigation and drainage	74.5	29.0	103.5	
5. Igoma scheme				
- Case 2	84.1	29.6	113.7	(121)
Irrigation and drainage	24.9	10.3	35.2	
Igoma dam	59.2	19.3	78.5	

To be continued.

Unit: TSh. 10^6

Scheme/Alternative	Foreign Currency Portion	Local Currency Portion	Total	(Economic Cost)
Sub-total Alternative 1	607.3	253.2	860.5	
Office & Quarter	9.2	5.7	14.9	
O&M equipment	15.0	1.0	16.0	
Administration expense	-	31.0	31.0	
Engineering services	66.9	20.0	86.9	
Physical contingency	69.4	31.1	100.5	
Total of Alternative 1	767.8	342.0	1,109.8	(1,168)
Sub-total Alternative 2	240.0	90.4	330.4	
Office & Quarter	9.2	5.7	14.9	
O&M equipment	15.0	1.0	16.0	
Administration expense	-	25.4	25.4	
Engineering services	61.8	16.8	78.6	
Physical contingency	32.2	13.8	46.0	
Total of Alternative 2	358.2	153.1	511.3	(540)
Sub-total Alternative 3	155.9	60.8	216.7	
Office & Quarter	7.8	4.8	12.6	
O&M equipment	15.0	1.0	16.0	
Administration expense	-	16.0	16.0	
Engineering services	38.3	18.7	57.0	
Physical contingency	21.7	10.2	31.9	
Total of Alternative 3	238.7	111.5	350.2	(368)

Remark: Economic Cost = 1.12 x Foreign Currency Portion + 0.9 x Local Currency Portion (Ref. Annex E)

Table G-9 GROSS AND NET PRODUCTION RETURN WITHOUT PROJECT IN EACH ALTERNATIVE PLAN

Scheme/Alternative Crop	Area (ha)	Unit Gross Income (Tsh./ha)	Total Gross Income (Tsh.x10^3)	Unit Production Cost (Tsh./ha)	Total Production Cost (Tsh.x10^3)	Unit Net Return (Tsh./ha)	Total Net Return (Tsh.x10^3)
(1) Kisiwani - Alternative 1, 2, 3							
1st Maize/1							
Irrigated/H.Y.V.	20	9,477	190	3,869	80	5,608	110
Irrigated/L.V.	60	7,062	420	3,518	210	3,544	210
Rainfed/L.V.	50	5,130	260	3,023	150	2,107	110
2nd Maize/2							
Rainfed/L.V.	10	2,898	30	2,001	20	897	10
Rainfed/L.V./4	10	2,898	30	2,001	20	897	10
3rd Maize/3							
Irrigated/H.Y.V.	10	9,477	90	3,871	30	5,606	60
Irrigated/L.V.	20	7,062	140	3,520	70	3,542	70
Rainfed/L.V./4	60	5,130	310	3,023	180	2,107	130
Paddy							
Irrigated/L.V.	60	14,784	890	5,553	340	9,231	550
Rainfed/L.V./4	70	14,784	1,030	5,348	370	9,436	660
Total			3,390		1,470		1,920
(2) Gonja - Alternative 1, 2, 3							
1st Maize/1							
Irrigated/H.Y.V.	20	9,477	190	3,869	80	5,608	110
Irrigated/L.V.	60	7,062	420	3,518	210	3,544	210
Rainfed/L.V.	210	5,130	1,080	3,023	640	2,107	440
2nd Maize/2							
Rainfed/L.V.	30	2,898	90	2,001	60	897	30
Rainfed/L.V./4	230	2,898	670	2,001	460	897	210
3rd Maize/3							
Irrigated/H.Y.V.	10	9,477	90	3,871	30	5,606	60
Irrigated/L.V.	30	7,062	210	3,520	100	3,542	110
Rainfed/L.V./4	80	5,130	410	3,023	240	2,107	170
Paddy							
Irrigated/L.V.	40	10,560	420	5,174	200	5,386	220
Rainfed/L.V./4	290	10,560	3,060	4,998	1,450	5,562	1,610
Total			6,640		3,470		3,170
(3) Ndungu - Alternative 1, 2, 3							
1st Maize/1							
Irrigated/H.Y.V.	30	9,477	280	3,869	110	5,608	170
Irrigated/L.V.	70	7,062	490	3,518	240	3,544	250
Rainfed/L.V.	210	5,130	1,080	3,023	640	2,107	440
2nd Maize/2							
Rainfed/L.V.	40	2,898	120	2,001	80	897	40
Rainfed/L.V./4	170	2,898	490	2,001	340	897	150
3rd Maize/3							
Irrigated/H.Y.V.	40	9,477	380	3,871	160	5,606	220
Irrigated/L.V.	100	7,062	710	3,520	360	3,542	350
Rainfed/L.V./4	30	5,130	150	3,023	90	2,107	60
Paddy							
Irrigated/L.V.	170	9,504	1,620	5,063	860	4,441	760
Irrigated/L.V./4	210	9,504	2,000	4,887	1,030	4,617	970
Total			7,320		3,910		3,410
(4) Kihurio - Alternative 1, 2, 3							
1st Maize/1							
Irrigated/H.Y.V.	110	9,477	1,040	3,869	420	5,608	620
Irrigated/L.V.	290	7,062	2,050	3,518	1,020	3,544	1,030
Rainfed/L.V.	110	5,130	560	3,023	330	2,107	230
2nd Maize/2							
Rainfed/L.V.	20	2,898	60	2,001	40	897	20
Rainfed/L.V./4	70	2,898	200	2,001	140	897	60
3rd Maize/3							
Irrigated/H.Y.V.	80	9,477	760	3,871	310	5,606	450
Irrigated/L.V.	200	7,062	1,410	3,520	700	3,542	710
Rainfed/L.V./4	440	5,130	2,260	3,023	1,330	2,107	930
Paddy							
Irrigated/L.V.	160	14,784	2,370	5,553	890	9,231	1,480
Rainfed/L.V./4	140	14,784	2,070	5,348	750	9,436	1,320
Total			12,780		5,930		6,850
(5) Igoma - Alternative 1, 2							
1st Maize							
Rainfed/L.V.	20	5,130	100	3,023	60	2,107	40
Total Project							
Alternative 1, 2			30,230		14,840		15,390
Alternative 3			30,130		14,780		15,350

Notes: /1 = Rainy season maize mixed cropping with beans

/2 = Rainy season maize

/3 = Dry season maize mixed cropping with beans

/4 = Cropping in the lowlying area

Table G-10 GROSS AND NET PRODUCTION RETURN WITH PROJECT IN EACH ALTERNATIVE PLAN

Scheme/Alternative Production	Area (ha)	Unit Gross Income (TSh./ha)	Total Gross Income (TSh.x10^3)	Unit Production Cost (TSh./ha)	Total Production Cost (TSh.x10^3)	Unit Net Return (TSh./ha)	Total Net Return (TSh.x10^3)
(1) Kishiwani - Alternative 1, 2, 3							
Paddy (dry season)	180	23,760	4,280	8,917	1,610	14,843	2,670
(rainy season)	360	26,400	9,500	8,836	3,180	17,564	6,320
Maize with Beans	180	14,124	2,540	6,610	1,190	7,514	1,350
Total			16,320		5,980		10,340
(2) Conja - Alternative 1 (with flow regulation condition)							
Paddy (dry season)	800	23,760	19,010	8,917	7,140	14,843	11,870
(rainy season)	1,200	26,400	31,680	8,836	10,600	17,564	21,080
Maize with Beans	400	14,124	5,650	6,610	2,640	7,514	3,010
Total			56,340		20,380		35,960
Conja - Alternative 2, 3 (without flow regulation condition)							
Paddy (dry season)	300	23,760	7,130	8,917	2,680	14,843	4,450
(rainy season)	600	26,400	15,840	8,836	5,300	17,564	10,540
Maize with Beans	740	14,124	10,450	6,610	4,890	7,514	5,560
Total			33,420		12,870		20,550
(3) Ndungu - Alternative 1 (with flow regulation condition)							
Paddy (dry season)	770	23,760	18,300	8,917	6,870	14,843	11,430
(rainy season)	1,180	26,400	31,150	8,836	10,420	17,564	20,730
Maize with Beans	410	14,124	5,790	6,610	2,710	7,514	3,080
Total			55,240		20,000		35,240
Nudungu - Alternative 2, 3 (without flow regulation condition)							
Paddy (dry season)	230	23,760	5,460	8,917	2,050	14,843	3,410
(rainy season)	680	26,400	17,950	8,836	6,010	17,564	11,940
Maize with Beans	780	14,124	11,020	6,610	5,160	7,514	5,860
Total			34,430		13,220		21,210
(4) Kihurio - Alternative 1 (with flow regulation condition)							
Paddy (dry season)	1,670	23,760	39,680	8,917	14,890	14,843	24,790
(rainy season)	1,670	26,400	44,090	8,836	14,760	17,564	29,330
Maize with Beans	-	-	-	-	-	-	-
Total			83,770		29,650		54,120
Kihurio - Alternative 2, 3 (without flow regulation condition)							
Paddy (dry season)	620	23,760	14,730	8,917	5,530	14,843	9,200
(rainy season)	1,670	26,400	44,090	8,836	14,760	17,564	29,330
Maize with Beans	1,050	14,124	14,830	6,610	6,940	7,514	7,890
Total			73,650		27,230		46,420
(5) Igoma - Alternative 1, 2 (with flow regulation condition)							
Paddy (dry season)	750	23,760	17,820	8,917	6,690	14,843	11,130
(rainy season)	750	26,400	19,800	8,836	6,630	17,564	13,170
Maize with Beans	-	-	-	-	-	-	-
Total			37,620		13,320		24,300
Total Project							
Alternative 1			249,290		89,330		159,960
Alternative 2			195,440		72,620		122,820
Alternative 3			157,820		59,300		98,520

Table G-11 (1/3) INCREMENTAL BENEFIT AT FULL DEVELOPMENT STAGE - ALTERNATIVE 1

Unit: TSh. x 10^3

Scheme/Description	With Project	Without Project	Increment
(1) Kisiwani			
Gross production value	16,320	3,390	12,930
Total production cost	5,980	1,470	4,510
Net production value	10,340	1,920	8,420
(2) Gonja			
Gross production value	56,340	6,640	49,700
Total production cost	20,380	3,470	16,910
Net production value	35,960	3,170	32,790
(3) Ndungu			
Gross production value	55,240	7,320	47,920
Total production cost	20,000	3,910	16,090
Net production value	35,240	3,410	31,830
(4) Kihurio			
Gross production value	83,770	12,780	70,990
Total production cost	29,650	5,930	23,720
Net production value	54,120	6,850	47,270
(5) Igoma			
Gross production value	37,620	100	37,520
Total production cost	13,320	60	13,260
Net production value	24,300	40	24,260
Total project			
Gross production value	249,290	30,230	219,060
Total production cost	89,330	14,840	74,490
Net production value	159,960	15,390	144,570

Table G-11 (2/3) INCREMENTAL BENEFIT AT FULL DEVELOPMENT STAGE - ALTERNATIVE 2

Unit: TSh. x 10^3

Scheme/Description	With Project	Without Project	Increment
(1) Kisiwani			
Gross production value	16,320	3,390	12,930
Total production cost	5,980	1,470	4,510
Net production value	10,340	1,920	8,420
(2) Gonja			
Gross production value	33,420	6,640	26,780
Total production cost	12,870	3,470	9,400
Net production value	20,550	3,170	17,380
(3) Ndungu			
Gross production value	34,430	7,320	27,110
Total production cost	13,220	3,910	9,310
Net production value	21,210	3,410	17,800
(4) Kihurio			
Gross production value	73,650	12,780	60,870
Total production cost	27,230	5,930	21,300
Net production value	46,420	6,850	39,570
(5) Igoma			
Gross production value	37,620	100	37,520
Total production cost	13,320	60	13,260
Net production value	24,300	40	24,260
Total project			
Gross production value	195,440	30,230	165,210
Total production cost	72,620	14,840	57,780
Net production value	122,820	15,390	107,430

Table G-11 (3/3) INCREMENTAL BENEFIT AT FULL DEVELOPMENT STAGE - ALTERNATIVE 3

Unit: TSh. x 10^3

	Scheme/Description	With Project	Without Project	Increment
(1)	Kisiwani			
	Gross production value	16,320	3,390	12,930
	Total production cost	5,980	1,470	4,510
	Net production value	10,340	1,920	8,420
(2)	Gonja			
	Gross production value	33,420	6,640	26,780
	Total production cost	12,870	3,470	9,400
	Net production value	20,550	3,170	17,380
(3)	Ndungu			
	Gross production value	34,430	7,320	27,110
	Total production cost	13,220	3,910	9,310
	Net production value	21,210	3,410	17,800
(4)	Kihurio			
	Gross production value	73,650	12,780	60,870
	Total production cost	27,230	5,930	21,300
	Net production value	46,420	6,850	39,570
(5)	Igoma			
	Gross production value	-	-	-
	Total production cost	-	-	-
	Net production value	-	-	-
	Total project			
	Gross production value	157,820	30,130	127,690
	Total production cost	59,300	14,780	44,520
	Net production value	98,520	15,350	83,170

Table G-12 PRELIMINARY COST ESTIMATE OF DETAILED ALTERNATIVE

Unit: TSh. 10^6

Scheme/Alternative	Foreign Currency Portion	Local Currency Portion	Total
1. Kisiwani scheme,			
- Alternative 2-1, 2-2, 2-3	18.4	6.9	25.3
Irrigation and drainage	18.4	6.9	25.3
2. Gonja scheme,			
- Alternative 2-1, 2-2, 2-3	32.1	12.4	44.5
Irrigation and drainage	32.1	12.4	44.5
3. Ndungu scheme			
- Alternative 2-1	31.6	12.8	44.4
Irrigation and drainage	31.6	12.8	44.4
- Alternative 2-2	31.1	12.6	43.7
Irrigation and drainage	31.1	12.6	43.7
- Alternative 2-3	30.9	12.5	43.4
Irrigation and drainage	30.9	12.5	43.4
4. Kihurio scheme			
- Alternative 2-1	74.5	29.0	103.5
Irrigation and drainage	74.5	29.0	103.5
- Alternative 2-2	86.7	33.7	120.4
Irrigation and drainage	74.5	29.0	103.5
Kalimawe dam	12.2	4.7	16.9
- Alternative 2-3	88.4	34.4	122.8
Irrigation and drainage	74.5	29.0	103.5
Kalimawe dam	13.9	5.4	19.3
5. Igoma scheme			
- Alternative 2-1, 2-2, 2-3	84.1	29.6	113.7
Irrigation and drainage	24.9	10.3	35.2
Igoma dam	59.2	19.3	78.5

To be continued.

Unit: TSh. 10^6

Scheme/Alternative	Foreign Currency Portion	Local Currency Portion	Total	(Economic Cost)
Sub-total of Alternative 2-1	240.7	90.7	331.4	
Office & Quarter	9.2	5.7	14.9	
O&M equipment	15.0	7.0	16.0	
Administration expense	-	25.4	25.4	
Engineering services	61.8	17.6	79.4	
Physical contingency	32.2	14.0	46.2	
Total of Alternative 2-1	358.9	154.4	513.3	(541)
Sub-total of Alternative 2-2	252.4	95.2	347.6	
Office & Quarter	9.2	5.7	14.9	
O&M equipment	15.0	1.0	16.0	
Administration expense	-	25.4	25.4	
Engineering services	61.9	17.6	79.5	
Physical contingency	33.4	14.5	47.9	
Total of Alternative 2-2	371.9	159.4	531.3	(560)
Sub-total of Alternative 2-3	235.9	95.8	349.7	
Office & Quarter	9.2	5.7	14.9	
O&M equipment	15.0	1.0	16.0	
Administration expense	-	25.4	25.4	
Engineering services	61.8	16.8	78.6	
Physical contingency	34.1	14.3	48.4	
Total of Alternative 2-3	374.0	159.0	533.0	(562)

Remark: Economic Cost = 1.12 x Foreign Currency Portion + 0.9 x Local Currency Portion (Ref. Annex E)

Table G-13 (1/2) GROSS AND NET PRODUCTION RETURN WITHOUT PROJECT IN EACH DETAILED ALTERNATIVE PLAN

Scheme/Alternative Crop	Area (ha)	Unit Gross Income (TSh./ha)	Total Gross Income (TSh.x10^3)	Unit Production Cost (TSh./ha)	Total Production Cost (TSh.x10^3)	Unit Net Return (TSh./ha)	Total Net Return (TSh.x10^3)
Ndungu - Alternative 2-1							
1st Mainze /1							
Irrigated/H.Y.V.	30	9,477	280	3,896	110	5,608	170
Irrigated/L.V.	70	7,062	490	3,518	240	3,544	250
Rainfed/L.V.	210	5,130	1,080	3,023	640	2,107	440
2nd Maize /2							
Rainfed/L.V.	40	2,898	120	2,001	80	897	40
Rainfed/L.V. /4	170	2,898	490	2,001	340	897	150
3rd Maize /3							
Irrigated/H.Y.V.	40	9,477	380	3,871	160	5,606	220
Irrigated/L.V.	100	7,062	710	3,520	360	3,542	350
Rainfed/L.V. /4	30	5,130	150	3,023	90	2,107	60
Paddy							
Irrigated/L.V.	170	9,504	1,620	5,063	860	4,441	760
Rainfed/L.V. /4	210	9,504	2,000	4,887	1,030	4,617	970
Total			7,320		3,910		3,410
Ndungu - Alternative 2-2							
1st Maize /1							
Irrigated/H.Y.V.	30	9,477	280	3,896	110	5,608	170
Irrigated/L.V.	70	7,062	490	3,518	240	3,544	250
Rainfed/L.V.	210	5,130	1,080	3,023	640	2,107	440
2nd Maize /2							
Rainfed/L.V.	40	2,898	120	2,001	80	897	40
Rainfed/L.V. /4	150	2,898	430	2,001	300	897	130
3rd Maize /3							
Irrigated/H.Y.V.	40	9,477	380	3,871	160	5,606	220
Irrigated/L.V.	100	7,062	710	3,520	360	3,542	350
Rainfed/L.V. /4	30	5,130	150	3,023	90	2,107	60
Paddy							
Irrigated/L.V.	160	9,504	1,520	5,063	810	4,441	710
Rainfed/L.V. /4	200	9,504	1,900	4,887	980	4,617	920
Total			7,060		3,770		3,290
Ndungu - Alternative 2-3							
1st Maize /1							
Irrigated/H.Y.V.	30	9,477	280	3,896	110	5,608	170
Irrigated/L.V.	70	7,062	490	3,518	240	3,544	250
Rainfed/L.V.	210	5,130	1,080	3,023	640	2,107	440
2nd Maize /2							
Rainfed/L.V.	40	2,898	120	2,001	80	897	40
Rainfed/L.V. /4	130	2,898	380	2,001	260	897	120
3rd Maize /3							
Irrigated/H.Y.V.	40	9,477	380	3,871	160	5,606	220
Irrigated/L.V.	100	7,062	710	3,520	360	3,542	350
Rainfed/L.V. /4	30	5,130	150	3,023	90	2,107	60
Paddy							
Irrigated/L.V.	160	9,504	1,520	5,063	810	4,441	710
Rainfed/L.V. /4	190	9,504	1,810	4,887	930	4,617	880
Total			6,920		3,680		3,240
Other Four Schemes - Alternative 2			22,910		10,930		11,980
Total Project							
Alternative 2-1			30,230		14,840		15,390
Alternative 2-2			29,970		14,700		15,270
Alternative 2-3			29,830		14,610		15,220

Note: /1 = Rainy season maize mixed cropping with Beans
/2 = Rainy season maize
/3 = Dry season maize mixed cropping with Beans
/4 = Cropping in the lowlying area

Table G-14 GROSS AND NET PRODUCTION RETURN WITH PROJECT IN EACH DETAILED ALTERNATIVE PLAN

Scheme/Alternative Production	Area (ha)	Unit Gross Income (TSh./ha)	Total Gross Income (TSh.x10^3)	Unit Production Cost (TSh./ha)	Total Production Cost (TSh.x10^3)	Unit Net Return (TSh./ha)	Total Net Return (TSh.x10^3)
Ndungu - Alternative 2-1							
Paddy (dry season)	230	23,760	5,460	8,917	2,050	14,843	3,410
(rainy season)	680	26,400	17,950	8,836	6,010	17,564	11,940
Maize with Beans	780	14,124	11,020	6,610	5,160	7,514	5,860
Total			34,430		13,220		21,210
Ndungu - Alternative 2-2							
Paddy (dry season)	230	23,760	5,460	8,917	2,050	14,843	3,410
(rainy season)	680	26,400	17,950	8,836	6,010	17,564	11,940
Maize with Beans	740	14,124	10,450	6,610	4,890	7,514	5,560
Total			33,860		12,950		20,910
Ndungu - Alternative 2-3							
Paddy (dry season)	230	23,760	5,460	8,917	2,050	14,843	3,410
(rainy season)	680	26,400	17,950	8,836	6,010	17,564	11,940
Maize with Beans	710	14,124	10,030	6,610	4,700	7,514	5,330
Total			33,440		12,760		20,680
Kihurio - Alternative 2-1							
Paddy (dry season)	620	23,760	14,730	8,917	5,530	14,843	9,200
(rainy season)	1,670	26,400	44,090	8,836	14,760	17,564	29,330
Maize with Beans	1,050	14,124	14,830	6,610	6,940	7,514	7,890
Total			73,650		27,230		46,420
Kihurio - Alternative 2-2							
Paddy (dry season)	920	23,760	21,860	8,917	8,200	14,843	13,660
(rainy season)	1,670	26,400	44,090	8,836	14,760	17,564	29,330
Maize with Beans	750	14,124	10,590	6,610	4,950	7,514	5,640
Total			76,540		27,910		48,630
Kihurio - Alternative 2-3							
Paddy (dry season)	1,320	23,760	31,360	8,917	11,770	14,843	19,590
(rainy season)	1,670	26,400	44,090	8,836	14,760	17,564	29,330
Maize with Beans	350	14,124	4,940	6,610	2,310	7,514	2,630
Total			80,390		28,840		51,550
Other Three Schemes - Alternative 2							
			87,360		32,170		55,190
Total Project							
Alternative 2-1			195,440		72,620		122,820
Alternative 2-2			197,760		73,030		124,730
Alternative 2-3			201,190		73,770		127,420

Table G-15 (1/3) INCREMENTAL BENEFIT AT FULL DEVELOPMENT STAGE - DETAILED ALTERNATIVE 2-1

Unit: TSh. x 10^3

	Scheme/Description	With Project	Without Project	Increment
(1)	Kisiwani			
	Gross production value	16,320	3,390	12,930
	Total production cost	5,980	1,470	4,510
	Net production value	10,340	1,920	8,420
(2)	Gonja			
	Gross production value	33,420	6,640	26,780
	Total production cost	12,870	3,470	9,400
	Net production value	20,550	3,170	17,380
(3)	Ndungu			
	Gross production value	34,430	7,320	27,110
	Total production cost	13,220	3,910	9,310
	Net production value	21,210	3,410	17,800
(4)	Kihurio			
	Gross production value	73,650	12,780	60,870
	Total production cost	27,230	5,930	21,300
	Net production value	46,420	6,850	39,570
(5)	Igoma			
	Gross production value	37,620	100	37,520
	Total production cost	13,320	60	13,260
	Net production value	24,300	40	24,260
	Total project			
	Gross production value	195,440	30,230	165,210
	Total production cost	72,620	14,840	57,780
	Net production value	122,820	15,390	107,430

Table G-15 (2/3) INCREMENTAL BENEFIT AT FULL DEVELOPMENT STAGE
- DETAILED ALTERNATIVE 2-2

Unit: TSh. x 10^3

	Scheme/Description	With Project	Without Project	Increment
(1)	Kisiwani			
	Gross production value	16,320	3,390	12,930
	Total production cost	5,980	1,470	4,510
	Net production value	10,340	1,920	8,420
(2)	Gonja			
	Gross production value	33,420	6,640	26,780
	Total production cost	12,870	3,470	9,400
	Net production value	20,550	3,170	17,380
(3)	Ndungu			
	Gross production value	33,860	7,060	26,800
	Total production cost	12,950	3,770	9,180
	Net production value	20,910	3,290	17,620
(4)	Kihurio			
	Gross production value	76,540	12,780	63,760
	Total production cost	27,910	5,930	21,980
	Net production value	48,630	6,850	41,780
				(41,660)
(5)	Igoma			
	Gross production value	37,620	100	37,520
	Total production cost	13,320	60	13,260
	Net production value	24,300	40	24,260
	Total project			
	Gross production value	197,760	29,970	167,790
	Total production cost	73,030	14,700	58,330
	Net production value	124,730	15,270	109,460
				(109,340)

Note: Figure in parentheses shows the benefits deducted Tsh. 120 x 10^3 of negative benefits to be derived from 40 ha of submerged area by hightening the Kalimawe dam.
The negative benefits are estimated as shown in Table G-16.

Table G-15 (3/3) INCREMENTAL BENEFIT AT FULL DEVELOPMENT STAGE - DETAILED ALTERNATIVE 2-3

Unit: TSh. x 10^3

	Scheme/Description	With Project	Without Project	Increment
(1)	Kisiwani			
	Gross production value	16,320	3,390	12,930
	Total production cost	5,980	1,470	4,510
	Net production value	10,340	1,920	8,420
(2)	Gonja			
	Gross production value	33,420	6,640	26,780
	Total production cost	12,870	3,470	9,400
	Net production value	20,550	3,170	17,380
(3)	Ndungu			
	Gross production value	33,440	6,920	26,520
	Total production cost	12,760	3,680	9,080
	Net production value	20,680	3,240	17,440
(4)	Kihurio			
	Gross production value	80,390	12,780	67,610
	Total production cost	28,840	5,930	22,910
	Net production value	51,550	6,850	44,700
				(44,530)
(5)	Igoma			
	Gross production value	37,620	100	37,520
	Total production cost	13,320	60	13,260
	Net production value	24,300	40	24,260
	Total project			
	Gross production value	201,190	29,830	171,360
	Total production cost	73,770	14,610	59,160
	Net production value	127,420	15,220	112,200
				(112,030)

Note: Figure in parentheses shows the benefits deducted Tsh. 170 x 10^3 of negative benefits to be derived from 70 ha of submerged area by hightening the Kalimawe dam.
The negative benefits are estimated as shown in Table G-16.

Table G-16(1/2) ESTIMATION OF NEGATIVE BENEFITS - 40HA OF SUBMERGED AREA (Detailed alternative 2-2)

Crop	Area (ha)	Unit Gross Income (TSh./ha)	Total Gross Income (TSh.x10^3)	Unit Production Cost (TSh./ha)	Total Production Cost (TSh.x10^3)	Unit Net Return (TSh./ha)	Total Net Return (TSh.x10^3)
2nd Maize							
Rainfed/L.V.	20	2,900	60	2,000	40	900	20
Paddy							
Irrigated/L.V.	10	9,500	100	5,060	50	4,440	50
Rainfed/L.V.	10	9,500	100	4,890	50	4,620	50
Total			260		140		120

Table G-16(2/2) ESTIMATION OF NEGATIVE BENEFITS - 70HA OF SUBMERGED AREA (Detailed alternative 2-3)

Crop	Area (ha)	Unit Gorss Income (TSh./ha)	Total Gross Income (TSh.x10^3)	Unit Production Cost (TSh./ha)	Total Production Cost (TSh.x10^3)	Unit Net Return (TSh./ha)	Total Net Return (TSh.x10^3)
2nd Maize							
Rainfed/L.V.	40	2,900	120	2,000	80	900	40
Paddy							
Irrigated/L.V.	10	9,500	100	5,060	60	4,440	40
Rainfed/L.V.	20	9,500	190	4,890	100	4,620	90
Total			410		240		170

Table G-17 STORAGE EFFECT OF THE LAKE MANKA

Item		Existing		Present	
		Return period in year			
		2	5	5	20
Inflow to the lake					
from Saseni river	(m^3/sec)	91	144	144	203
from Kalimawe dam	(m^3/sec)	50	81	81	126
Storage effect of the lake					
Water level	(EL.m)	498.9	499.7	498.7	499.4
Inundated area	(ha)	390	400	180	180
Storage	(10^3m^3)	3,290	5,520	1,980	3,240
Regulated outflow	(m^3/sec)	48	90	100	155

Table G-18 (1/6) PRINCIPAL FEATURES OF KISIWANI SCHEME

1.	Source of irrigation water	:	Nakombo river
2.	Net development area	:	360 ha
3.	Net irrigable area	:	360 ha
4.	Intake facility		
	4.1 Nakombo diversion weir		
	(1) Design discharge	:	0.29 m^3/sec
	(2) Weir type	:	Floating type concrete weir
	(3) Weir height x Crest length	:	2.6 m x 25 m
	4.2 Existing Kisiwani diversion weir		
	(1) Design discharge of intake	:	0.25 m^3/sec
	(2) Intake weir	:	Fixed type concrete weir
	(3) Weir height x Crest length	:	1.6 m x 10 m
5.	Irrigation facility		
	5.1 Main canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	0.3 - 0.1 m^3/sec
	(3) Canal length	:	5.1 km
	(4) Related structure		
	- Turnout	:	12 Nos.
	- Culvert	:	11 Nos.
	- Drop	:	3 Nos.
	- Wasteway	:	2 Nos.
	5.2 Secondary canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	Less than 0.1 m^3/sec
	(3) Canal length	:	3.6 km
	(4) Related structure		
	- Turnout	:	17 Nos.
	- Culvert	:	4 Nos.
	- Wasteway	:	5 Nos.
6.	Drainage facility		
	6.1 Main drainage canal		
	(1) Canal type	:	Trapezoidal unlined canal
	(2) Design discharge	:	50.4 m^3/sec
	(3) Canal length	:	3.7 km
	6.2 Secondary drainage		
	(1) Canal type	:	Trapezoidal unlined canal
	(2) Design discharge	:	28.6 - 7.8 m^3/sec
	(3) Canal length	:	5.7 km
	6.3 Related structure		
	- Drainage drop	:	33 Nos.
	- Crossdrain	:	4 Nos.
7.	River improvement		
	7.1 Design discharge	:	77 m^3/sec
	7.2 Length	:	2.6 km
8.	Farm road		
	8.1 Length of main road	:	8.8 km
	8.2 Length of secondary road	:	9.3 km
9.	On-farm development		
	9.1 Area of on-farm development	:	360 ha
	9.2 Related structure		
	- Division box	:	80 Nos.
	- Culvert	:	50 Nos.
	- Drainage culvert	:	50 Nos.

