

TABLE 5-3-18

IRRIGABLE AREA BY DIVERSION WATER FROM KURULE SITE
ON PEAK REQUIRED WATER FOR EACH MONTHUnit: m²/sec
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	Kurule Site Natural Flow	Kurule Site Discharge After Regulation by SU-3	Kamla Natural Flow	Maintenance Discharge for Kamla Downstream	Usable Water for Irrigation		Peak Water Requirement	Irrigable Area (103 ha)	
					Without SU-3	With SU-3		Without SU-3	With SU-3
	1	2	3	4	1 + 3 - 4	2 + 3 - 4	ℓ/s/ha		
Jan.	204.9	232.1	11.6	9.3	207.2	234.4	0.278	745	843
Feb.	158.0	203.1	8.6	7.8	158.8	203.9	0.442	359	461
Mar.	136.7	183.9	6.6	7.0	136.3	183.5	1.011	134.8	182
Apr.	*130.4	*177.1	7.2	7.1	*130.5	*177.2	1.160	*113	*153
May	161.6	189.1	7.2	7.1	161.7	189.2	0.744	217	254
Jun.	386.7	386.7	57.1	32.0	411.8	411.8	0.195	2,112	2,112
Jul.	1,424.2	1,404.7	127.1	50.0	1,501.3	1,481.8	1.252	1,201	1,184
Aug.	1,771.0	1,581.4	165.1	50.0	1,886.1	1,696.5	1.144	1,649	1,483
Sep.	1,328.5	1,328.5	111.3	50.0	1,389.8	1,389.8	0.707	1,966	1,966
Oct.	475.2	475.2	44.6	25.8	494.0	494.0	1.179	419	419
Nov.	272.3	272.3	16.0	11.5	276.8	276.8	0.314	882	882
Dec.	225.4	247.1	13.5	10.3	228.6	250.3	0.277	825	904

Note: t

* minimum condition

TABLE 5-3-19

MONTHLY DISCHARGE AT KAMLA DAM SITE

Month	Evaporation on Surface (3200 ha) of Reservoir		Downstream Maintenance flow		Kamla Natural Flow	
	mm	m ³ /s	m ³ /s	10 ⁶ m ³	m ³ /s	10 ⁶ m ³
Jan.	1.9	0.70	9.3	24.91	11.6	31.07
Feb.	2.4	0.89	7.8	18.87	8.6	20.81
Mar.	4.7	1.74	7.0	18.75	6.6	17.68
Apr.	6.7	2.48	7.1	18.40	7.2	18.66
May	6.6	2.44	7.1	19.02	7.2	49.82
Jun.	5.7	2.11	32.0	82.94	57.1	148.00
Jul.	4.7	1.74	50.0	133.92	127.1	340.42
Aug.	4.5	1.67	50.0	133.92	165.1	442.20
Sep.	4.0	1.48	50.0	129.60	111.3	288.49
Oct.	3.2	1.19	25.8	69.10	44.6	119.46
Nov.	2.6	0.96	11.5	29.81	16.0	41.47
Dec.	2.1	0.78	10.3	27.59	13.5	36.16
Total				706.83		1,555.24

TABLE 5-3-20
1 of 2

WATER BALANCE OF KAMLA RESERVOIR (CASE: SK-400-BK PLAN)

		Net Area: 175,100ha		400ft Intake		Unit: 10 ⁶ m ³						
Required Water		Diversion Water from Kurule Intake										
Evaporation from Reservoir	Down-Stream Maintenance Flow	Crop Water Requirement	Total (Out-Flow)	70m ³ /s		80m ³ /s		90m ³ /s		100m ³ /s		
				Inflow of Kamla Dam	Water Balance of Kamla Dam	Inflow of Kamla Dam	Water Balance of Kamla Dam	Inflow of Kamla Dam	Water Balance of Kamla Dam			
1	2	3	4	5	7-1	7-2	7-3	7-4				
Jan.	1.88	126.56	153.35	31.07	218.56	65.21	245.34	91.99	272.13	118.78	298.91	145.56
Feb.	2.15	18.87	196.39	20.81	190.15	-6.24	214.35	17.96	238.54	42.15	262.73	66.34
Mar.	4.66	18.75	361.08	17.68	205.17	-155.91	231.95	-129.13	258.74	-102.34	285.52	-75.56
Apr.	6.43	18.40	422.86	18.66	200.10	-222.76	226.02	-196.84	251.94	-170.92	277.86	-145.00
May	6.55	19.02	365.69	49.82	237.31	-128.38	264.09	-101.60	290.88	-74.81	317.66	-48.03
Jun.	5.47	82.94	141.06	148.00	329.44	188.38	353.36	214.30	381.28	240.22	407.20	266.14
Jul.	4.66	133.92	484.69	340.42	527.91	43.22	554.69	70.00	581.48	96.79	608.26	123.57
Aug.	4.46	133.92	454.95	442.20	629.69	174.74	656.47	201.52	683.26	228.31	710.04	255.09
Sep.	3.84	129.60	423.00	288.49	469.93	46.93	495.85	72.85	521.77	98.77	547.69	124.69
Oct.	3.17	69.10	547.31	119.46	306.95	-240.36	333.73	-213.58	360.52	-186.79	387.30	-160.01
Nov.	2.50	29.81	112.19	41.47	222.91	110.72	248.83	136.64	274.75	162.56	300.67	188.48
Dec.	2.08	27.59	148.79	36.16	223.65	74.68	250.43	101.64	277.22	128.43	304.00	155.21
Total	47.85	706.83	3,811.36	1,555.24	3,761.77	-49.59	4,077.11	265.75	4,392.51	581.15	4,707.84	896.48

Note: Inflow of Kamla Dam = Diversion water + Kamla Natural flow

TABLE 5-3-20 WATER BALANCE OF KAMLA RESERVOIR (CASE: SK-450-BK PLAN)

2 of 2

		Net Area: 215,200ha		450ft Intake		Unit: 10 ⁶ m ³							
		Diversion Water from Kurule Intake											
		Required Water		90 m ³ /s		100 m ³ /s		110 m ³ /s		120 m ³ /s			
Evaporation from Reservoir	Down Stream Maintenance Flow	Crop Water Requirement	Total (Out-flow)	Kamla Natural Flow	In Flow of Kamla Balance of Kamla		In Flow of Kamla Balance of Kamla		In Flow of Kamla Balance of Kamla				
					Dam	Dam	Dam	Dam	Dam	Dam			
1	2	3	4	5	7-1	7-2	7-3	7-4	7-4	7-4	7-4		
Jan.	1.88	24.91	181.84	31.07	272.13	90.29	298.91	117.07	325.69	143.85	352.47	170.63	
Feb.	2.15	18.87	236.55	20.81	238.54	1.99	262.73	26.18	286.91	50.36	311.11	74.56	
Mar.	4.66	18.75	438.41	17.68	258.74	-179.67	285.52	-152.89	312.98	-125.43	339.08	-99.33	
Apr.	6.43	18.40	523.02	18.66	251.94	-271.08	277.86	-245.16	303.78	-219.24	329.70	-193.32	
May	6.55	19.02	443.45	49.82	290.88	-152.57	317.66	-125.79	344.44	-99.01	371.22	-72.23	
Jun.	5.47	82.94	153.11	148.00	381.28	228.17	407.20	254.09	433.12	280.01	459.04	305.93	
Jul.	4.66	133.92	563.96	340.42	581.48	17.52	608.26	44.30	635.04	71.08	661.82	97.86	
Aug.	4.46	133.92	527.44	442.20	683.26	155.82	710.04	182.60	736.82	209.38	763.60	236.16	
Sep.	3.84	129.60	489.33	288.49	521.77	32.44	547.69	58.36	573.61	84.28	599.53	110.20	
Oct.	3.17	69.10	656.15	119.46	360.52	-295.63	387.30	-268.85	414.08	-242.07	440.86	-215.29	
Nov.	2.50	29.81	130.48	41.47	274.75	144.27	300.67	170.19	326.59	196.11	352.51	222.03	
Dec.	2.08	27.59	176.07	36.16	277.22	101.15	304.00	127.93	330.78	154.71	357.56	181.49	
Total	47.85	706.83	3,765.13	4,519.81	1,555.24	4,392.51	-127.30	4,707.84	188.03	5,023.84	504.30	5,338.50	818.69

TABLE 5-3-21

ANNUAL WATER BALANCE OF KAMLA RESERVOIR
SUN KOSI MULTIPURPOSE SCHEMEUnit: 10⁶m³/year

	Bagmati - Kanro River	450 ft Intake	Jhim - Kanro River	450 ft Intake	Marha - Kanro River	450 ft Intake
Evaporation	136,700	160,600	159,100	175,100	215,200	47.85
Maintenance Flow						706.83
Crop Water Requirement	2,385.98	2,803.13	2,776.97	3,312.79	3,056.68	3,765.13
Total (Out Flow)	3,140.66	3,557.81	3,531.65	4,067.47	3,811.36	4,519.81
Diversion Water (m ³ /s)						
50 In Flow of Kamla Dam	3,130.97					
50 Annual Water Balance	-9.69					
60 In Flow of Kamla Dam	3,446.37	3,446.43	3,446.43			
60 Annual Water Balance	305.71	-111.38	-85.22			
70 In Flow of Kamla Dam	3,761.77	3,761.77	3,761.77	3,761.77	3,761.77	
70 Annual Water Balance	621.11	203.96	230.12	-305.76	-49.59	
80 In Flow of Kamla Dam	4,077.11	4,077.11	4,077.11	4,077.11	4,077.11	
80 Annual Water Balance	936.45	519.30	545.46	9.64	265.65	
90 In Flow of Kamla Dam		4,392.51	4,392.51	4,392.51	4,392.51	
90 Annual Water Balance		834.70	860.86	325.04	581.15	
100 In Flow of Kamla Dam				4,707.84	4,707.84	
100 Annual Water Balance				640.37	896.48	
110 In Flow of Kamla Dam						5,023.17
110 Annual Water Balance						503.36
120 In Flow of Kamla Dam						5,338.57
120 Annual Water Balance						818.76

TABLE 5-3-22
1 of 6

WATER BALANCE AT KAMLA DAM RESERVOIR (CASE SK-400-RT)

Unit: 10⁶m³

	51m ³ /s			60m ³ /s			70m ³ /s			80m ³ /s							
	Outflow (Required Water)	Inflow (2)	Ad- ditional (1)	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total		
Jan.	125.28	167.67	42.39	-	-15.64	191.77	66.49	66.49	0	218.56	93.28	93.28	0	245.34	120.06	120.06	0
Feb.	157.93	144.19	-13.74	-	-29.38	165.96	8.03	8.03	0	190.15	32.22	32.22	0	214.35	56.42	56.42	0
Mar.	287.03	154.28	-132.75	-	-162.13	178.38	-108.65	-108.65	-	205.17	-81.86	-81.86	-	231.95	-55.08	-55.08	-
Apr.	335.57	150.85	-184.72	-	-346.85	174.18	-161.39	-161.39	-	200.10	-135.46	-135.46	-	226.02	-109.55	-109.55	-
May	291.02	186.42	-104.60	-	-451.45	210.52	-80.50	-80.50	-	237.31	-53.71	-53.71	-	264.09	-26.93	-26.93	-
Jun.	129.51	280.19	150.68	-	-300.77	303.52	174.01	174.01	-	329.44	199.93	199.93	-	355.36	225.85	225.85	0
Jul.	408.79	477.02	68.23	-	-232.54	501.12	92.33	92.33	-	527.91	119.12	119.12	48.01	554.69	145.90	145.90	0
Aug.	385.52	578.80	193.28	-	-39.26	602.90	217.38	133.18	0	629.69	244.16	244.16	255.17	656.47	270.95	270.95	0
Sep.	359.50	420.68	61.18	21.92	-	444.01	84.51	84.51	0	469.93	110.43	110.43	0	495.85	136.35	136.35	0
Oct.	443.17	256.06	-187.11	-	-187.11	280.16	-163.01	-163.01	-	306.95	-136.22	-136.22	-	333.73	-109.44	-109.44	-
Nov.	94.67	173.66	78.99	-	-108.12	196.99	102.32	102.32	-	222.91	128.24	128.24	-	248.83	154.16	154.16	0
Dec.	122.67	172.76	50.09	-	-58.03	196.86	74.19	74.19	13.5	223.65	100.98	100.98	93.00	250.43	127.76	127.76	0
Total	3,140.66	3,162.58	21.92	21.92	-	3,446.37	305.71	305.71	-	3,761.77	62.11	62.11	-	4,077.11	936.45	936.45	-

Outflow = Water Requirement + Evaporation of Kamla Reservoir + Maintenance flow for down stream

Inflow = Kamla Natural flow + Division Water

Additional flow means additional discharge for down stream

TABLE 5-3-22 WATER BALANCE AT KAMLA DAM RESERVOIR (CASE SE-450-MK)

2 of 6

Unit: 10⁶m³

Outflow (Required Water)	64m ³ /s			70m ³ /s			80m ³ /s			90m ³ /s							
	Inflow	Water Balance	Ad- ditional	Inflow	Water Balance	Ad- ditional	Inflow	Water Balance	Ad- ditional	Inflow	Water Balance	Ad- ditional					
	(1)	(2)-(1)	(2)-(1)	(2)	(2)-(1)	(2)-(1)	(2)	(2)-(1)	(2)-(1)	(2)	(2)-(1)	(2)-(1)					
Jan.	142.50	202.49	60.00	13.31	0	218.56	76.06	76.06	0	245.34	102.84	102.84	0	272.13	129.63	129.63	0
Feb.	181.87	175.64	-6.23	-	-6.23	190.15	8.28	8.28	0	214.35	32.47	32.46	0	238.54	56.67	56.67	0
Mar.	333.12	189.10	-144.02	-	-150.25	205.17	-127.95	-	-127.95	231.95	-101.17	-	-101.17	258.74	-74.38	-	-74.38
Apr.	389.90	184.55	-205.35	-	-355.60	200.10	-189.80	-	-317.75	226.02	-163.88	-	-265.05	251.94	-137.96	-	-212.34
May	337.43	221.24	-116.19	-	-471.79	237.31	-100.12	-	-417.87	264.09	-73.34	-	-338.39	290.86	-46.55	-	-258.89
Jun.	136.70	313.89	177.19	-	-294.60	329.44	192.74	-	-225.13	355.36	218.66	-	-119.73	381.28	244.58	-	-74.31
Jul.	455.03	511.84	55.81	-	-238.79	427.91	71.88	-	-153.25	554.69	98.66	-	-21.07	581.48	125.45	-	111.14
Aug.	428.73	613.62	184.89	-	-53.90	629.69	200.96	47.71	0	656.47	227.74	206.67	0	683.26	254.53	254.53	0
Sep.	399.02	454.38	55.36	1.46	0	469.93	70.91	70.91	0	495.85	96.83	0	521.77	122.75	122.75	0	
Oct.	508.01	290.88	-217.13	-	-217.13	306.95	-201.06	-	0	333.73	-174.28	-	-174.28	360.52	-147.49	-	-147.49
Nov.	105.57	207.36	101.79	-	-115.34	222.91	117.34	0	83.72	248.83	143.26	-	-31.02	274.75	169.18	21.69	0
Dec.	138.93	207.58	68.65	-	-46.69	223.65	84.72	1.00	0	250.43	111.50	80.48	0	277.22	138.29	188.29	0
Total	3,557.80	3,572.57	14.77	14.77	-	3,761.77	203.96	203.96	-	4,077.11	519.30	519.30	-	4,392.51	834.70	834.70	-