Table G-18 (2/6) PRINCIPAL FEATURES OF GONJA SCHEME

1.	Source of irrigation water	:	Hingilili river
2.	Net development area	:	1,040 ha
3.	Net irrigable area	:	600 ha
4.	Intake facility		
	4.1 Design discharge of intake	:	0.82 m^3/sec
	4.2 Intake weir	:	Fixed type concrete weir
	4.3 Weir height x Crest length	:	3.5 m x 20 m
5.	Irrigation facility		
	5.1 Main canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	0.8 - 0.1 m^3/sec
	(3) Canal length	:	7.6 km
	(4) Related structure		
	- Turnout	:	14 Nos.
	- Culvert	:	9 Nos.
	- Drop and chute	:	10 Nos.
	- Siphon	:	1 No.
	- Spillway and wasteway	:	3 Nos.
	5.2 Secondary canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	0.5 - 0.1 m^3/sec
	(3) Canal length	:	13.3 km
	(4) Related structure		
	- Turnout	:	44 Nos.
	- Culvert	:	32 Nos.
	- Drop and chute	:	9 Nos.
	- Wasteway	:	5 Nos.
6.	Drainage facility		
	6.1 Main drainage canal		
	(1) Canal type	:	Trapezoidal unlined canal
	(2) Design discharge	:	67.4 - 55.7 m^3/sec
	(3) Canal length	:	3.3 km
	6.2 Secondary drainage		
	(1) Canal type	:	Trapezoidal unlined canal
	(2) Design discharge	:	4.5 - 0.2 m^3/sec
	(3) Canal length	:	14.4 km
	6.3 Related structure		
	- Drainage drop	:	5 Nos.
	- Crossdrain	:	2 Nos.
7.	Short cut		
	7.1 Design discharge	:	127 m^3/sec
	7.2 Length	:	4.6 km
	7.3 Gabion	:	59 m^3
8.	Farm road		
	8.1 Length of main road	:	10.9 km
	8.2 Length of secondary road	:	27.7 km
9.	On-farm development		
	9.1 Area of on-farm development	:	1,040 ha
	9.2 Related structure		
	- Division box	:	230 Nos.
	- Drainage drop	:	140 Nos.
	- Drainage culvert	:	140 Nos.

Table G-18 (3/6) PRINCIPAL FEATURES OF NDUNGU SCHEME

1.	Source of irrigation water	: Yongoma river
2.	Net development area	: 940 ha
3.	Net irrigable area	: 680 ha
4.	Intake facility	
	4.1 Design discharge of intake	: 0.93 m^3/sec
	4.2 Intake weir	: Fixed type concrete weir
	4.3 Weir height x Crest length	: 9.4 m x 25 m
5.	Irrigation facility	
	5.1 Main Canal	
	(1) Canal type	: Trapezoidal concrete lined canal
	(2) Design discharge	: 0.9 - 0.3 m^3/sec
	(3) Canal length	: 7.9 km
	(4) Related structure	
	- Turnout	: 16 Nos.
	- Culvert	: 11 Nos.
	- Drop	: 3 Nos.
	- Siphon	: 1 No.
	- Spilway and wasteway	: 4 Nos.
	5.2 Secondary canal	
	(1) Canal type	: Trapezoidal concrete lined canal
	(2) Design discharge	: 0.3 - 0.1 m^3/sec
	(3) Canal length	: 9.7 km
	(4) Related structure	
	- Turnout	: 40 Nos.
	- Culvert	: 14 Nos.
	- Drop	: 14 Nos.
	- Wasteway	: 9 Nos.
6.	Drainage facility	
	6.1 Secondary drainage	
	(1) Canal type	: Trapezoidal unlined canal
	(2) Design discharge	: 34.4 - 0.1 m^3/sec
	(3) Canal length	: 15.4 km
	6.2 Related structure	
	- Drainage drop	: 17 Nos.
	- Crossdrain	: 7 Nos.
7.	River improvement	
	7.1 Design discharge	: 127 m^3/sec
	7.2 Length	: 4.2 km
	7.3 Gabion	: 110 m^3
8.	Farm road	
	8.1 Length of main road	: 7.9 km
	8.2 Length of secondary road	: 25.1 km
9.	On-farm development	
	9.1 Area of on-farm development	: 940 ha
	9.2 Related structure	
	- Division box	: 200 Nos.
	- Culvert	: 120 Nos.
	- Drainage culvert	: 120 Nos.
10.	Flood dike Length	: 2.5 km

Table G-18 (4/6) PRINCIPAL FEATURES OF SASENI SUB-SCHEME

1.	Source of irrigation water	:	Saseni river
2.	Net development area	:	930 ha
3.	Net irrigable area	:	930 ha
4.	Intake facility		
	4.1 Design discharge of intake	:	1.27 m^3/sec
	4.2 Intake weir	:	Fixed type concrete weir
	4.3 Weir height x Crest length	:	13.5 m x 40 m
5.	Irrigation facility		
	5.1 Main canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	1.0 - 0.1 m^3/sec
	(3) Canal length	:	11.8 km
	(4) Related structure		
	- Turnout	:	22 Nos.
	- Culvert	:	22 Nos.
	- Drop	:	13 Nos.
	- Spillway and wasteway	:	4 Nos.
	- Siphon	:	1 No.
	5.2 Secondary canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	0.4 - 0.1 m^3/sec
	(3) Canal length	:	6.4 km
	(4) Related structure		
	- Turnout	:	21 Nos.
	- Culvert	:	7 Nos.
	- Drop	:	4 Nos.
	- Wasteway	:	5 Nos.
6.	Drainage facility		
	6.1 Secondary drainage		
	(1) Canal type	:	Trapezoidal unlined canal
	(2) Design discharge	:	38.8 - 0.09 m^3/sec
	(3) Canal length	:	13.7 km
	6.2 Related structure		
	- Drainage drop	:	30 Nos.
	- Crossdrain	:	8 Nos.
7.	River improvement		
	7.1 Design discharge	:	203 m^3/sec
	7.2 Length	:	3 km
8.	Farm road		
	8.1 Length of main road	:	11.8 km
	8.2 Length of secondary road	:	20.1 km
9.	On-farm development		
	9.1 Area of on-farm development	:	930 ha
	9.2 Related structure		
	- Division box	:	200 Nos.
	- Culvert	:	120 Nos.
	- Drainage culvert	:	120 Nos.
10.	Flood dike Length	:	6.5 km

Table G-18 (5/6) PRINCIPAL FEATURES OF KALIMAWE SUB-SCHEME

1.	Source of irrigation water	: Kambaga river
2.	Net development area	: 740 ha
3.	Net irrigable area	: 740 ha
4.	Dam	
	4.1 Design discharge of intake	: 1.82 m^3/sec
	4.2 Dam type	: Center core earthfill type
	4.3 Effective storage capacity	: 14.9 x $10^6 m^3$
5.	Irrigation facility	
	5.1 Main canal	
	(1) Canal type	: Trapezoidal concrete lined canal
	(2) Design discharge	: 1.8 - 0.3 m^3/sec
	(3) Canal length	: 8.9 km
	(4) Related structure	
	- Turnout	: 19 Nos.
	- Culvert	: 12 Nos.
	- Spillway and wasteway	: 3 Nos.
	- Siphon	: 1 No.
	5.2 Secondary canal	
	(1) Canal type	: Trapezoidal concrete lined canal
	(2) Design discharge	: 0.2 - 0.1 m^3/sec
	(3) Canal length	: 2.6 km
	(4) Related structure	
	- Turnout	: 3 Nos.
	- Culvert	: 1 No.
	- Wasteway	: 1 No.
6.	Drainage facility	
	6.1 Main drainage canal	
	(1) Canal type	: Trapezoidal unlined canal
	(2) Design discharge	: 59 m^3/sec
	(3) Canal length	: 0.8 km
	6.2 Secondary drainage	
	(1) Canal type	: Trapezoidal unlined canal
	(2) Design discharge	: 29.5 - 0.11 m^3/sec
	(3) Canal length	: 8.6 km
	6.3 Related structure	
	- Drainage drop	: 55 Nos.
	- Crossdrain	: 5 Nos.
7.	River improvement	
	7.1 Design discharge	: 155 - 126 m^3/sec
	7.2 Length	: 6.0 km
8.	Farm road	
	8.1 Length of main road	: 9.7 km
	8.2 Length of secondary road	: 11.2 km
9.	On-farm development	
	9.1 Area of on-farm development	: 740 ha
	9.2 Related structure	
	- Division box	: 160 Nos.
	- Culvert	: 100 Nos.
	- Drainage culvert	: 100 Nos.

Table G-18 (6/6) PRINCIPAL FEATURES OF IGOMA SCHEME

1.	Source of irrigation water	:	Kambaga river
2.	Net developmetn area	:	750 ha
3.	Net irrigable area	:	750 ha
4.	Dam		
	4.1 Dam type	:	Homogeneous earthfill type
	4.2 Dam height	:	25 m
	4.3 Effective storage capacity	:	$39 \times 10^6 m^3$
	4.4 Embankment volume	:	$524 \times 10^3 m^3$
5.	Intake facility		
	5.1 Design discharge of intake	:	1.20 m^3/sec
	5.2 Intake weir	:	Floating type concrete weir
	5.3 Weir height x Crest length	:	3.5 m x 20 m
6.	Irrigation facility		
	6.1 Main canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	0.6 - 0.1 m^3/sec
	(3) Canal length	:	8.5 km
	(4) Related structure		
	- Turnout	:	13 Nos.
	- Culvert	:	8 Nos.
	- Drop	:	1 No.
	- Wasteway	:	2 Nos.
	6.2 Secondary canal		
	(1) Canal type	:	Trapezoidal concrete lined canal
	(2) Design discharge	:	0.2 - 0.1 m^3/sec
	(3) Canal length	:	7.3 km
	(4) Related structure		
	- Turnout	:	24 Nos.
	- Culvert	:	10 Nos.
	- Drop	:	3 Nos.
	- Wasteway	:	6 Nos.
7.	Drainage facility		
	7.1 Secondary drainage		
	(1) Canal type	:	Trapezoidal unlined canal
	(2) Design discharge	:	29.4 - 0.5 m^3/sec
	(3) Canal length	:	3.4 km
	7.2 Related structure		
	- Drainage drop	:	12 Nos.
	- Crossdrain	:	7 Nos.
8.	River improvement		
	8.1 Design discharge	:	70 m^3/sec
	8.2 Length	:	5.3 km
9.	Farm road		
	9.1 Length of main road	:	8.5 km
	9.2 Length of secondary road	:	10.7 km
10.	On-farm development		
	10.1 Area of on-farm development	:	750 ha
	10.2 Related structure		
	- Division box	:	160 Nos.
	- Culvert	:	100 Nos.
	- Drainage culvert	:	100 Nos.
11.	Flood dike Length	:	1.5 km

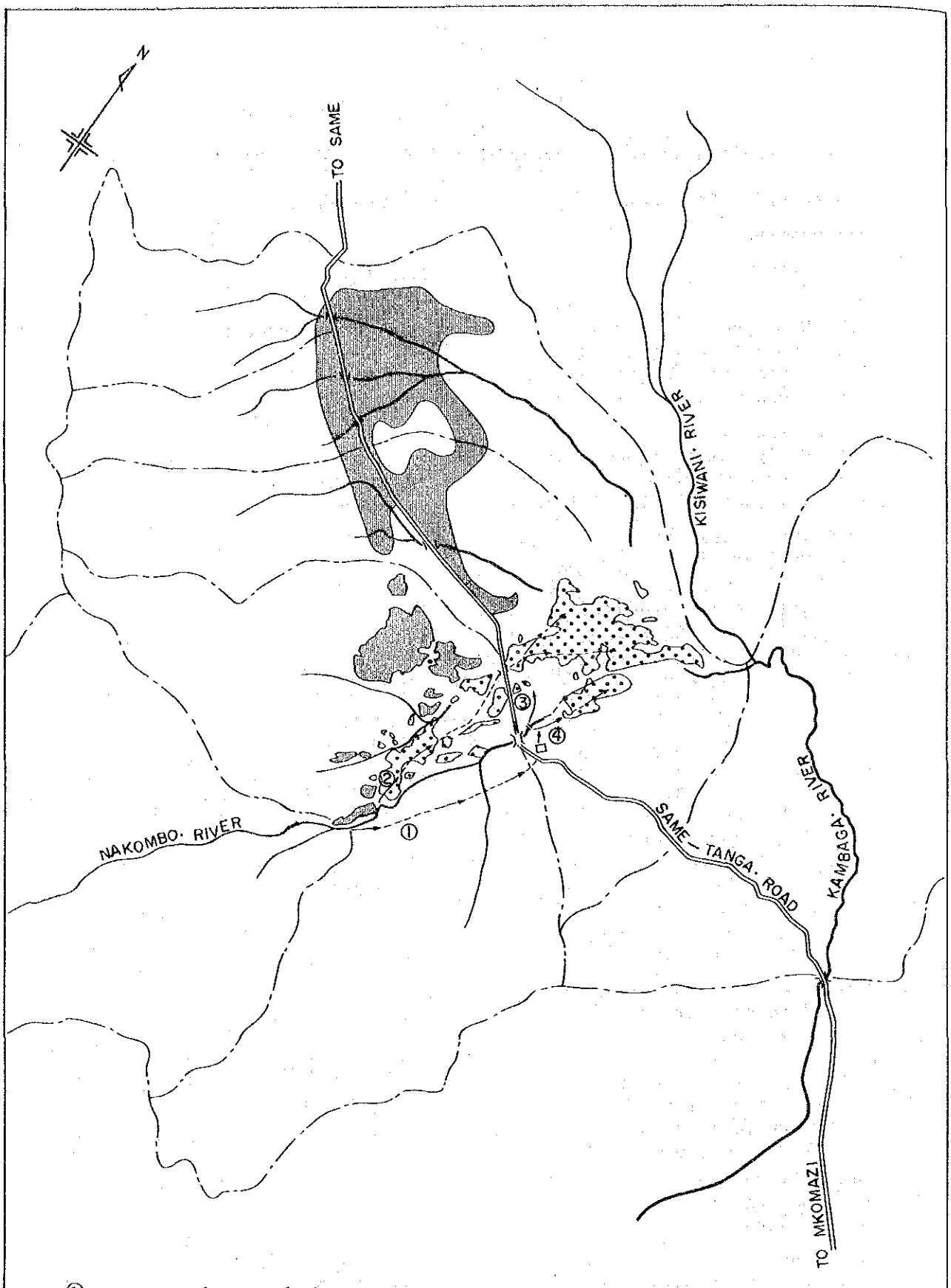


Fig. G-1 (1/3) EXISTING IRRIGATION SYSTEM IN KISIWANI SCHEME AREA

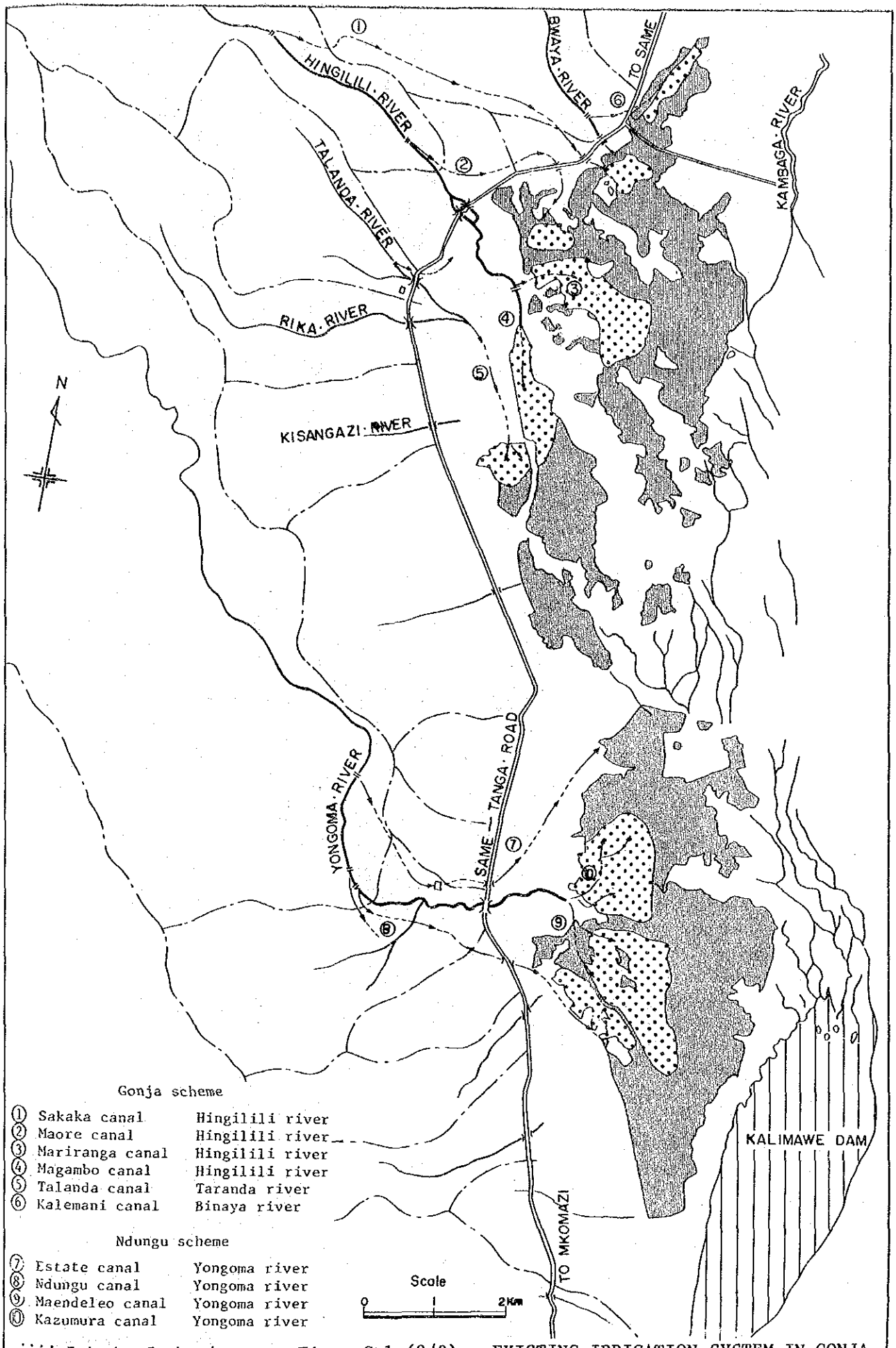


Fig. G-1 (2/3) EXISTING IRRIGATION SYSTEM IN GONJA AND NDUNGU SCHEME AREA

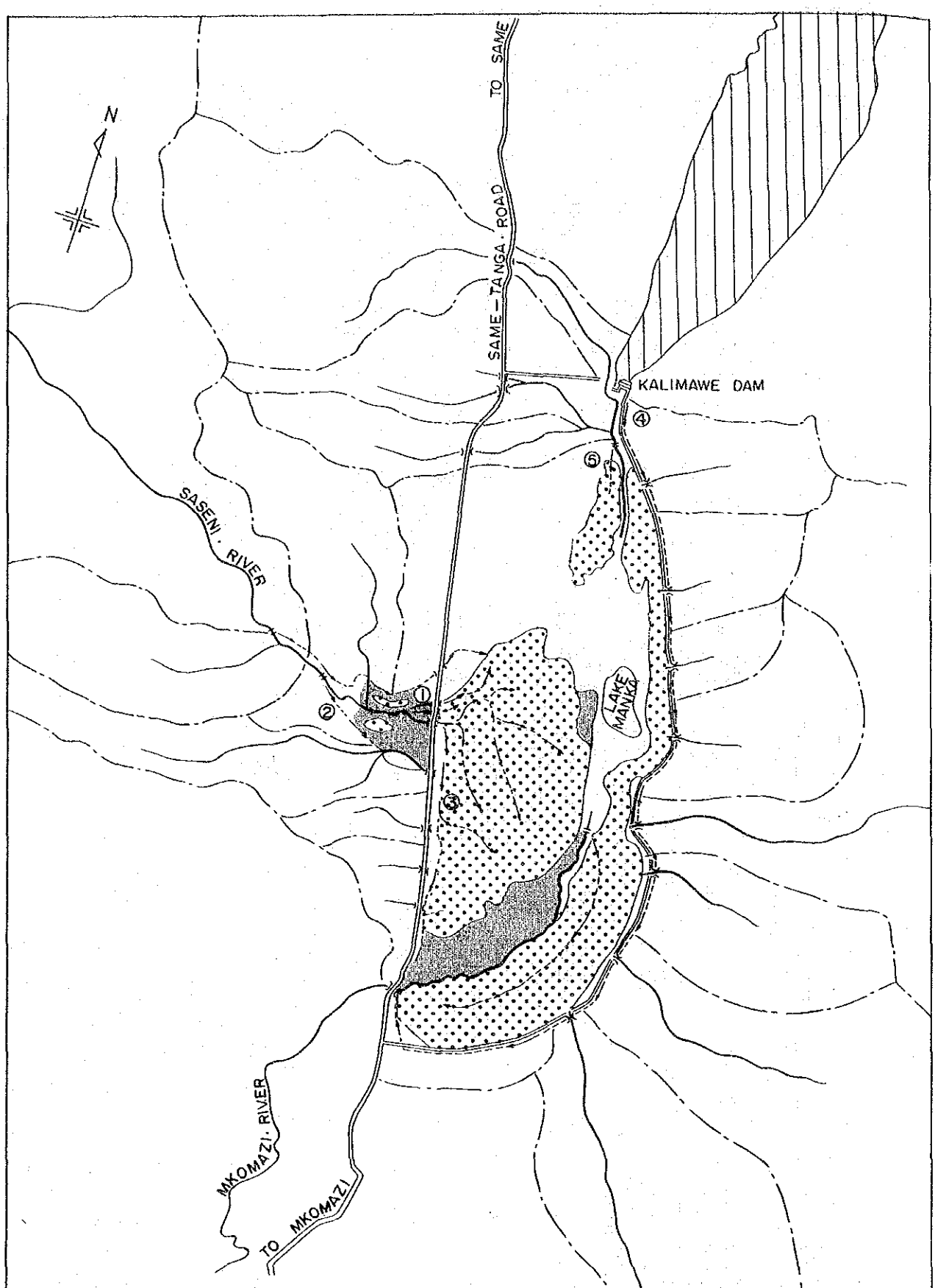
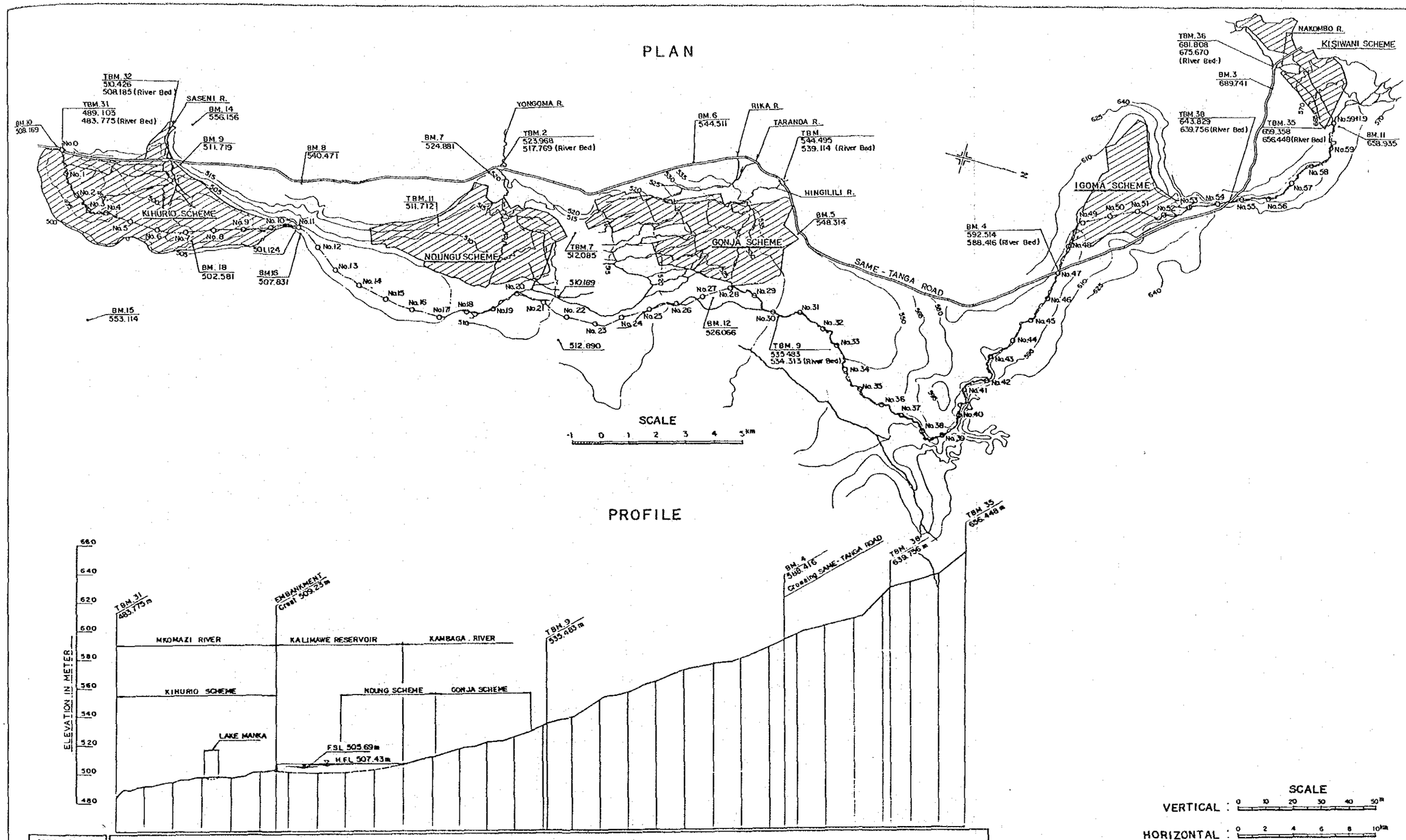


Fig. G-1 (3/3) EXISTING IRRIGATIN SYSTEM IN KIHURIO SCHEME AREA



PLAN

PROFILE

STATION	No 0	No 2	No. 4	No. 6	No. 8	No 10	No 11 +0.1	No 12	No 14	No 16	No 18	No 20	No 22	No 24	No 26	No 28	No 30	+0.3
CANAL BASE ELEVATION																		
WATER SURFACE ELEVATION																		
GROUND SURFACE ELEVATION	483.775	491.0	494.0	497.0	497.0	502.0	509.23					507.0	511.0	517.0	522.0	528.0	533.0	535.483
REDUCED DISTANCE (IN KM)	0.0 km	2.0	4.0	6.0	8.0	10.0	11.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0	30.5
DISTANCE (IN KM)	0.0 km	2.0	2.0	2.0	2.0	2.0	1.1	0.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.3

STATION	No 32	No 34	No 36	No 38	No 40	No. 42	No 44	No 46	No 47 +0.1	No 48	No 50	No 52	No 54	+0.5	No 56	No 58	No 59 +0.9
CANAL BASE ELEVATION																	
WATER SURFACE ELEVATION																	
GROUND SURFACE ELEVATION	539.0	552.0	557.0	564.0	572.0	577.0	580.0	588.0	588.416	597.0	603.0	609.0	624.0	639.756	634.0	640.0	656.448
REDUCED DISTANCE (IN KM)	32.0	34.0	36.0	38.0	40.0	42.0	44.0	46.0		48.0	50.0	52.0	54.0	54.5	56.0	58.0	59.9
DISTANCE (IN KM)	1.7	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.1	0.9	2.0	2.0	2.0	0.5	1.5	2.0	1.9

SCALE

VERTICAL : 0 10 20 30 40 50m

HORIZONTAL : 0 2 4 6 8 10km

Fig. G-2 PROFILE OF KAMBAGA RIVER

THE UNITED REPUBLIC OF TANZANIA
KILIMANJARO REGION
THE MKOMAZI VALLEY AREA IRRIGATION DEVELOPMENT PROJECT

TITLE OF DRAWING

PROFILE OF RIVERS

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO

DWG. NO.

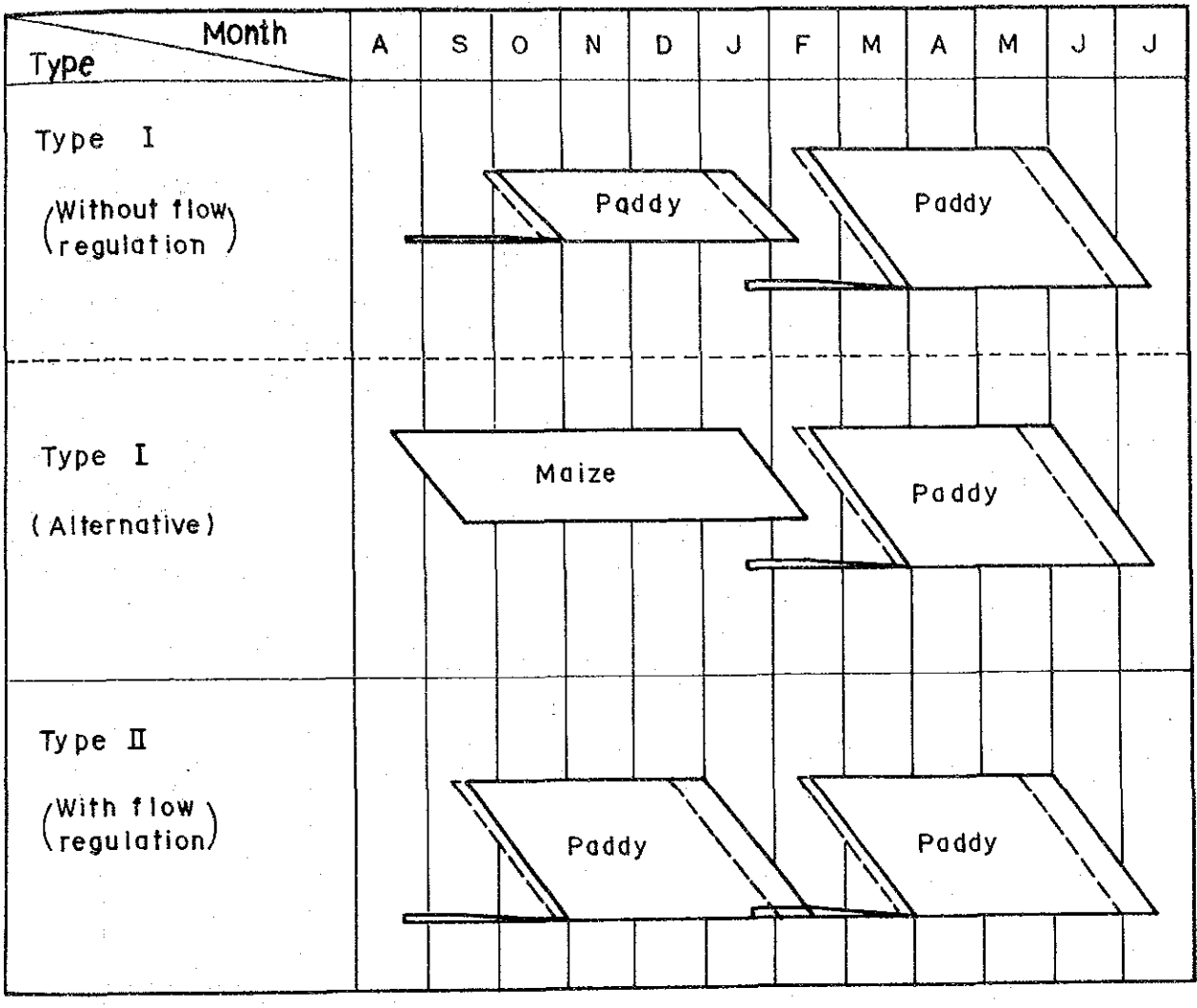


Fig. G-3 PROPOSED CROPPING PATTERN

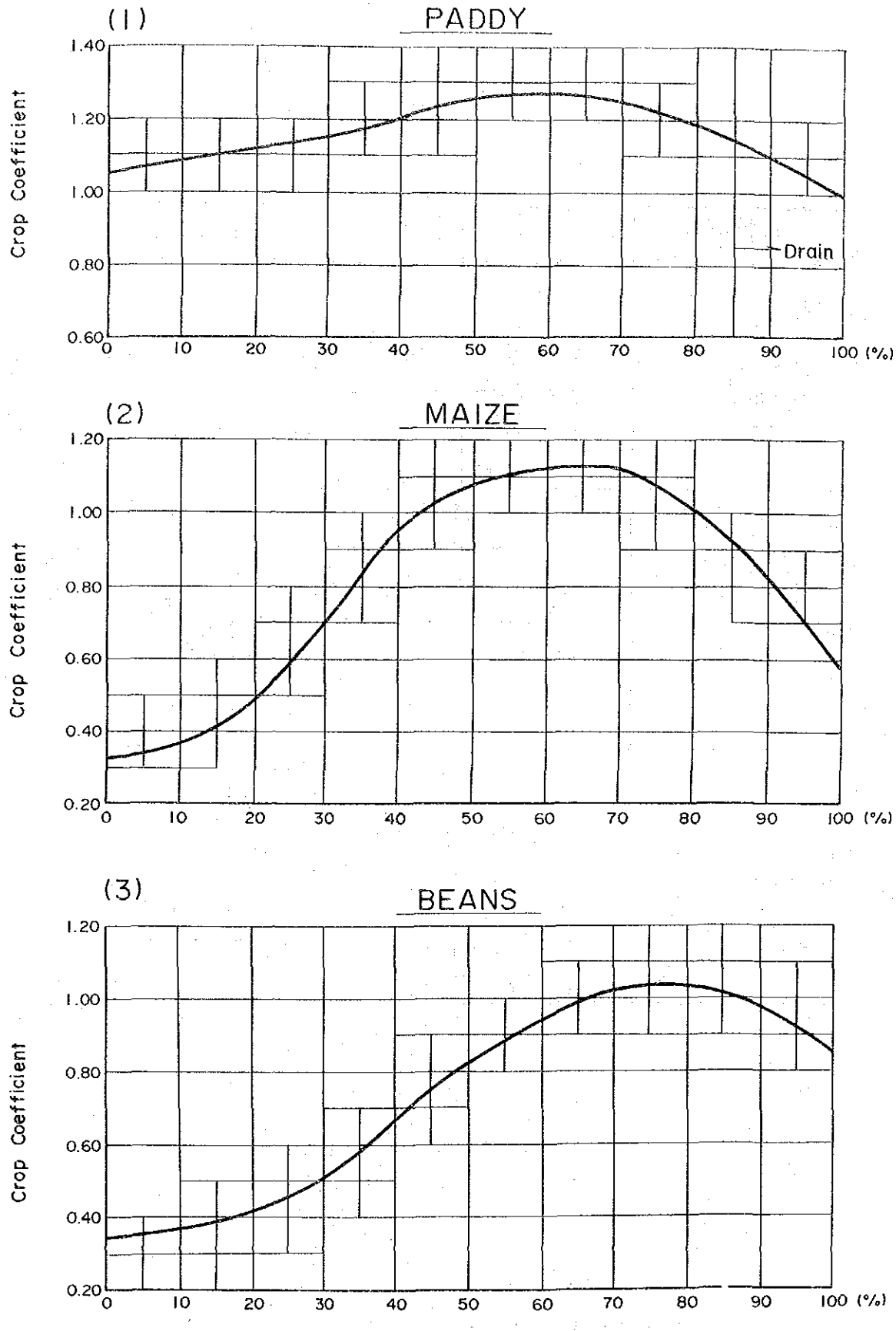


Fig. G-4 CROP COEFFICIENT OF MAJOR CROPS

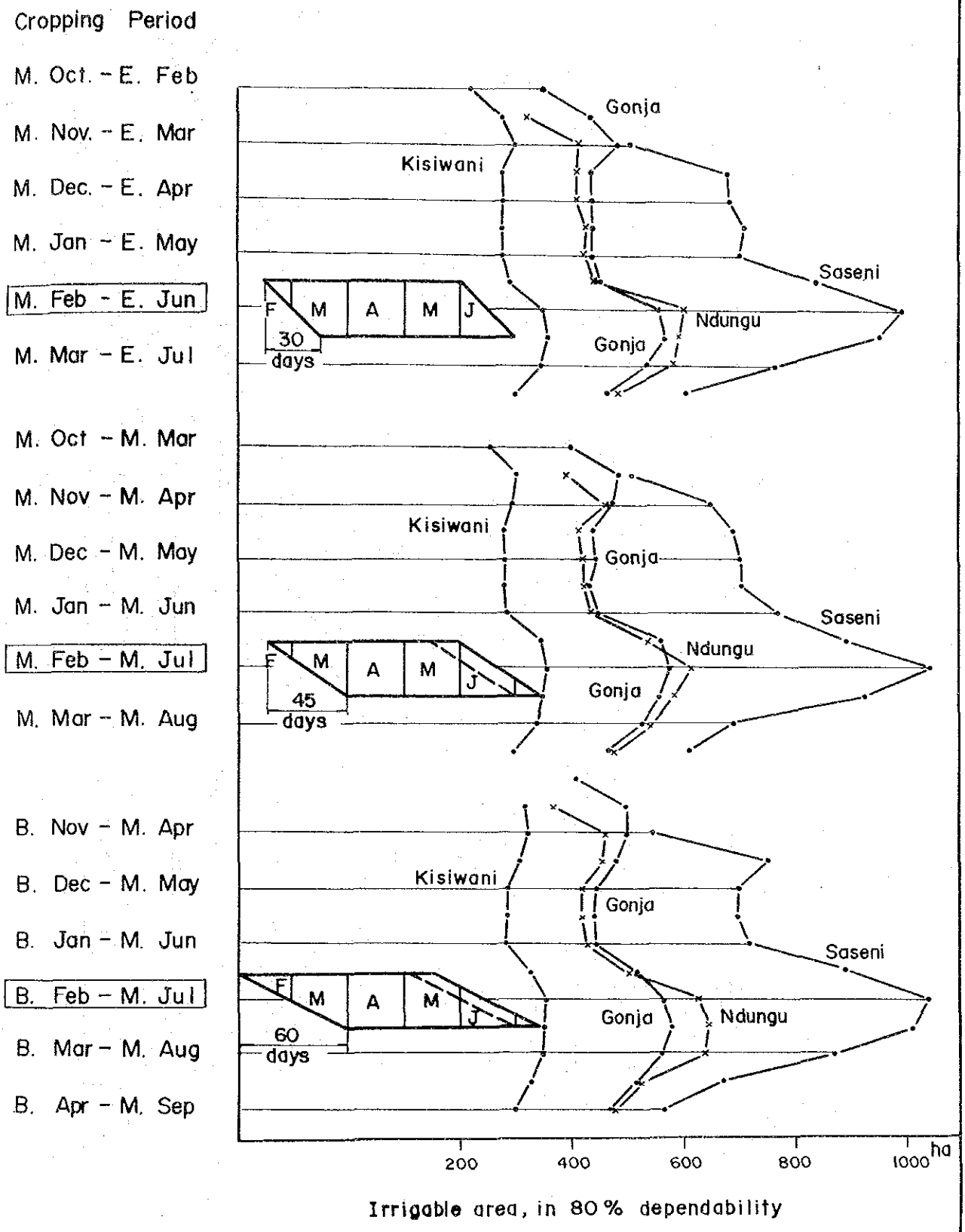


Fig. G-5 SEASONAL IRRIGATION AREA FOR PADDY CULTIVATION

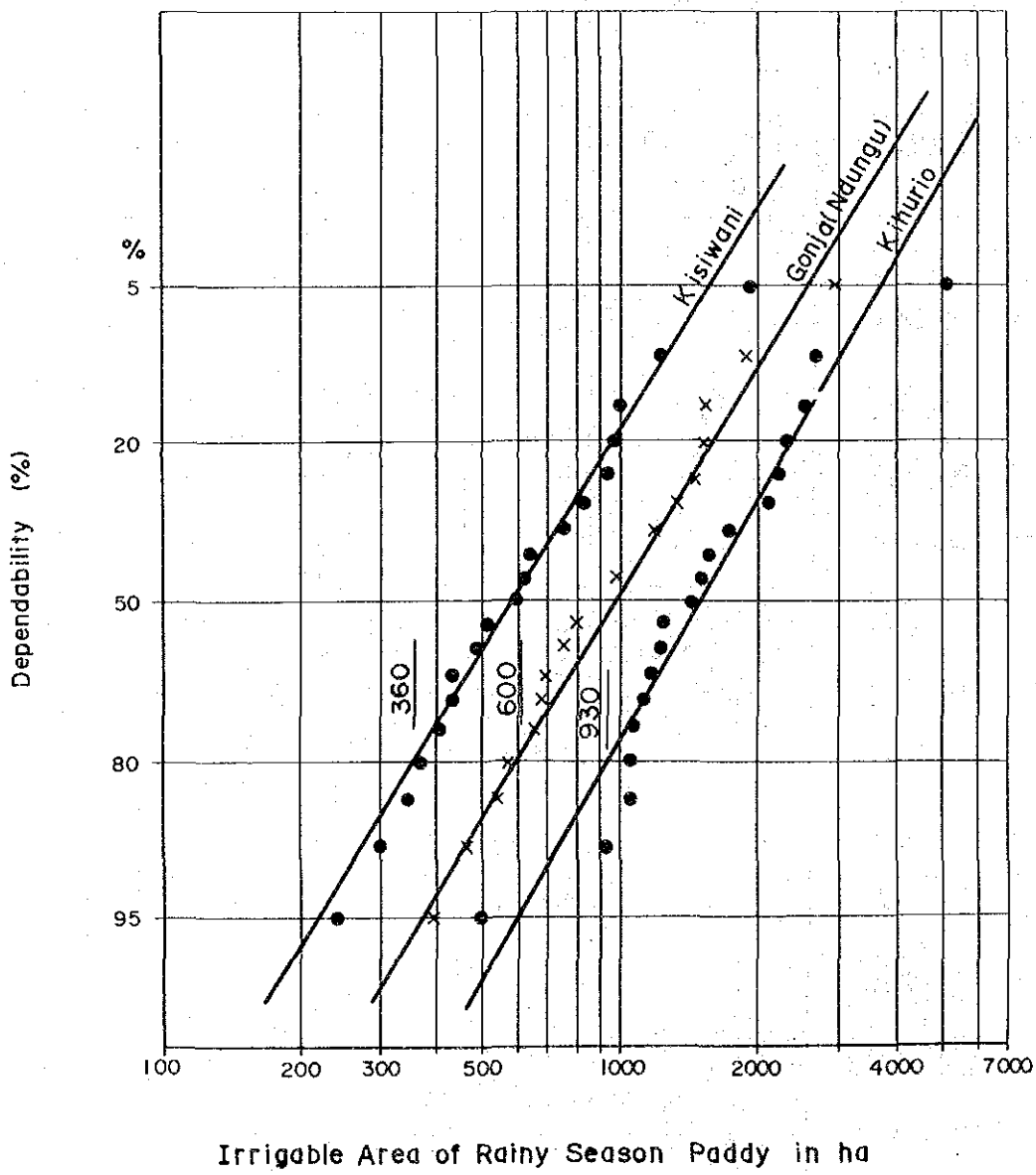


Fig. G-6 PROBABILITY OF SEASONAL IRRIGATION AREA

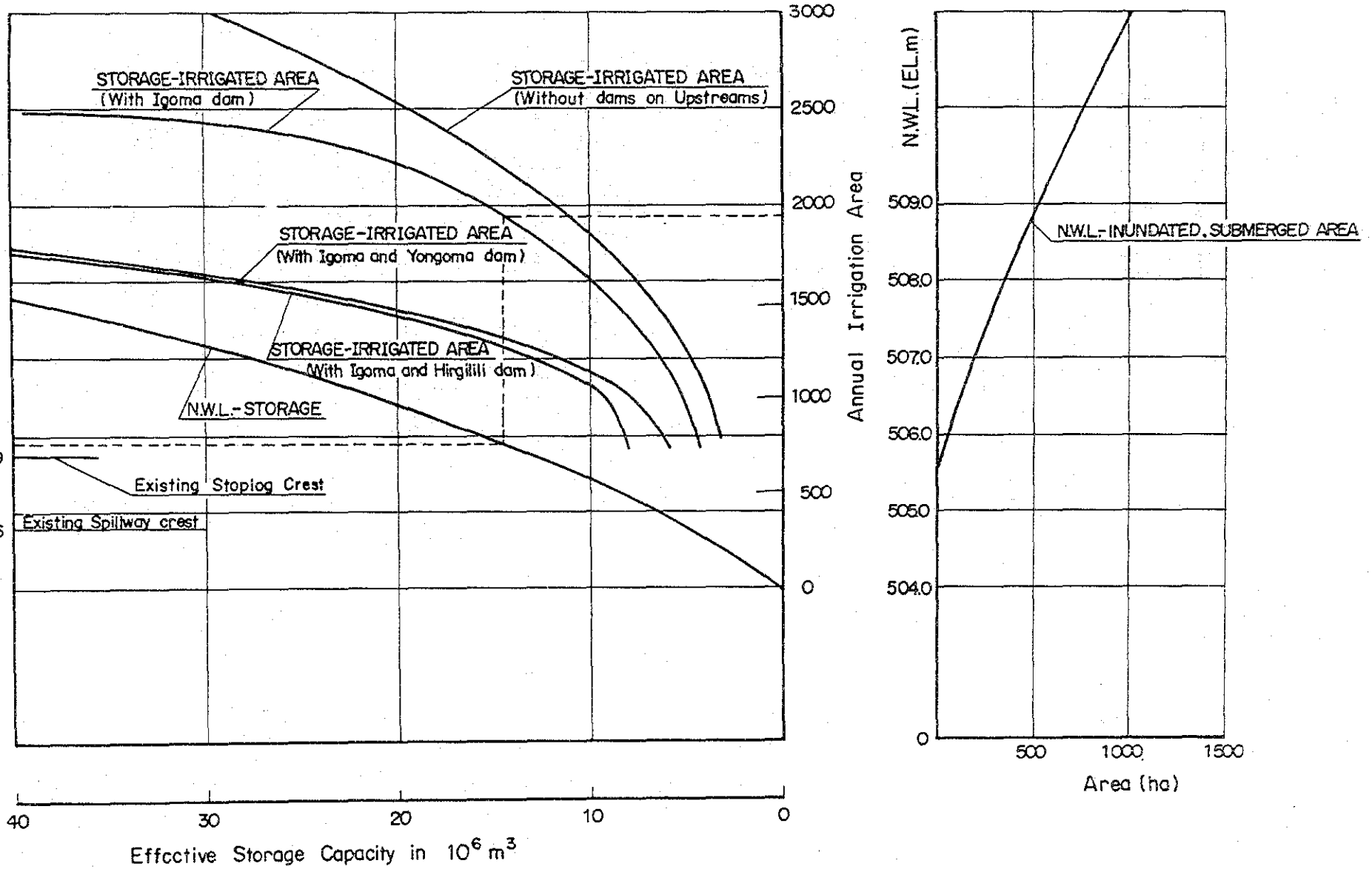


Fig. G-7 RELATIONSHIP BETWEEN IRRIGATION AREA AND REQUIRED STORAGE IN THE KALIMAWE DAM

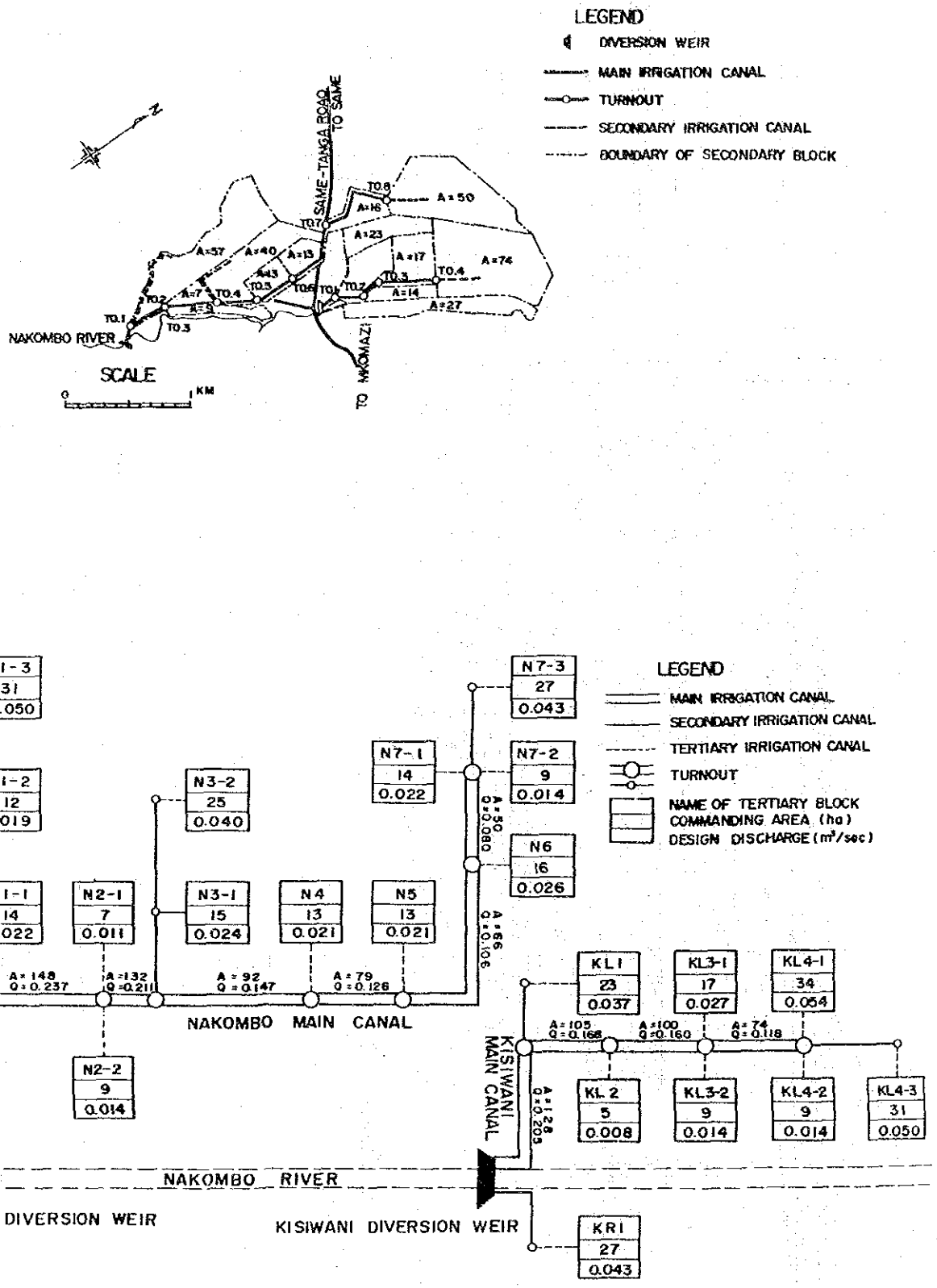
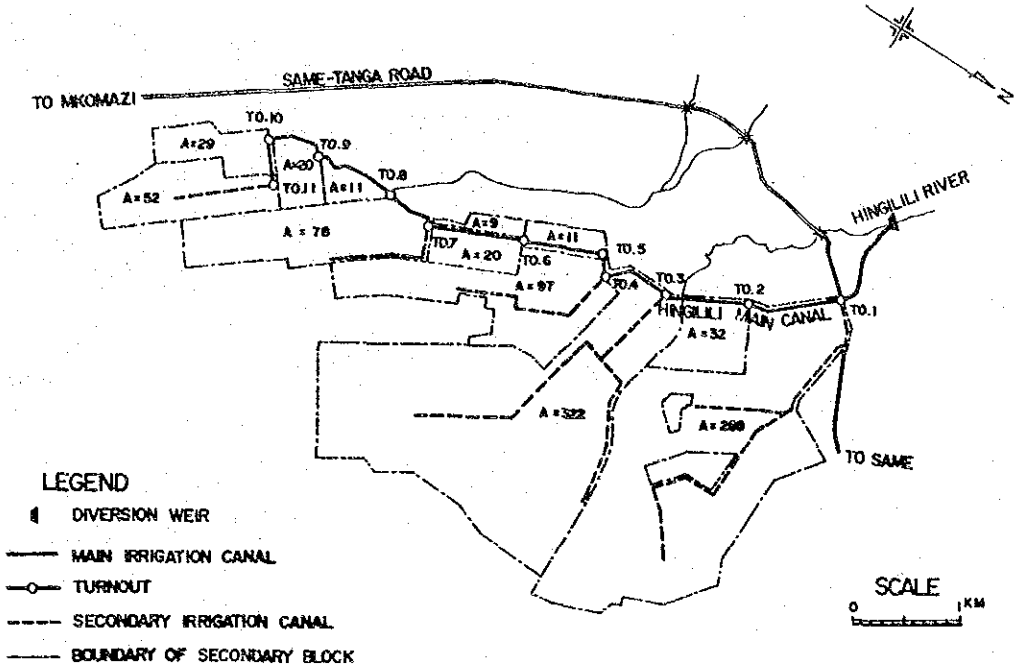


Fig. G-8 (1/5) PROPOSED IRRIGATION CANAL SYSTEM IN KISIWANI SCHEME AREA



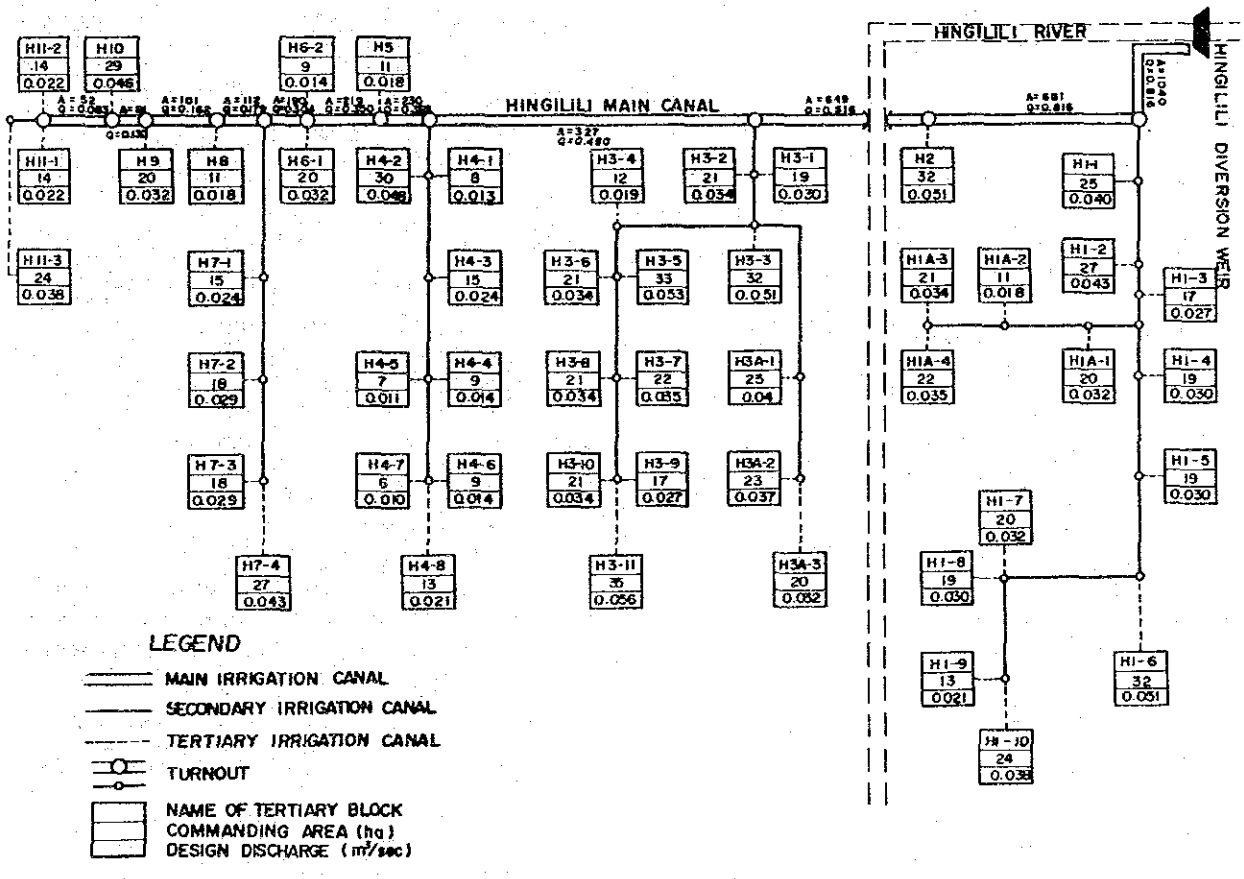
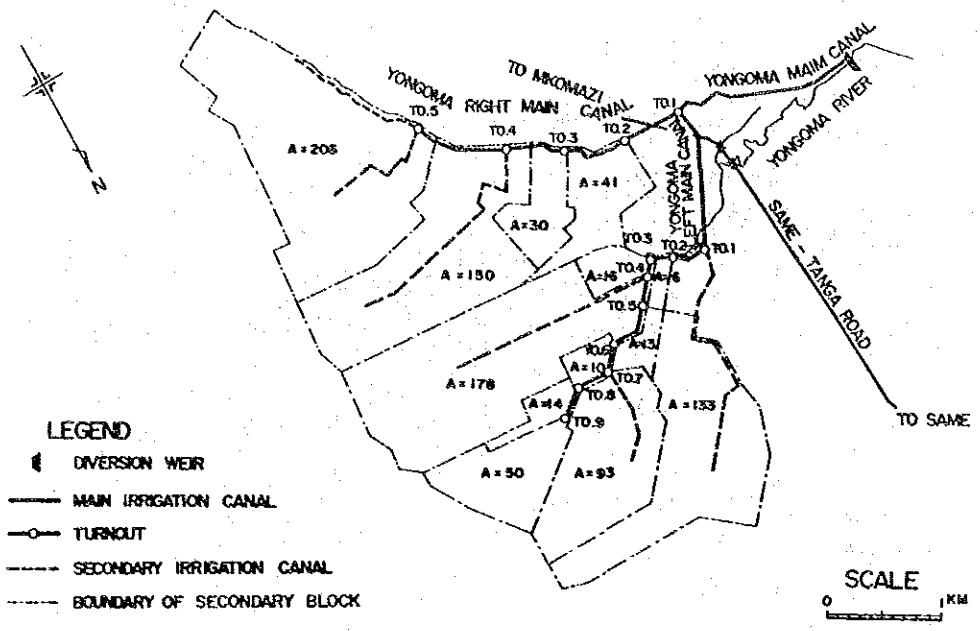