Outflow = Water Requirement + Evaporation of Kamla Reservoir + Maintenance flow for down stream

Inflow = Kamla Natural flow + Division Water

Additional flow means additional discharge for down stream

TABLE 5-3-22 WATER BALANCE AT KAMLA DAM RESERVOIR (CASE SK-100-JK)

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	63m ³ /s				70m ³ /s				80m ³ /s				90m ³ /s				
	Outflow Water (1)	Inflow (2)	Total (2)-(1)	Ad- ditional (2)-(1)	Inflow (2)	Inflow Water Balance (2)-(1)	Total (2)-(1)	Ad- ditional (2)-(1)	Inflow (2)	Inflow Water Balance (2)-(1)	Total (2)-(1)	Ad- ditional (2)-(1)	Inflow (2)	Inflow Water Balance (2)-(1)	Total (2)-(1)	Ad- ditional (2)-(1)	
Jan.	141.42	199.81	58.39	9.39	0	218.56	77.14	77.14	0	245.34	103.72	103.92	0	272.13	130.71	130.71	0
Feb.	180.37	173.22	-7.15	-	-7.15	190.15	9.78	9.78	0	214.35	32.98	33.98	0	238.54	58.17	58.17	0
Mar.	330.23	186.42	-143.81	-	-150.96	205.17	-125.06	-	-125.06	231.95	-98.28	-	-98.28	258.74	-71.49	-	-71.49
Apr.	386.49	181.96	-204.53	-	-355.49	200.10	-186.39	-	-311.45	226.02	-160.47	-	-258.75	251.94	-134.25	-	-206.04
May	334.52	218.56	-115.96	-	-471.45	237.31	-97.21	-	-408.66	264.09	-70.43	-	-329.18	290.88	-43.64	-	-249.68
Jun.	136.25	311.30	175.05	-	-296.40	329.44	193.19	-	-215.47	355.36	219.11	-	-110.07	381.28	245.03	-	-4.65
Jul.	453.07	509.16	56.09	-	-240.31	527.91	74.84	-	-140.63	554.69	101.62	-	-8.45	581.48	128.41	-	123.76
Aug.	426.02	610.94	184.92	-	-55.30	629.69	204.67	63.04	0	656.47	230.45	-222.00	0	693.26	257.24	257.24	0
Sep.	396.54	451.79	55.25	-	-0.14	469.93	73.39	73.39	0	495.85	99.31	99.31	0	521.77	125.23	125.23	0
Oct.	503.94	288.20	-215.74	-	-215.88	306.95	-196.99	-	-196.99	333.73	-170.21	-	-170.21	360.52	-143.42	-	-143.42
Nov.	104.89	204.77	99.88	-	-116.00	222.91	118.02	-	-78.97	248.83	143.94	-	-26.27	274.75	169.86	169.86	0
Dec.	137.91	204.90	66.99	-	-49.01	223.65	85.74	6.77	0	250.43	112.52	86.25	0	277.22	139.31	139.31	0
Total	3,531.65	3,511.03	-20.62	9.38	-	3,761.77	230.12	230.12	-	4,077.11	515.46	545.46	-	4,392.51	860.86	860.86	-

Outflow = Water Requirement + Evaporation of Kamla Reservoir + Maintenance flow for down stream

Inflow = Kamla Natural flow + Division Water

Additional flow means additional discharge for down stream

WATER BALANCE AT KAMLA DAM RESERVOIR (CASE SK-450-JK)

TABLE 5-3-22
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Unit: 106m³

	80m ³ /s			90m ³ /s			100m ³ /s					
	Outflow Required Water (1)	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total	
Jan.	163.54	245.34	81.80	6.40	0	108.59	108.59	0	298.91	135.37	135.37	0
Feb.	211.11	214.35	3.24	3.24	0	238.54	27.43	27.43	0	262.73	47.62	51.62
Mar.	389.43	231.95	-157.48	-157.48	-157.48	258.74	-130.69	-130.69	-130.69	285.52	-103.91	-103.91
Apr.	456.28	226.02	-230.26	-387.74	-387.74	251.94	-204.34	-204.34	-335.03	277.86	-178.42	-282.33
May	394.13	264.09	-130.04	-517.78	-517.78	290.88	-103.25	-103.25	-438.28	317.66	-76.47	-358.80
Jun.	145.47	355.36	209.89	-307.89	-307.89	381.28	235.81	235.81	-202.47	407.20	261.73	-97.07
Jul.	513.75	554.69	40.94	-266.95	-266.95	581.48	67.73	67.73	-134.74	608.26	94.51	-2.56
Aug.	481.52	656.47	174.95	-92.00	-92.00	683.26	201.74	201.74	67.00	710.04	228.52	225.96
Sep.	447.31	495.85	48.54	-43.46	-43.46	521.77	74.46	74.46	0	547.69	100.38	100.38
Oct.	587.24	333.73	-253.51	-596.97	-596.97	360.52	-226.72	-226.72	-226.72	387.30	-199.94	-199.94
Nov.	118.90	248.83	129.93	-167.04	-167.04	274.75	155.85	155.85	-70.87	300.67	181.77	-18.17
Dec.	158.79	250.43	91.64	-75.40	-75.40	277.22	118.43	118.43	0	304.00	145.21	127.04
Total	4,067.47	4,077.11	9.64	9.64	-4,392.51	325.04	325.04	325.04	-4,707.84	640.37	640.37	-

Outflow = Water Requirement + Evaporation of Kamla Reservoir + Maintenance flow for down stream

Inflow = Kamla Natural flow + Division Water

Additional flow means additional discharge for down stream

TABLE 5-3-22
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WATER BALANCE AT KAMLA DAM RESERVOIR (CASE SK-400-9K)

	72m ³ /s				80m ³ /s				90m ³ /s				100m ³ /s				
	Outflow (Required Water)	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional (1)	Total
Jan.	153.35	223.91	70.56	13.42	0	245.34	91.99	91.99	0	272.13	118.78	118.78	0	298.91	145.56	145.56	0
Feb.	196.39	194.99	-1.4	-	-1.4	214.35	17.96	19.96	0	238.54	42.15	42.15	0	262.73	66.34	66.34	0
Mar.	361.08	210.52	-150.56	-	-151.96	231.95	-129.13	-	-129.13	258.74	-102.34	-	-102.34	285.52	-75.56	-	-75.56
Apr.	422.86	205.28	-217.58	-	-269.54	226.02	-196.84	-	-326.07	251.94	-170.92	-	-273.26	277.86	-145.00	-	-220.56
May	365.69	242.60	-123.03	-	-492.57	264.09	-101.60	-	-427.67	290.88	-74.81	-	-346.08	317.66	-48.03	-	-268.59
Jun.	334.62	334.62	0	-	0	355.36	0	0	-213.37	381.28	0	0	-107.85	407.20	0	0	-2.45
Jul.	484.69	533.26	48.57	-	0	554.69	70.0	0	-143.37	581.48	96.79	0	-11.06	608.26	123.57	121.12	0
Aug.	454.95	635.04	180.09	-	0	656.47	201.52	58.15	0	683.26	228.31	217.25	0	710.04	255.09	255.09	0
Sep.	423.00	475.11	52.11	-	0	495.85	72.85	72.85	0	521.77	98.77	98.77	0	547.69	124.69	124.69	0
Oct.	547.31	312.30	-235.01	-	-253.25	333.73	-213.58	-	-213.58	360.52	-186.79	-	-	387.30	-160.01	-	-160.01
Nov.	112.19	228.09	115.90	-	-137.35	248.83	136.64	-	-76.94	274.75	162.56	-	-24.23	300.67	188.48	28.47	0
Dec.	148.79	229.00	80.21	-	-57.14	250.43	101.64	24.10	0	277.22	128.43	104.20	0	304.00	155.21	155.21	0
Total	4,098.83	3,824.78	13.42	13.42	-	4,077.11	265.65	265.65	-	4,392.51	581.15	581.15	-	4,707.84	896.48	896.48	-

Outflow = Water Requirement + Evaporation of Kamla Reservoir + Maintenance flow for down stream

Inflow = Kamla Natural flow + Division Water

Additional flow means additional discharge for down stream

TABLE 5-3-22
6 of 6

WATER BALANCE AT KAMLA DAM RESERVOIR (CASE SK-150-BK)

	95m ³ /s				100m ³ /s				110m ³ /s				120m ³ /s				
	Inflow (1)	Water Balance (2)-(1)	Ad- ditional	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional	Total	Inflow (2)	Water Balance (2)-(1)	Ad- ditional	Total	
Jan.	181.84	285.52	103.68	16.28	0	298.91	117.07	117.07	0	-325.69	143.85	143.85	0	352.48	170.64	170.64	0
Feb.	236.55	250.63	14.08	14.08	0	262.73	26.18	26.18	0	286.92	50.37	50.37	0	311.11	74.56	74.56	0
Mar.	438.41	272.13	-166.28	-166.28	-166.28	285.52	-152.89	-152.89	-152.89	312.30	-126.11	-126.11	-126.11	339.09	-99.32	-99.32	-99.32
Apr.	523.02	264.90	-258.12	-258.12	-424.40	277.86	-245.16	-245.16	-398.05	303.78	-219.24	-219.24	-345.35	329.70	-193.32	-193.32	-292.64
May	443.45	304.27	-139.18	-139.18	-563.58	317.66	-125.79	-125.79	-523.84	344.44	-99.01	-99.01	-444.36	371.23	-72.22	-72.22	-364.86
Jun.	153.11	394.24	241.13	241.13	-322.45	407.20	254.09	254.09	-269.75	433.12	280.01	280.01	-164.35	459.04	305.93	305.93	-58.93
Jul.	563.96	594.87	30.91	30.91	-891.54	608.26	44.30	44.30	-225.45	635.04	71.08	71.08	-93.27	661.83	97.87	97.87	38.94
Aug.	527.24	696.65	169.21	169.21	-122.33	710.04	183.60	183.60	-42.85	736.82	209.38	209.38	116.11	763.61	236.17	236.17	0
Sep.	489.33	534.73	45.40	45.40	-76.93	547.69	58.36	58.36	15.51	573.61	84.28	84.28	84.28	599.53	110.20	110.20	0
Oct.	656.15	373.91	-282.24	-282.24	-359.17	387.30	-268.85	-268.85	-268.85	414.08	-242.07	-242.07	-242.07	440.87	-215.28	-215.28	-215.28
Nov.	130.48	287.71	157.23	157.23	-201.94	300.67	170.19	170.19	-98.66	326.59	196.11	196.11	-45.96	352.51	222.03	222.03	0
Dec.	176.07	290.61	114.54	114.54	-87.40	304.00	127.93	127.93	29.27	330.78	154.71	154.71	108.75	357.57	181.50	181.50	0
Total	4,519.61	4,550.17	30.36	30.36	-	4,707.84	188.03	188.03	-	5,023.17	503.36	503.36	-	5,338.57	818.76	818.76	-

Outflow = Water Requirement + Evaporation of Kamla Reservoir + Maintenance flow for down stream

Inflow = Kamla Natural flow + Division Water

Additional flow means additional discharge for down stream

TABLE 5-3-23 OPTIMUM COMBINATION OF KAMLA DAM SCALE
AND DIVERSION WATER WITH DIVERSION POWER STATION (TUNNEL LENGTH = 16.6KM)

System	Net Command Area ha	Diversion Water m ³ /s	Dam Height m	Diversion Tunnel	Cost Kamla Dam 10 ⁶ US\$	Total
Marha River - Kanro River	136,700	51	50	82.5	63.9	146.4*
		60	47.5	92.7	57.1	149.8
		70	45.2	103.8	51.4	155.2
		80	42.8	114.1	45.6	159.7
Jhim River - Kanro River	160,600	64	50.5	97.1	65.2	162.3*
		70	49.2	103.8	61.7	165.5
		80	47.1	114.1	56.0	170.1
		90	44.9	123.1	50.7	173.8
Jhim River - Kanro River	159,100	63	50.0	96.0	63.9	159.9*
		70	49.0	103.8	61.1	164.9
		80	46.9	114.1	55.5	169.6
		90	44.6	123.1	50.0	173.1
Bagmati River - Kanro River	189,800	80	51.6	114.1	68.2	182.3*
		90	49.7	123.1	63.0	186.1
		100	47.7	131.4	57.6	189.0
		72	51.0	105.8	66.6	172.4*
Bagmati River - Kanro River	175,100	80	49.4	114.1	62.2	176.3
		90	47.4	123.1	56.8	179.9
		100	45.2	131.4	51.4	182.8
		95	52.6	127.3	70.9	198.2*
215,200	100	51.7	131.4	68.5	199.9	
	110	49.8	140.1	63.6	203.7	
	120	47.9	148.7	58.2	206.9	

Note: Optimum Combination

TABLE 5-3-24 OPTIMUM COMBINATION OF KAMLA DAM SCALE AND DIVERSION WATER
WITHOUT DIVERSION POWER STATION (TUNNEL LENGTH = 13.9KM)

System	Net Command Area ha	Diversion Water m ³ /s	Dam Height m	Diversion Tunnel	Cost		Total
					Kamla Dam 10 ⁶ US\$		
Marha River - Kanro River	136,700	51	50	69.0	63.9	132.9*	
		60	47.5	77.6	57.1	134.7	
		70	45.2	86.9	51.4	138.3	
		80	42.8	95.6	45.6	141.2	
Jhim River - Kanro River	159,100	64	50.5	81.3	65.2	146.5*	
		70	49.2	86.9	61.7	148.6	
		80	47.1	95.6	56.0	151.6	
		90	44.9	103.1	50.7	153.8	
		63	50.0	80.4	63.9	144.3*	
		70	49.0	86.9	61.1	148.0	
Bagmati River - Kanro River	189,800	80	46.9	95.6	55.5	151.1	
		90	44.6	103.1	50.0	153.1	
		100	47.7	110.0	57.6	167.6	
Bagmati River - Kanro River	175,100	80	51.6	95.6	68.2	163.8*	
		90	49.7	103.1	63.0	166.1	
		100	47.7	110.0	57.6	167.6	
		72	51.0	88.6	66.6	155.2*	
Bagmati River - Kanro River	215,200	80	49.4	95.6	62.2	157.8	
		90	47.4	103.1	56.8	159.9	
		100	45.2	110.0	51.4	161.4	
		95	52.6	106.6	70.9	177.5*	
Bagmati River - Kanro River	215,200	100	51.7	110.0	68.5	178.5	
		110	49.8	117.3	63.5	180.9	
		120	47.9	124.5	58.2	182.7	

Note: * Optimum Combination

TABLE 5-3-25 USABLE TRIJUGA NATURAL FLOW AND REQUIRED
DIVERSION WATER FOR SAPT KOSI WEST IRRIGATION SCHEME

Unit: 10⁶m³

	Trijuga River		Sunkosi-Trijuga Irrigation (17,100ha)		Sapt Kosi Intake (20,900ha)	
	Natural Flow	Usable Discharge for Irrigation	Required Diversion Water	Water Requirement	Required Diversion Water	Water Requirement
Jan.	12.51	12.20	0.12	12.32	2.86	15.06
Feb.	8.37	8.37	8.76	17.13	12.56	20.93
Mar.	7.12	7.12	25.86	32.98	33.18	40.30
Apr.	7.52	7.52	31.35	38.87	39.99	47.51
May	7.52	7.52	25.69	33.21	33.06	40.58
Jun.	59.59	5.14	-	5.14	1.14	6.28
Jul.	137.05	33.80	-	33.80	7.51	41.31
Aug.	178.03	30.92	-	30.92	6.87	37.79
Sep.	116.15	28.28	-	28.28	6.28	34.56
Oct.	48.10	43.56	2.84	46.40	13.15	56.71
Nov.	16.69	7.80	-	7.80	1.73	9.53
Dec.	14.54	11.63	-	11.63	2.59	14.22
Total	613.19	203.86	94.62	298.48	160.92	364.78

TABLE 5-3-26

REQUIRED DIVERSION WATER OF
EACH MONTH FOR SAPT KOSI WEST IRRIGATION SCHEME

Unit: m³/sec

	Trijuga River Natural Flow	Sunkosi-Trijuga Irrigation		Sapt Kosi Intake	
		Water Requirement for Irrigation (17,100 ha)	Required Diversion for Water (17,100 ha)	Water Requirement for Irrigation (3,800 ha)	Required Diversion for Water (20,900 ha)
Jan.	4.67	4.75	0.08	1.06	1.14
Feb.	3.46	7.56	4.10	1.68	5.78
Mar.	2.66	17.29	14.63	3.84	18.47
Apr.	2.90	19.34	16.44	4.41	20.85
May	2.90	12.71	9.82	2.83	12.65
Jun.	22.99	3.34	-	0.74	0.74
Jul.	51.17	15.42	-	3.43	3.43
Aug.	66.47	19.56	-	4.35	4.35
Sep.	44.81	12.09	-	2.69	2.69
Oct.	17.96	20.16	2.20	4.48	6.68
Nov.	6.44	5.37	-	1.19	1.19
Dec.	5.43	4.74	-	1.05	1.05

Note: Figures show peak discharge of each month.

TABLE 5-3-27

PEAK WATER REQUIREMENT OF THE SAFT KOSI EASTERN ZONE
(COMPONENT AREA SR1 & SR2)

1 of 2

Crops	(I/C) %	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Summer Paddy	(25)			0.690	0.458	0.533	0.158						
Rainy Paddy (Medium duration)	(83)						0.689	0.423	0.581	0.938	0.224		
Rainy Paddy (Short duration)	(14)						0.146	0.053	0.092	0.077			
Winter Pulses	(8)	0.047	0.064	0.017									0.027
Maize	(15)		0.018	0.108	0.147	0.122							
Wheat	(35)	0.193	0.263	0.179									0.109
Summer Pulses	(17)			0.019	0.107	0.136							
Oilseed	(15)	0.071	0.056								0.041	0.056	
Jute	(5)			0.028	0.038	0.042							
Potato	(1)	0.005	0.003									0.003	0.004
Sugar Cane	(1)	0.005	0.007	0.010	0.008	0.008				0.001	0.002	0.003	
Total		0.321	0.411	1.056	0.758	0.842	0.158	0.835	0.476	0.673	1.016	0.270	0.199

TABLE 5-3-27
2 of 2

PEAK WATER REQUIREMENT OF THE SAPT KOSI EASTERN ZONE
(COMPONENT AREA SR3)

Crops	(I/C) %	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Summer Paddy	(25)			0.950	0.930	0.983	0.548						
Rainy Paddy (Medium duration)	(83)							1.262	1.228	1.527	2.034	0.548	
Rainy Paddy (Short duration)	(14)							0.293	0.207	0.242	0.169		
Winter Pulses	(8)	0.058	0.079	0.022									0.034
Maize	(15)		0.023	0.135	0.183	0.152							
Wheat	(35)	0.242	0.326	0.224									0.133
Summer Pulses	(17)			0.024	0.134	0.168							
Oilseed	(15)	0.087	0.069									0.050	0.069
Jute	(5)			0.035	0.047	0.052							
Potato	(1)	0.006	0.004									0.004	0.005
Sugar Cane	(1)	0.006	0.009	0.012	0.010	0.009				0.001	0.003	0.004	
Total		0.399	0.510	1.402	1.304	1.364	0.548	1.555	1.435	1.769	2.204	0.605	0.245

TABLE 5-3-28
1 of 6

CONSTRUCTION COST OF
SUN KOSI MULTIPURPOSE SCHEME
(CASE, SK-400-MK)

Discription	Unit	10 ⁶ US\$
1. Kurule Intake Dam		51.19
- Dam Height	48.9 m	
- Dam Crest Length	316 m	
- Max. Flood Discharge	19,000 m ³ /s	
2. Diversion Tunnel		82.50
- Length	16.6 km	
- Max. Discharge	51 m ³ /s	
- Diameter	4.3 m	
3. Diversion Power Station		24.30
- Effective Head	102.5 m	
- Design Discharge	51 m ³ /s	
- Installation Capacity	43.5 MW	
4. Kamla Dam		63.9
- Dam Height	50.0 m	
5. Kamla Dam Power Station		21.83
- Effective Head	31.5 m	
- Design Discharge	100 m ³ /s	
- Installation Capacity	26.24 MW	
6. Transmission Line		6.23
- Length	32 km (132 kV)	
7. Irrigation Facilities		154.32
- Main Canal	116.5 km	
- Siphon	25 Nos.	
- Others	1 L.P.S	
- Net Command Area	136,700 ha	
8. Chisapani Barrage		19.64
9. Access Road		31.39
- Chisapani Barrage - Kamla Dam	8 km	
- Kamla Dam - Diversion Station	27 km	
- Diversion Station		
- Kurule Dam Site	40 km	
Total		455.84

TABLE 5-3-28
2 of 6

CONSTRUCTION COST OF
SUN KOSI MULTIPURPOSE SCHEME
(CASE, SK-450-MK)

Discription	Unit	10 ⁶ US\$
1. Kurule Intake Dam ("Marha River - Khanro River")		51.19
2. Diversion Tunnel		97.10
- Length	16.6 km	
- Max. Discharge	64 m ³ /s	
- Diameter	5.05 m	
3. Diversion Power Station		29.19
- Effective Head	102.5 m	
- Design Discharge	64 m ³	
- Installation Capacity	54.6 MW	
4. Kamla Dam		65.20
- Dam Height	50.5 m	
5. Kamla Dam Power Station		21.89
- Effective Head	31.9 m	
- Design Discharge	110 m ³ /s	
- Installation Capacity	29.23 MW	
6. Transmission Line		7.02
- Length	32 km (132kV)	
7. Irrigation Facilities		262.65
- Main Canal	116.8 km	
- Siphon	27 Nos.	
- Others	L.P.S	
- Net Command Area	160,600 ha	
8. Access Road (Refer to "Marha River - Khanro River")		31.93
Total		566.17

TABLE 5-3-28

3 of 6

CONSTRUCTION COST OF
SUN KOSI MULTIPURPOSE SCHEME
(CASE, SK-400-JK)

Discription	Unit	10 ⁶ US\$
1. Kurule Intake Dam ("Marha River - Khanro River")		51.19
2. Diversion Tunnel		96.00
- Length	16.6 km	
- Max. Discharge	63 m ³ /s	
- Diameter	5.0 m	
3. Diversion Power Station		28.42
- Effective Head	102.5 m	
- Design Discharge	63 m ³ /s	
- Installation Capacity	53.7 MW	
4. Kamla Dam		63.90
- Dam Height	51.6 m	
- Dam Height	50.0 m	
5. Kamla Dam Power Station		21.89
- Effective Head	31.9 m	
- Design Discharge	110 m ³ /s	
- Installation Capacity	29.23 MW	
6. Transmission Line Length	326 m	7.75
7. Irrigation Facilities		187.19
- Main Canal	136.5 km	
- Siphon	30 Nos.	
- Others	L.P.S	
- Net Command Area	159,100 ha	
8. Access Road (Refer to "Marha River - Khanro River")		31.93
Total		507.18

TABLE 5-3-28
4 of 6

CONSTRUCTION COST OF
SUN KOSI MULTIPURPOSE SCHEME
(CASE, SK-450-JK)

Discription	Unit	10 ⁶ US\$
1. Kurule Intake Dam ("Marha River - Khanro River")		51.19
2. Diversion Tunnel		114.10
- Length	16.6 km	
- Max. Discharge	80 m ³ /s	
- Diameter	5.45 m	
3. Diversion Power Station		35.17
- Effective Head	102.5 m	
- Design Discharge	80 m ³ /s	
- Installation Capacity	68.2 MW	
4. Kamla Dam		
- Dam Height	51.6 m	68.20
5. Kamla Dam Power Station		7.75
- Effective Head	32.1 m	
- Design Discharge	130 m ³ /s	
- Installation Capacity	34.76 MW	
6. Transmission Line Length	326 m	7.02
7. Irrigation Facilities		314.56
- Main Canal	135.8 km	
- Siphon	32 Nos.	
- Others	1 L.P.S	
- Net Command Area	189,800 ha	
8. Chisapani Barrage		-
9. Access Road (Refer to "Marha River - Khanro River")		31.93
Total		648.38

TABLE 5-3-28
5 of 6

CONSTRUCTION COST OF
SUN KOSI MULTIPURPOSE SCHEME
(CASE, SK-400-BK)

Discription	Unit	10 ⁶ US\$
1. Kurule Intake Dam ("Marha River - Khanro River")		51.19
2. Diversion Tunnel		105.80
- Length	16.6 km	
- Max. Discharge	72 m ³ /s	
- Diameter	5.25 m	
3. Diversion Power Station		31.96
- Effective Head	102.5 m	
- Design Discharge	72 m ³	
- Installation Capacity	61.4 MW	
4. Kamla Dam		66.60
- Dam Height	51.0 m	
5. Kamla Dam Power Station		23.36
- Effective Head	32.0 m	
- Design Discharge	120 m ³ /s	
- Installation Capacity	31.99 MW	
6. Transmission Line		7.32
- Length	32 km (132 kV)	
7. Irrigation Facilities		212.90
- Main Canal	152.5 km	
- Siphon	33 Nos.	
- Others	L.P.S	
- Net Command Area	175,100 ha	
8. Chisapani Barrage		19.64
9. Access Road (Refer to "Marha River - Khanro River")		31.93
Total		550.70

TABLE 5-3-28
6 of 6

CONSTRUCTION COST OF
SUN KOSI MULTIPURPOSE SCHEME
(CASE, SK-450-BK)

Discription	Unit	10 ⁶ US\$
1. Kurule Intake Dam ("Marha River - Khanro River")		51.19
2. Diversion Tunnel		127.30
- Length	16.6 km	
- Max. Discharge	95 m ³ /s	
- Diameter	5.7 m	
3. Diversion Power Station		39.93
- Effective Head	102.5 m	
- Design Discharge	95 m ³ /s	
- Installation Capacity	81.0 MW	
4. Kamla Dam		70.90
- Dam Height	52.6 m	
5. Kamla Dam Power Station		26.82
- Effective Head	32.5 m	
- Design Discharge	140 m ³ /s	
- Installation Capacity	37.90 MW	
6. Transmission Line		8.48
- Length	32 km (132kV)	
7. Irrigation Facilities		391.80
- Main Canal	155.3 km	
- Siphon	35 Nos.	
- Others	L.P.S	
- Net Command Area	215,200 ha	
8. Access Road (Refer to "Marha River - Khanro River")		31.93
Total		748.35

TABLE 5-3-29
1 of 3

CONSTRUCTION COST OF
SAPT KOSI WEST IRRIGATION SCHEME
(SUN KOSI - TRIJUGA DIVERSION PLAN)

Discription	Unit	10 ⁶ US\$
1. Intake Facilities		1.43
2. Diversion Tunnel		11.67
- Length	5 km	
- Max. Discharge	16.5 m ³ /s	
- Diameter	3.0 m	
3. Barrage		13.29
4. Irrigation Facilities		20.87
- main Canal	30.9 km	
- Siphon	5 Nos.	
- Others	1 L.P.S	
- Net Command Area	17,100 ha	
5. Access Road		13.09
- Barrage - Outlet of Tunnel	15 km	
- Outlet of Tunnel - Intake Site	12.5 km	
Total		60.35

TABLE 5-3-29
2 of 3

CONSTRUCTION COST OF
SAPT KOSI WEST IRRIGATION SCHEME
(SAPT KOSI INTAKE PLAN - DAM HEIGHT: 39M)

Discription	Unit	10 ⁶ US\$
1. Intake Dam		20.55
- Dam Height	39 m	
- Crest Length	310 m	
2. Diversion Tunnel		19.04
- Length	6.5 km	
- Max. Discharge	21 m ³ /s	
- Diameter	3.25 m	
3. River Training		8.35
- Length	27.8 km	
- Embankment Height	3.0 m	
4. Barrage		13.29
5. Irrigation Facilities		40.84
- Main Canal	68 km	
- Siphon	13 Nos.	
- Others	L.P.S	
- Net Command Area	20,900 ha	
6. Access Road		9.11
- Outlet of Tunnel - Dam Site	16 km	
Total		111.18

TABLE 5-3-29
3 of 3

CONSTRUCTION COST OF
SAPT KOSI WEST IRRIGATION SCHEME
(SAPT KOSI INTAKE PLAN - DAM HEIGHT: 77M)