Fig. G-8 (2/5) PROPOSED IRRIGATION CANAL SYSTEM IN GONJA SCHEME AREA



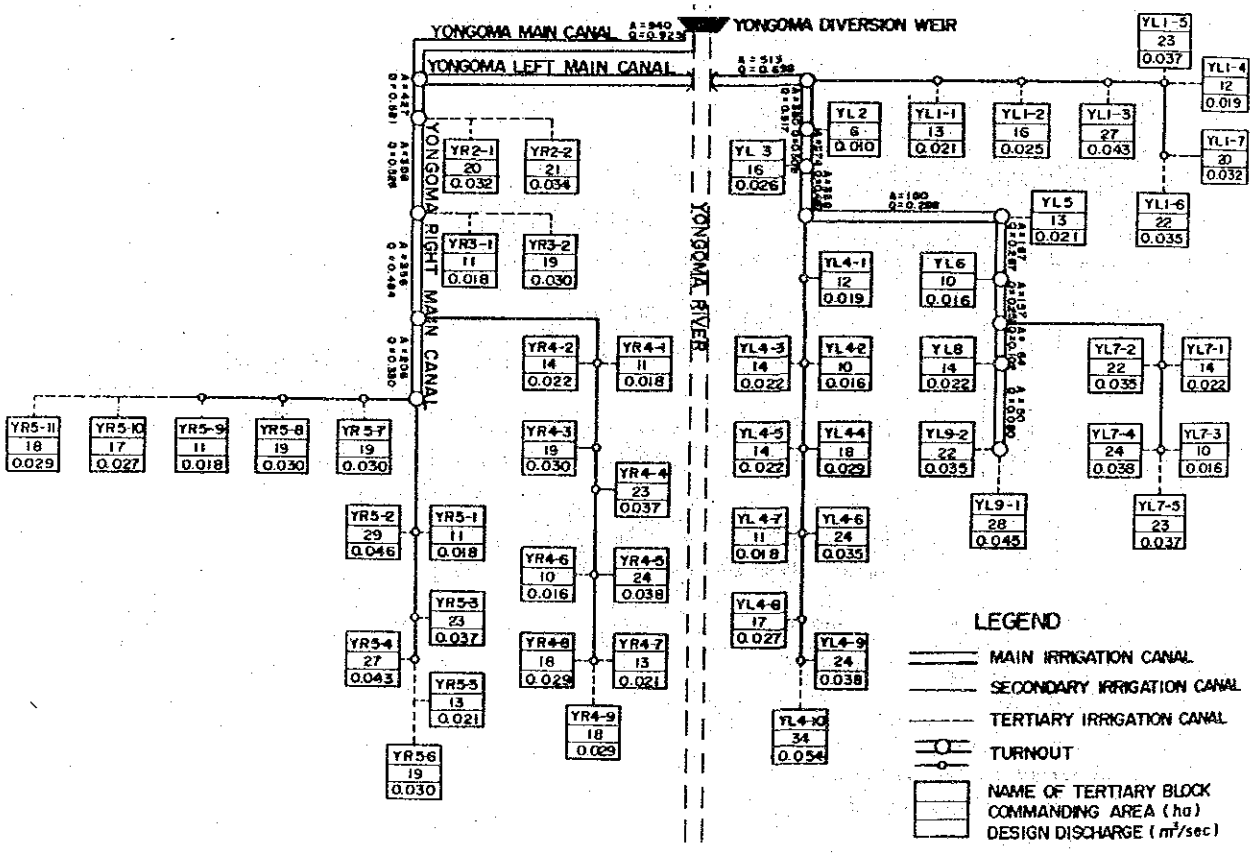


Fig. G-8 (3/5) PROPOSED IRRIGATION CANAL SYSTEM IN NDUNGU SCHEME AREA

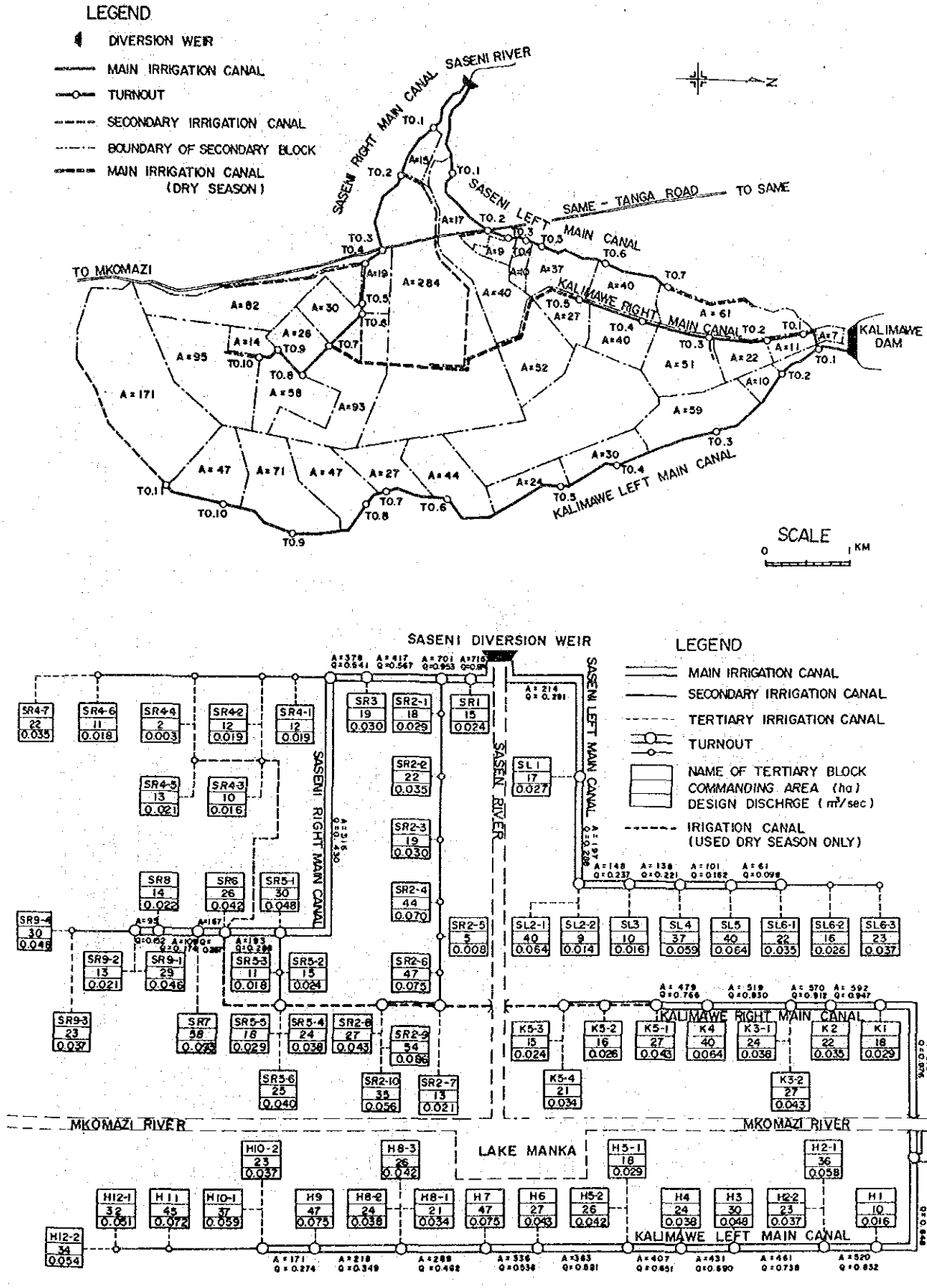


Fig. G-8 (4/5) PROPOSED IRRIGATION CANAL SYSTEM IN KIHURIO SCHEME AREA

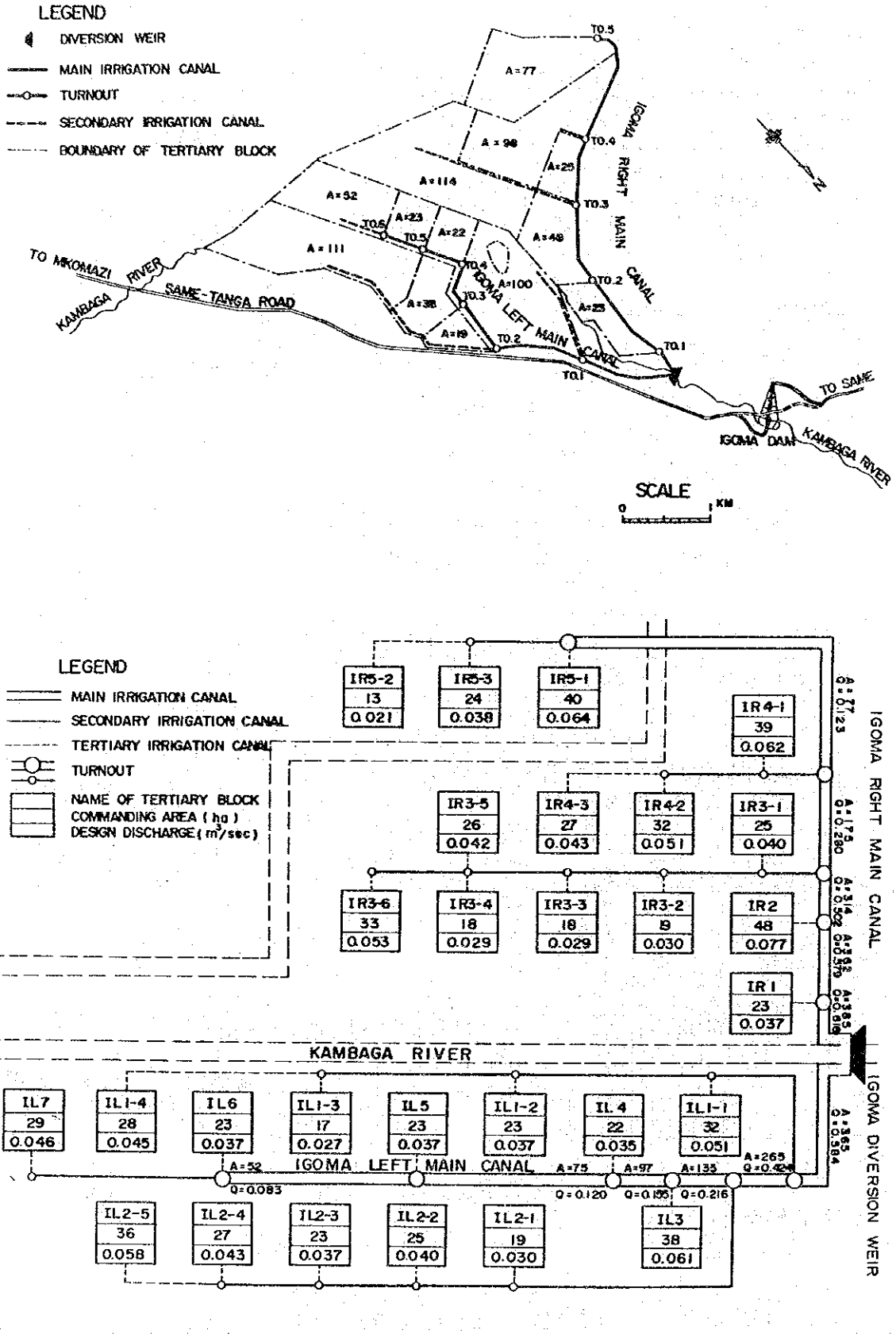


Fig. G-8 (5/5) PROPOSED IRRIGATION CANAL SYSTEM IN IGOMA SCHEME AREA

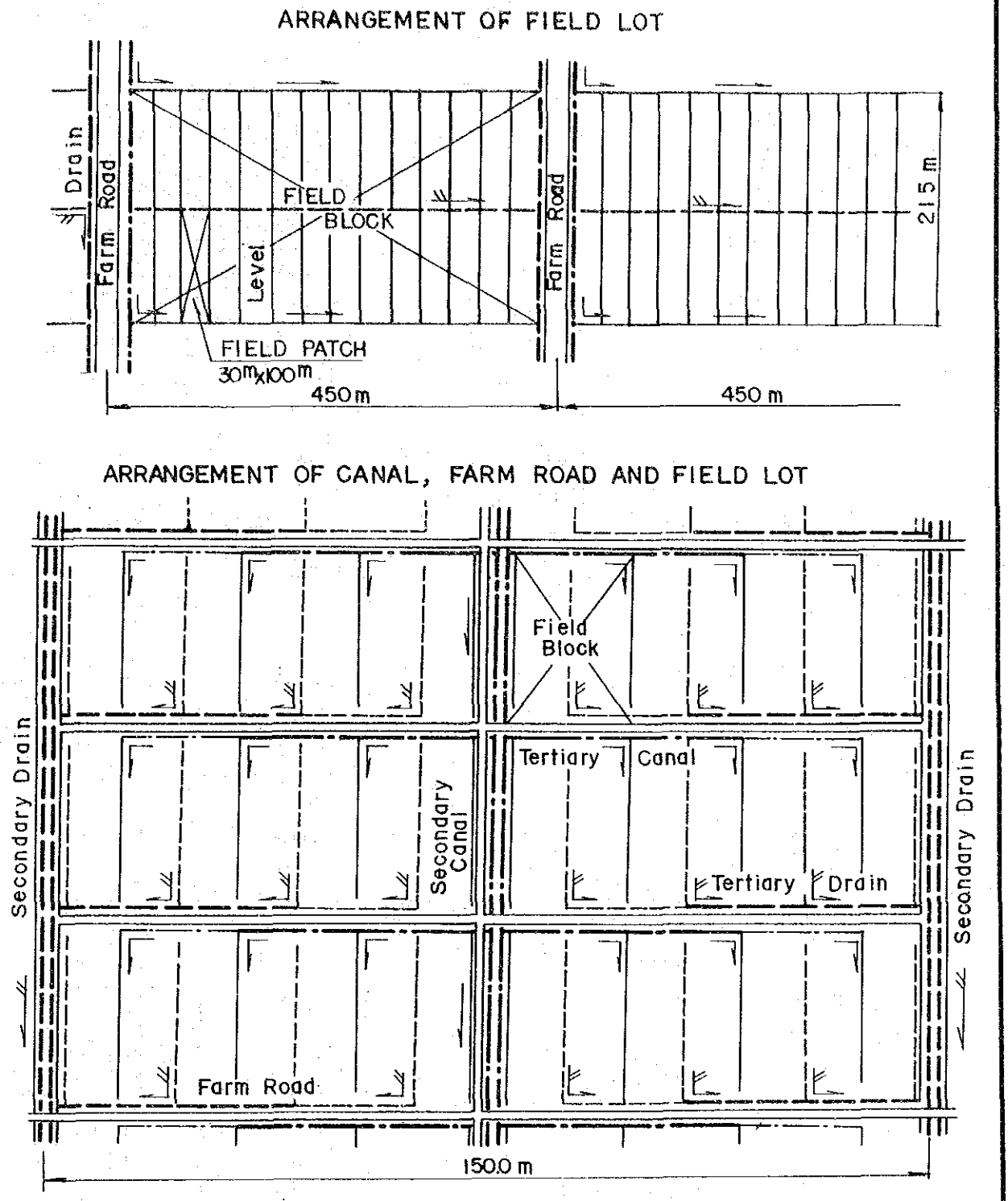


Fig. G-9 TYPICAL FIELD LAYOUT

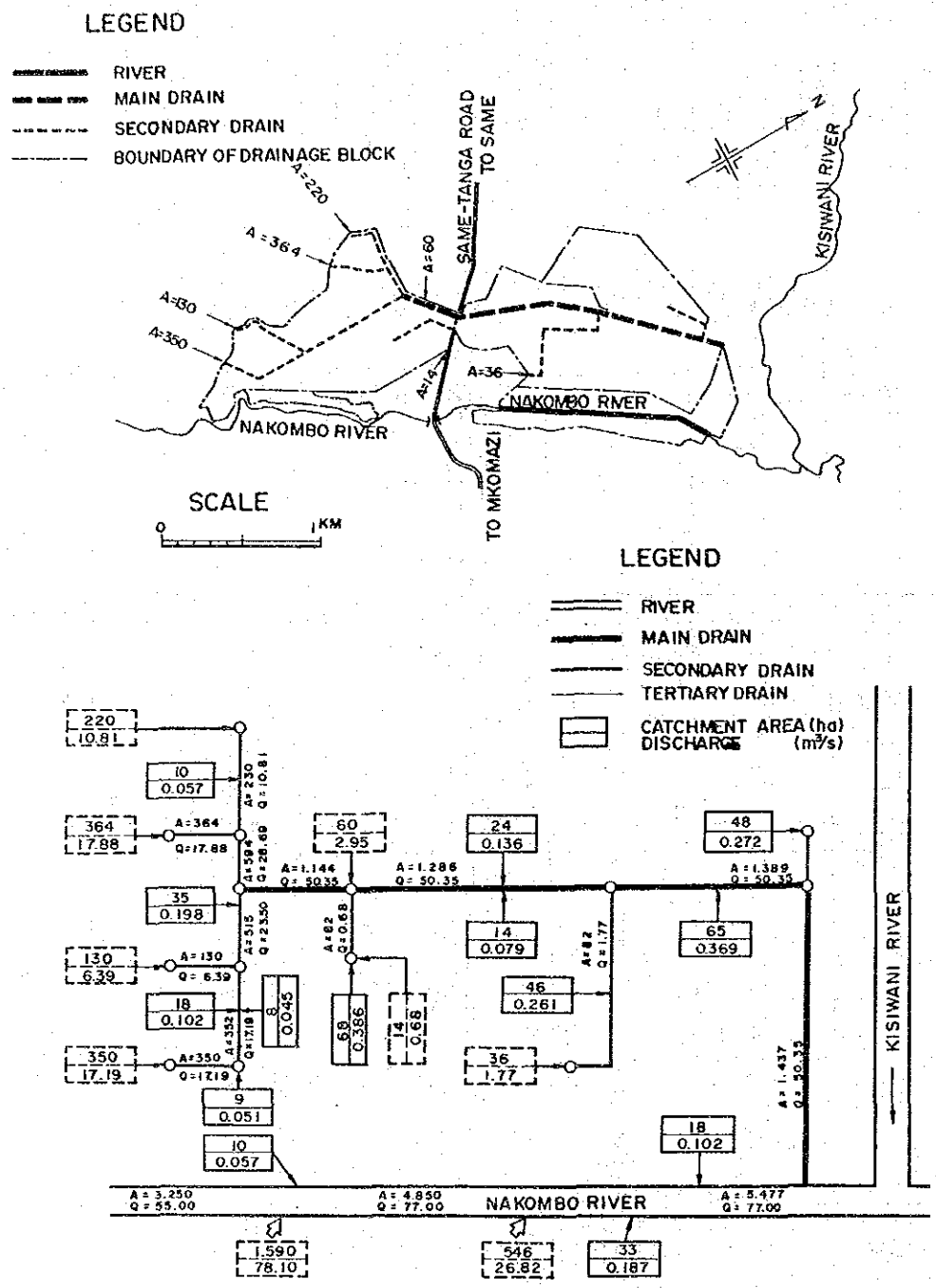
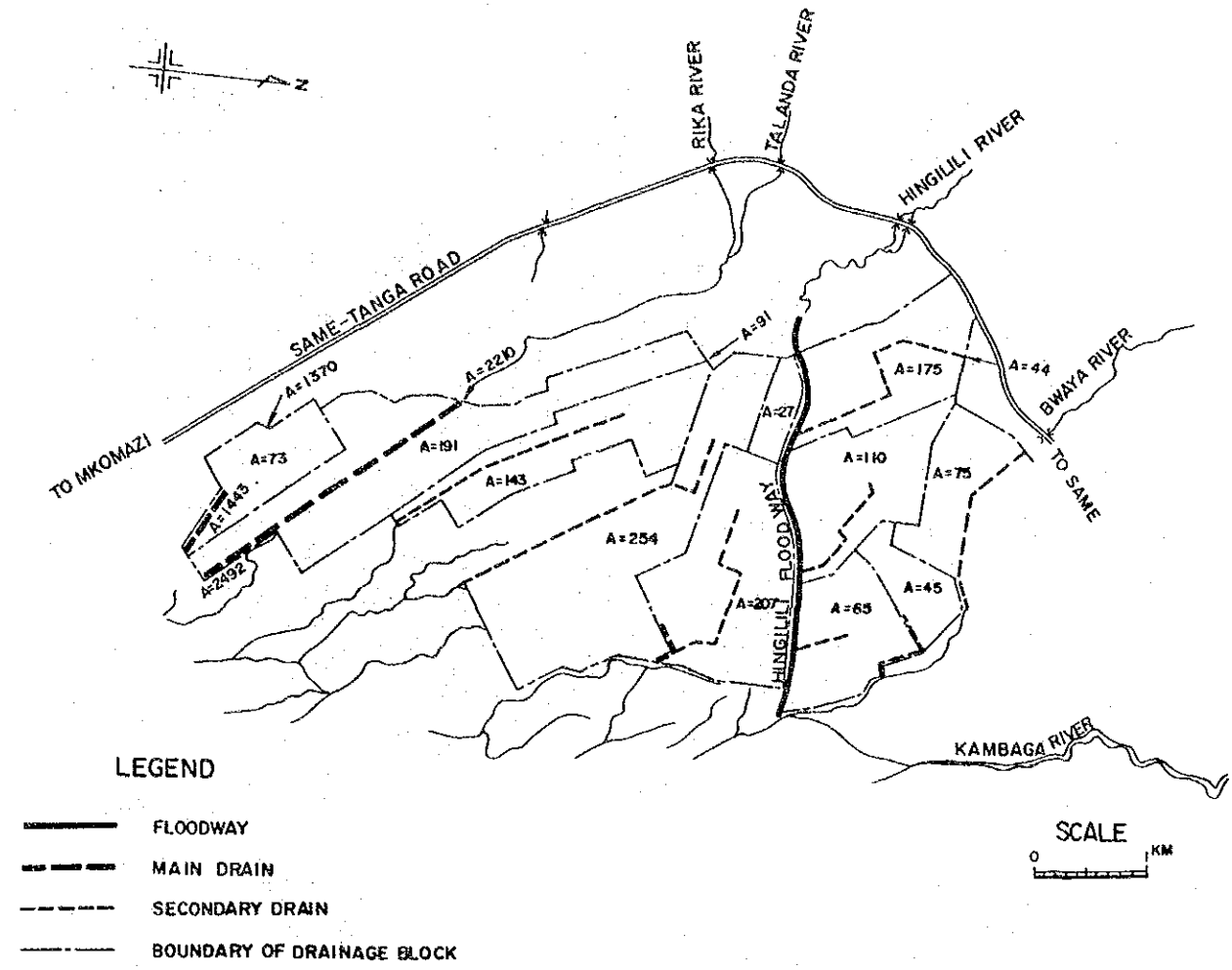


Fig. G-10 (1/5) PROPOSED DRAINAGE CANAL SYSTEM IN KISIWANI SCHEME AREA



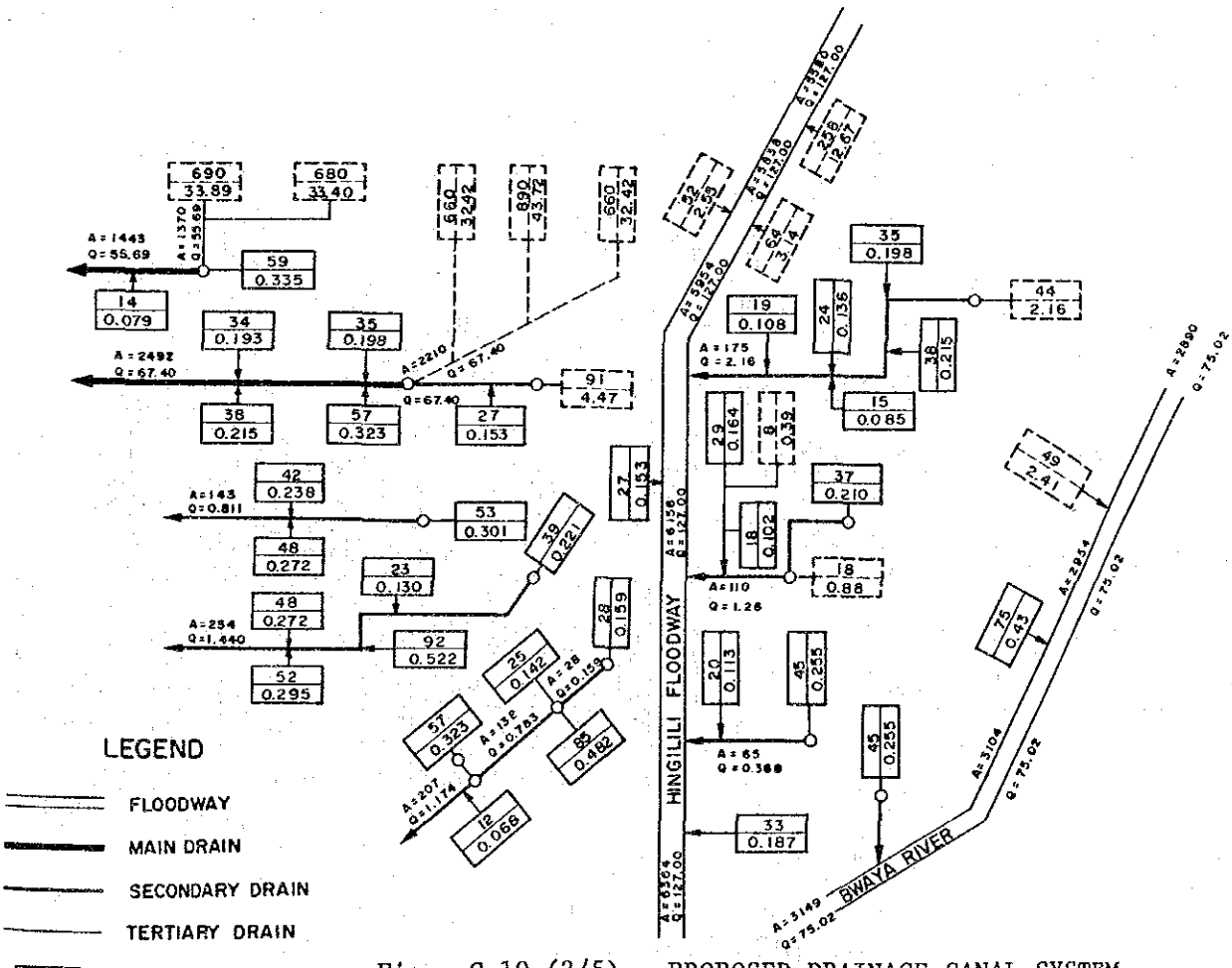


Fig. G-10 (2/5) PROPOSED DRAINAGE CANAL SYSTEM IN GONJA SCHEME AREA

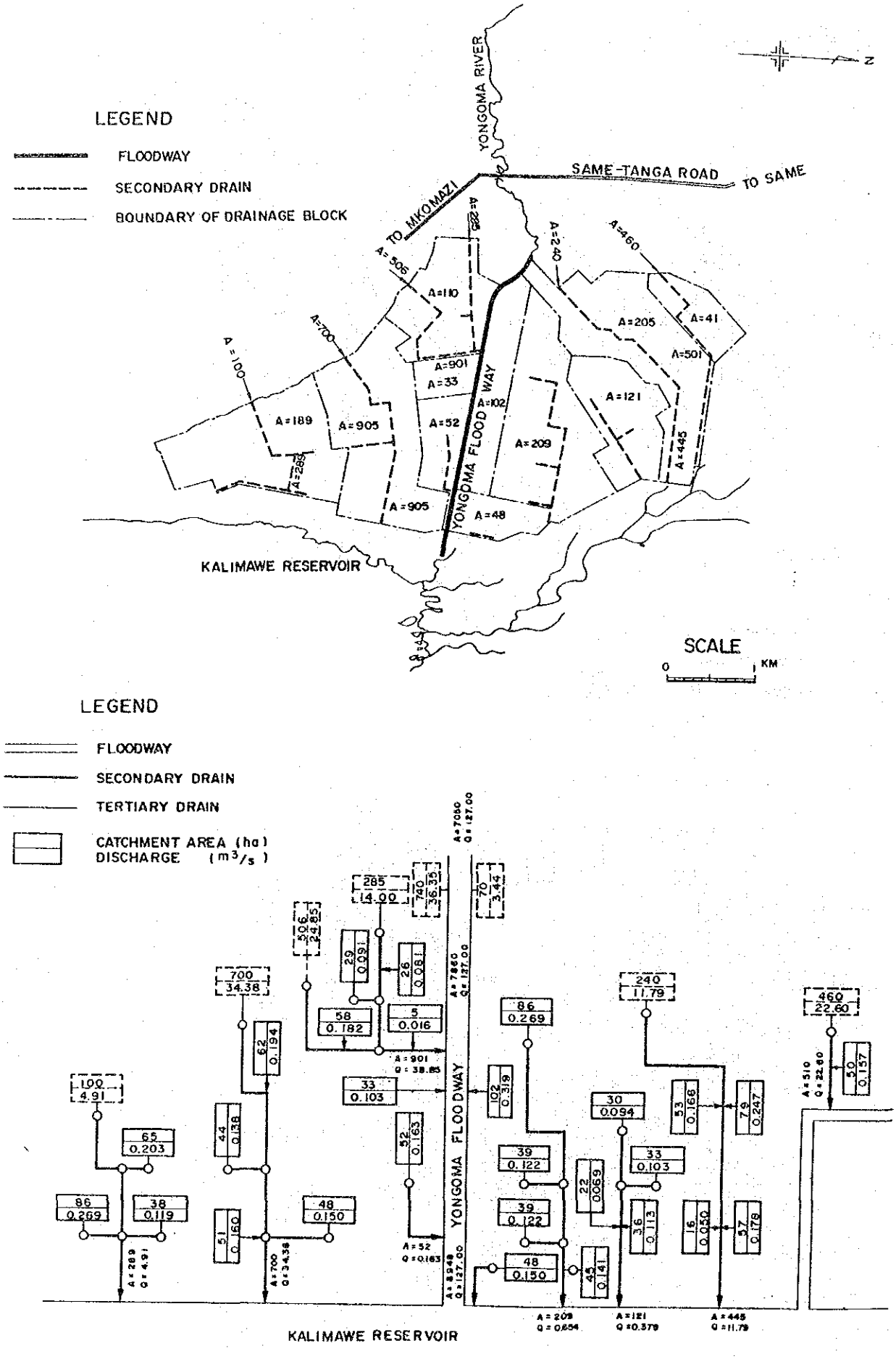


Fig. G-10 (3/5) PROPOSED DRAINAGE CANAL SYSTEM IN NDUNGU SCHEME AREA

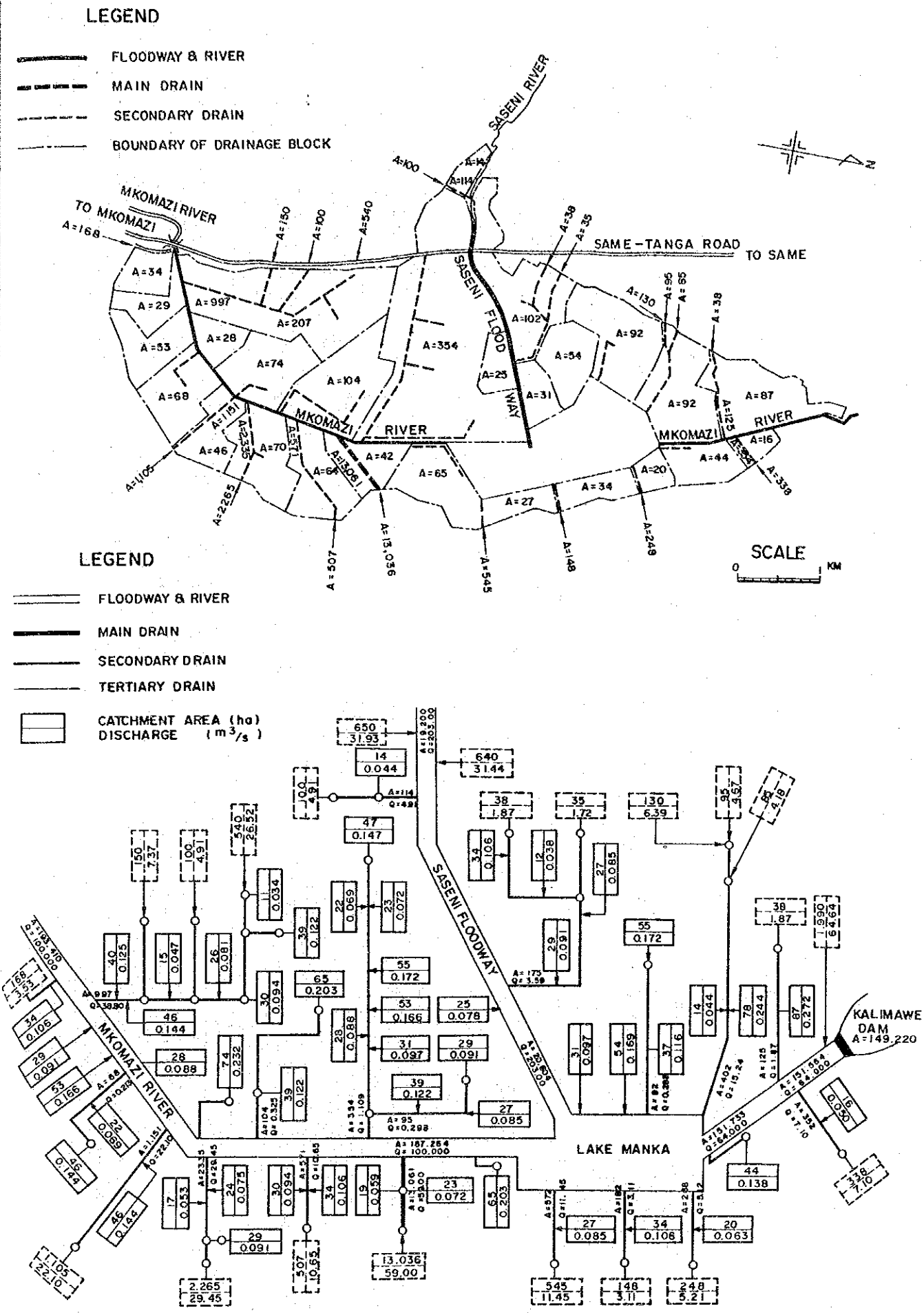


Fig. G-10 (4/5) PROPOSED DRAINAGE CANAL SYSTEM IN KIHURIO SCHEME AREA

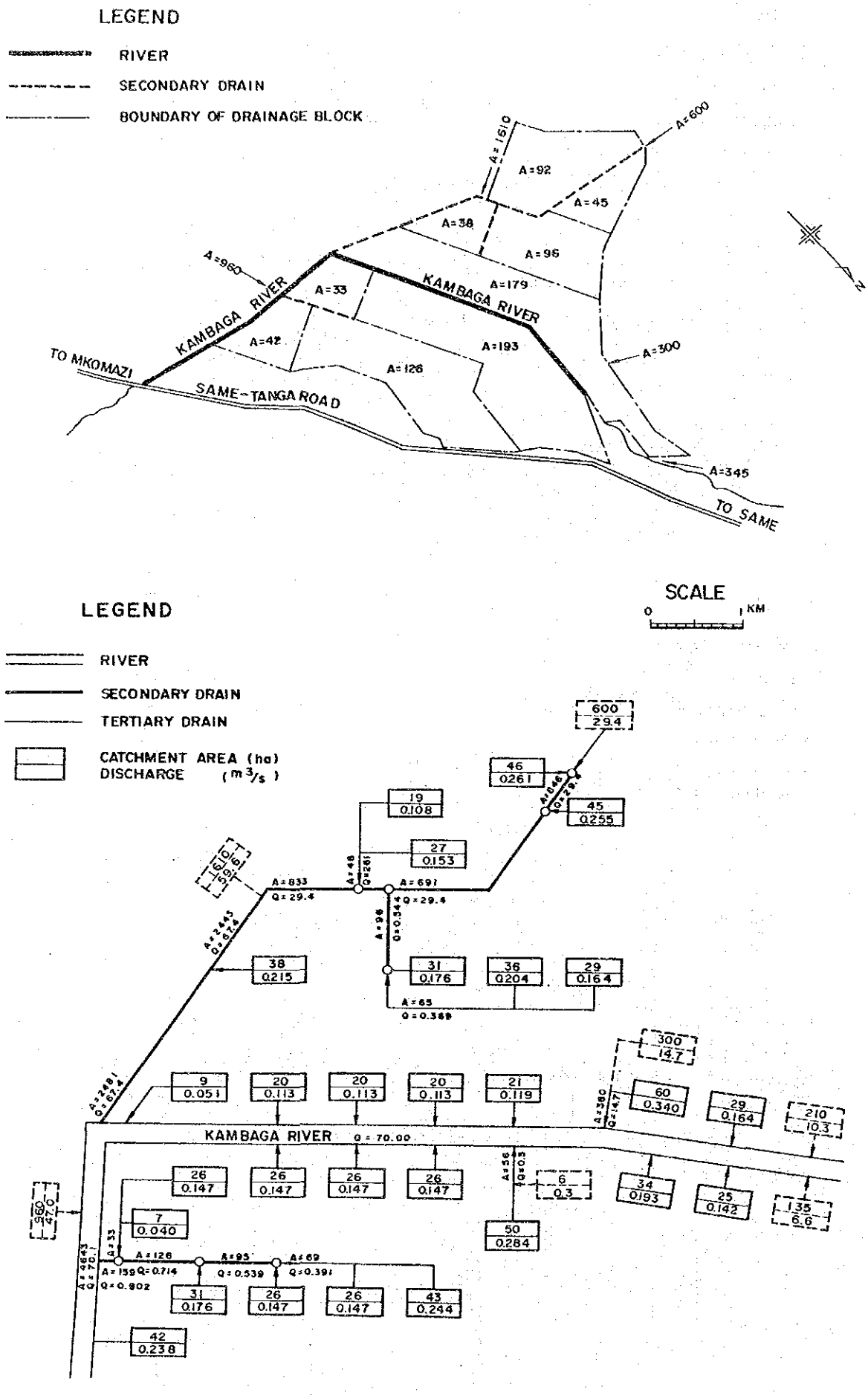
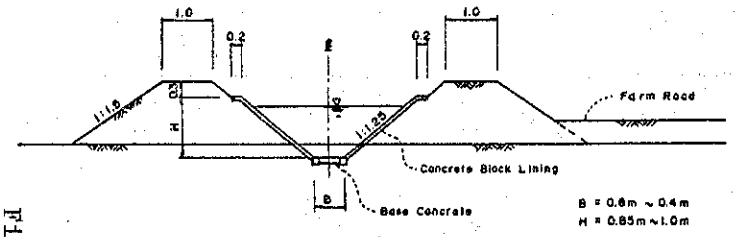
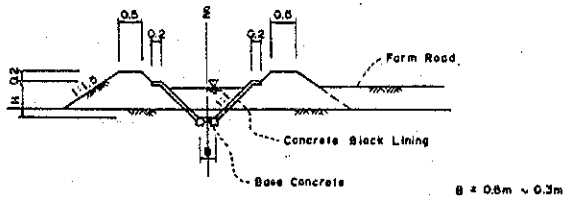