Discription	Unit	10 ⁶ US\$
1. Intake Dam		44.29
- Dam Height	77 m	
- Crest Length	480 m	
2. Diversion Tunnel		19.04
- Length	6.5 km	
- Max. Discharge	21 m ³ /s	
- Diameter	3.25 m	
3. River Training		8.35
- Length	27.8 km	
- Embankment Height	3.0 m	
4. Barrage		13.29
5. Irrigation Facilities		40.84
- Main Canal	68 km	
- Siphon	13 Nos.	
- Others	L.P.S	
- Net Command Area	20,900 ha	
6. Access Road		9.11
- Outlet of Tunnel - Dam Site	16 km	
Total		134.92

TABLE 5-3-30

1 of 3

CONSTRUCTION COST OF
SAPT KOSI EAST IRRIGATION SCHEME
(SAPT KOSI INTAKE PLAN - DAM HEIGHT: 39M)

Discription	Unit	10 ⁶ US\$
1. Intake Dam		47.70
- Dam Height	39 m	
- Crest Length	310 m	
2. Diversion Tunnel		38.80
- Length	6.5 km	
- Max. Discharge	57 m ³ /s	
- Diameter	4.8 m	
3. Irrigation Facilities		76.31
- Main Canal	62.3 km	
- Siphon	18 Nos.	
- Others	L.P.S	
- Net Command Area	47,950 ha	
4. Access Road		1.19
- Chatra Village - Intake Dam Site	4.8 km	
5. Pumping Facilities		56.93
Total		221.65

TABLE 5-3-30

2 of 3

CONSTRUCTION COST OF
SAPT KOSI EAST IRRIGATION SCHEME
(SAPT KOSI INTAKE PLAN - DAM HEIGHT: 77M)

Discription	Unit	10 ⁶ US\$
1. Intake Dam		101.98
- Dam Height	77 m	
- Crest Length	480 m	
2. Diversion Tunnel		38.80
- Length	6.5 km	
- Max. Discharge	57 m ³ /s	
- Diameter	4.8 m	
3. Irrigation Facilities		76.31
- Main Canal	62.3 km	
- Siphon	18 Nos.	
- Others	L.P.S	
- Net Command Area	47,950 ha	
6. Access Road		1.19
- Chatra Village - Intake Dam		
Total		219.00

TABLE 5-3-30
3 of 3

CONSTRUCTION COST OF
SAPT KOSI EAST IRRIGATION SCHEME
(TAMUR - EAST TERAI DIVERSION PLAN)

Discription	Unit	10 ⁶ US\$
1. Intake Dam		65.52
- Dam Height	68 m	
- Crest Length	260 m	
2. Diversion Tunnel		81.00
- Length	18 km	
- Max. Discharge	59 m ³ /s	
- Diameter	4.9 m	
3. Barrage		5.50
4. Irrigation Facilities		74.09
- Main Canal	57 km	
- Siphon	15 Nos.	
- Others	L.P.S	
- Net Command Area	49,350 ha	
6. Access Road		6.38
- E-W High Way - Outlet of Tunnel	13.5 km	
- (Dharan - Dhankuta Road) (Intake Dam Site)	2.5 km	
Total		232.49

TABLE 5-3-31 CONSTRUCTION COST OF EACH PLAN AND ALLOCATED COST
SUN KOSI MULTIPURPOSE SCHEME

Unit: 106 US\$

Discription	Marha - Kanro		Jhim - Kanro		Bagmati - Kanro	
	136,700	160,600	159,100	189,800	175,100	215,200
	51 m ³ /s	64 m ³ /s	63 m ³ /s	80 m ³ /s	72 m ³ /s	95 m ³ /s
1. Kurule Intake Dam	51.19	51.19	51.19	51.19	51.19	51.19
2. Diversion Tunnel	82.50	97.10	96.00	114.10	105.80	127.30
3. Diversion Power Station	24.30	29.19	28.42	35.17	31.96	39.93
4. Kamla Dam	63.90	65.20	63.90	68.20	66.60	70.90
5. Kamla Dam Power Station	21.83	21.89	21.89	25.48	23.36	26.82
6. Transmission Line	6.23	7.02	7.02	7.75	7.32	8.48
7. Irrigation Facilities	154.32	262.65	187.19	314.56	212.90	391.80
8. Chisapari Barrage	19.64	-	19.64	-	19.64	-
9. Access Road	31.93	31.93	31.93	31.93	31.93	31.93
Grand Total	455.84	566.17	507.18	648.75	550.70	748.35
Irrigation (allocated)	343.54	432.05	382.80	493.54	414.64	572.07
Hydro Power (allocated)	111.30	134.12	124.38	154.84	136.06	176.28

TABLE 5-3-32

BENEFIT COST ANALYSIS

1 of 2

SUN KOSI MULTIPURPOSE SCHEME

Unit: 106 US\$

Scheme	Construction Cost	Cost ^{1/}	Benefit ^{1/}	B/C	B-C
Sun Kosi Multipurpose Scheme					
Marha R. - Kanro R. (Chisapani Barrage Intake Plan)					
Net Command Area 136,700 ha					
	Irrigation	344.54	765.9	1.42	227.6
	Hydropower	111.30	253.6	1.44	77.4
	Total	455.84	1019.5	1.43	305.0
" (Kamla Dam Intake Plan)					
Net Command Area 160,600 ha					
	Irrigation	432.05	899.8	1.33	224.7
	Hydropower	134.12	311.6	1.47	99.3
	Total	566.17	1211.4	1.37	324.0
Jhim R. - Kanro R. (Chisapani Barrage Intake Plan)					
Net Command Area 159,100 ha					
	Irrigation	382.80	891.4	1.49	293.3
	Hydropower	124.38	307.3	1.56	110.4
	Total	507.18	1198.7	1.51	403.7
" (Kamla Dam Intake Plan)					
Net Command Area 189,800 ha					
	Irrigation	493.54	1063.4	1.38	292.2
	Hydropower	154.84	384.5	1.57	139.4
	Total	648.38	1447.9	1.42	431.6
Bagmati R. - Kanro R.					
(Chisapani Barrage Intake Plan)					
Net Command Area 175,100 ha					
	Irrigation	414.64	981.1	1.51	333.2
	Hydropower	136.06	348.2	1.62	132.8
	Total	550.70	1329.2	1.54	466.0
" (Kamla Dam Intake Plan)					
Net Command Area 215,200 ha					
	Irrigation	572.07	1205.7	1.35	311.8
	Hydropower	176.28	451.7	1.62	172.7
	Total	748.35	1657.5	1.41	484.6

^{1/} Discounted

TABLE 5-3-32

2 of 2

BENEFIT COST ANALYSIS
(SAPT KOSI WEST AND EAST IRRIGATION SCHEME)

Unit: 10⁶ US\$

Scheme	Construction Cost	Cost	Benefit	B/C	B-C
Sapt Kosi West Irrigation Scheme					
Sunkosi - Trijuga Diversion Plan	60.35	86.92	95.81	1.10	8.89
Sapt Kosi Intake Plan (Dam Height H = 39 m)	111.18	159.19	117.10	0.74	-42.09
" (Dam Height H = 77 m)	134.92	198.12	117.10	0.59	-81.02
Sapt Kosi East Irrigation Scheme					
Sapt Kosi Intake Plan (Dam Height H = 39 m)	221.65	367.78	255.42	0.69	-112.36
" (Dam Height H = 77 m)	219.00	322.25	255.42	0.79	-66.84
Tamur - East Terai Diversion Plan	232.49	346.65	265.04	0.76	-81.61

1/ Discounted

TABLE 5-3-33 POSSIBLE COMBINATION OF SAPT KOSI WEST AND SAPT KOSI EAST IRRIGATION SCHEME

Method Number	Sapt Kosi West Irrigation Scheme			Sapt Kosi East Irrigation Scheme		
	Sunkosi-Trijuga Diversion	Sapt Kosi Intake Dam Hight H = 39 m	Sapt Kosi Intake Dam Hight H = 77 m	Sapt Kosi Intake Dam Hight H = 39 m	Sapt Kosi Intake Dam Hight H = 77 m	Tamur - East Terai Diversion
W.E. - 1	o					o
W.E. - 2		o		o		
W.E. - 3			o		o	

	Construction Cost	Discounted Cost	Discounted Benefits	B/C	B-C
W.E. - 1	292.84	433.57	360.85	0.83	-72.72
W.E. - 2	332.84	526.97	372.52	0.71	-154.45
W.E. - 3	353.92	520.37	372.52	0.72	-147.85

TABLE 5-3-34

OUTLINE OF SUN KOSI MULTIPURPOSE SCHEME

1 of 2

(DIMENSIONS AND COSTS FOR MAIN STRUCTURES)

			(With Diversion Power Station)		
			Sun Kosi Diversion & Irrigation (175,100ha)		
Item			Dimension		Cost 10 ⁶ US\$
1. Kurule Diversion Dam			Dam height	48.9m	
	Dam Type: Concrete Gravity		Dam Crest length	316m	
			Concrete volume	230x10 ³ m ³	
			Flood Discharge	19,000m ³ /s	51.19
2. Diversion Tunnel			Total length	16.6km	
			Design Discharge	72m ³ /s	
			Tunnel Diameter	5.2m	105.80
3. Diversion Power Station			Effective head	1,025m	
			Design discharge	72m ³ /s	
			installation Capacity	61MW	31.96
4. Kamla Dam & Reservoir			Dam height	51.5m	
	Dam Type: Sand Gravel Fill		Dam Crest length	697m	
	H.W.L.	178.5m	Dam volume	3,280x10 ³ m ³	
	L.W.L.	163m	Flood discharge	5,000m ³	
	Vg	713x10 ⁶ m ³			
	Ve	493x10 ⁶ m ³			66.60
5. Kamla Dam Power Station			Effective head	32.5m	
			Design Discharge	120m ³ /s	
			Installation Capacity	32.5MW	23.36
6. Transmission Line			Length	32km (132kV)	
7. Irrigation Facilities			Main Canal length		
			Right Bank	78.4km	
			Left Bank	74.1km	
	Net Area		Main Canal (Qmax.)		
	(R)	107,900ha	Right Bank	135m ³ /s	
	(L)	67,200ha	Left Bank	84m ³ /s	
			* Including all Irrigation Facilities		212.90
8. Chisapani Barrage			Barrage height	3m	
	All Gate Type		Barrage Crest length	300m	
			Flood Discharge	5,000m ³ /s	19.64

TABLE 5-3-34
2 of 2

OUTLINE OF SUN KOSI MULTIPURPOSE SCHEME
(DIMENSIONS AND COSTS FOR MAIN STRUCTURES)

(With Diversion Power Station)			
Sun Kosi Diversion & Irrigation (175,100ha)			
Item	Dimension		Cost 10 ⁶ US\$
9. Access Road	Chisapani - Kamla Dam	8km	
	Kamla Dam - Diversion Power Station	27km	
	Diversion Power Station - SU-1 Intake Dam	40km	31.93
Grand Total	B/C = 1.54	B-C = 466.0 x 10 ⁶ US\$	550.70

TABLE 5-3-37 BENEFIT COST ANALYSIS IN CASE-A AND CASE-B
(SUN KOSI MULTIPURPOSE SCHEME)

		Unit: 10 ⁶ US\$	
Item		Case-A	Case-B
Irrigation Area		55,500 ha	45,900 ha
Installation Capacity of Hydropower	Diversion Power	61,400 kW	0
	Kamla Dam Power	0	0
Construction Cost	Irrigation	162.48	171.82
	Hydropower	138.51	0
	Total	300.99	171.32
Discounted Benefit	Irrigation	310.96	257.17
	Hydropower	280.35	0
	Total	591.31	257.17
Discounted Cost	Irrigation	253.40	268.27
	Hydropower	218.81	0
	Total	472.21	268.27
B/C	Irrigation	1.23	0.96
	Hydropower	1.28	-
	Total	1.25	0.96
B-C	Irrigation	57.56	-11.10
	Hydropower	61.54	-
	Total	119.10	-11.10

Construction Items are as bellow:

Case-A (only SK Diversion)	Case-B (only Kamla Dam)
Access Road	Access Road
Kurule Intake Dam	Kamla Dam
Diversion Tunnel	Irrigation facilities between
Diversion Power Station	Kamla Riber and Bhati Balon
Transmission Line	River
Irrigation facilities between	
Kamla River and Bhati Balon River	

TABLE 5-3-38

BENEFIT COST ANALYSIS FOR EACH COMPONENT
(SUN KOSI MULTIPURPOSE SCHEME)

	①	②	③	③'	④	⑤	⑤'	⑥
Net Irrigation Area (ha)	25,000	0	30,500	30,500	24,200	66,200	66,200	29,200
Hydropower (kW)	61,400	32,000	-	-	-	-	-	-
Construction Cost								
Irrigation	73.87	47.46	72.79	53.15	24.55	90.36	110.00	44.84
Hydropower	154.33	42.50	0	0	0	0	0	0
Total	228.20	89.96	72.79	53.15	24.55	90.36	110.00	44.84
Discounted Benefit								
Irrigation	140.07	0	170.89	170.89	135.59	370.91	370.91	163.60
Hydropower	280.35	67.84	0	0	0	0	0	0
Total	420.42	67.84	170.89	170.89	135.59	370.91	370.91	163.60
Discounted Cost								
Irrigation	115.03	0	113.74	83.05	38.36	141.19	171.88	70.06
Hydropower	243.44	141.43	0	0	0	0	0	0
Total	358.47	141.43	113.74	83.05	38.36	141.19	171.88	70.06
B/C								
Irrigation	1.22	0	1.50	2.06	3.53	2.63	2.16	2.34
Hydropower	1.15	0.48	-	-	-	-	-	-
Total	1.17	0.48	1.50	2.06	3.53	2.63	2.16	2.34
B-C								
Irrigation	25.04	0	57.15	87.84	97.23	229.72	199.03	93.54
Hydropower	36.91	-73.59	0	0	0	0	0	0
Total	61.95	-73.59	57.15	87.84	97.23	229.72	199.03	93.54

③: Including Chisapani Barrage

③': Excluding " "

⑤: Excluding Chisapani Barrage

⑤': Including " "

TABLE 5-3-39
1 of 3

STAGE DEVELOPMENT FOR
SUN KOSI MULTIPURPOSE SCHEME
(Case - a)

Combination of Divided Construction Scope	Stage-1	Stage-2	Stage-3	Stage-4	Stage-5
	①	③	② + ④	⑤	⑥
Net Irrigation Area (ha)	25,000	30,500	24,200	66,200	29,200
Hydropower (kW)	61,400	-	32,000	-	-
Construction Cost					
Irrigation	73.87	72.79	72.01	90.36	44.84
Hydropower	154.33	0	42.50	0	0
Total	228.20	72.79	114.51	90.36	44.84
Discounted Benefit					
Irrigation	140.07	170.89	135.59	370.91	163.60
Hydropower	280.35	0	67.84	0	0
Total	420.42	170.89	203.43	370.91	163.60
Discounted Cost					
Irrigation	115.03	113.74	117.39	141.19	70.06
Hydropower	243.44	0	62.40	0	0
Total	358.47	113.74	179.79	141.19	70.06
B/C					
Irrigation	1.22	1.50	1.16	2.63	2.34
Hydropower	1.15	-	1.09	-	-
Total	1.17	1.50	1.13	2.63	2.34
B-C					
Irrigation	25.04	57.15	18.20	229.72	93.54
Hydropower	36.91	0	5.44	0	0
Total	61.95	57.15	23.64	229.72	93.54

TABLE 5-3-39

2 OF 3

STAGE DEVELOPMENT FOR
SUN KOSI MULTIPURPOSE SCHEME
(Case - b)

Construction Scope	Stage-2		Stage-3		Stage-1		Stage-2		Stage-3	
	①	② + ③ + ④	⑤ + ⑥	⑦ + ⑧	① + ③	② + ④	⑤ + ⑥	⑦ + ⑧	⑨ + ⑩	⑪ + ⑫
Net Irrigation Area (ha)	25,000	54,700	95,400	95,400	55,500	24,200	95,400	55,500	24,200	95,400
Hydropower (kW)	61,400	32,000	-	-	61,400	32,000	-	61,400	32,000	-
Construction Cost	73.87	152.84	135.20	135.20	162.48	72.01	135.20	162.48	72.01	135.20
Irrigation	154.33	34.46	0	0	138.51	42.50	0	138.51	42.50	0
Hydropower	228.20	187.30	135.20	135.20	300.99	114.51	135.20	300.99	114.51	135.20
Total										
Discounted Benefit	140.07	306.48	534.51	534.51	310.96	135.59	534.51	310.96	135.59	534.51
Irrigation	280.35	67.84	0	0	280.35	67.84	0	280.35	67.84	0
Hydropower	420.42	374.32	534.51	534.51	591.31	203.43	534.51	591.31	203.43	534.51
Total										
Discounted Cost	115.03	238.96	211.25	211.25	253.40	117.39	211.25	253.40	117.39	211.25
Irrigation	243.44	54.57	0	0	218.81	62.40	0	218.81	62.40	0
Hydropower	358.47	293.53	211.25	211.25	472.21	179.79	211.25	472.21	179.79	211.25
Total										
B/C	1.22	1.28	2.53	2.53	1.23	1.16	2.53	1.23	1.16	2.53
Irrigation	1.15	1.24	-	-	1.28	1.09	-	1.28	1.09	-
Hydropower	1.17	1.28	2.53	2.53	1.25	1.13	2.53	1.25	1.13	2.53
Total										
B-C	25.04	37.52	323.26	323.26	57.56	18.20	323.26	57.56	18.20	323.26
Irrigation	36.91	13.27	0	0	61.54	5.44	0	61.54	5.44	0
Hydropower	61.95	80.79	323.26	323.26	119.10	23.64	323.26	119.10	23.64	323.26
Total										

TABLE 5-3-39
3 of 3

STAGE DEVELOPMENT FOR
SUN KOSI MULTIPURPOSE SCHEME
(Case - c)

	Stage-1 ① + ② + ③	Stage-2 ④ + ⑤ + ⑥	Stage-1 ① + ② + ⑤ + ③	Stage-2 ③ + ④ + ⑥
Net Irrigation Area (ha) Hydropower (kW)	55,500 93,400	119,600 -	91,200 93,400	83,900 -
Construction Cost	Irrigation Hydro Power Total	185.71 205.24 390.95	159.75 0 159.75	257.32 170.84 428.16
Discounted Benefit	Irrigation Hydropower Total	310.96 348.19 659.15	670.10 0 670.10	510.98 348.20 859.18
Discounted Cost	Irrigation Hydropower Total	289.52 324.12 613.64	249.61 0 249.61	401.66 270.12 671.78
B/C	Irrigation Hydropower Total	1.07 1.07 1.07	2.68 - 2.68	1.27 1.29 1.28
B-C	Irrigation Hydropower Total	21.44 24.07 45.51	420.49 0 420.49	109.82 78.08 187.39
				278.61 0 278.61

TABLE 5-3-40
1 of 4

ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST
(THREE STAGES)

Unit: 106 US\$

Item	Total	1988	89	90	91	92	93	94	95	96	97	98	99	2000
1. Civil Work														
Temporary Work	69.2	-	-	-	6.5	6.5	7.9	7.0	13.9	23.3	-	3.2	-	-
Kurule Intake Dam	35.9	-	-	-	-	-	-	8.9	9.0	9.0	9.0	-	-	-
Diversion Tunnel	74.2	-	-	-	-	-	14.8	14.8	14.8	14.9	14.9	-	-	-
Kamla Dam	46.7	-	-	-	-	-	-	-	-	11.6	11.7	11.7	11.7	-
Hydropower	43.9	-	-	-	-	-	-	-	-	13.8	13.8	5.4	10.9	-
Irrigation	170.2	-	-	-	5.6	5.6	8.1	15.3	31.8	24.6	24.6	19.0	19.1	16.5
Access Road	23.4	-	-	-	7.8	7.8	7.8	-	-	-	-	-	-	-
2. O/M Facilities	14.0	-	2.5	2.6	4.0	1.5	1.7	1.7	-	-	-	-	-	-
3. Administration & Engineering	32.4	1.8	1.8	2.4	2.5	3.3	3.3	3.3	3.3	3.3	3.3	1.6	1.6	0.9
4. Physical Contingency	40.8	0.1	0.3	0.4	2.1	2.0	3.5	4.2	5.8	8.0	6.3	3.3	3.5	1.4
TOTAL	550.7	1.9	4.6	5.4	28.5	26.7	47.1	56.1	78.6	108.5	83.5	44.2	46.8	18.8

TABLE 5-3-40
2 of 4

ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST
(STAGES - 1)

Unit: 106 US\$

Item	Total	1988	89	90	91	92	93	94	95	96	97	98	99	2000
1. Civil Work														
Temporary Work	39.0	-	-	-	6.5	6.5	6.5	6.5	6.5	6.5	-	-	-	-
Kurule Intake Dam	35.9	-	-	-	-	-	-	9.0	9.0	9.0	8.9	-	-	-
Diversion Tunnel	74.2	-	-	-	-	-	14.9	14.9	14.8	14.8	14.8	-	-	-
Kamla Dam	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydropower	27.6	-	-	-	-	-	-	-	-	13.8	13.8	-	-	-
Irrigation	53.3	-	-	-	5.6	5.6	5.6	12.9	12.8	5.4	5.4	-	-	-
Access Road	23.4	-	-	-	7.8	7.8	7.8	-	-	-	-	-	-	-
2. O/M Facilities	7.6	-	2.5	2.5	2.6	-	-	-	-	-	-	-	-	-
3. Administration & Engineering	17.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	-	-	-
4. Physical Contingency	22.3	0.1	0.4	0.4	1.9	1.7	3.0	3.5	3.6	4.1	3.6	-	-	-
SUB-TOTAL	301.0	1.9	4.7	4.7	26.2	23.4	39.6	48.6	48.4	55.3	48.2	-	-	-

TABLE 5-3-40
3 of 4

ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST
(STAGES - 2)

Unit: 106 US\$

Item	Total	1988	89	90	91	92	93	94	95	96	97	98	99	2000
1. Civil Work														
Temporary Work	15.3	-	-	-	-	-	1.3	1.3	-	9.4	-	3.3	-	-
Kurule Intake Dam	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diversion Tunnel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kamla Dam	46.7	-	-	-	-	-	-	-	-	11.7	11.7	11.7	11.6	-
Hydropower	16.4	-	-	-	-	-	-	-	-	-	-	5.5	10.9	-
Irrigation	18.0	-	-	-	-	-	2.6	2.6	2.6	2.6	2.6	2.5	2.5	-
Access Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. O/M Facilities	2.9	-	-	-	1.4	1.5	-	-	-	-	-	-	-	-
3. Administration & Engineering	6.7	-	-	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	-
4. Physical Contingency	8.5	-	-	0.1	0.2	0.2	0.4	0.4	0.2	1.9	1.2	1.9	2.0	-
SUB-TOTAL	114.5	-	-	0.8	2.3	2.4	5.0	5.0	3.5	26.3	16.1	25.5	29.6	-

TABLE 5-3-40

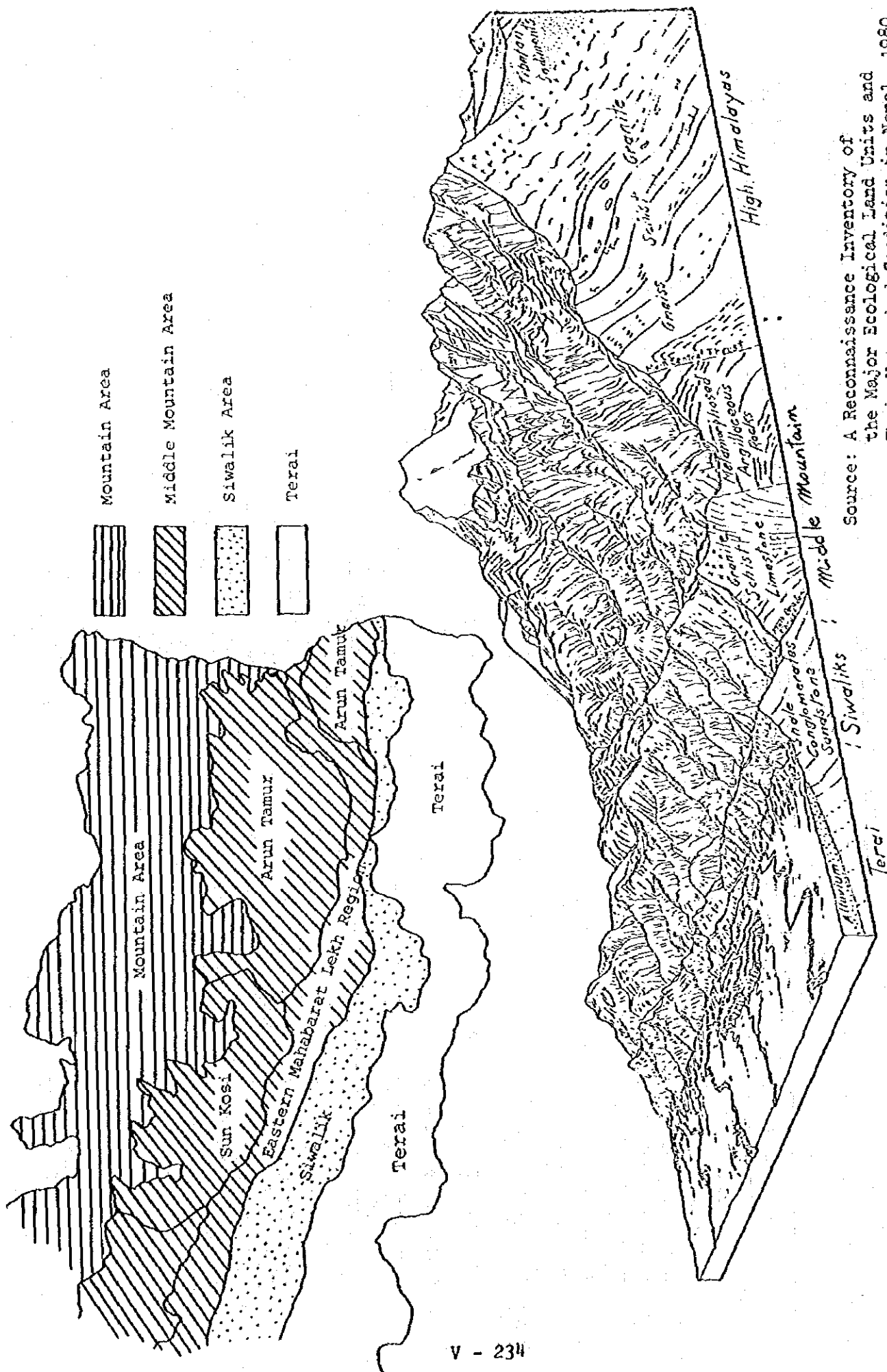
4 of 4

ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST

(STAGES - 3)

Unit: 106 US\$

Item	1988	89	90	91	92	93	94	95	96	97	98	99	2000
1. Civil Work													
Temporary Work	14.8	-	-	-	-	-	-	7.4	7.4	-	-	-	-
Kurule Intake Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
Diversion Tunnel	-	-	-	-	-	-	-	-	-	-	-	-	-
Kamla Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydropower	-	-	-	-	-	-	-	-	-	-	-	-	-
Irrigation	99.0	-	-	-	-	-	-	16.5	16.5	16.5	16.5	16.5	16.5
Access Road	-	-	-	-	-	-	-	-	-	-	-	-	-
2. O/M Facilities	3.4	-	-	-	-	1.7	1.7	-	-	-	-	-	-
3. Administration & Engineering	8.0	-	-	-	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
4. Physical Contingency	10.0	-	-	-	0.1	0.2	0.2	1.9	2.0	1.4	1.4	1.4	1.4
SUB-TOTAL	135.2	-	-	-	0.9	2.8	2.8	26.7	26.8	18.8	18.8	18.8	18.8



Source: A Reconnaissance Inventory of the Major Ecological Land Units and Their Watershed Condition in Nepal, 1980
 Dep. of Soil Conservation and Watershed Management, Min. of Forest