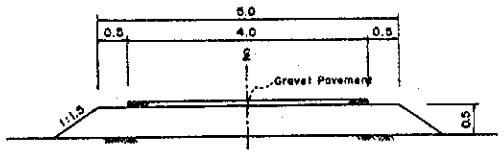
Fig. G-10 (5/5) PROPOSED DRAINAGE CANAL SYSTEM IN IGOMA SCHEME AREA

IRRIGATION CANAL

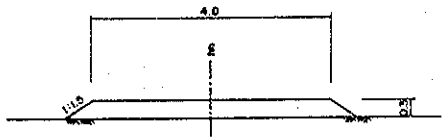




FARM ROAD

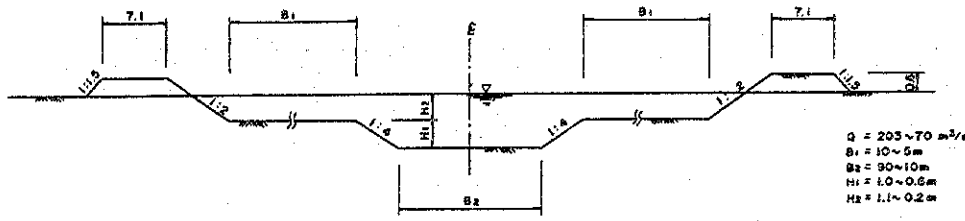


MAIN FARM ROAD

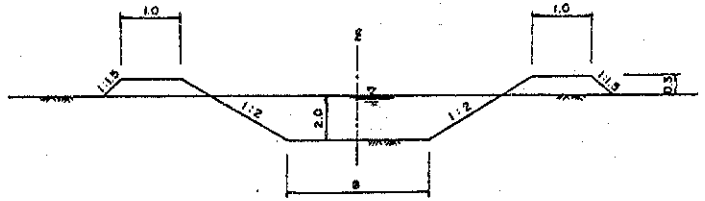


SECONDARY FARM ROAD

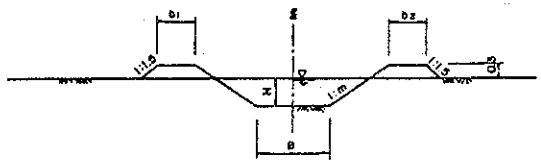
FLOODWAY & DRAINAGE CANAL



FLOODWAY



MAIN DRAINAGE CANAL

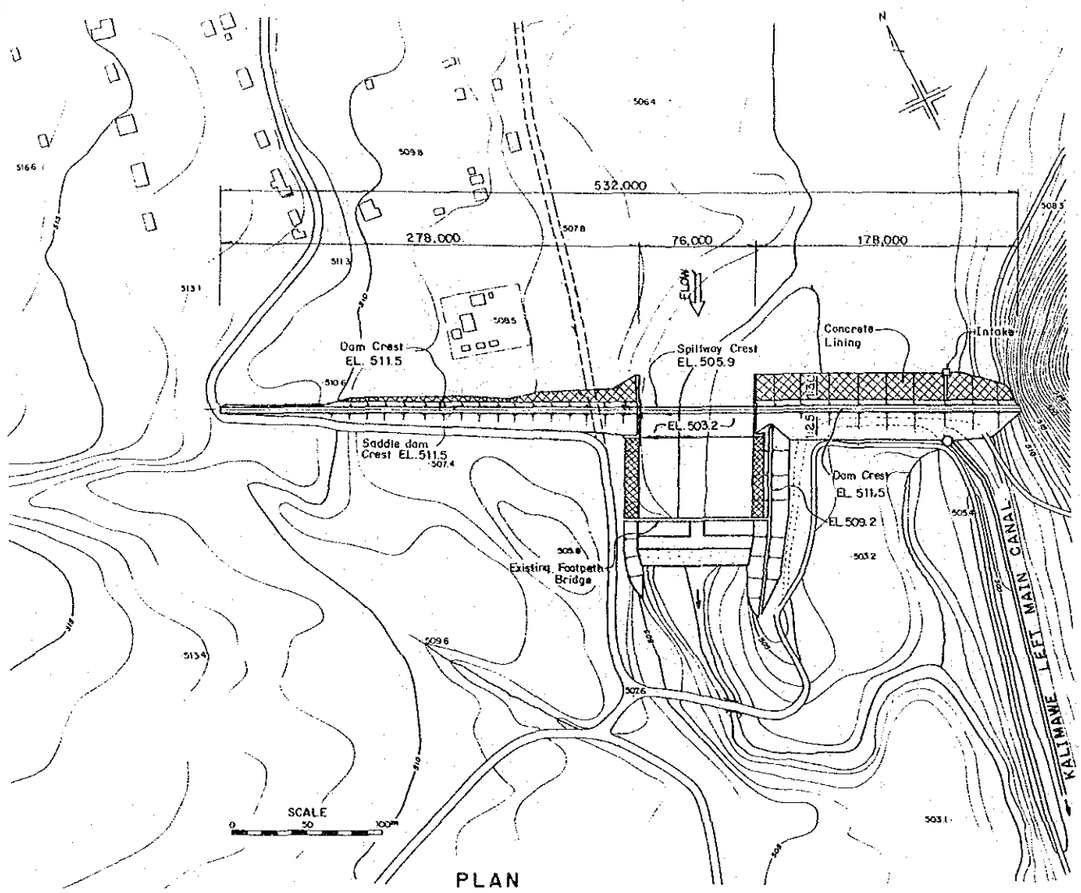


SECONDARY DRAINAGE CANAL

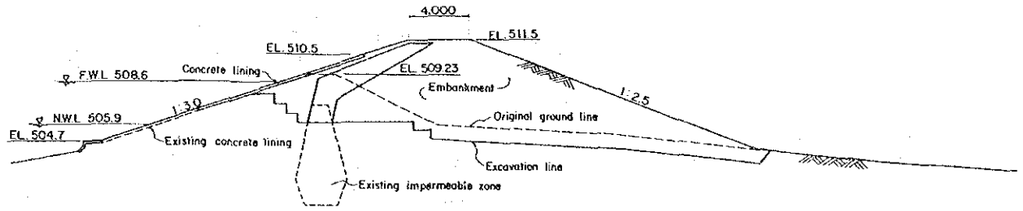
Fig. G-11 TYPICAL CROSS SECTION OF CANALS

THE UNITED REPUBLIC OF TANZANIA KILIMANJARO REGION THE MKOMAZI VALLEY AREA IRRIGATION DEVELOPMENT PROJECT	
TITLE OF DRAWING TYPICAL CROSS SECTION OF IRRIGATION CANAL, FARM ROAD, FLOODWAY & DRAINAGE CANAL	
JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO	DWG. NO. 6-6

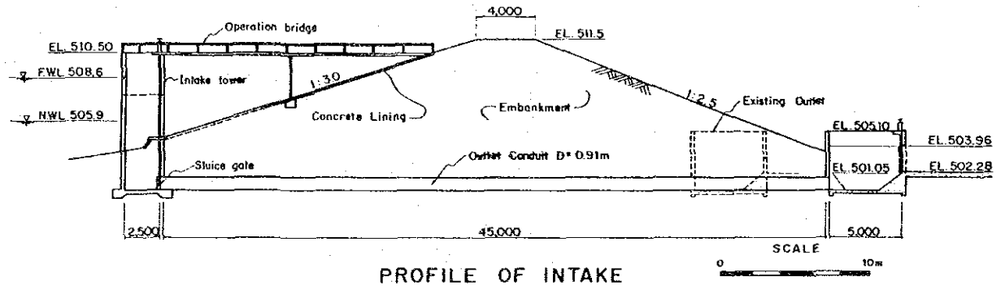
PLATE No. 6



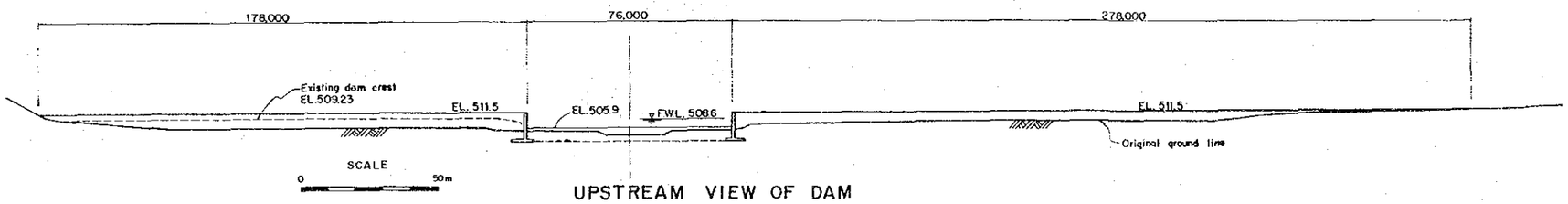
PLAN



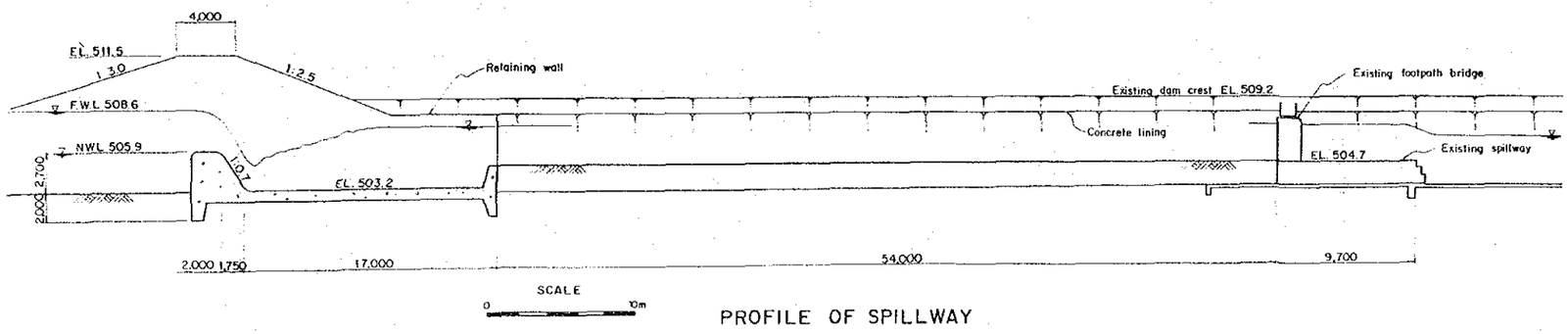
TYPICAL CROSS SECTION



PROFILE OF INTAKE



UPSTREAM VIEW OF DAM



PROFILE OF SPILLWAY

Fig. G-12 PRELIMINARY DESIGN OF KALIMAWE DAM IMPROVEMENT

THE UNITED REPUBLIC OF TANZANIA KILIMANJARO REGION THE MKOMAZI VALLEY AREA IRRIGATION DEVELOPMENT PROJECT	
TITLE OF DRAWING KALIMAWE DAM	
JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO	DWG. No. 2-1

ANNEX H

PROJECT ORGANIZATION

ANNEX H

PROJECT ORGANIZATION

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1. PROPOSED ORGANIZATION

1.1 Organization for Project Implementation

For the implementation of the Mkomazi Valley Area Irrigation Development Project, it is proposed to establish an Executing Organization tentatively called the Project Office under the jurisdiction of the Regional Development Director (RDD). To coordinate, guide and assist the Project Office in the implementation, an Executive Committee will also be organized under the RDD. The Committee will be constituted by the representatives concerned such as Regional Planning Officer, Regional Manpower Management Officer, Regional Accountant, Regional Irrigaion Engineer, Regional Agricultural Development Officer, Regional Officer of Tanzanian Rural Development Bank, District Development Director and Village Chiefs.

The main functions of the Project Office will be as follows:

- Design and construction supervision of irrigation and drainage facilities down to tertiary system and farm road networks, and
- Accounting and administrative management of the construcion works as well as office operation.

The Project Office will consist of one main office and five branch offices. It is proposed to organize and construct the main office at Gonja before getting into the major construction works of the project. The branch offices will be constructed at Kihurio, Ndungu, Gonja, Igoma and Kisiwani in keeping pace with the progress of constructon works.

At the implementation stage of the project, the Project Office will have five working sections, such as (1) Survey and Design Section, (2) Construction Supervision Section, (3) Mechanical Section, (4) Accounting Section and (5) Administrative Section under the management of the Project Manager to be appointed by the RDD. The organization chart is shown in Fig. H-1.

1.2 Organization for Operation and Maintenance

After completion of the construction works, the Project Office at the implementation stage will be re-organized into the operation and maintenance office having the five working sections: (1) Operation Section, (2) Maintenance Section, (3) Mechanical Section, (4) Accounting Section and (5) Administrative Section. The Operation and Maintenance Office will be responsible for operation and maintenance of the dams and reservoirs, the irrigation and drainage facilities and road networks down to inlets of tertiary blocks. The Operation and Maintenance of the tertiary blocks down to the terminal facilities will be entrusted to the Irrigaiion Associations to be organized by farmers themselves. The organization of the Operation and Maintenance Office is shown in Fig. H-2.

The Kilimanjaro Agricultural Development Center (KADC), which was constructed in the Chekereni village under the technical and financial assistance of the Japanese Government, will directly coordinate and assist the Office in operation and management of the Project.

The Operation and Maintenance Office will consist of one main office and five branch offices. The main office will be responsible for the overall activities necessary for proper operation and maintenance of all the project facilities including preparation of overall operation and maintenance program, design and construction/supervision of maintenance works, budgeting, training of staffs, etc. The branch offices will provide the operation and maintenance works according to the program prepared by the main office, and periodical consultation to Irrigaion Associations on operation and maintenance of tertiary canals down to terminal facilities.

2. STAFFING AND EXPATRIATE ASSISTANCE

Number of staff required in the Project Office is estimated paying due attention to the working quantities, implementation method and schedule, and number of tertiary irrigation block. Total number of staff required in the implementation stage is estimated to be 45 at maximum, which include administrative staffs, engineers, experts and field attendants.

Required number of the staff in the full operation stage of the Project will be 45. In addition, a considerable number of seasonal employees will be required for the maintenance works.

The staffs required during the implementation stage and operation and maintenance stage are shown in Table H-1 and H-2, respectively.

To cope with severe shortage of experienced personnel in Tanzania, some specialists would have to be engaged from abroad throughout the design and construcion stages, and at the initial stage of the operation and maintenance. The required numbers of the experts to be invited for these stages are shown in Table H-3.

3. WATER USERS' ASSOCIATION

At the farmers' level, the Irrigation Associations will be organized in each scheme to operate and maintain the tertiary system under the supervision of the Project Office. The Irrigaton Association will be a farmers' group like the present communal working group in each village. The Irrigation Association would have to coordinate and maintain good communication with the Operation and Maintenance Office in water supply and management and maintenance of facilities in the tertiary system.

Under the Irrigation Association, the Irrigation Group will be set up at the rate of one group per about 20 ha which will be corresponding to the on-farm area covered by one tertiary canal.

Table H-1 REQUIRED NUMBER OF PROJECT STAFF IN IMPLEMENTATION STAGE

	Project Staff	1984	1985	1986	1987	1988	1989	1990
1.	Main Office							
(1)	Project Manager	1	1	1	1	1	1	1
(2)	Senior Irrigation Engineer	1	1	1	1	1	1	1
(3)	Irrigation Engineer	1	1	1	1	1	1	1
(4)	Administrator	1	1	1	1	1	1	1
(5)	Accountant	1	1	1	1	1	1	1
(6)	Clerk/Typist	1	1	2	2	2	2	2
(7)	Surveyor	6	6	6	0	0	0	0
(8)	Draftman	6	6	6	0	0	0	0
(9)	Mechanic	1	1	1	1	1	1	1
(10)	O&M Equipment Operator	0	0	0	3	4	5	5
(11)	Driver	2	2	3	3	3	3	3
		21	21	23	14	15	16	16
2.	Branch Office							
(1)	Chief	0	0	4	6	6	6	6
(2)	Officer	0	0	4	6	6	6	6
(3)	Watchman	0	0	14	15	15	17	17
		0	0	22	27	27	29	29
	Total	21	21	45	41	42	45	45

Table H-2 REQUIRED NUMBER OF PROJECT STAFF IN OPERATION AND MAINTENANCE STAGE

Project Staff	No. of Personnel
1. Main Office	23
(1) Project Manager	1
(2) Senior Irrigation Engineer	1
(3) Irrigation Engineer	2
(4) Administrator	1
(5) Accountant	1
(6) Mechanic	1
(7) Clerk/Typist	6
(8) O&M Equipment Operator	5
(9) Driver	5
2. Branch Office	29
2.1 Kisiwani Office	
(1) Irrigation Engineer	1
(2) Gate Keeper	1
(3) Watchman	2
2.2 Gonja Office	
(1) Irrigation Engineer	1
(2) Gate Keeper	1
(3) Watchman	3
2.3 Ndungu Office	
(1) Irrigation Engineer	1
(2) Gate Keeper	1
(3) Watchman	4
2.4 Kihurio Office	
(1) Irrigation Engineer	1
(2) Gate Keeper	2
(3) Watchman	5
2.5 Igoma Office	
(1) Irrigation Engineer	1
(2) Gate Keeper	2
(3) Watchman	3
Total	52

Table H-3 REQUIRED NUMBER OF FOREIGN CONSULTANTS

Speciality	No. of Personnel	
	1st Stage	2nd Stage
1. Detailed Design		
(1) Project Director	1	1
(2) Team Leader	1	1
(3) Sr. Design Engineer	1	-
(4) Sr. Irrigation Engineer	3	2
(5) Design Engineer	1	1
(6) Dam Engineer	1	1
(7) Hydrologist	1	1
(8) Hydraulic Engineer	1	1
(9) Geologist	1	1
(10) Soil Mechanical Engineer	1	1
(11) Construction Planner	1	1
(12) Specification Engineer	1	1
(13) O&M Expert	1	-
(14) Sr. Surveyor	1	1
(15) Surveyor	4	2
(16) Others as required	L.S.	L.S.
2. Construction Supervision		
(1) Project Director	1	1
(2) Team Leader	1	1
(3) Design Engineer	1	1
(4) Construction Engineer	2	2
(5) O&M Expert	2	1
(6) Others as required	L.S.	L.S.

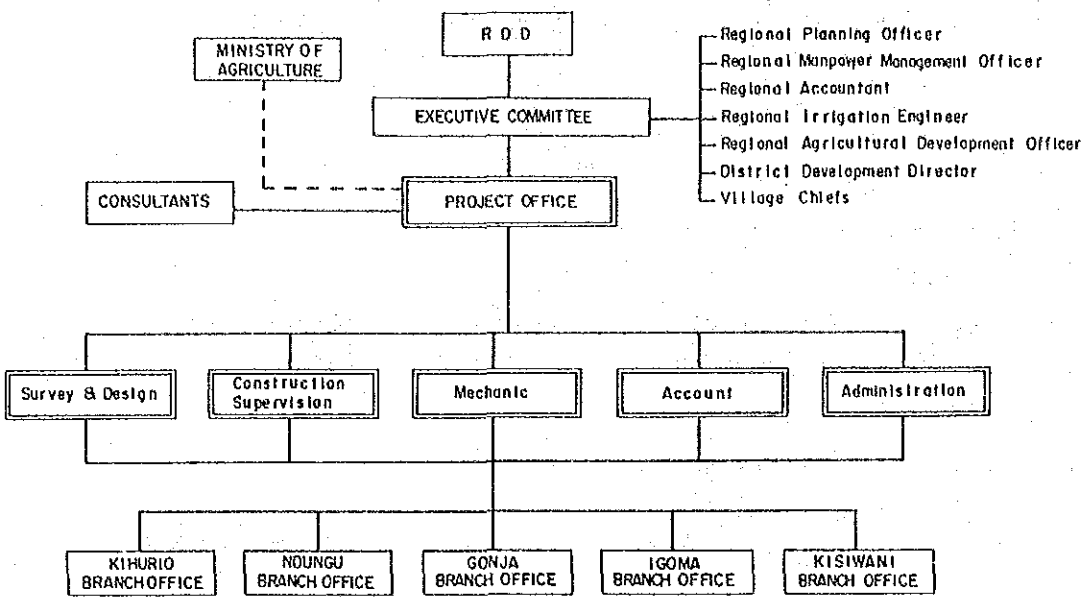

Fig. H-1 ORGANIZATION CHART FOR PROJECT INPLEMENTATION

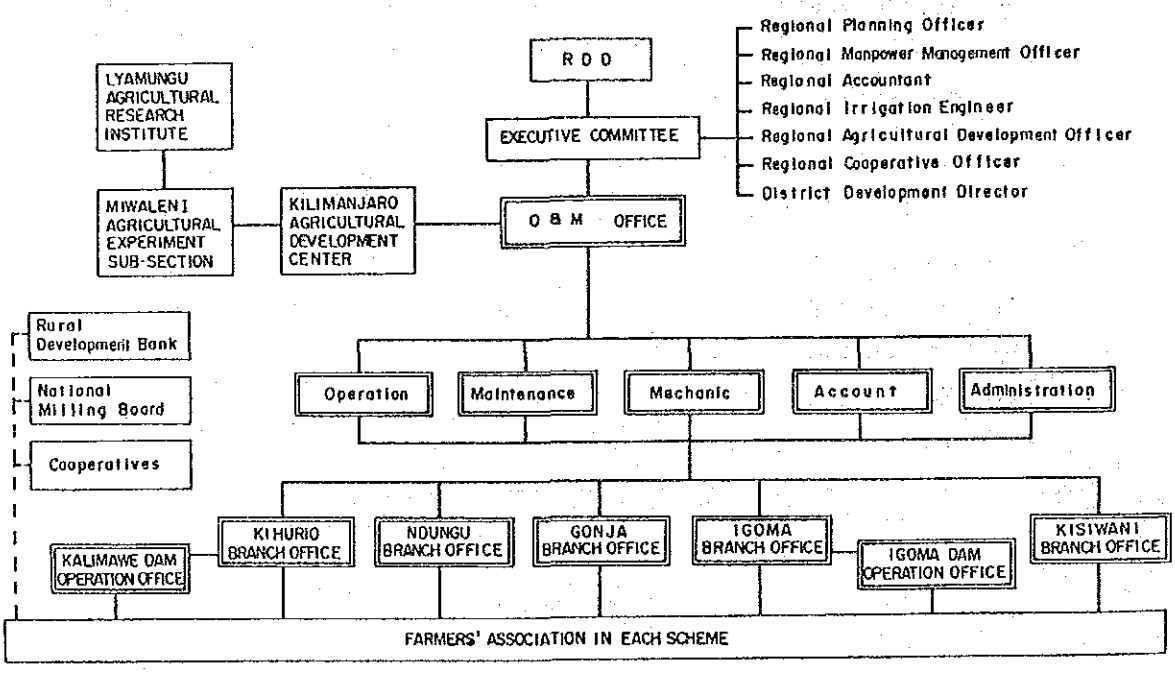

Fig. H-2 ORGANIZATION CHART FOR OPERATION & MAINTENANCE

ANNEX I

PROJECT IMPLEMENTATION AND PROJECT COST

ANNEX I

PROJECT IMPLEMENTATION AND PROJECT COST

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1. PROJECT IMPLEMENTATION

1.1 Basic Considerations of Project Implementation

The implementation schedule for the Mkomazi Valley Area Irrigation Development Project is worked out on the basis of the following basic considerations:

(1) The project consists of five independent schemes: the Kihurio scheme, the Ndungu scheme, the Gonja scheme, the Kisiwani scheme and the Igoma scheme. In principle, the implementation of the five schemes will be made simultaneously. The implementation of the Igoma scheme, however, will be commenced after the detailed investigations for the design and construction of the dam.

(2) Taking into consideration the dispersion of the five schemes and the scale of the construction work for each scheme, the project will be implemented stagewise as follows:

   (a) Detailed design and construction of project facilities for the Kihurio, Ndungu, Gonja and Kisiwani schemes, and aerophoto mapping of the damsite, reservoir area and irrigation area for the Igoma scheme, and

   (b) Detailed design and construction of project facilities for the Igoma scheme.

(3) A mechanized construction method will be principally introduced as the civil works include a large volume of earth works. To increase employment opportunities among the local people, however, construction by manpower will be used as much as possible.

(4) Since there are few local contractors in Tanzania with sufficient experience and enough equipment for this kind of works, it is proposed that the construction works including land leveling works will be undertaken by qualified international contractors selected through international competitive bidding.

(5) The consultant will be engaged by the Project Office for preparation of the detailed design and tender documents, and the supervision of the construction works, and assistance and guidance in operation and maintenance of the project facilities.

(6) Since the ownership of all lands in Tanzania belongs to the Government, no compensation will be required for land acquisition and right of way for the project facilities.

1.2 Implementation Schedule

The project implementation schedule is shown in Fig. I-1. It includes the project preparatory works and the construction works for each development stage. The project preparatory works for the first

development stage will last 18 months including the time necessary for survey works, detailed design works and project mobilization including selection of the Contractors. In parallel with the above design works and project mobilization, the aerophoto mapping work and basic investigations for the Igoma dam scheme will be carried out. The construction works of the first development stage lasts 42 months.

The detailed design works for the Igoma and scheme will be commenced after completion of the project mobilization for the first development stage and last 8 months. The construction works of the second development stage will start 5 months after preparation of detailed design under the separate contract of the first development stage. The construction of dam will last 29 months and other facilities in the Igoma scheme will be completed within 69 months from the commencement of preparatory works for the first development stage.

The farm operation will be able to commence on the newly developed farm of about 400 ha consisting of 150 ha in the Kisiwani scheme 250 ha in the Ndungu scheme, at first, from dry season cultivation in third year, and on whole project area of 4,760 ha in total from rainy season cultivation in seventh year.

1.3 Construction Plan

1.3.1 Work quantities and construction materials

The quantities of major works and major construction materials needed for the project are estimated as shown in the following table.

Work Quantities

	Unit	Kisiwani	Gonja	Ndungu	Kihurio	Igoma	Total
Excavation	$10^3 m^3$	400	900	800	1,800	600	4,500
Earthfill	$10^3 m^3$	200	500	400	800	700	2,600
Concrete	$10^3 m^3$	1	2	2	14	13	32
Lining Concrete	$10^3 m^2$	1	2	2	4	2	11
Farm	10^3 m	8	13	9	69	38	137

Construction Materials

	Unit	Kisiwani	Gonja	Ndungu	Kihurio	Igoma	Total
Cement	10^3t	0.6	1.2	1.2	5.4	4.5	12.9
Reinforcement bar	t	40	60	50	220	280	650
Gate	t	60	70	80	100	100	410
Gravel for concrete	$10^3 m^3$	1	3	3	12	10	29
Gravel for road pavement	$10^3 m^3$	7	9	6	17	7	46
Sand for concrete	$10^3 m^3$	0.8	1.6	1.6	7.4	6.2	18.8
Rock for gabion	$10^3 m^3$	4.1	1.2	1.8	8.8	1.6	17.5
Timber	$10^3 m^3$	0.2	0.3	0.3	1.4	0.9	3.1
Fuel	kℓ	500	1,000	900	2,000	1,000	5,400

1.3.2 Construction plan

The project comprises construction of a medium scale earthfill dam and irrigation and drainage canals and road net-work systems. Hence, due attention must be paid to a characteristics of earth materials, which directly affect earth moving plan, selection of construction equipment, specification of earth works, etc.

The construction of dams and main canals will mostly be executed by heavy construction machinery. The secondary and tertiary canals and other minor works would be executed by manpower, resulting in increase in the opportunities for employment among the local people in and around the project area.

Earth work is mostly commanded by rainfall. In establishing the construction time schedule, the workable days for each month are estimated based on the following assumptions:

(a) The following time lengths to suspend the works are set for the respective range of daily rainfall, by applying the rainfall data recorded at the Kalimawe meteorological station in 1979.

Daily rainfall depth (mm)	Time to be suspended (day)
0 to 10	0
10 to 30	0.5
30 to 50	1.0
more than 50	2.0

(b) Holidays including national holidays are deduced from the workable days.

(c) Main construction works of the Igoma dam consisting of embankment and concrete works of spillway are carried out only during 7-month period from the middle of April to the middle of November.

The workable days for the construction works except for the Igoma dam are estimated to be 275 days. The detailed estimation is shown in Table I-1.

The construction time schedule for the project is shown in Fig. I-2. The construction plans in the first and second development stages are described hereunder.

(1) First Development Stage

The construction work in this stage consist of the construction of intake facilities, irrigation and drainage canal systems, road networks, river improvement works and on-farm facilities for the Kihurio, Ndungu, Gonja and Kisiwani schemes.