FIG. 5-1-1 TYPICAL SCHEMATIC MAP AND ECOLOGICAL ZONES IN THE STUDY AREA

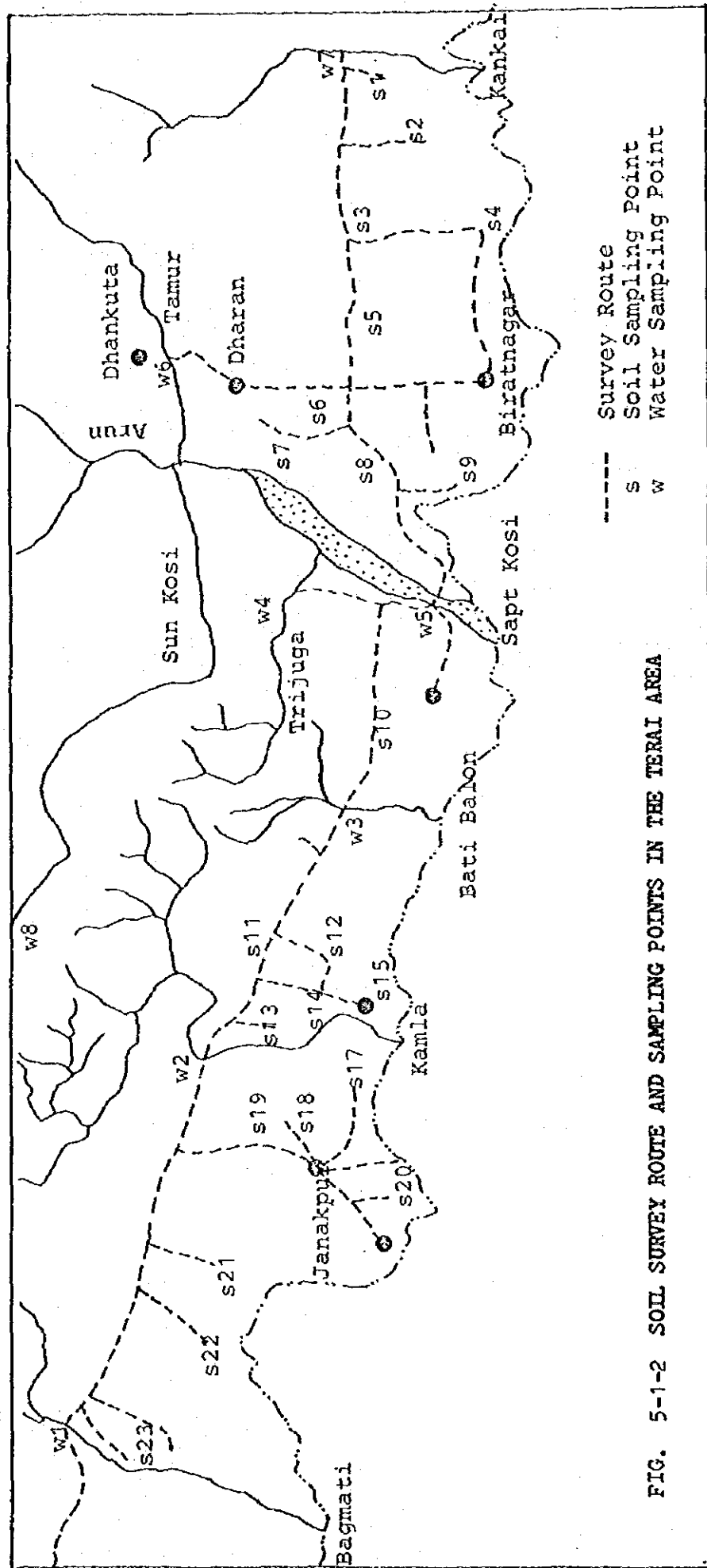


FIG. 5-1-2 SOIL SURVEY ROUTE AND SAMPLING POINTS IN THE TERAI AREA

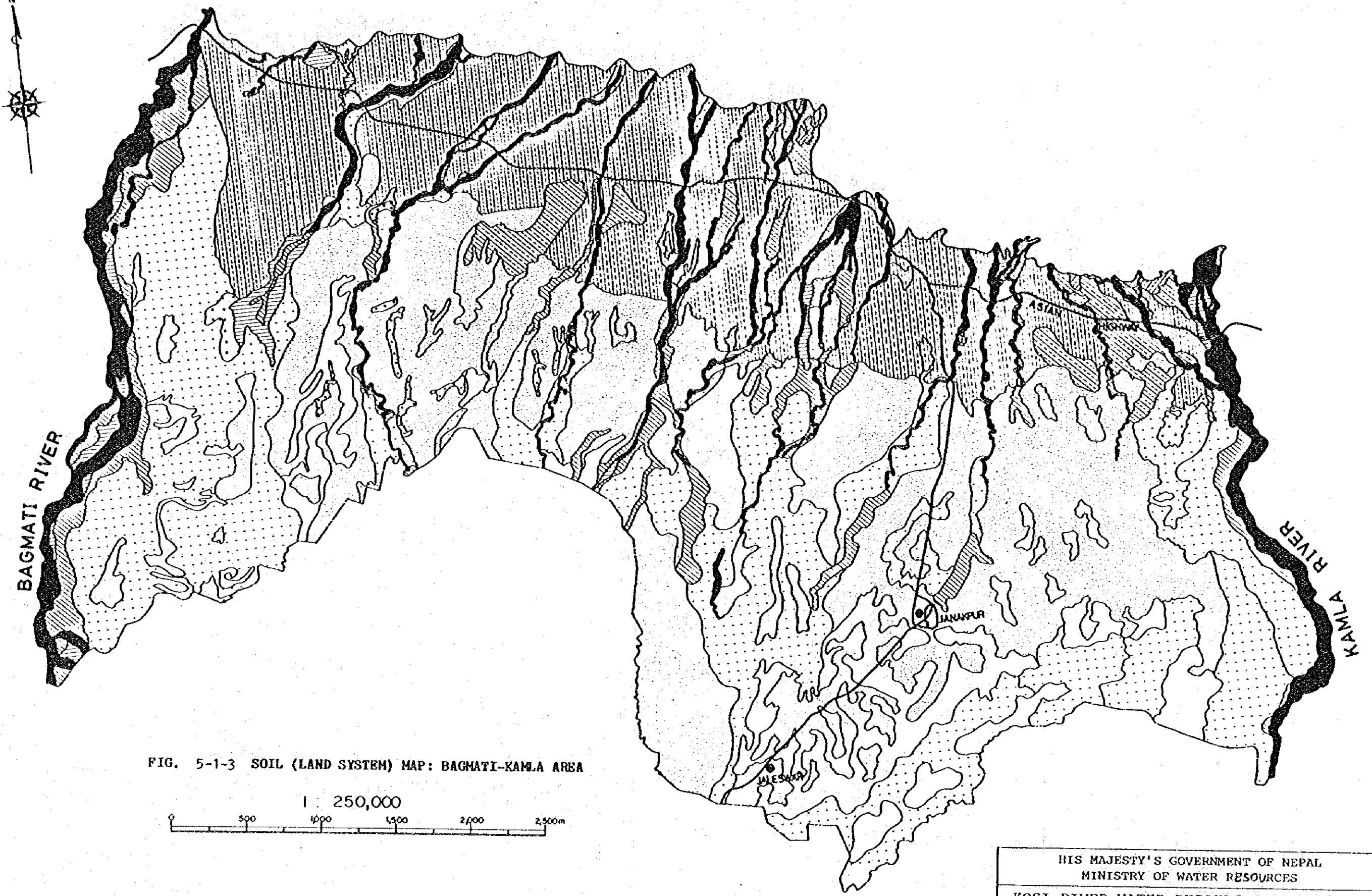
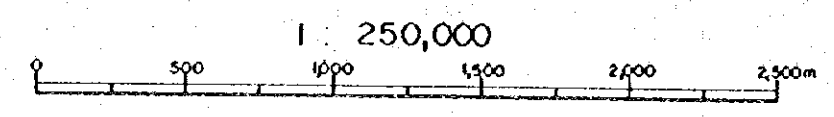


FIG. 5-1-3 SOIL (LAND SYSTEM) MAP: BAGMATI-KAMLA AREA



HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG.	SOIL (LAND SYSTEM) MAP BAGMATI-KAMLA AREA
JAPAN INTERNATIONAL COOPERATION AGENCY	
Date: February 1985	Sheet No.

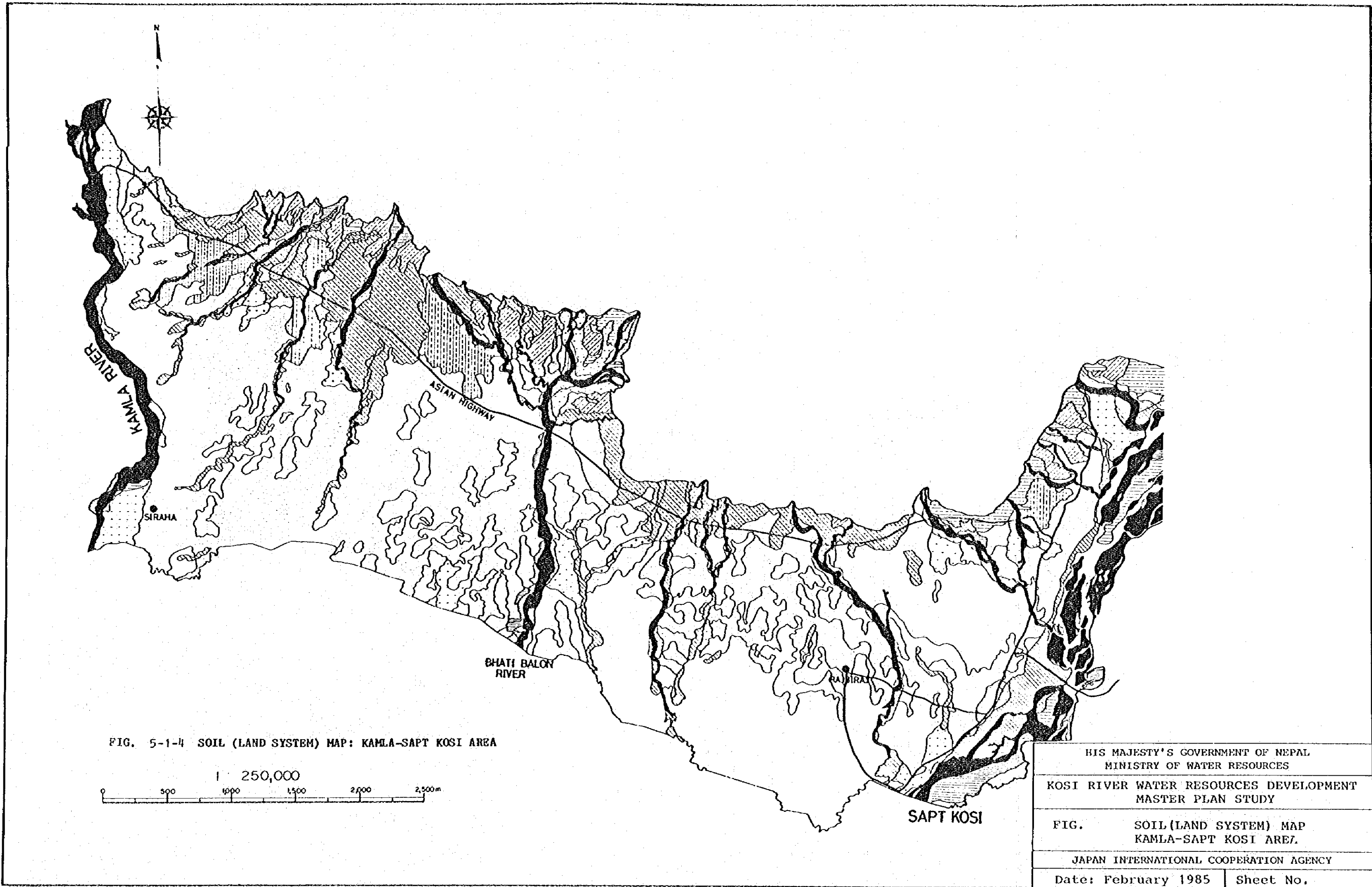
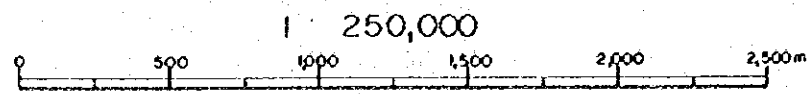
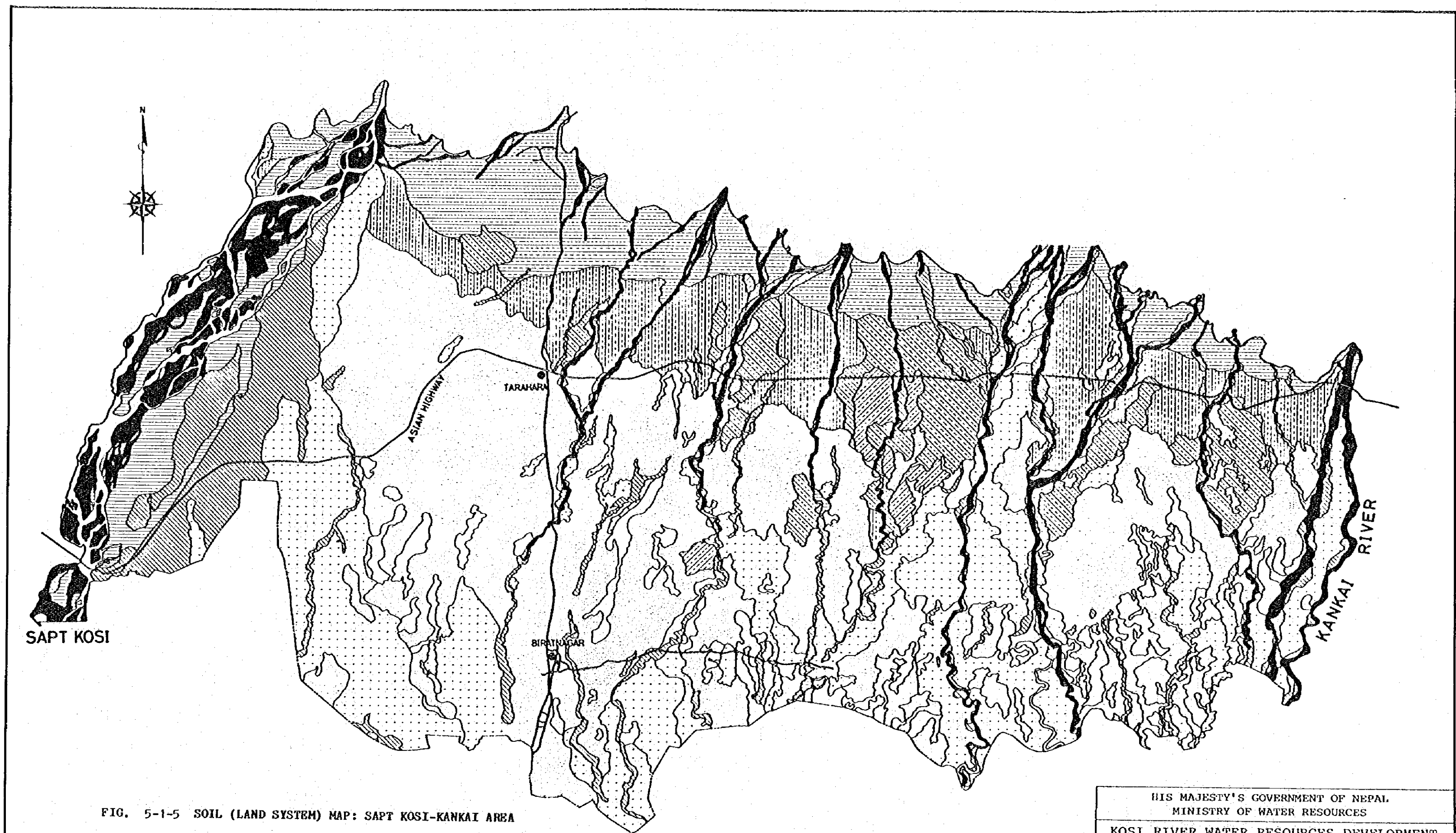


FIG. 5-1-4 SOIL (LAND SYSTEM) MAP: KAMLA-SAPT KOSI AREA



HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG. SOIL (LAND SYSTEM) MAP KAMLA-SAPT KOSI AREA.	
JAPAN INTERNATIONAL COOPERATION AGENCY	
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SAPT KOSI

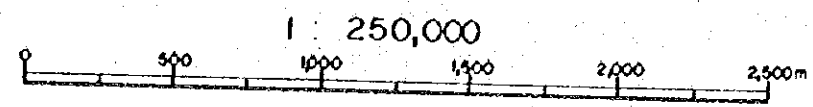
TARAHARA

ASIAN HIGHWAY

BIRATNAGAR

KANKAI RIVER

FIG. 5-1-5 SOIL (LAND SYSTEM) MAP: SAPT KOSI-KANKAI AREA



HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG.	SOIL (LAND SYSTEM) MAP SAPT KOSI-KANKAI AREA
JAPAN INTERNATIONAL COOPERATION AGENCY	
Date: February 1985	Sheet No.