The constructions of intake facilities include the construction of five new intake facilities and the improvement of two existing intake facilities. Taking into consideration the scale of construction and the large volume of concrete works for headworks and intakes, enough number of construction equipment will be required for the construction. The construction works of the main and secondary canal systems and road networks, and river improvement works will be executed simultaneously, considering of the efficient earth moving.

(2) Second Development Stage

The construction works of the project facilities for the Igoma scheme is carried out in this stage. The project facilities include the Igoma dam, intake facility, main and secondary irrigation and drainage canal systems, road networks, flood protection dike and on-farm facilities.

The construction works of the Igoma dam are mainly divided into the three works: (i) diversion works, (ii) coffering works and (iii) main civil works. The diversion works will be started after the rainy season in 4th year of the project implementation schedule. The construction of Igoma dam will last for 29 months taking three dry seasons.

Other construction works of the intake facilities, main and secondary irrigation and drainage canal systems, etc. will begin from beginning of 5th year and last 27 months.

1.4 Construction Machinery

The major civil works of the project would principally be carried out by construction machinery. The type and number of construction machinery to be required for the major civil works are estimated based on the work quantity, construction time schedule and the natured condition in the project area. Table I-2 shows the required type and number of construction machinery.

2. PROJECT COST

2.1 Conditions

The costs for the implementation of the project are estimated on the basis of the preliminary design of the project facilities, taking into account the construction method to be applied, productivity of labour and machinery and also based on the following assumptions:

(1) The exchange rate used in the estimate is:

US$1.00 = TSh.12.0
= ¥240

(2) The main construction works will be carried out by contractor(s) selected through international cmpetitive bidding. The construction machinery and equipment required for the construction works will be imported by the contractor(s).

(3) Taxes on the construction materials, machinery and equipment to be imported from abroad are exempted from estimateion of the construction cost.

(4) The unit prices are divided into foreign and local currency portions. Local currency portion is estimated based on the current prices in 1983 in Kilimanjaro region, and on the cost data of on-going civil works obtained from the Government authorities concerned. Foreign currency portion is estimated based on the CIF prices at Tanga, making reference to FOB prices of materials and equipment in Japan in 1983. The classification of local and foreign currency portions is defined as follows:

Local currency portion

- Labour force,
- Sand, gravel, rock and wooden materials,
- Inland transportation costs, and
- Administration expenses.

Foreign currency portion

- Reinforcement bar and structural steel,
- Fuel, oil, etc.,
- Cement,
- PVC pipe and steel pipe
- Steel gates for dam, intake facilities and canal related structures,
- Depreciation costs of construction machinery and equipment,
- Contractor's general expenses and profits for foreign contractor(s),
- Expenses and fees of engineering services by foreign consultants.

(5) Physical contingencies related to the construction quantities; 10% of the direct construction cost, is included.

(6) Price contingency; 5% per annum for the foreign currency portion and 15% per annum for the local currency portion, is also included.

(7) The associated costs to be financed by the Government, such as the costs for strengthening the extension services, facilities of the water users' association, and improvment of the social structures are not included in this estimate.

2.2 Cost Estimate

The total construction costs of the project are estimated at US$61.2 million equivalent, which comprise US$23.5 million equivalent of local currency and US$37.7 million of foreign currency. The summary and breakdown of cost estimate are shown in Tables I-3 through I-5.

The prices of local materials and labour wages used in the estimate and the unit rates for the major works are shown in Tables I-16 and I-17, respectively.

2.3 Annual Disbursement Schedule

The annual disbursement schedule is worked out based on the construction time schedule, as shown in Table I-4.

2.4 Annual Operation and Maintenance Costs

The annual operation and maintenance costs include the salaries of the project administrative and water control staffs, the materials and labour costs for repair and maintenance of project facilities, the costs for operation, repair and maintenance of O & M equipment, and the running costs of project facilities.

The annual operation and maintenance costs at the full development stage of the project is estimated at TSh.5.3 million. The summary of these costs are shown in Table I-18.

2.5 Replacement Costs

Some of the facilities, especially mechanical and electrical facilities have a shorter useful life than civil works and have to be periodically replaced. The replacement costs and useful lives of these facilities are listed in Table I-20.

Table I-1 ESTIMATION OF WORKABLE DAYS

Unit: day

Item	J	F	M	A	M	J	J	A	S	O	N	D	Total
1. Monthly day	31	28	31	30	31	30	31	31	30	31	30	31	365
2. Frequency of rainfall /1													
0 - 10 mm	11	9	5	12	11	3	3	2	4	5	8	9	82
10 - 30 mm	2	1	2	1	3	1	0	1	0	1	0	1	13
30 - 50 mm	1	2	0	0	0	0	0	0	0	0	0	1	3
more than 50 mm	0	1	0	0	0	0	0	0	0	0	0	1	2
3. Time length to be suspended	2	3	1	1	2	1	0	1	0	1	0	2	14
4. Holidays	6	7	7	7	7	6	6	7	5	5	6	7	76
5. Total days to be suspended	8	10	8	8	9	7	6	8	5	6	6	9	90
6. Workable days	23	18	23	22	22	23	25	23	25	25	24	22	275

/1: Rainfall data recorded at the Kalimawe meteorological station in 1979.

Table I-2 REQUIRED MAJOR CONSTRUCTION EQUIPMENT

	Equipment	Specification	Required Number
1.	Bulldozer	21 ton	15
2.	Bulldozer	17 ton	8
3.	Buldolzer	11 ton	18
4.	Backhoe	0.6 m^3	10
5.	Backhoe	0.3 m^3	4
6.	Motor scraper	11 m^3	4
7.	Tractor shovel	1.2 m^3	3
8.	Wheel loader	1.2 m^3	3
9.	Dump truck	8 ton	15
10.	Tamping roller	7.5-15.2 ton	4
11.	Tire roller	6-10 ton	2
12.	Motor grador	3.7 m	2
13.	Vibrating compactor	100 kg	12
14.	Rammer	60-100 kg	15
15.	Tamper	60-100 kg	15
16.	Water tanker	5.5 kℓ	5
17.	Belt-conveyor	10 m	5
18.	Breaker (attachment for backhoe)	200 kg	2
19.	Aggregate plant (Crushing and screening)	165 ton/day	2 sets
20.	Concrete batcher plant	0.5 m^3x1	4
21.	Concrete mixer	0.4 m^3	3
22.	Concrete mixer	0.2 m^3	5
23.	Agitator truck	1.6 m^3	5
24.	Vibrator	45 mm	30
25.	Truck crane	15 ton	2
26.	Wheel crane	5.5 ton	2
27.	Cargo truck with crane	3 ton	6
28.	Cargo truck	6 ton	15
29.	Fork lift	3 ton	3
30.	Fuel tanker	10 kℓ	1
31.	Fuel tanker	4 kℓ	3
32.	Pick-up car	1 ton	15
33.	Micro bus	25 persons	6
34.	Jeep	4 drive	15
35.	Maintenance car	6 ton	1
36.	Grease car	6 ton	1
37.	Submersible pump	100 mm	4
38.	Submersible pump with generator	50 mm	10
39.	Block making plant	5 m^3/day	4
40.	Power supply system		1
41.	Water supply system		1
42.	Testing and survey equipment		1 set
43.	Repair shop equipment		1 set
44.	Truck mounted rotary drilling machine with accessories		1

Table I-3 SUMMARY OF CONSTRUCTION COST

Unit: TSh.10^3

Item	Foreign Currency	Local Crrency	Total
1. Preparatory Works	14,120	5,850	19,970
2. Igoma Dam	56,800	18,400	75,200
3. Intake Facilities	24,090	11,150	35,240
4. Canals and Roads			
(1) Irrigation canals	48,330	19,420	67,750
(2) Drainage canals	19,220	8,830	28,050
(3) Farm roads	7,680	2,230	9,910
5. Floodway & Flood Dike	18,320	4,880	23,200
6. Rehabilitation of Existing Dam	13,900	5,400	19,300
7. On-farm Development	51,440	19,640	71,080
8. Office and Quarter	9,200	5,700	14,900
Sub- total	263,100	101,500	364,600
9. O & M Equipment	15,000	1,000	16,000
10. Administration Expenses	-	25,400	25,400
11. Engineering Services	59,600	16,200	75,800
Sub-total	74,600	42,600	117,200
Total	337,700	144,100	481,800
12. Physical Contingency	33,300	14,900	48,200
Total	371,000	159,000	530,000
13. Price Contingency	81,000	123,000	204,000
Grand Total (US$10^6)	452,000 (37.7)	282,000 (23.5)	734,000 (61.2)

Note: Price Contingency: Foreign currency 5%, Local currency 15%

US$1.00 = TSh.12.00 ≈ ¥240.-

Table I-4 ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST

Unit: TSh.10^3

Item	Investment			1st Year		2nd Year		3rd Year		4th Year		5th Year		6th Year		7th Year	
	FC	LC	Total	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparatory Works	14,120	5,850	19,970	-	-	4,700	2,100	1,900	800	4,700	1,840	1,800	710	800	320	220	80
2. Igoma Dam	56,800	18,400	75,200	-	-	-	-	-	-	14,600	5,000	28,200	9,000	14,000	4,400	0	0
3. Intake Facilities	24,090	11,150	35,240	-	-	-	-	14,780	6,960	7,500	3,400	-	-	1,810	790	-	-
4. Canals and Roads																	
(1) Irrigation Canals	48,330	19,420	67,750	-	-	-	-	24,780	9,620	16,230	6,970	3,700	1,300	3,620	1,530	-	-
(2) Drainage Canals	19,220	8,830	28,050	-	-	-	-	4,040	1,670	7,600	3,560	4,480	2,040	3,100	1,560	-	-
(3) Farm Roads	7,680	2,230	9,910	-	-	-	-	2,700	750	2,500	800	1,510	420	970	260	-	-
5. River Improvement/ Floodway and Flood Dike	18,320	4,880	23,200	-	-	-	-	300	100	6,470	1,630	8,010	2,190	3,140	860	400	100
6. Rehabilitation of Existing Dam	13,900	5,400	19,300	-	-	-	-	13,900	5,400	-	-	-	-	-	-	-	-
7. On-Farm Development	51,440	19,640	71,080	-	-	-	-	17,200	6,800	21,400	7,400	7,700	3,100	5,140	2,340	-	-
8. Office and Quarter	9,200	5,700	14,900	-	-	5,500	3,400	3,700	2,300	-	-	-	-	-	-	-	-
Sub-total	263,100	101,500	364,600	-	-	10,200	5,500	83,300	34,400	81,000	30,600	55,400	18,760	32,580	12,060	620	180
9. O & M Equipment	15,000	1,000	16,000	-	-	-	-	3,000	-	12,000	1,000	-	-	-	-	-	-
10. Administration Expenses	-	25,400	25,400	-	2,000	-	2,400	-	4,000	-	5,100	-	5,100	-	4,000	-	2,800
11. Engineering Services	59,600	16,200	75,800	7,000	2,400	9,400	2,400	17,000	4,000	9,000	2,400	10,000	3,100	9,000	2,400	400	100
Sub-total	74,600	42,600	117,200	4,800	3,800	9,400	4,800	20,000	8,000	21,000	8,500	10,000	8,200	9,000	6,400	400	2,900
Total	337,700	144,100	481,800	4,800	3,800	19,600	10,300	103,300	42,400	102,000	39,100	65,400	26,960	41,580	18,460	1,020	3,080
12. Physical Contingency	33,300	14,900	48,200	500	400	2,000	1,100	10,300	4,400	10,000	4,000	6,300	2,740	4,120	1,940	80	320
Total	371,000	159,000	530,000	5,300	4,200	21,600	11,400	113,600	46,800	112,000	43,100	71,700	29,700	45,700	20,400	1,100	3,400
13. Price Contingency	81,000	123,000	204,000	300	600	2,300	3,600	18,000	24,300	24,200	32,200	19,900	30,000	15,600	26,700	700	5,600
Grand Total	452,000	282,000	734,000	5,600	4,800	23,900	15,000	131,600	71,100	136,200	75,300	91,600	59,700	61,300	47,100	1,800	9,000

Note: Price contingency is estimated based on the annual increase rate of 5% and 15% for foreign currency portion and local currency portion respectively. The conversion rates are US$1.00 = TSh.12.00 = Yen 240.

Table I-5 SUMMARY OF DIRECT CONSTRUCTION COST OF EACH SCHEME

Unit: TSh.10^3

Item	Total		Kisiwani Scheme		Gonja Scheme		Ndungu Scheme		Kihurio Scheme		Igoma Scheme	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparatory Works	14,120	5,850	1,200	490	2,250	930	2,150	870	4,520	2,050	4,000	1,510
2. Igoma Dam	56,800	18,400	-	-	-	-	-	-	-	-	56,800	18,400
3. Intake Facilities	24,090	11,150	2,670	1,130	1,760	780	2,350	1,050	15,500	7,400	1,810	790
4. Canals and Roads												
(1) Irrigation canals	48,330	19,420	4,040	1,560	10,160	4,200	9,810	3,830	17,400	7,100	6,920	2,730
(2) Drainage canals	19,220	8,830	4,500	1,710	2,040	990	3,580	1,970	7,370	3,280	1,730	880
(3) Farm roads	7,680	2,230	1,100	300	1,600	490	1,210	380	2,710	770	1,060	290
5. River Improvement/ Floodway and Flood Dike	18,320	4,880	790	210	3,290	810	3,300	900	9,200	2,500	1,740	460
6. Rehabilitation of Existing Dam	13,900	5,400	-	-	-	-	-	-	13,900	5,400	-	-
7. On-farm Development	51,440	19,640	4,100	1,500	11,000	4,200	8,500	3,500	17,800	5,900	10,040	4,540
8. Office and Quarter	9,200	5,700	-	-	-	-	-	-	-	-	-	-
Total	263,100	101,500	18,400	6,900	32,100	12,400	30,900	12,500	88,400	34,400	84,100	29,600

Table I-6 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR THE KISIWANI SCHEME

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
1.	Preparatory Works			1,200,000	490,000
2.	Diversion Weirs				
	Excavation	m^3	7,000	126,000	14,000
	Backfill	m^3	2,000	13,000	10,000
	Embankment	m^3	3,000	36,000	9,000
	Concrete works	m^3	900	1,800,000	900,000
	Masonry works	m^3	160	160,000	80,000
	Gabion	m^3	300	150,000	60,000
	Metal works	ton	20	360,000	40,000
	Miscellaneous works	L.S.		25,000	17,000
	Sub-total			2,670,000	1,130,000
3.	Irrigation Canals				
3.1	Main canal (5.1 km)			2,800,000	1,120,000
	Site clearing and stripping	m^3	2,500	12,500	2,500
	Excavation	m^3	2,700	13,500	5,400
	Embankment	m^3	8,000	60,000	12,000
	Sod facing	m^2	14,000	14,000	70,000
	Concrete lining	m^3	700	2,100,000	840,000
	Related structures				
	- Turnout	nos.	17	426,000	108,000
	- Culvert	nos.	11	66,000	22,000
	- Drop	nos.	3	60,000	45,000
	- Wasteway	nos.	2	30,000	8,000
	Miscellaneous works			18,000	7,100
3.2	Secondary canal (3.6 km)			1,240,000	440,000
	Site clearing and stripping	m^3	3,000	15,000	3,000
	Excavation	m^3	100	500	200
	Embankment	m^2	12,000	96,000	24,000
	Sod facing	m^3	8,000	8,000	40,000
	Concrete lining	m^3	200	600,000	240,000
	Related structures				
	- Turnout	nos.	12	420,000	105,000
	- Culvert	nos.	4	12,000	5,000
	- Wasteway	nos.	5	77,000	21,000
	Miscellaneous works	L.S.		11,500	1,800
	Sub-total			4,040,000	1,560,000
4.	Drainage Canals (9.4 km)				
	Embankment	m^3	4,000	4,000	2,000
	Excavation	m^3	190,000	1,520,000	380,000
	Related structures				
	- Drainage drop	nos.	33	1,980,000	660,000
	- Crossdrain	nos.	4	960,000	660,000
	Miscellaneous works	L.S.		36,000	8,000
	Sub-total			4,500,000	1,710,000

- to be continued -

Kisiwani

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
5.	Farm Roads				
5.1	Main road (8.8 km)			920,000	225,000
	Site clearing and stripping	m^3	6,000	30,000	6,000
	Embankment	m^3	32,000	224,000	48,000
	Sod facing	m^2	16,000	16,000	80,000
	Gravel pavement	m^3	7,000	616,000	84,000
	Miscellaneous	L.S.		34,000	7,000
5.2	Secondary road (9.3 km)			180,000	75,000
	Site clearing and stripping	m^3	4,000	20,000	4,000
	Embankment	m^3	16,000	128,000	24,000
	Sod facing	m^2	8,000	8,000	40,000
	Miscellaneous works	L.S.		24,000	7,000
	Sub-total			1,100,000	300,000
6.	River Improvement (2.6 km)				
	Excavation	m^3	94,000	752,000	188,000
	Embankment	m^3	30,000	30,000	15,000
	Miscellaneous works	L.S.		8,000	7,000
	Sub-total			790,000	210,000
7.	On-farm Development (360 ha)				
7.1	Tertiary canal			395,000	285,000
	Stripping	m^3	8,000	40,000	8,000
	Embankment	m^3	14,000	112,000	196,000
	Related structures				
	- Division box	nos.	80	40,000	24,000
	- Culvert	nos.	50	125,000	50,000
	Miscellaneous works	L.S.		78,000	7,000
7.2	Tertiary drain			165,000	60,000
	Excavation	m^3	5,000	40,000	10,000
	Related structures				
	- Drainage culvert	nos.	50	125,000	50,000
7.3	Tertiary road			660,000	405,000
	Stripping	m^3	20,000	100,000	20,000
	Embankment	m^3	70,000	560,000	385,000
7.4	Land levelling	m^3	130,000	2,340,000	390,000
7.5	Field ditch, drain and road	ha	360	540,000	360,000
	Sub-total			4,100,000	1,500,000
	Total			18,400,000	6,900,000

Table I-7 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR THE GONJA SCHEME

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
1.	Preparatory Works			2,250,000	930,000
2.	Diversion Weir				
	Excavation, Common	m^3	1,000	18,000	2,000
	Excavation, Rock	m^3	200	28,000	2,000
	Backfill	m^3	200	1,300	1,000
	Embankment	m^3	400	4,800	1,200
	Concrete works	m^3	600	1,200,000	600,000
	Masonry works	m^3	250	250,000	125,000
	Gabion	m^2	90	45,000	18,000
	Metal works	ton	11	198,000	22,000
	Miscellaneous works	L.S.		14,900	8,800
	Sub-total			1,760,000	780,000
3.	Irrigation Canals				
3.1	Main canal (7.6 km)			5,660,000	2,520,000
	Site clearing and stripping	m^3	5,000	25,000	5,000
	Excavation	m^3	2,500	125,000	5,000
	Embankment	m^3	23,000	172,500	34,500
	Sod facing	m^2	26,000	26,000	130,000
	Concrete lining	m^3	1,200	3,600,000	1,440,000
	Related structures				
	- Turnout	nos.	14	532,000	126,000
	- Culvert	nos.	9	63,000	18,000
	- Drop	nos.	7	182,000	140,000
	- Chute	nos.	3	570,000	420,000
	- Siphon	nos.	1	250,000	140,000
	- Spillway	nos.	2	40,000	26,000
	- Wasteway	nos.	1	17,000	5,000
	Miscellaneous works	L.S.		57,500	30,500
3.2	Secondary canal (13.3 km)			4,500,000	1,680,000
	Site clearing and stripping	m^3	12,000	60,000	12,000
	Excavation	m^3	1,000	5,000	2,000
	Embankment	m^3	43,000	344,000	86,000
	Sod facing	m^2	30,000	30,000	150,000
	Concrete lining	m^3	700	2,100,000	840,000
	Related structures				
	- Turnout	nos.	44	1,547,000	389,000
	- Culvert	nos.	32	160,000	60,000
	- Drop	nos.	9	131,000	99,000
	- Wasteway	nos.	5	77,000	23,000
	Miscellaneous works	L.S.		46,000	19,000
	Sub-total			10,160,000	4,200,000
4.	Drainage Canals (17.7 km)				
	Excavation	m^3	180,000	900,000	360,000
	Embankment	m^3	8,000	8,000	4,000
	Related structures				
	- Drainage drop	nos.	5	500,000	200,000
	- Crossdrain	nos.	2	616,000	420,000
	Miscellaneous works	L.S.		16,000	6,000
	Sub-total			2,040,000	990,000

- to be continued -

Gonja

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
5.	Farm Roads				
5.1	Main road (10.9 km)			1,120,000	280,000
	Site clearing and stripping	m^3	7,000	35,000	7,000
	Embankment	m^3	38,000	266,000	57,000
	Sod facing	m^2	20,000	20,000	100,000
	Gravel pavement	m^3	9,000	792,000	108,000
	Miscellaneous works	L.S.		7,000	8,000
5.2	Secondary Road (27.7 km)			480,000	210,000
	Site clearing and stripping	m^3	13,000	65,000	13,000
	Embankment	m^3	48,000	384,000	72,000
	Sod facing	m^2	24,000	24,000	120,000
	Miscellaneous works	L.S.		7,000	5,000
	Sub-total			1,600,000	490,000
6.	Floodway (4.6 km)				
	Excavation	m^3	360,000	2,880,000	720,000
	Embankment	m^3	50,000	350,000	75,000
	Gabion	m	60	30,000	12,000
	Miscellaneous works	L.S.		30,000	3,000
	Sub-total			3,290,000	810,000
7.	On-farm Development (1,040 ha)				
7.1	Tertiary canal			1,072,000	873,000
	Stripping	m^3	21,000	105,000	21,000
	Embankment	m^3	40,000	320,000	560,000
	Related structures				
	- Division box	nos.	230	115,000	69,000
	- Culvert	nos.	140	350,000	140,000
	Miscellaneous works	L.S.		182,000	83,000
7.2	Tertiary drain			478,000	172,000
	Excavation	m^3	16,000	128,000	32,000
	Related structures				
	- Drainage culvert	nos.	140	350,000	140,000
7.3	Tertiary road			1,770,000	1,095,000
	Site clearing and stripping	m^3	50,000	250,000	50,000
	Embankment	m^3	190,000	1,520,000	1,045,000
7.4	Land levelling	m^3	340,000	6,120,000	1,020,000
7.5	Field ditch, drain and road	ha	1,040	1,560,000	1,040,000
	Sub-total			11,000,000	4,200,000
	Total			32,100,000	12,400,000

Table I-8 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR THE NDUNGU SCHEME

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
1.	Preparatory Works			2,150,000	870,000
2.	Diversion Weir				
	Excavation, Common	m^3	3,000	54,000	6,000
	Excavation, Rock	m^3	50	7,000	500
	Backfill	m^3	1,000	6,500	5,000
	Embankment	m^3	1,000	12,000	3,000
	Concrete works	m^2	900	1,800,000	900,000
	Masonry works	m^3	140	140,000	70,000
	Gabion	m	140	70,000	28,000
	Metal works	ton	13	234,000	26,000
	Miscellaneous works	L.S.		26,500	11,500
	Sub-total			2,350,000	1,050,000
3.	Irrigation Canals				
3.1	Main Canal (7.9 km)			5,780,000	2,330,000
	Site clearing and stripping	m^3	6,000	30,000	6,000
	Excavation	m^3	14,000	70,000	28,000
	Embankment	m^2	20,000	150,000	30,000
	Sod facing	m^3	27,000	27,000	135,000
	Concrete lining	m	1,400	4,200,000	1,680,000
	Related structures				
	- Turnout	nos.	16	608,000	144,000
	- Culvert	nos.	11	99,000	33,000
	- Drop	nos.	3	90,000	60,000
	- Siphon	nos.	1	380,000	160,000
	- Spillway	nos.	2	40,000	26,000
	- Wasteway	nos.	2	30,000	8,000
	Miscellaneous works	L.S.		56,000	20,000
3.2	Secondary canal (9.7 km)			4,030,000	1,500,000
	Site clearing and stripping	m^3	9,000	45,000	9,000
	Excavation	m^3	400	2,000	800
	Embankment	m^2	30,000	240,000	60,000
	Sod facing	m^3	22,000	22,000	110,000
	Concrete lining	m	600	1,800,000	720,000
	Related structures				
	- Turnout	nos.	40	1,440,000	360,000
	- Culvert	nos.	14	84,000	28,000
	- Drop	nos.	14	224,000	168,000
	- Wasteway	nos.	9	135,000	36,000
	Miscellaneous works	L.S.		38,000	8,200
	Sub-total			9,810,000	3,830,000
4.	Drainage canals (15.4 km)				
	Excavation	m^3	170,000	850,000	340,000
	Embankment	m	6,000	6,000	3,000
	Related structures				
	- Drainage drop	nos.	17	799,000	323,000
	- Crossdrain	nos.	7	1,890,000	1,288,000
	Miscellaneous works	L.S.		35,000	16,000
	Sub-total			3,580,000	1,970,000

- to be continued -

Ndungu

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
5.	Farm Road				
5.1	Main road (7.9 km)			770,000	190,000
	Site clearing and stripping	m^3	5,000	25,000	5,000
	Embankment	m^3	28,000	196,000	42,000
	Sod facing	m^2	14,000	14,000	70,000
	Gravel pavement	m^3	6,000	528,000	72,000
	Miscellaneous works	m		7,000	1,000
		L.S.			
5.2	Secondary road (25.1 km)			440,000	190,000
	Site clearing and stripping	m^3	12,000	60,000	12,000
	Embankment	m^3	44,000	352,000	66,000
	Sod facing	m^2	21,000	21,000	105,000
	Miscellaneous works	m		7,000	7,000
		L.S.			
	Sub-total			1,210,000	380,000
6.	Flood Protection Works				
6.1	Floodway (4.2 km)			3,050,000	825,000
	Excavation	m^3	350,000	2,800,000	700,000
	Embankment	m^3	50,000	50,000	25,000
	Gabion	m	100	50,000	20,000
	Miscellaneous works	L.S.		150,000	80,000
6.2	Flood dike (2.5 km)				
	Embankment	m^3	50,000	350,000	75,000
	Sub-total			3,300,000	900,000
7.	On-farm Development (940 ha)				
7.1	Tertiary canal			928,000	737,000
	Stripping	m^3	19,000	95,000	19,000
	Embankment	m^3	36,000	288,000	504,000
	Related structures				
	- Division box	nos.	200	100,000	60,000
	- Culvert	nos.	120	300,000	120,000
	Miscellaneous works	L.S.		145,000	34,000
7.2	Tertiary drain			412,000	148,000
	Excavation	m^3	14,000	112,000	28,000
	Related structures				
	- Drainage culvert	nos.	120	300,000	120,000
7.3	Tertiary road			1,610,000	985,000
	Stripping	m^3	50,000	250,000	50,000
	Embankment	m^3	170,000	1,360,000	935,000
7.4	Land levelling	m^3	230,000	4,140,000	690,000
7.5	Field ditch, drain and road	ha	940	1,410,000	940,000
	Sub-total			8,500,000	3,500,000
	Total			30,900,000	12,500,000

Table I-9 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR THE KIHURIO SCHEME

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
1.	Preparatory Works	L.S.		4,520,000	2,050,000
2.	Rehabilitation of Kalimawe Dam				
2.1	Dam			4,310,000	750,000
	Excavation	m^3	15,000	360,000	90,000
	Embankment	m^3	44,000	2,860,000	440,000
	Plain concrete	m^3	700	1,050,000	210,000
	Miscellaneous works	L.S.		40,000	10,000
2.2	Spillway			9,140,000	4,530,000
	Excavation	m^3	5,000	90,000	10,000
	Concrete works	m^3	4,500	9,000,000	4,500,000
	Miscellaneous works	L.S.		50,000	20,000
2.3	Intake			300,000	100,000
	Concrete works	m^3	40	108,000	72,000
	Metal works	ton	10	180,000	20,000
	Miscellaneous works	L.S.		12,000	8,000
2.4	Access road	km	2.0	150,000	20,000
	Sub-total			13,900,000	5,400,000
3.	Saseni Diversion Weir				
	Temporary diversion works	L.S.		300,000	100,000
	Excavation, Common	m^3	13,000	234,000	26,000
	Excavation, Rock	m^3	1,400	196,000	14,000
	Backfill	m^3	3,000	19,500	15,000
	Embankment	m^3	1,000	12,000	3,000
	Concrete works	m^3	7,100	14,200,000	7,100,000
	Gabion	m^2	200	100,000	40,000
	Metal works	ton	18	324,000	36,000
	Miscellaneous works	L.S.		114,500	66,000
	Sub-total			15,500,000	7,400,000
4.	Irrigation Canals				
4.1	Main canal (20.7 km)			14,530,000	6,010,000
	Site clearing and stripping	m^3	12,000	60,000	12,000
	Excavation	m^3	12,000	60,000	24,000
	Embankment	m^3	53,000	397,500	79,500
	Sod facing	m^2	60,000	60,000	300,000
	Concrete lining	m^3	3,700	11,100,000	4,440,000
	Related structures				
	- Turnout	nos.	41	1,435,000	369,000
	- Culvert	nos.	34	280,000	80,000
	- Drop	nos.	13	377,000	286,000
	- Siphon	nos.	2	580,000	340,000
	- Spillway	nos.	4	50,000	30,000
	- Wasteway	nos.	3	48,000	12,000
	Miscellaneous works	L.S.		82,500	37,500

- to be continued -

Kihurio

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
4.2	Secondary canal (9.0 km)			2,870,000	1,090,000
	Site clearing and stripping	m^3	8,000	40,000	8,000
	Excavation	m^3	600	3,000	1,200
	Embankment	m^2	28,000	224,000	56,000
	Sod facing	m^3	20,000	20,000	100,000
	Concrete lining	m	500	1,500,000	600,000
	Related structures				
	- Turnout	nos.	24	840,000	216,000
	- Culvert	nos.	8	40,000	16,000
	- Drop	nos.	4	66,000	50,000
	- Spillway	nos.	7	112,000	28,000
	Miscellaneous works	L.S.		25,000	14,800
	Sub-total			17,400,000	7,100,000
5.	Drainage Canals (23.1 km)				
	Excavation	m^3	190,000	1,520,000	380,000
	Embankment	m	10,000	10,000	5,000
	Related structures				
	- Drainage drop	nos.	85	4,080,000	1,700,000
	- Crossdrain	nos.	13	1,690,000	1,170,000
	Miscellaneous works	L.S.		70,000	25,000
	Sub-total			7,370,000	3,280,000
6.	Farm Rood				
6.1	Main road (21.5 km)			2,150,000	530,000
	Site clearing and stripping	m^3	14,000	70,000	14,000
	Embankment	m^3	76,000	532,000	114,000
	Sod facing	m^2	39,000	39,000	195,000
	Gravel pavement	m^3	17,000	1,496,000	204,000
	Miscellaneous works	m		13,000	3,000
6.2	Secondary road (31.3 km)	L.S.		560,000	240,000
	Site clearing and stripping	m^3	14,000	70,000	14,000
	Embankment	m^3	56,000	448,000	84,000
	Sod facing	m^2	27,000	27,000	135,000
	Miscellaneous works	m		15,000	7,000
	Sub-total	L.S.		2,710,000	770,000
7.	Flood Protection Works				
7.1	Floodway (9.0 km)			8,300,000	2,300,000
	Excavation	m^3	900,000	7,200,000	1,800,000
	Embankment	m^3	110,000	110,000	55,000
	Gabion	m	500	250,000	100,000
	Related structures	L.S.		740,000	345,000
7.2	Flood dike (6.5 km)			900,000	200,000
	Embankment	m^3	124,000	868,000	186,000
	Miscellaneous works	L.S.		32,000	14,000
	Sub-total			9,200,000	2,500,000

- to be continued -

Kihurio

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
8.	On-farm Development (1,670 ha)				
8.1	Tertiary canal			1,029,000	442,000
	Stripping	m^3	34,000	170,000	34,000
	Embankment	m^3	4,000	32,000	56,000
	Related structures				
	- Division box	nos.	360	180,000	108,000
	- Culvert	nos.	220	550,000	220,000
	Miscellaneous works	L.S.		97,000	24,000
8.2	Tertiary drain			750,000	270,000
	Excavation	m^3	25,000	200,000	50,000
	Related structures				
	- Drainage culvert	nos.	220	550,000	220,000
8.3	Tertiary road			2,800,000	1,730,000
	Stripping	m^3	80,000	400,000	80,000
	Embankment	m^3	300,000	2,400,000	1,650,000
8.4	Land reclamation			10,716,000	1,788,000
	Land clearing	ha	60	276,000	48,000
	Land levelling	m^3	580,000	10,440,000	1,740,000
8.5	Field ditch, drain and road	ha	1,670	2,505,000	1,670,000
	Sub-total			17,800,000	5,900,000
	Total			88,400,000	34,400,000

Table I-10 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR THE IGOMA SCHEME

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
1.	Preparatory Works	L.S.		4,000,000	1,510,000
2.	Igoma Dam				
2.1	Diversion works	L.S.		300,000	100,000
2.2	Dam			29,900,000	6,010,000
	Stripping	m^3	45,000	225,000	45,000
	Excavation, foundation	m^3	36,000	864,000	216,000
	Embankment	m^3	380,000	24,700,000	3,800,000
	Riprap	m^3	12,000	2,400,000	1,200,000
	Grouting for foundation	m	2,200	1,320,000	660,000
	Miscellaneous works	L.S.		391,000	89,000
2.3	Spillway			25,200,000	11,800,000
	Excavation, Common	m^3	30,000	540,000	60,000
	Excavation, Rock	m^3	10,000	1,400,000	100,000
	Concrete works	m^3	11,500	23,000,000	11,500,000
	Miscellaneous works	L.S.		260,000	140,000
2.4.	Intake and outlet structure			800,000	390,000
	Excavation	m^3	1,000	18,000	2,000
	Concrete works	m^3	200	540,000	360,000
	Metal works	ton	13	234,000	26,000
	Miscellaneous works	L.S.		8,000	2,000
2.5	Access road	km	4.0	600,000	100,000
	Sub-total			56,800,000	18,400,000
3.	Diversion Weir				
	Excavation	m^3	2,000	36,000	4,000
	Backfill	m^3	400	2,600	2,000
	Embankment	m^3	1,000	12,000	3,000
	Concrete works	m^3	600	1,200,000	600,000
	Masonry works	m^2	250	250,000	125,000
	Gabion	m^3	90	45,000	18,000
	Metal works	ton	14	252,000	28,000
	Miscellaneous works	L.S.		12,400	10,000
	Sub-total			1,810,000	790,000
4.	Irrigation Canals				
4.1	Main canal (8.5 km)			4,800,000	1,930,000
	Site clearing and stripping	m^3	6,000	30,000	6,000
	Excavation	m^3	2,000	10,000	4,000
	Embankment	m^3	27,000	202,500	40,500
	Sod facing	m^2	30,000	30,000	150,000
	Concrete lining	m^3	1,300	3,900,000	1,560,000
	Related structures				
	- Turnout	nos.	13	468,000	117,000
	- Culvert	nos.	8	56,000	16,000
	- Drop	nos.	1	22,000	16,000
	- Wasteway	nos.	2	30,000	8,000
	Miscellaneous works	L.S.		51,500	12,500

- to be contined -

Igoma

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
4.2	Secondary canal (7.3 km)			2,120,000	800,000
	Site clearing and stripping	m^3	6,000	30,000	6,000
	Excavation	m^3	500	2,500	1,000
	Embankment	m^2	14,000	112,000	28,000
	Sod facing	m^3	20,000	20,000	100,000
	Concrete lining	m	300	900,000	360,000
	Related structures				
	- Turnout	nos.	24	840,000	216,000
	- Culvert	nos.	10	50,000	20,000
	- Drop	nos.	3	51,000	39,000
	- Wasteway	nos.	6	96,000	24,000
	Miscellaneous works	L.S.		18,500	6,000
	Sub-total			6,920,000	2,730,000
5.	Drainage Canals (3.4 km)				
	Excavation	m^3	60,000	300,000	120,000
	Embankment	m^3	2,000	2,000	1,000
	Related structures				
	- Drainage drop	nos.	12	744,000	300,000
	- Crossdrain	nos.	7	672,000	448,000
	Miscellaneous works	L.S.		12,000	11,000
	Sub-total			1,730,000	880,000
6.	Farm Roads				
6.1	Main road (8.5 km)			870,000	210,000
	Site clearing and stripping	m^3	5,000	25,000	5,000
	Embankment	m^3	30,000	210,000	45,000
	Sod facing	m^2	15,000	15,000	75,000
	Gravel pavement	m^3	7,000	616,000	84,000
	Miscellaneous works	m		4,000	1,000
		L.S.			
6.2	Secondary road (10.7 km)			190,000	80,000
	Site clearing and stripping	m^3	5,000	25,000	5,000
	Embankment	m^3	19,000	152,000	28,500
	Sod facing	m	9,000	9,000	45,000
	Miscellaneous works	L.S.		4,000	1,500
	Sub-total			1,060,000	290,000
7.	Flood Protection Works				
7.1	River improvement (5.3 km)			1,530,000	415,000
	Excavation	m^3	180,000	1,440,000	360,000
	Embankment	m	60,000	60,000	30,000
	Miscellaneous works	L.S.		30,000	25,000
7.2	Flood dike (1.5 km)				
	Embankment	m^3	30,000	210,000	45,000
	Sub-total			1,740,000	460,000

- to be continued -

Igoma

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
8.	On-farm Development (750 ha)				
8.1	Tertiary canal			837,000	653,000
	Stripping	m^3	15,000	75,000	15,000
	Embankment	m^3	30,000	240,000	420,000
	Related structures				
	- Division box	nos.	160	80,000	48,000
	- Culvert	nos.	100	250,000	100,000
	Miscellaneous works	L.S.		192,000	70,000
8.2	Tertiary drain			338,000	122,000
	Excavation	m^3	11,000	88,000	22,000
	Related structures				
	- Drainage culvert	nos.	100	250,000	100,000
8.3	Tertiary road			1,320,000	810,000
	Stripping	m^3	40,000	200,000	40,000
	Embankment	m^3	140,000	1,120,000	770,000
8.4	Land reclamation			6,420,000	1,080,000
	Land clearing	ha	300	1,380,000	240,000
	Land levelling	m^3	280,000	5,040,000	840,000
8.5	Field ditch, drain and road	ha	750	1,125,000	1,875,000
	Sub-total			10,040,000	4,540,000
	Total			84,100,000	29,600,000

Table I-11 BREAKDOWN OF DIRECT CONSTRUCTION COST OF OFFICE AND QUARTERS

Unit: TSh.

	Item	Unit	Q'ty	Foreign Currency	Local Currency
1.	Main Office	m^2	250	950,000	600,000
2.	Branch Office ($90m^2$ x 4)	m^2	360	1,260,000	720,000
3.	Dam Operation Office ($50m^2$ x 2)	m^2	100	250,000	150,000
4.	Work Shop	m^2	100	200,000	120,000
5.	Storehouse	m^2	1,000	1,500,000	1,000,000
6.	Quarters	m^2	1,200	4,800,000	3,000,000
7.	Motor Pool	m^2	5,000	150,000	80,000
8.	Land Reparation for Office Yard including fencing, etc.		L.S.	90,000	30,000
	Total			9,200,000	5,700,000

Table I-12 PROCUREMENT COST OF MAJOR OPERATION AND MAINTENANCE EQUIPMENT

Unit: 1,000 Yen

No.	Equipment		Unit Price	Q'ty	Total
1.	Bulldozer	16 ton	18,000	3	54,000
2.	Wheel loader	1.4 m^3	11,000	1	11,000
3.	Backhoe	0.45 m^3	13,000	1	13,000
4.	Motor grader	3.7 m	15,500	1	15,500
5.	Road Roller	8 ton	7,000	1	7,000
6.	Drag line	0.8 m^3	35,000	1	35,000
7.	Track crane	7 ton	9,000	1	9,000
8.	Tractor & trailer	25 ton	14,500	1	14,500
9.	Slope compactor	3 HP	1,300	1	1,300
10.	Concrete mixer	0.12 m^3	800	2	1,600
11.	Pump with engine	7 HP	400	4	1,600
12.	Dump truck	8 ton	6,500	3	19,500
13.	Cargo truck	6 ton	4,000	3	12,000
14.	Water tanker	4 kℓ	5,000	1	5,000
15.	Light truck, 4-wheel drive	1 ton	3,100	3	9,300
16.	Passenger car, 4-wheel drive		3,200	5	16,000
17.	Forklift	2.5 ton	2,700	1	2,700
18.	Motor cycles	90 cc	200	10	2,000
	Sub-total				230,000
	Workshop equipment and miscellaneous				24,000
	Spare parts (20%)				46,000
	Total				300,000

Table I-13 ADMINISTRATION EXPENSES

(Construction Stage)

Unit: TSh. 10^3

Year	Staff Salary /1	Labour Wage	Office Expenses	Equipment Running Cost	Other Related Cost	Total
1984	1,284	100	200	200	166	1,950
1985	1,566	200	250	200	204	2,420
1986	2,643	300	300	400	337	3,980
1987	3,525	400	300	400	455	5,080
1988	3,525	400	300	400	455	5,080
1989	2,763	300	300	300	357	4,020
1990	1,926	200	200	300	244	2,870
Total	17,232	1,900	1,850	2,200	2,218	25,400

/1 : Refer to Table I-14.

Table I-14 STAFF SALARY FOR THE PROJECT OFFICE
(Construction Stage)

Unit: TSh. 10^3

Year	Grade I		Grade II		Grade III		Grade IV		Grade V		Total
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	
1984	1	87	1	75	5	282	20	720	5	120	1,284
1985	1	87	1	75	10	564	20	720	5	120	1,566
1986	1	87	2	150	15	846	30	1,080	20	480	2,643
1987	1	87	2	150	20	1,128	40	1,440	30	720	3,525
1988	1	87	2	150	20	1,128	40	1,440	30	720	3,525
1989	1	87	2	150	15	846	30	1,080	25	600	2,763
1990	1	87	1	75	10	564	20	720	20	480	1,926
Total		609		825		5,358		7,200		3,240	17,232

Note:
- Grade I ; Project Manager, TSh. 7,250/month
- Grade II ; Senior Engineer, TSh. 6,250/month
- Grade III ; Engineer, Administrator, TSh. 4,700/month
- Grade IV ; Draftman, Surveyor, Inspector, Clerk, Typist, TSh. 3,000/month
- Grade V ; Diver, Watchman, TSh. 2,000/month
- (1) ; No. of required staff
- (2) ; Total annual salary (TSh.)

Table I-15 COST ESTIMATE OF ENGINEERING SERVICES

(Unit: US$)

Item	Quantity	Amount
1. Detailed Design Stage		
(1) Remuneration	161 M/M	1,449,000
(2) Per diem	83 M/M	124,500
(3) Air freight	30 round trips	168,750
(4) Documentation	L.S.	20,000
(5) Other related cost	L.S.	88,750
Sub-total		1,851,000 (TSh. 22.2 x 10^6 eq.)
2. Construction Stage		
(1) Remuneration	268 M/M	2,412,000
(2) Per diem	268 M/M	402,000
(3) Air freight	27 round trips	151,875
(4) Other related cost	L.S.	148,125
Sub-total		3,114,000 (TSh. 37.4 x 10^6 eq.)
Total		5,152,000 (TSh. 59.6 x 10^6 eq.)

Note: Remuneration; $9,000 per M/M on an average
Per diem; $1,500 per M/M
International freight; $5,500/round trip
Domestic freight; $125/round trip (= TSh.1,500/round trip)

Table I-16 PRICE LIST OF BASIC MATERIALS AND LABOUR WAGES

Unit: TSh.

ITEM	UNIT	UNIT PRICE
A. Materials*		
1. Ordinary portland cement	ton	1,650
2. Reinforcement bar	ton	4,400
3. Coarse aggregate	m^3	405
4. Fin aggregate	m^3	215
5. Fimber	m^3	2,250
B. Fuel		
1. Gasoline	ℓ	10.3
2. Light diesel oil	ℓ	4.7
3. Diesel engine oil	ℓ	25.0
C. Labour		
1. Common labour	Man-day	35
2. Mason	Man-day	60
3. Welder	Man-day	40
4. Carpenter	Man-day	93

* Note: The major material costs are estimated as follows:

1. Cement — Used price: Tsh.1,650.- per ton

(a) Imported cement

F.O.B. Japan	US$65-70/ton	
	Say US$70.-	
Freight, Insurance, etc.	US$40.-	
Total (CIF Tanga)	US$110.-	
	= TSh.1,320.-	eq.
Handling charge & inland transportation	TSh.330.-	
Total (CIF at site)	TSh.1,650.-	

(b) Local cement

Government price	TSh.1,240.-	ex. factory
- do -	TSh.1,360.-	at Tanga
Transportation & handling Charge	TSh.330.-	
Total (CIF at site)	TSh.1,690.-	

(c) Local cement

Retail price TSh.82-/bag of 50 kg

= TSh.1,640.- at KRTC/TCC

(d) Retail price procured during investigation

TSh.107.-/bag of 50kg

= TSh.2,140.- at Same

- to be continued -

2. Reinforcement bar — Used price: TSh.4,400.- per ton

(a) Imported steel bar

F.O.B. Japan	¥72,000/ton
Freight, Insurance, etc.	¥8,000
C.I.F. Tanga	¥80,000
	= TSh.4,000.- eq.
Handling charge & inland transportation	TSh.400.- eq.
Total (CIF at site)	TSh.4,400.- per ton

(b) Local

Ex-Store RTC Tanga	TSh.7,500.-/ton
Inland transportation and handling charge	TSh.400.-
Total (CIF at site)	TSh.7,900.- per ton

3. Gravel for concrete — Used: TSh. 400.- per m^3

(a) Local (at Same) — TSh.420.- per m^3

(b) Produced at Aggregate plant site — TSh.405.- per m^3

	At quarry	Transportation (4km)	Crushing & screening	Total
Labour	82.-	8.-	50.-	140.-
Material	80.-	10.-	30.-	120.-
Equipment	75.-	20.-	50.-	145.-
Total	237.-	38.-	130.-	405.-

4. Sand for concrete — Used: TSh.215.- per m^3

(a) Local (at Same) — TSh.80.- per m^3

(b) With Equipment — TSh.215.- per m^3

At quarry	At quarry	Transportation	Total
Material	20.-	40.-	60.-
Equipment	40.-	75.-	115.-
Labour	15.-	25.-	40.-
Total	75.-	140.-	215.-

Table I-17 LIST OF UNIT PRICE FOR MAJOR WORK ITEMS

Unit: TSh.

Work Items	Unit	Foreign Currency	Local Currency	Total
1. Stripping including site clearing	m^3	5.00	1.00	6.00
2. Excavation				
- Rock	m^3	140.00	10.00	150.00
- Dam foundation including weathered rock	m^3	24.00	6.00	30.00
- Weir foundation including de-watering	m^3	18.00	2.00	20.00
- Irrigation canal	m^3	5.00	2.00	7.00
- Drains/floodway	m^3	8.00	2.00	10.00
3. Compacted earthfill				
- Dam embankment	m^3	65.00	10.00	75.00
- River bank at intake weir	m^3	12.00	3.00	15.00
- Canal embankment	m^3	8.00	2.00	10.00
- Road embankment	m^3	8.00	1.50	9.50
- Flood dike	m^3	7.00	1.50	8.50
4. Backfill	m^3	6.50	5.00	11.50
5. Sod facing	m^2	1.00	5.00	6.00
6. Land clearing	m^2	0.46	0.08	0.54
7. Land leveling	m^3	23.00	3.00	26.00
8. Concrete works				
- Reinforced concrete	m^3	1,700	300	2,000
- Plain concrete	m^3	1,500	300	1,800
- Base concrete	m^3	1,400	300	1,700
- Concrete block lining	m^3	3,000	1,200	4,200
9. Form works for concrete	m^2	10.00	120.00	130.00
10. Reinforcement bar works	kg	6.20	2.00	8.20
11. Metalworks	kg	18.00	2.00	20.00
12. Grout works	m^3	600	300	900
13. Masonry	m^3	1,000	500	1,500
14. Gabion	m^3	500	200	700
15. Riprap	m^3	200	100	300
16. Gravel metalling	m^3	88	12	100
17. Concrete works for diversion weir/ spillway including reinforcement bars, form works and related works	m^3	2,000	1,000	3,000
18. Concrete works for intake structure including reinforcement bars, farm works and related works	m^3	2,700	1,800	4,500
19. Field ditch, drain and road construction	ha	1,500	1,000	2,500

Table I-18 ANNUAL OPERATION AND MAINTENANCE COST

Unit: TSh.

	Item	Amount
1.	Salary and Wages	
	(1) Staff salaries (see Table I-19)	1,818,000
	(2) Labour wages 200 M/M x TSh. 1,000	200,000
2.	Office Expenses L.S.	160,000
3.	Operation Cost L.S.	810,000
4.	Repair and Maintenance Cost (0.5% of direct construction cost)	
	(1) Kihurio Scheme	610,000
	(2) Ndungu Scheme	220,000
	(3) Gonja Scheme	220,000
	(4) Kisiwani Scheme	130,000
	(5) Igoma Scheme	570,000
5.	Miscellaneous	562,000
	Total	5,300,000

TAble I-19 STAFF SALARY AT O&M STAGE

Unit: TSh.

Item	Required Number	Monthly Rate	Yearly Amount
1. Project Office			
(1) Project Manager	1	7,250	87,000
(2) Senior Engineer	1	6,250	75,000
(3) Engineer	2	4,700	112,800
(4) Administrator	1	4,700	56,400
(5) Accountant	1	4,700	56,400
(6) Clerk/Typist/Surveyor	6	3,000	216,000
(7) Mechanic	1	4,700	56,400
(8) O&M Equipment Operator	5	3,000	180,000
(9) Driver	5	2,000	120,000
2. Branch Office			
(1) Engineer	5	4,700	282,000
(2) Gate Keeper	7	2,000	168,000
(3) Watchment	17	2,000	408,000
Total	52		1,818,000

Table I-20 REPLACEMENT COST AND USEFUL LIFE

Item	Useful Life (Year)	Replacement Cost (TSh.10^3)
1. O&M Equipment (See Table I-12)		
(1) Heavy equipment	10	10,000
(2) Vehicles & small equipment	5	5,000
2. Project Facilities		
(1) Igoma and Kalimawe dam, gate	25	300
(2) Intake facilities, gate	25	2,000
(3) Irrigation facilities, gate	25	16,000

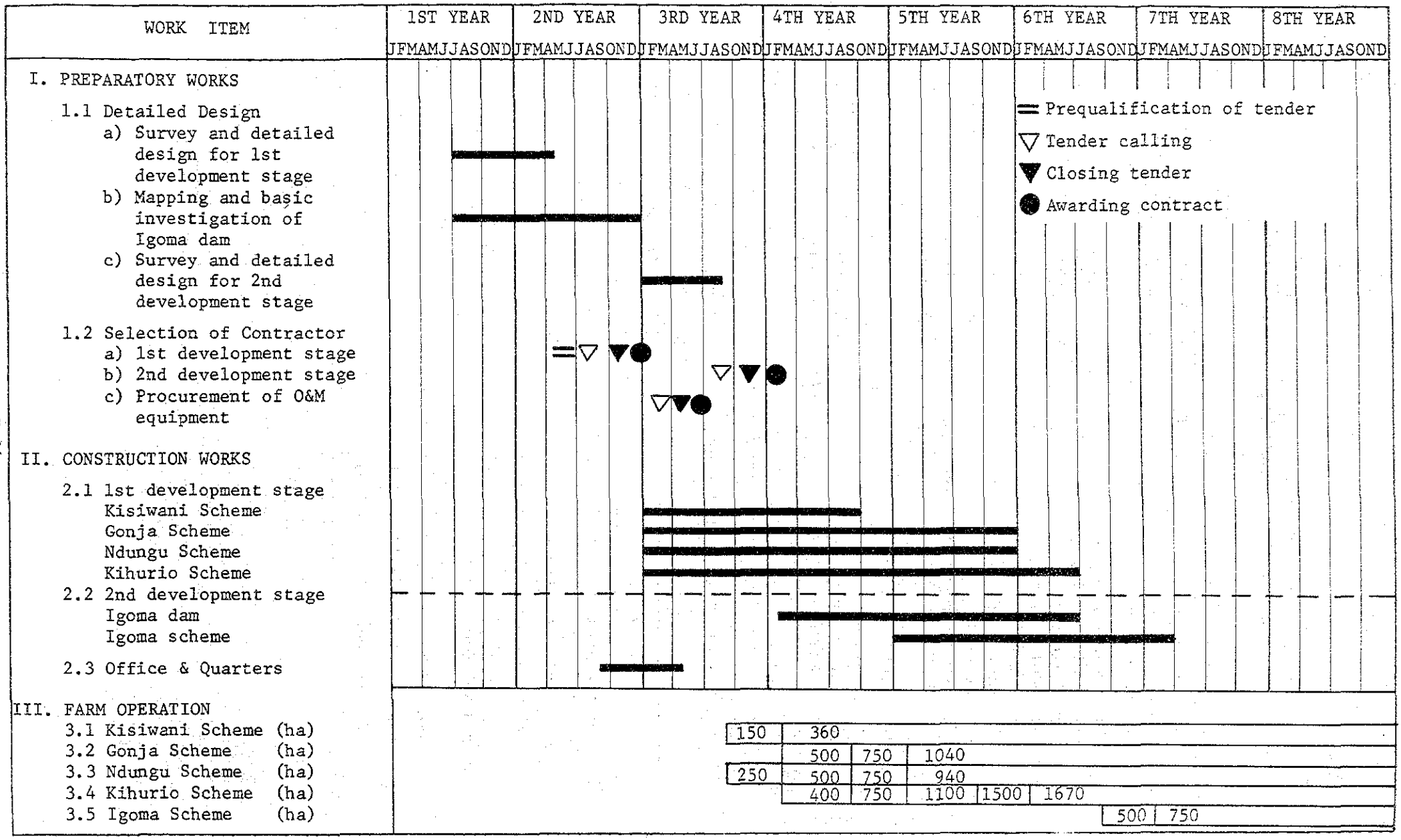

Fig. I-1 PROJECT IMPLEMENTATION SCHEDULE

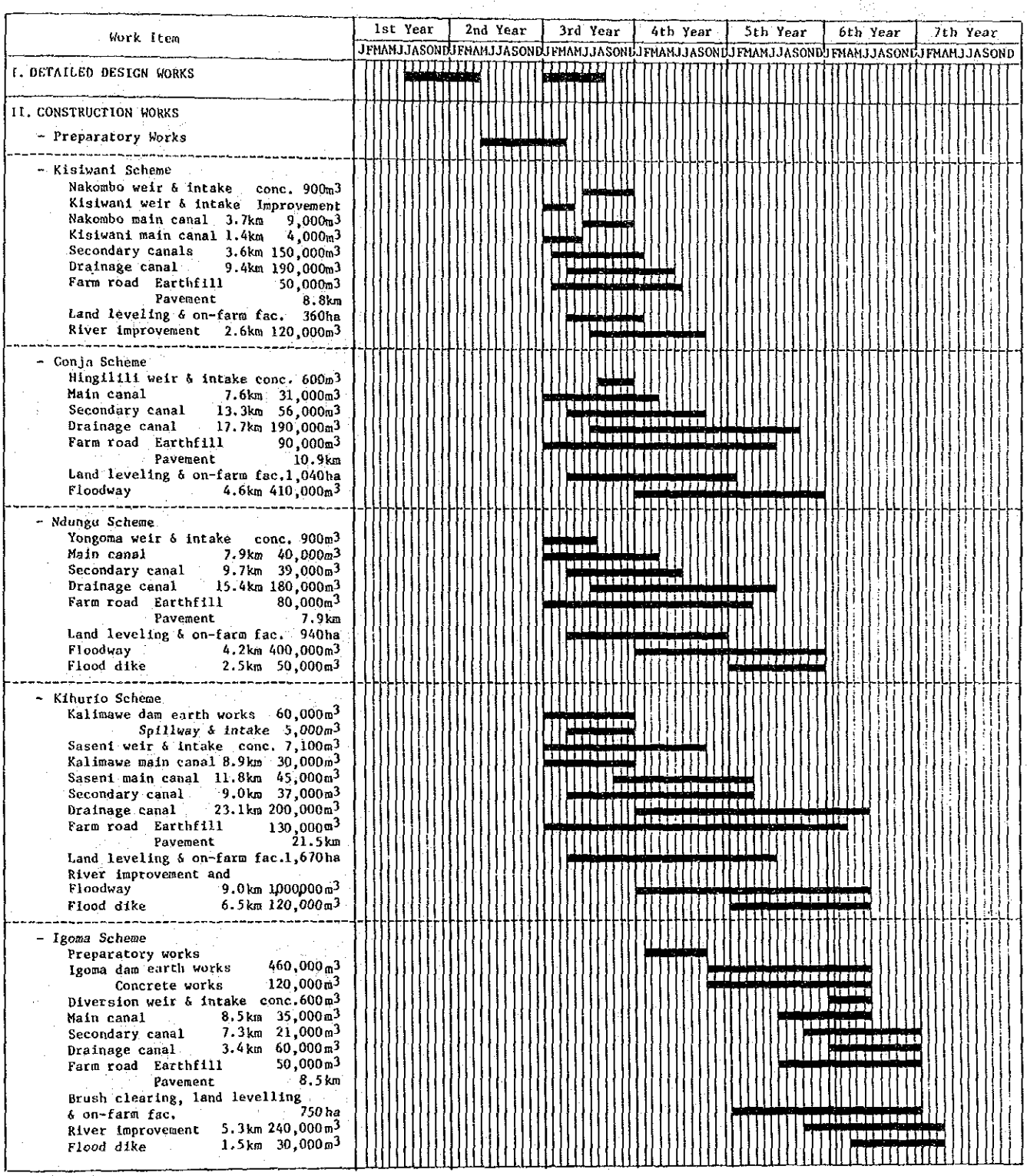

Fig. I-2 PROJECT CONSTRUCTION SCHEDULE

ANNEX J

PROJECT EVALUATION

ANNEX J

PROJECT EVALUATION

CONTENTS

LIST OF TABLES

1. GENERAL

The economic feasibility of the Mkomazi Valley Area Irrigation Development Project is evaluated in terms of the internal rate of return (IRR) for the five individual schemes and also for the whole project. In this evaluation, the sensitivity analysis is also made, aiming to asess the elasticity range of the project under changeable conditions in future such as over-run of the project cost, delay of the attainment to production target, decline of the market prices of crops. The financial evaluation is also carried out by analyzing the farm budget and by preparing a financial statement for the project as a whole. The farm budget analysis is made for assessment of the net reserve of the average farm household. The analysis of financial statement of the project is made to evaluate the repayment capacity on the basis of the estimated fund requirement with assumed financial terms of the anticipated loan and the expected revenue from the project. The socio-economic impact from the implementation of the project which would give the effects on the regional development, is also studied briefly.

2. BASIC CONSIDERATION FOR PRICE PROSPECTS

The prospective costs and prices of farm products, farm inputs, construction materials and equipment etc. are studied to assess the economic and financial prices for the purpose of evaluating both economic and financial viabilities of the project. In this context, all the conversions between the local currency portion and foreign currency portion are made at the exchange rate of TSh.12.00 equal to US$1.00 in terms of the financial prices, and at TSh.13.50 equal to US$1.00 in terms of the economic prices, taking into account the shadow price factor (SPF) at 1.12 as mentioned in ANNEX E. In addition, in the capitalization of the financial cost, the annual price escalations at 5% and 15% are preliminarily applied to the foreign currency portion and the local currency portion, respectively.

2.1 Economic Prices

The economic farm gate prices of farm inputs and outputs are estimated on the basis of the projected international market price forcasted by IBRD as stated in ANNEX E.

The economic prices of the construction materials and equipment to be imported from abroad are estimated based on the CIF prices in Dar es Salaam which are preliminarily converted from the present FOB prices in Japan, and prices and costs related to the inland transportation between Dar es Salaam and Same. In this context, the border prices are converted to local curency by applying SPF at 1.12.

As for the local materials, 10% of the financial price is assumed to be transfer payment such as direct/indirect taxes and duties, so that the economic prices of the local materials are obtained by deducting the transfer payment from the financial prices.

2.2 Financial Prices

All of the prices and costs related to the construction and farming are estimated on the basis of the current market prices as of the middle of 1983.

3. ECONOMIC EVALUATION

3.1 Economic Cost

The total economic cost of the project is as shown in Table J-1 and Table J-2, and summarized below:

Scheme	Total Economic Cost (TSh. x 10^3)
Kisiwani	45,400
Gonja	83,500
Ndungu	81,600
Kihurio	178,500
Igoma	169,200
Total	558,200

In the above economic costs, the physical contingency is estimated at 10% of the direct construction cost.

According to the construction schedule proposed in ANNEX I and the work quantities, the flows of the project costs, O & M cost and replacement cost are made as shown in Table J-3.

3.2 Project Benefits

3.2.1 Agricultural benefit

The agricultural benefit is evaluated as the difference of net income from crops in future between "without project" and "with project" as mentioned in ANNEX E.

The crop production gradually increase after commencement of the partial operation of the project. The construction work for the whole project area will be completed in 1990, and the full development stage will be attained in 1996.

The gross direct benefits at the full development stage are estimated at TSh.112,270 x 10^3 per annum in the whole project.

The production losses for 70 ha of farm land due to submargence by hightening the Kalimawe dam are estimated at TSh.107 x 10 per annum. These losses or negative benefits are counted in the estimate of the primary icremental production value by deducting these values from the net production value in the Kihurio scheme.

Accordingly, the net direct benefits amount to TSh.112,100 x 10^3 per annum in the whole project at the full development stage,

as shown in the table below:

Unit: TSh. x 10^3

Scheme	Net Return With Project	Net Return Without Project	Negative Net Benefit	Net Direct Benefit
Kisiwani	10,350	1,910	-	8,440
Gonja	20,550	3,160	-	17,390
Ndungu	20,690	3,240	-	17,450
Kihurio	51,560	6,840	170	44,550
Igoma	24,310	40	-	24,270
Whole Project	127,460	15,190	170	112,100

3.2.2 Flood protection benefit

According to the result of field investigation and interpretation of aerial photograph (1:20,000) and topographic map (1:5,000), the land being affected by seasonal floods is estimated 750 ha every year. The area affected by probable flood once in 2 years occurrence, that of once in 10 years and that of once in 20 years is estimated 1,200 ha, 2,000 ha and 3,000 ha, respectively.

By virtue of the proposed flood protection facilities, the existing marshy and swampy area of 750 ha is changed to arable land, furthermore, about 2,000 ha of arable land including the above new arable land is protected from seasonal inundation, so that the prospective agricultural production from the area is secured completely.