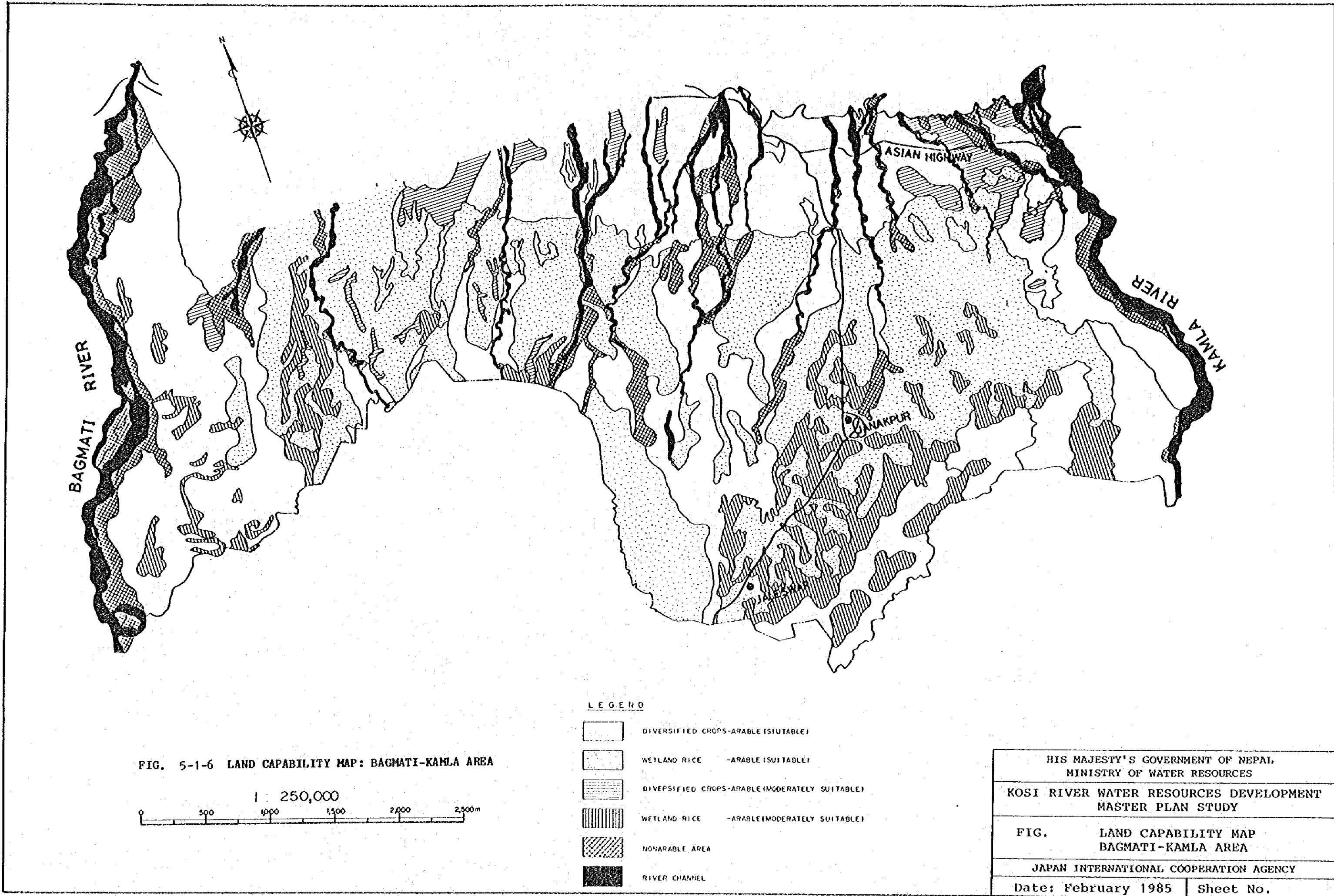
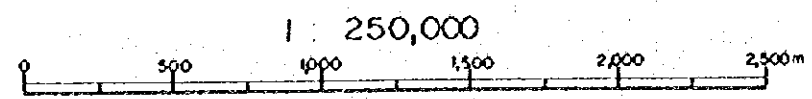
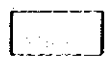

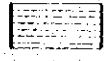





FIG. 5-1-6 LAND CAPABILITY MAP: BAGMATI-KAMLA AREA



LEGEND

-  DIVERSIFIED CROPS-ARABLE (SUITABLE)
-  WETLAND RICE -ARABLE (SUITABLE)
-  DIVERSIFIED CROPS-ARABLE (MODERATELY SUITABLE)
-  WETLAND RICE -ARABLE (MODERATELY SUITABLE)
-  NONARABLE AREA
-  RIVER CHANNEL

HIS MAJESTY'S GOVERNMENT OF NEPAL, MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG. LAND CAPABILITY MAP BAGMATI-KAMLA AREA	
JAPAN INTERNATIONAL COOPERATION AGENCY	
Date: February 1985	Sheet No.

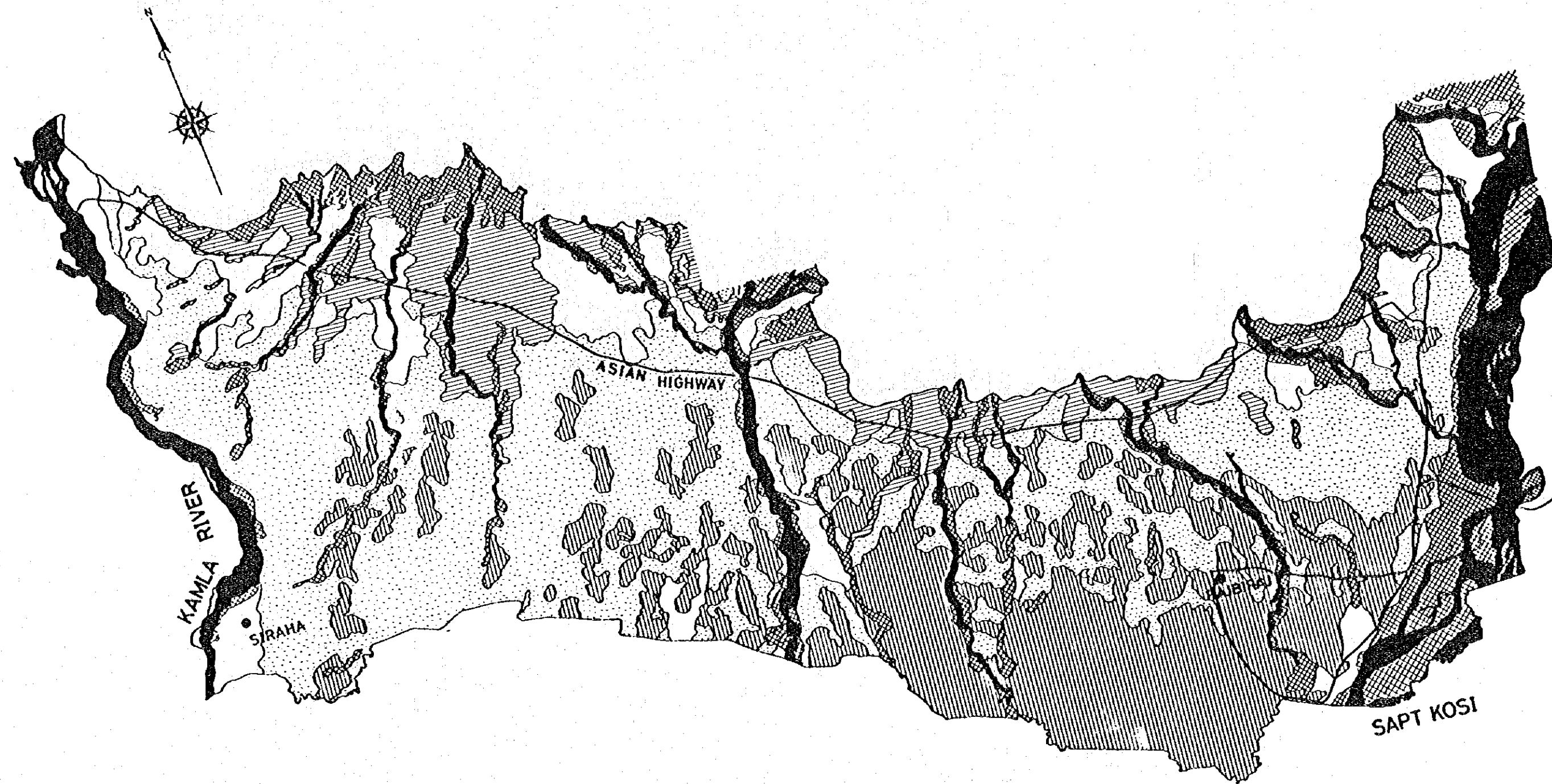
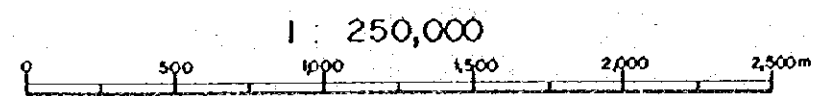
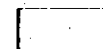
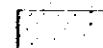
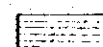

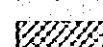



FIG. 5-1-7 LAND CAPABILITY MAP: KAMLA-SAPT KOSI AREA



LEGEND

-  DIVERSIFIED CROPS-ARABLE (SUITABLE)
-  WETLAND RICE -ARABLE (SUITABLE)
-  DIVERPSIFIED CROPS-ARABLE (MODERATELY SUITABLE)
-  WETLAND RICE -ARABLE (MODERATELY SUITABLE)
-  NONARABLE AREA
-  RIVER CHANNEL

HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG. LAND CAPABILITY MAP KAMLA-SAPT KOSI AREA	
JAPAN INTERNATIONAL COOPERATION AGENCY	
Date: February 1985	Sheet No.

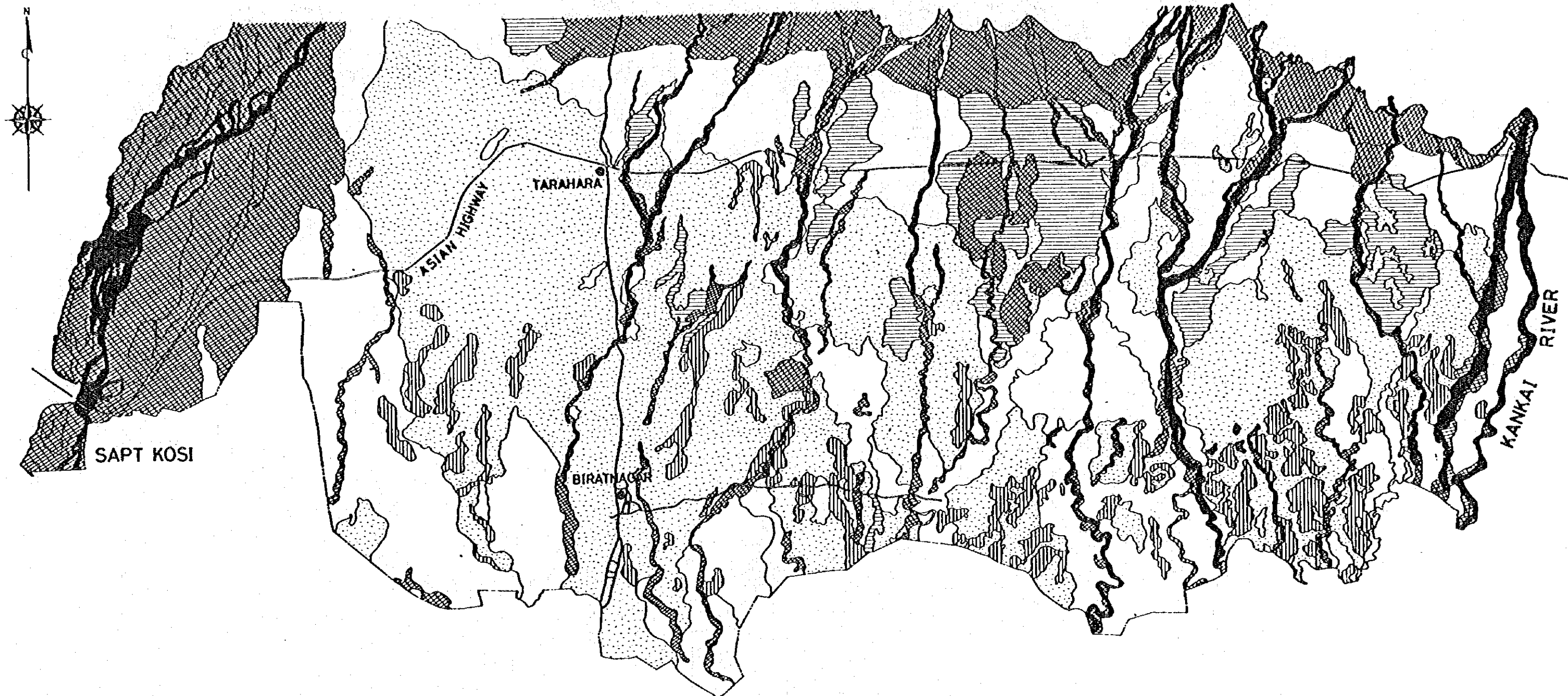
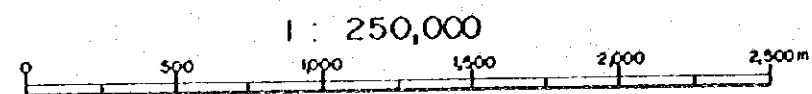