In addition to the above direct benefit, the certain amount of flood damages ad losses are decreased by the proposed facilities. The damages and losses consist of damage to properties including houses, damage to roads, losses due to suspension of business and losses due to interruption of traffic. These are estimated as shown in Table J-4 to J-14 and summarized below.

Unit: TSh. x 10^3

Item	Return period			
	1.01	2	10	20
Damage to properties incl. houses	0	0	74	231
Damage to roads	0	0	4	14
Losses due to suspension of business	0	17	124	224
Losses due to interruption of transport	0	35	136	268
Total	0	52	338	737

As the proposed flood protection facilities are designed to have a capacity of once in 20 year probable flood, the average annual flood protection benefit is calculated at about TSh.120 x 10^3 by integration of the flood damages caused by each probable flood as shown below.

Unit: TSh. x 10^3

Scheme	Flood Protection Benefit
Kisiwani	10
Gonja	30
Ndungu	20
Kihurio	40
Igoma	20
Total	120

3.2.3 Benefit of water release for potable water

A certain amount of water will be released from the Igoma dam throughout the year for potable water use for the houses in the Igoma scheme. The value of this water is evaluated in monetary terms on the assumption that as the alternative use, this water is used for the crop production which is the most beneficial use.

The valuation is made based on the following expression:

$$Wv = \frac{Ab}{Ir} \times Po \times Dw$$

Where, Wv : value of water release
Ab : annual agricultural benefit (TSh. 24,270 x 10^3)
Ir : annual irrigation requirement (16,500 x 10^3 m^3)
Po : total population in the Igoma scheme (7,800 persons in 2000)
Dw : annual potable water requirement per capita (36.5 m^3)

According to the above calculation, the water value is estimated at about TSh. 420 x 10^3 and counted as the project benefit in the economic evaluation.

3.3 Economic Evaluation

3.3.1 Internal rate of return

On the basis of the project benefits and cost estimated in the above, the internal rate of return (IRR) of the Mkomazi Valley Area Irrigation Development Project is calculated individually for the five development schemes and for the whole project. In this calculation,

project benefits are estimated based on the direct benefits derived from the crop production to be attributable to flood protection and irrigation and drainage development as mentioned before. The benefit derived from the livestock production, which will also be incremented to a certain extent with the proposed project implementation, are conceptionally excluded from this evaluation.

The IRR is calculated based on a 50 years project life from 1984 which will be the starting year of project implementation.

The results of calculation are as shown in Table J-3 and are summarized as follows:

Scheme	Internal Rate of Return (%)
Kisiwani	17.3
Gonja	20.2
Ndungu	20.3
Kihurio	21.6
Igoma	12.1
Whole Project	19.0

As shown in the above table, IRR is calculated at 19.0% for the whole project and shows that the project is economically feasible.

3.3.2 Sensivity analysis

In order to evaluate further the soundness of the project, the sensitivity analysis is made for the following critical conditions in terms of internal rate of return.

1) Over-run of the project cost.
2) Decline of the forcasted market price of products.
3) Over-run of the build-up period.

Te following eight cases are examined for the above critical conditions.

	I	II	III	IV	V	VI	VII	VII
Cost	0	0	+10%	+10%	+10%	+20%	+20%	+20%
Benefit	-10%	-20%	0%	-10%	-20%	0	-10%	-20%

The following table shows the calculated result of IRR for each case. As shown in the table, the elasticity of the project feasibility for the critical condition is not so sensitive ranging from 12.2% under the most adverse conditions caused by 20% price decline and 20% cost over-run to 19.0 under the normal conditions assumed.

Unit: %

Cost Over-run	Benefit Decline 0%	10%	20%
0%	19.0	17.0	14.9
10%	17.2	15.3	13.4
20%	15.6	13.9	12.2

4. FINANCIAL EVALUATION

4.1 General

The financial feasibility of the project is evaluated from the viewpoint of farmer's economy. In this connection, the assessment on the amount of water charges to be collected from the water users is made on preliminary basis. The study on the capability of capital cost repayment is also made on the project level by preparing the cash flow table.

4.2 Financial Cost

Based on the current market prices and costs as of middle of 1983, the financial cost of the project is estimated at TSh.734,000 x 10^3 including price contingency as shown in Tables J-15 and J-16. In this estimation, the physical contingency also includes 10% of the direct construction cost.

4.3 Capacity to Pay

For evaluating the project feasibility from the financial aspect of farmers, average farm budget analysis is made in both the future with and without project conditions as studied in ANNEX E and the result is outlined below:

Item	Without Project Condition	With Project Condition
A) Gross Income	8,000	31,920
B) Gross Outgo	8,000	17,310
C) Net Reserve (Capacity to pay)	0	14,610

The expected capacity to pay of average farm household will be TSh.14,610 in the future with project condition.

4.4 Water Charge

When the project facilities are completed and irrigation water is released to the farmer, but if the water charge is not collected, all the cost of the project will have to be borne by the Government, and such expenditure will become a heavy hurden to the Government. It is generally understood that a water charge is imposed to the water users,

and the water charges thus collected are used for the payment of O & M cost and replacement cost expenditures incurred to the project and for the repayment of the capital cost of the project. In Tanzania, however, no specific regulation on water charges has been established, and hence, the farmers are now using the irrigation water freely based on traditional rights.

The annual O & M cost and replacement cost required for the project are estimated at TSh.8,780 x 10^3 which is equivalent to about TSh.1,200/user/year. This correspond to about 10% of the capaity to pay aforementioned. On the other hand, the full charge to the water users for repayment are estimated at about TSh. 6,300/user/year corresponding to about 45% of the capacity to pay.

The water charge to be collected from the water users should be within a reasonable range in the capacity to pay that could still give sufficient incentive to the farmers. With this view, the prospective water charge is recommended to cover the required O & M and replacement costs. This prospective water charge would be the project revenue.

4.5 Repayment of Project Cost

The financial evaluation of the project is made by examining the repayment capability for the capital cost of the project. For the examination, the cash flow table using the anticipated project revenue and fund requirement are prepared.

In the examination of repayment capability, it is assumed that the capital required for the project implementation will be arranged under the following conditions.

1) For the foreign currency portion, the capital is financed by bilateral or international organizations with an interest rate of 3.0% per annum for a repayment period of 30 years including 10-year grace period.

2) For the local currency portion, the capital is financed by the budget allocation of the Government with no repayment.

Based on the above conditions, the repayment schedule for the foreign currency portion is prepared as shown in Table J-17.

5. SOCIO-ECONOMIC IMPACTS

In additon to the direct benefit stipulated in the economic evaluation, favorable but intangible socio-economic impacts are expected from the implementation of the project.

5.1 Foreign Exchange Saving

After completion of the project, production of paddy will increase to about 32,800 tons per annum from the present production of 2,600 tons. The expected annual increment of the production will be about 30,200 tons. Out of this increased production, it is expected that the marketable paddy would be about 23,000 tons (or 14,300 tons of rice) after deducting the home consumption as stated in ANNEX E. Thus, the estimated foreign exchange saving would amount to about US$8,250 x 10^3 per annum for substitution of imported rice.

5.2 Increase of Employment Opportunity to Local people

Employment opportunity to the local people will be increased by the project implementation, and a favourable impact will be given to the national economy. Furthermore, the employee will be able to gain more experience, technical know-how, skillfulness in the various working fields. These accumulations would be applied to the future development in the Region.

5.3 Improvement of Local Transportation

The local transportation will be much improved by the construction of the operation and maintenance roads along the irrigation canals. The expanded road system will not only enhance the economic activities in the project area but also contribute to inter-regional accessibility and communication.

5.4 Improvement of Environmental Sanitation

The construction of the project works would have a possitive effect on the overall ecology of the project area. The health and sanitary conditions would become better with drainage improvement as well as supply of fresh water through the irrigation canals.

5.5 Settlement from the Densely Populated Highland

After completion of the project works, about 870 ha of new arable land will be developed through construction of the dam in the Igoma scheme and improvement of the drainage conditions in the Kihurio scheme

as stated in ANNEX E. This newly developed land will be able to accept migrants from the highland in the South Pare Mountains where are densely populated. In consequence, some reformations for shortage of arable land in the highland will be expected.

Table J-1 SUMMARY OF ECONOMIC COST

Unit: TSh.10^3

Item	Economic Cost
1. Preparatory Works	21,160
2. Igoma Dam	80,170
3. Intake facilities	37,020
4. Canal and Roads	
(1) Irrigation canals	71,610
(2) Drainage canals	29,470
(3) Farm roads	10,610
5. Floodway & Flood Dike	24,910
6. Rehabilitation of Existing Dam	20,430
7. On-farm Development	75,210
8. Office and Quarter	15,430
Sub-Total	386,020
9. O & M Equipment	17,700
10. Engineering Services and Administration Expenses	104,200
11. Physical Contingency	50,280
Sub-Total	172,620
Total	558,200

Table J-2 ANNUAL DISBURSEMENT SCHEDULE OF ECONOMIC COST

Unit: TSh. x 10^3

Item	Total	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
1. Preparatory Works	21,160	-	7,150	2,850	6,920	2,670	1,190	380
2. Igoma Dam	80,170	-	-	-	20,850	39,680	19,640	-
3. Intake Facilities	37,020	-	-	22,820	11,460	-	2,740	-
4. Canals and Roads								
(1) Irrigation Canals	71,610	-	-	36,410	24,450	5,320	5,430	-
(2) Drainage Canals	29,470	-	-	6,030	11,720	6,850	4,870	-
(3) Farm Roads	10,610	-	-	3,700	3,520	2,070	1,320	-
5. River Improvement/ Floodway & Flood Dike	24,910	-	-	430	8,710	10,940	4,290	540
6. Rehabilitation of Existing Dam	20,430	-	-	20,430	-	-	-	-
7. On-farm Development	75,210	-	-	25,380	30,630	11,420	7,780	-
8. Office and Quarter	15,430	-	9,220	6,210	-	-	-	-
Sub-total	386,020	-	16,370	124,260	118,260	78,950	47,260	920
9. O & M Equipment	17,700	-	-	3,360	14,340	-	-	-
10. Administration Expenses	22,860	1,800	2,160	3,600	4,590	4,590	3,600	2,520
11. Engineering Services	81,340	7,000	12,690	22,640	12,240	13,990	12,240	540
Sub-total	121,900	8,800	14,850	29,600	31,170	18,580	15,840	3,060
Total	507,920	8,800	31,220	153,860	149,430	97,530	63,100	3,980
12. Physical Contingency	50,280	900	3,080	15,340	14,670	9,570	6,300	420
Grand Total	558,200	9,700	34,300	169,200	164,100	107,100	69,400	4,400

Table J-3 (1/6) ECONOMIC COST AND BENEFIT FLOW
(Whole Project)

Unit: TSh. x 10^3

Year in Order	Year (Tentative)	Economic Cost				Economic Benefit		
		Construction Cost	Replacement Cost	O & M Cost	Total	Agricultural Benefit	Other Benefit	Total
1	1984	9,700	-	-	9,700	-	-	-
2	1985	34,300	-	-	34,300	-	-	-
3	1986	169,200	-	450	169,650	5,500	20	5,520
4	1987	164,100	-	2,610	166,710	46,580	60	46,640
5	1988	107,100	-	3,750	110,850	76,980	120	77,100
6	1989	69,400	-	4,260	73,660	103,290	540	103,830
7	1990	4,400	-	4,710	9,110	108,120	540	108,660
8	1991	-	5,600	4,710	10,310	110,750	540	111,290
9	1992	-	-	4,710	4,710	111,740	540	112,280
10	1993	-	-	4,710	4,710	112,100	540	112,640
13	1996	:	16,800	:	21,510	:	:	:
:	:	:		:		:	:	:
18	2001	:	5,600	:	10,310	:	:	:
:	:	:		:		:	:	:
23	2006	:	16,800	:	21,510	:	:	:
:	:	:		:		:	:	:
28	2011	:	22,400	:	27,110	:	:	:
:	:	:		:		:	:	:
31	2014	:	3,700	:	8,410	:	:	:
:	:	:		:		:	:	:
33	2016	:	16,800	:	21,510	:	:	:
:	:	:		:		:	:	:
38	2021	:	5,600	:	10,310	:	:	:
:	:	:		:		:	:	:
43	2026	:	16,800	:	21,510	:	:	:
:	:	:		:		:	:	:
48	2031	:	5,600	:	10,310	:	:	:
:	:	:		:		:	:	:
50	2033	-	-	4,710	4,710	112,100	540	112,640

IRR: 19.0

Table J-3 (2/6) ECONOMIC COST AND BENEFIT FLOW
(Kisiwani Scheme)

Unit: TSh. x 10^3

Year in Order	Year (Tentative)	Economic Cost				Economic Benefit		
		Construction Cost	Replacement Cost	O & M Cost	Total	Agricultural Benefit	Other Benefit	Total
1	1984	3,600	-	-	3,600	-	-	-
2	1985	5,700	-	-	5,700	-	-	-
3	1986	29,200	-	180	29,380	1,890	10	1,900
4	1987	6,900	-	360	7,260	7,300	10	7,310
5	1988	-	-	360	360	8,150	10	8,160
6	1989	-	-	360	360	8,440	10	8,450
8	1991	:	450	:	810	:	:	:
:	:	:		:		:	:	:
13	1996	:	1,230	:	1,590	:	:	:
:	:	:		:		:	:	:
18	2001	:	450	:	810	:	:	:
:	:	:		:		:	:	:
23	2006	:	1,230	:	1,590	:	:	:
:	:	:		:		:	:	:
28	2011	:	2,240	:	2,600	:	:	:
:	:	:		:		:	:	:
33	2016	:	1,230	:	1,590	:	:	:
:	:	:		:		:	:	:
38	2021	:	2,240	:	2,600	:	:	:
:	:	:		:		:	:	:
43	2026	:	1,230	:	1,590	:	:	:
:	:	:		:		:	:	:
48	2031	:	2,240	:	2,600	:	:	:
:	:	:		:		:	:	:
50	2033	-	-	360	360	8,440	10	8,450

IRR: 17.3

Table J-3 (3/6) ECONOMIC COST AND BENEFIT FLOW
(Gonja Scheme)

Unit: TSh. x 10^3

Year in Order	Year (Tentative)	Economic Cost				Economic Benefit		
		Construction Cost	Replacement Cost	O & M Cost	Total	Agricultural Benefit	Other Benefit	Total
1	1984	4,600	-	-	4,600	-	-	-
2	1985	10,800	-	-	10,800	-	-	-
3	1986	32,900	-	270	33,170	3,950	10	3,960
4	1987	27,000	-	540	27,540	13,550	30	13,580
5	1988	7,600	-	1,080	8,680	16,680	30	16,710
6	1989	-	-	1,080	1,080	17,340	30	17,370
7	1990	-	-	1,080	1,080	17,390	30	17,420
8	1991	:	1,230	:	2,310	:	:	:
:	:	:		:		:	:	:
13	1996	:	3,700	:	4,780	:	:	:
:	:	:		:		:	:	:
18	2001	:	1,230	:	2,310	:	:	:
:	:	:		:		:	:	:
23	2006	:	3,700	:	4,780	:	:	:
:	:	:		:		:	:	:
28	2011	:	1,230	:	2,310	:	:	:
29	2012	:	4,370	:	5,450	:	:	:
:	:	:		:		:	:	:
33	2016	:	3,700	:	4,780	:	:	:
:	:	:		:		:	:	:
38	2021	:	1,230	:	2,310	:	:	:
:	:			:		:	:	:
43	2026	:	3,700	:	4,780	:	:	:
:	:	:		:		:	:	:
48	2031	:	1,230	:	2,310	:	:	:
:	:	:		:		:	:	:
50	2033	-	-	1,080	1,080	17,390	30	17,420

IRR: 20.2

Table J-3 (4/6) ECONOMIC COST AND BENEFIT FLOW
(Ndungu Scheme)

Unit: TSh. x 10^3

Year in Order	Year (Tentative)	Economic Cost				Economic Benefit		
		Construction Cost	Replacement Cost	O & M Cost	Total	Agricultural Benefit	Other Benefit	Total
1	1984	4,700	-	-	4,700	-	-	-
2	1985	13,800	-	-	13,800	-	-	-
3	1986	29,400	-	230	29,630	3,610	10	3,610
4	1987	25,400	-	450	25,850	12,240	10	12,250
5	1988	8,300	-	900	9,200	16,560	20	16,580
6	1989	-	-	900	900	17,360	20	17,380
7	1990	-	-	900	900	17,450	20	17,470
8	1991	:	1,120	:	2,020	:	:	:
:	:	:		:		:	:	:
13	1996	:	3,360	:	4,260	:	:	:
:	:	:		:		:	:	:
18	2001	:	1,120	:	2,020	:	:	:
:	:	:		:		:	:	:
23	2006	:	3,360	:	4,260	:	:	:
:	:	:		:		:	:	:
28	2011	:	1,120	:	2,020	:	:	:
29	2012	:	4,030	:	4,930	:	:	:
:	:	:		:		:	:	:
33	2016	:	3,360	:	4,260	:	:	:
:	:	:		:		:	:	:
38	2021	:	1,120	:	2,020	:	:	:
:	:	:		:		:	:	:
43	2026	:	3,360	:	4,260	:	:	:
:	:	:		:		:	:	:
48	2031	:	1,120	:	2,020	:	:	:
:	:	:		:		:	:	:
50	2033	-	-	900	900	17,450	20	17,470

IRR: 20.3

Table J-3 (5/6) ECONOMIC COST AND BENEFIT FLOW
(Kihurio Scheme)

Unit: TSh. x 10^3

Year in Order	Year (Tentative)	Economic Cost				Economic Benefit		
		Construction Cost	Replacement Cost	O & M Cost	Total	Agricultural Benefit	Other Benefit	Total
1	1984	6,900	-	-	6,900	-	-	-
2	1985	16,200	-	-	16,200	-	-	-
3	1986	59,200	-	-	59,200	-	-	-
4	1987	62,800	-	450	63,250	14,140	30	14,170
5	1988	23,900	-	1,130	25,030	32,010	40	32,050
6	1989	9,500	-	1,710	11,210	42,300	40	42,340
7	1990	-	-	1,710	1,710	44,160	40	44,200
8	1991	-	2,020	1,710	3,730	44,550	40	44,590
13	1996	:	5,940	:	7,650	:	:	:
:	:	:		:		:	:	:
18	2001	:	2,020	:	3,730	:	:	:
:	:	:		:		:	:	:
23	2006	:	5,940	:	7,650	:	:	:
:	:	:		:		:	:	:
28	2011	:	2,020	:	3,730	:	:	:
29	2012	:	6,610	:	8,320	:	:	:
:	:	:		:		:	:	:
33	2016	:	5,940	:	7,650	:	:	:
:	:	:		:		:	:	:
38	2021	:	2,020	:	3,730	:	:	:
:	:	:		:		:	:	:
43	2026	:	5,940	:	7,650	:	:	:
:	:	:		:		:	:	:
48	2031	:	2,020	:	3,730	:	:	:
:	:	:		:		:	:	:
50	2033	-	-	1,710	1,710	44,550	40	44,590

IRR: 21.6

Table J-3 (6/6) ECONOMIC COST AND BENEFIT FLOW
(Igoma Scheme)

Unit: TSh. x 10^3

Year in Order	Year (Tentative)	Economic Cost				Economic Benefit		
		Construction Cost	Replacement Cost	O & M Cost	Total	Agricultural Benefit	Other Benefit	Total
1	1984	-	-	-	-	-	-	-
2	1985	4,900	-	-	4,900	-	-	-
3	1986	47,300	-	-	47,300	-	-	-
4	1987	63,100	-	-	63,100	-	-	-
5	1988	52,100	-	260	52,360	3,840	20	3,860
6	1989	1,800	-	660	2,460	17,870	440	18,310
7	1990	-	-	660	660	20,680	440	21,120
8	1991	-	-	660	660	22,920	440	23,360
9	1992	-	-	660	660	23,910	440	24,350
10	1993	-	900	660	1,560	24,270	440	24,710
15	1998	:	2,580	:	3,240	:	:	:
:	:	:		:		:	:	:
20	2003	:	900	:	1,560	:	:	:
:	:	:		:		:	:	:
25	2008	:	2,580	:	3,240	:	:	:
:	:	:		:		:	:	:
30	2013	:	4,590	:	5,250	:	:	:
:	:	:		:		:	:	:
35	2018	:	2,580	:	3,240	:	:	:
:	:	:		:		:	:	:
40	2023	:	900	:	1,560	:	:	:
:	:	:		:		:	:	:
45	2028	:	2,580	:	3,240	:	:	:
:	:	:		:		:	:	:
50	2033	-	900	660	1,560	24,270	440	24,710

IRR: 12.1

Table J-4 INUNDATED AREA

Unit: ha

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	40	90	120	190
Gonja	180	250	390	770
Ndungu	230	390	680	950
Kihurio	200	370	580	820
Igoma	100	160	210	270
Total	750	1,260	1,980	3,000

Table J-5 SUBMERGED HOUSE

Unit: Nos.

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	0	0	0	0
Gonja	0	0	0	0
Ndungu	0	0	0	12
Kihurio	0	0	20	50
Igoma	0	0	0	0
Total	0	0	20	62

Table J-6 DAMAGE TO PROPERTIES INCLUDING HOUSES

Unit: TSh. 10^3

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	0	0	0	0
Gonja	0	0	0	0
Ndungu	0	0	0	45
Kihurio	0	0	74	186
Igoma	0	0	0	0
Total	0	0	74	231

Note: Properties of one family including house is assumed at TSh.30,000.

Damage rate to properties is variable from 0.124 to 0.572 according to inundation depth. (Source: Outline of Economic Survey on Flood Control prepared by Ministry of Construction, Japan)

TABLE J-7 LOSSES DUE TO SUSPENSION OF BUSINESS

Unit: TSh. 10^3

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	0	0	0	0
Gonja	0	0	0	0
Ndungu	0	0	0	3
Kihurio	0	0	4	11
Igoma	0	0	0	0
Total	0	0	4	14

Note: 6% of damage to houses and properties

Table J-8 SUBMERGENCE OF ROAD AND CULVERT

Unit: m, (Nos.)

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	0	0	150	250
			(0.5)	(1)
Gonja	0	200	800	1,400
			(0.5)	(1)
Ndungu	0	0	0	0
Kihurio	0	400	700	900
			(0.5)	(1)
Igoma	0	0	700	1,200
			(0.5)	(1)
Total	0	600	2,350	3,750
			(2)	(4)

Note: Figure in the brakets is a number of culvert broken by the flood.

Table J-9 DAMAGE TO ROADS

Unit: TSh. 10^3

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	0	0	19	37
Gonja	0	6	37	69
Ndungu	0	0	0	0
Kihurio	0	11	34	55
Igoma	0	0	34	63
Total	0	17	124	224

Table J-10 PERIOD OF INTERRUPTION OF TRAFFIC

Unit: Days

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	0	0	16	32
Gonja	0	6	17	33
Ndungu	0	0	0	0
Kihurio	0	11	16	32
Igoma	0	0	17	33

Table J-11 LOSSES DUE TO INTERRUPTION OF TRAFFIC

Unit: TSh. 10^3

Scheme	Return Period			
	1.01	2	10	20
Kisiwani	0	0	33	66
Gonja	0	12	35	68
Ndungu	0	0	0	0
Kihurio	0	23	33	66
Igoma	0	0	35	68
Total	0	35	136	268

Note: D = I.P.R.S.

where D: Losses due to interruption of traffic

I: Income of passengers per day (=TSh.23)

P: Number of passengers per day (=200 persons)

R: Ratio of working persons to the entire passengers (=0.45)

S: Period of interruption of traffic

Table J-12 ANNUAL INUNDATED AREA

Unit: ha

Return period	Probability	Difference	Inundated area	Average	Annual	Accumulated area
1.01	0.99		750	750	740	740
2	0.50	0.49	1,260	1,000	490	1,230
10	0.10	0.40	1,980	1,620	640	1,870
20	0.05	0.05	3,000	2,490	120	1,990

Table J-13 TOTAL DAMAGE

Unit: TSh.10^3

Item	Return Period			
	1.01	2	10	20
Damage to properties including houses	0	0	74	231
Losses due suspension of business	0	0	4	14
Damage to road	0	17	124	224
Losses due to interruption of traffic	0	35	136	268
Total	0	52	338	737

Table J-14 ANNUAL DAMAGE

Unit: TSh.10^3

Return period	Probability	Difference	Damage	Average	Annual	Accomulated
1.01	0.99		0	0	0	0
2	0.50	0.49	52	26	13	13
10	0.10	0.40	338	195	78	91
20	0.05	0.05	737	538	27	118

Table J-15 SUMMARY OF FINANCIAL COST

Unit: TSh.10^3

Item	Foreign Currency	Local Crrency	Total
1. Preparatory Works	14,120	5,850	19,970
2. Igoma Dam	56,800	18,400	75,200
3. Intake Facilities	24,090	11,150	35,240
4. Canals and Roads			
(1) Irrigation canals	48,330	19,420	67,750
(2) Drainage canals	19,220	8,830	28,050
(3) Farm roads	7,680	2,230	9,910
5. Floodway & Flood Dike	18,320	4,880	23,200
6. Rehabilitation of Existing Dam	13,900	5,400	19,300
7. On-farm Development	51,440	19,640	71,080
8. Office and Quarter	9,200	5,700	14,900
Sub- total	263,100	101,500	364,600
9. O & M Equipment	15,000	1,000	16,000
10. Administration Expenses	-	25,400	25,400
11. Engineering Services	59,600	16,200	75,800
Sub-total	74,600	42,600	117,200
Total	337,700	144,100	481,800
12. Physical Contingency	33,300	14,900	48,200
Total	371,000	159,000	530,000
13. Price Contingency	81,000	123,000	204,000
Grand Total (US10^6)	452,000 (37.7)	282,000 (23.5)	734,000 (61.2)

Note: Price Contingency: Foreign currency 5%, Local currency 15%

US$1.00 = TSh.12.00 = ¥240.-

Table J-16 ANNUAL DISBURSEMENT SCHEDULE OF FINANCIAL COST

Unit: TSh.10^3

Item	Investment			1st Year		2nd Year		3rd Year		4th Year		5th Year		6th Year		7th Year	
	FC	LC	Total	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparatory Works	14,120	5,850	19,970	-	-	4,700	2,100	1,900	800	4,700	1,840	1,800	710	800	320	220	80
2. Igoma Dam	56,800	18,400	75,200	-	-	-	-	-	-	14,600	5,000	28,200	9,000	14,000	4,400	0	0
3. Intake Facilities	24,090	11,150	35,240	-	-	-	-	14,780	6,960	7,500	3,400	-	-	1,810	790	-	-
4. Canals and Roads																	
(1) Irrigation Canals	48,330	19,420	67,750	-	-	-	-	24,780	9,620	16,230	6,970	3,700	1,300	3,620	1,530	-	-
(2) Drainage Canals	19,220	8,830	28,050	-	-	-	-	4,040	1,670	7,600	3,560	4,480	2,040	3,100	1,560	-	-
(3) Farm Roads	7,680	2,230	9,910	-	-	-	-	2,700	750	2,500	800	1,510	420	970	260	-	-
5. River Improvement/ Floodway and Flood Dike	18,320	4,880	23,200	-	-	-	-	300	100	6,470	1,630	8,010	2,190	3,140	860	400	100
6. Rehabilitation of Existing Dam	13,900	5,400	19,300	-	-	-	-	13,900	5,400	-	-	-	-	-	-	-	-
7. On-Farm Development	51,440	19,640	71,080	-	-	-	-	17,200	6,800	21,400	7,400	7,700	3,100	5,140	2,340	-	-
8. Office and Quarter	9,200	5,700	14,900	-	-	5,500	3,400	3,700	2,300	-	-	-	-	-	-	-	-
Sub-total	263,100	101,500	364,600	-	-	10,200	5,500	83,300	34,400	81,000	30,600	55,400	18,760	32,580	12,060	620	180
9. O & M Equipment	15,000	1,000	16,000	-	-	-	-	3,000	-	12,000	1,000	-	-	-	-	-	-
10. Administration Expenses	-	25,400	25,400	-	2,000	-	2,400	-	4,000	-	5,100	-	5,100	-	4,000	-	2,800
11. Engineering Services	59,600	16,200	75,800	7,000	2,400	9,400	2,400	17,000	4,000	9,000	2,400	10,000	3,100	9,000	2,400	400	100
Sub-total	74,600	42,600	117,200	4,800	3,800	9,400	4,800	20,000	8,000	21,000	8,500	10,000	8,200	9,000	6,400	400	2,900
Total	337,700	144,100	481,800	4,800	3,800	19,600	10,300	103,300	42,400	102,000	39,100	65,400	26,960	41,580	18,460	1,020	3,080
12. Physical Contingency	33,300	14,900	48,200	500	400	2,000	1,100	10,300	4,400	10,000	4,000	6,300	2,740	4,120	1,940	80	320
Total	371,000	159,000	530,000	5,300	4,200	21,600	11,400	113,600	46,800	112,000	43,100	71,700	29,700	45,700	20,400	1,100	3,400
13. Price Contingency	81,000	123,000	204,000	300	600	2,300	3,600	18,000	24,300	24,200	32,200	19,900	30,000	15,600	26,700	700	5,600
Grand Total	452,000	282,000	734,000	5,600	4,800	23,900	15,000	131,600	71,100	136,200	75,300	91,600	59,700	61,300	47,100	1,800	9,000

Note: Price contingency is estimated based on the annual increase rate of 5% and 15% for foreign currency portion and local currency portion respectively. The conversion rates are US$1.00 = TSh.12.00 = Yen 240.

Table J-17 CASH FLOW STATEMENT

Unit: Tsh. x 10^3

Year (Tentative)	Cash Outflow							Cash Inflow					Balance of Cash Flow
	Project Investment			Replacement Cost/2	O & M Cost	Loan Repayment	Total	Project Revenue			Government Subsidy / Loan Repayment	Total	
	F.C	L.C	Total					Loan	Government Budget Arrangement	Water Charge			
1984	5,600	4,800	10,400	-	-	-	10,400	5,600	4,800	-	-	10,400	0
85	23,900	15,000	38,900	-	-	-	38,900	23,900	15,000	-	-	38,900	0
86	131,600	71,100	202,700	-	500	-	203,200	131,600	71,000	500	-	203,200	0
87	136,200	75,300	211,500	-	2,900	-	214,400	136,200	75,300	2,900	-	214,400	0
88	91,600	59,700	151,300	-	4,170	-	155,470	91,600	59,700	4,170	-	155,470	0
89	61,300	47,100	108,400	3,580	4,730	-	116,710	61,300	47,100	8,310	-	116,710	0
90	1,800	9,000	10,800	3,580	5,200	-	19,580	1,800	9,000	8,780	-	19,580	0
91	-	-	-	3,580	5,200	-	8,780	-	-	8,780	-	8,780	0
92	-	-	-	3,580	5,200	-	8,780	-	-	8,780	-	8,780	0
93	(555,390)/1	-	-	3,580	5,200	-	8,780	-	-	8,780	-	8,780	0
94	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
95	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
96	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
97	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
98	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
99	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
2000	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
01	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
02	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
03	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
04	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
05	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
06	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
07	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
08	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
09	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
10	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
11	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
12	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0
13	-	-	-	3,580	5,200	37,330	46,110	-	-	8,780	37,330	46,110	0

Note: /1 = Compound amount of investment for foreign currency

/2 = This expenditure in each year shows an average value of the replacement cost which will be disbursed every 2 to 5 years.