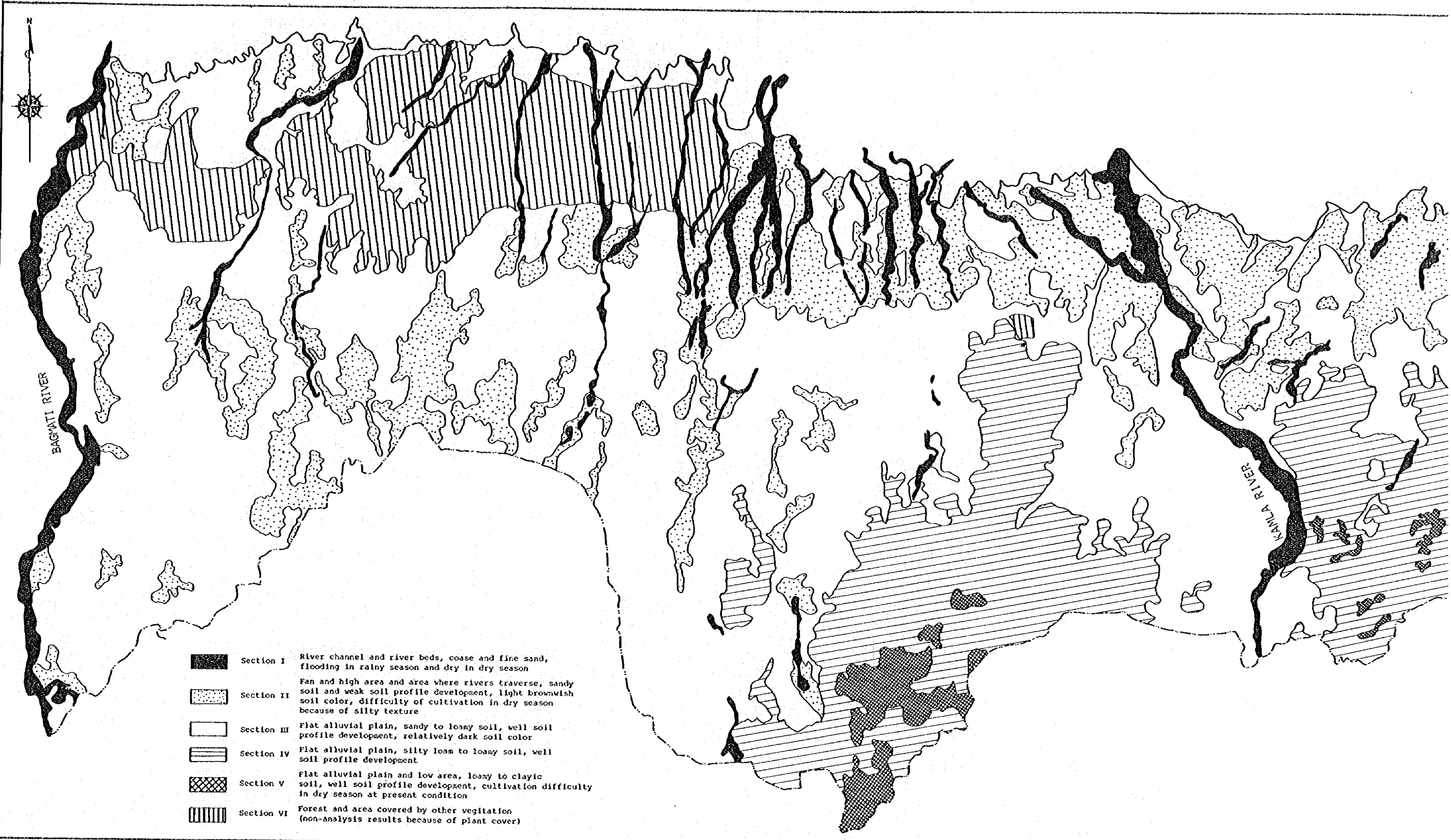
FIG. 5-1-8 LAND CAPABILITY MAP: SAPT KOSI-KANKAI AREA



LEGEND

-  DIVERSIFIED CROPS-ARABLE (SUITABLE)
-  WETLAND RICE -ARABLE (SUITABLE)
-  DIVERSIFIED CROPS-ARABLE (MODERATELY SUITABLE)
-  WETLAND RICE -ARABLE (MODERATELY SUITABLE)
-  NONARABLE AREA
-  RIVER CHANNEL

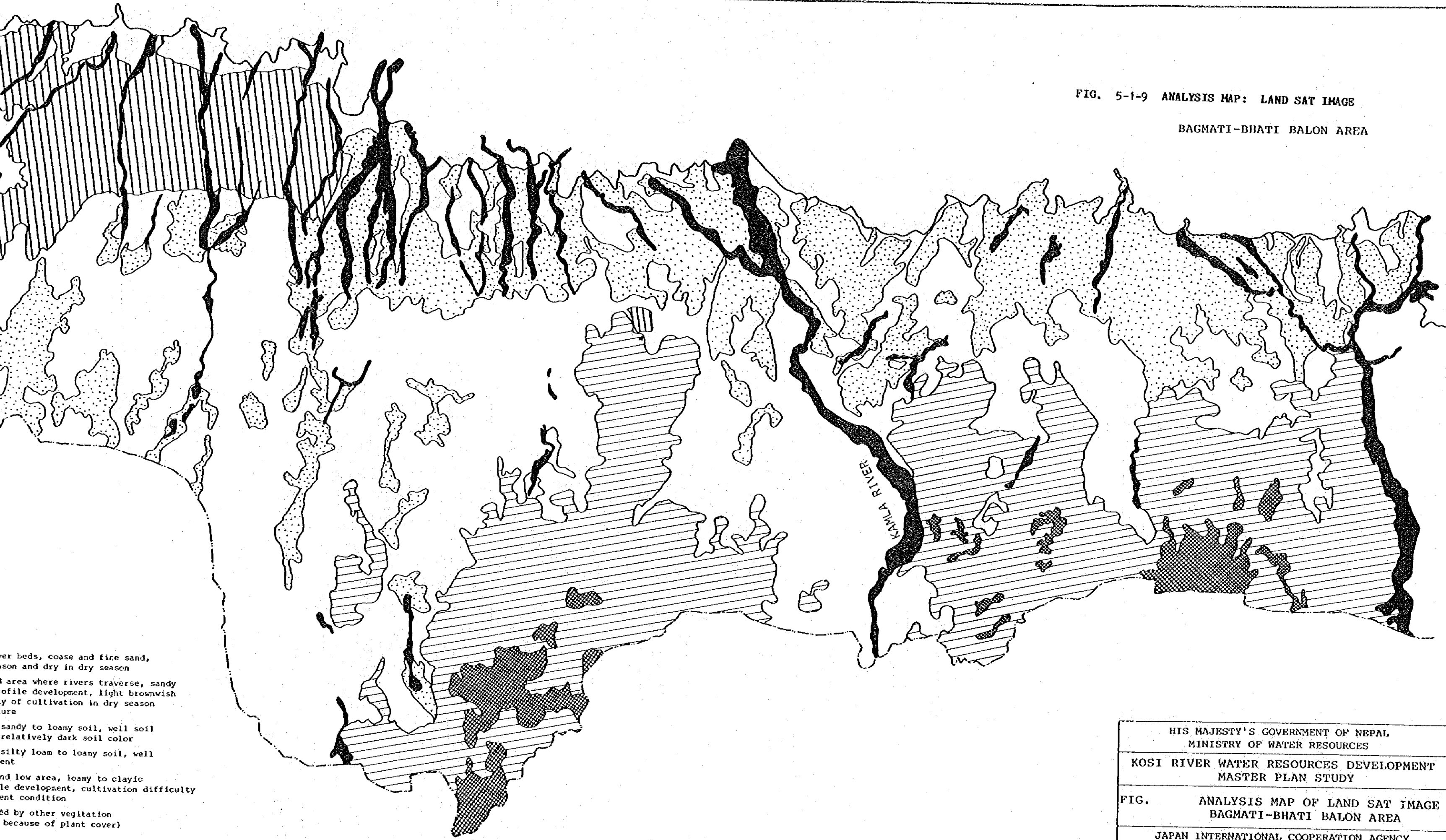
HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG. LAND CAPABILITY MAP SAPT KOSI-KANKAI AREA	
JAPAN INTERNATIONAL COOPERATION AGENCY	
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- Section I River channel and river beds, coarse and fine sand, flooding in rainy season and dry in dry season
- Section II Fan and high area and area where rivers traverse, sandy soil and weak soil profile development, light brownish soil color, difficulty of cultivation in dry season because of silty texture
- Section III Flat alluvial plain, sandy to loamy soil, well soil profile development, relatively dark soil color
- Section IV Flat alluvial plain, silty loam to loamy soil, well soil profile development
- Section V Flat alluvial plain and low area, loamy to clayic soil, well soil profile development, cultivation difficulty in dry season at present condition
- Section VI Forest and area covered by other vegetation (non-analysis results because of plant cover)

FIG. 5-1-9 ANALYSIS MAP: LAND SAT IMAGE

BAGMATI-BHATI BALON AREA

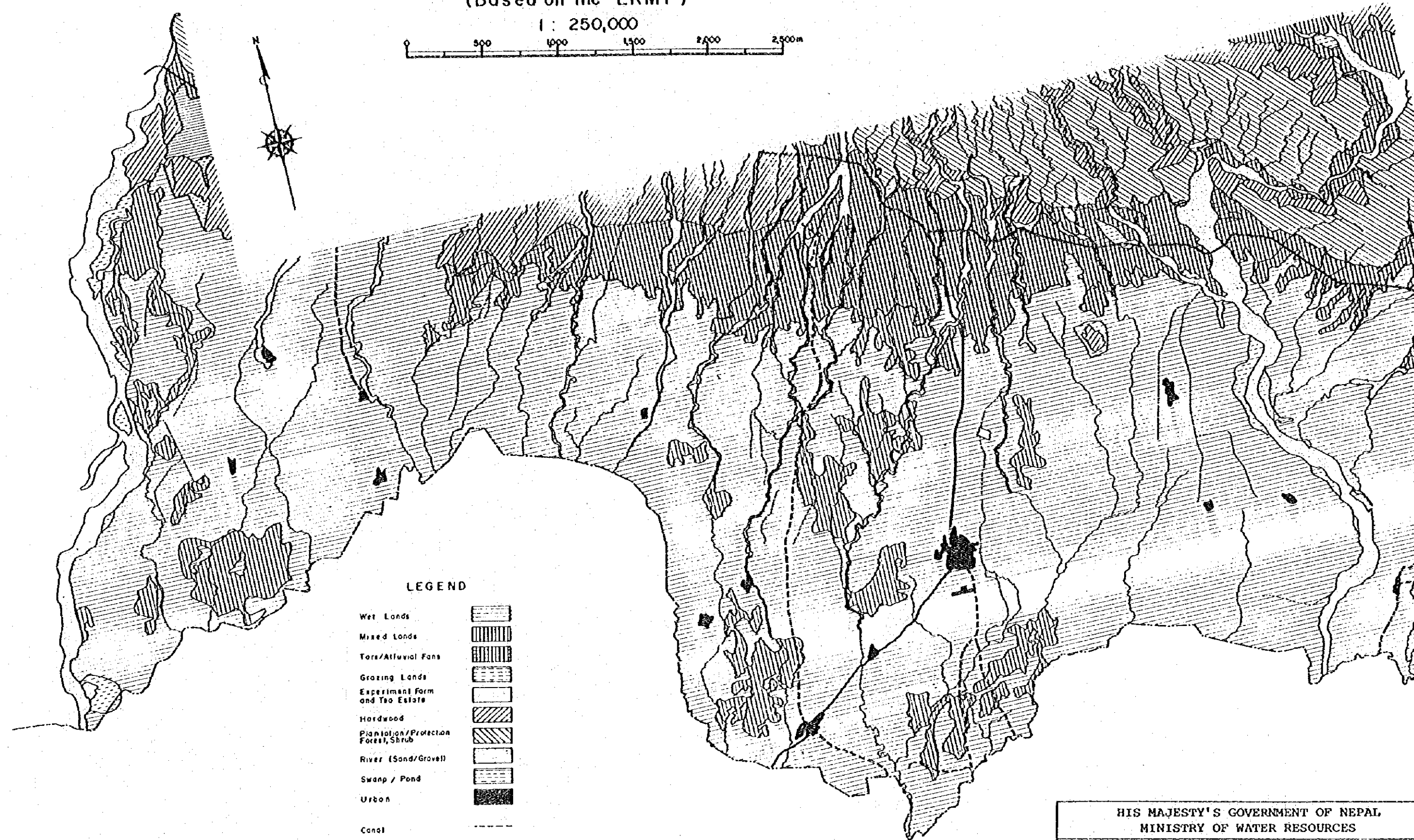
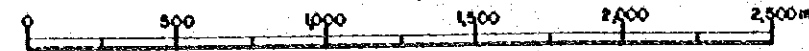


river beds, coarse and fine sand, season and dry in dry season
 area where rivers traverse, sandy soil profile development, light brownish color, low yield of cultivation in dry season, low moisture
 sandy to loamy soil, well soil profile development, relatively dark soil color
 silty loam to loamy soil, well soil profile development
 low area, loamy to clayic soil profile development, cultivation difficulty, poor soil condition
 not defined by other vegetation (because of plant cover)

HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG. ANALYSIS MAP OF LAND SAT IMAGE BAGMATI-BHATI BALON AREA	
JAPAN INTERNATIONAL COOPERATION AGENCY	
Date: February 1985	Sheet No.

LAND USE MAP (BAGMATI - KAMLA - AREA)
(Based on the LRMP)

1 : 250,000



LEGEND

- Wet Lands
- Mixed Lands
- Terrace/Alluvial Fans
- Grazing Lands
- Experiment Farm and Tea Estate
- Hardwood
- Plantation/Protection Forest, Shrub
- River (Sand/Grovel)
- Swamp / Pond
- Urban
- Canal
- Main Road
- Secondary Road
- River / Stream
- International Boundary

HIS MAJESTY'S GOVERNMENT OF NEPAL
MINISTRY OF WATER RESOURCES

KOSI RIVER WATER RESOURCES DEVELOPMENT
MASTER PLAN STUDY

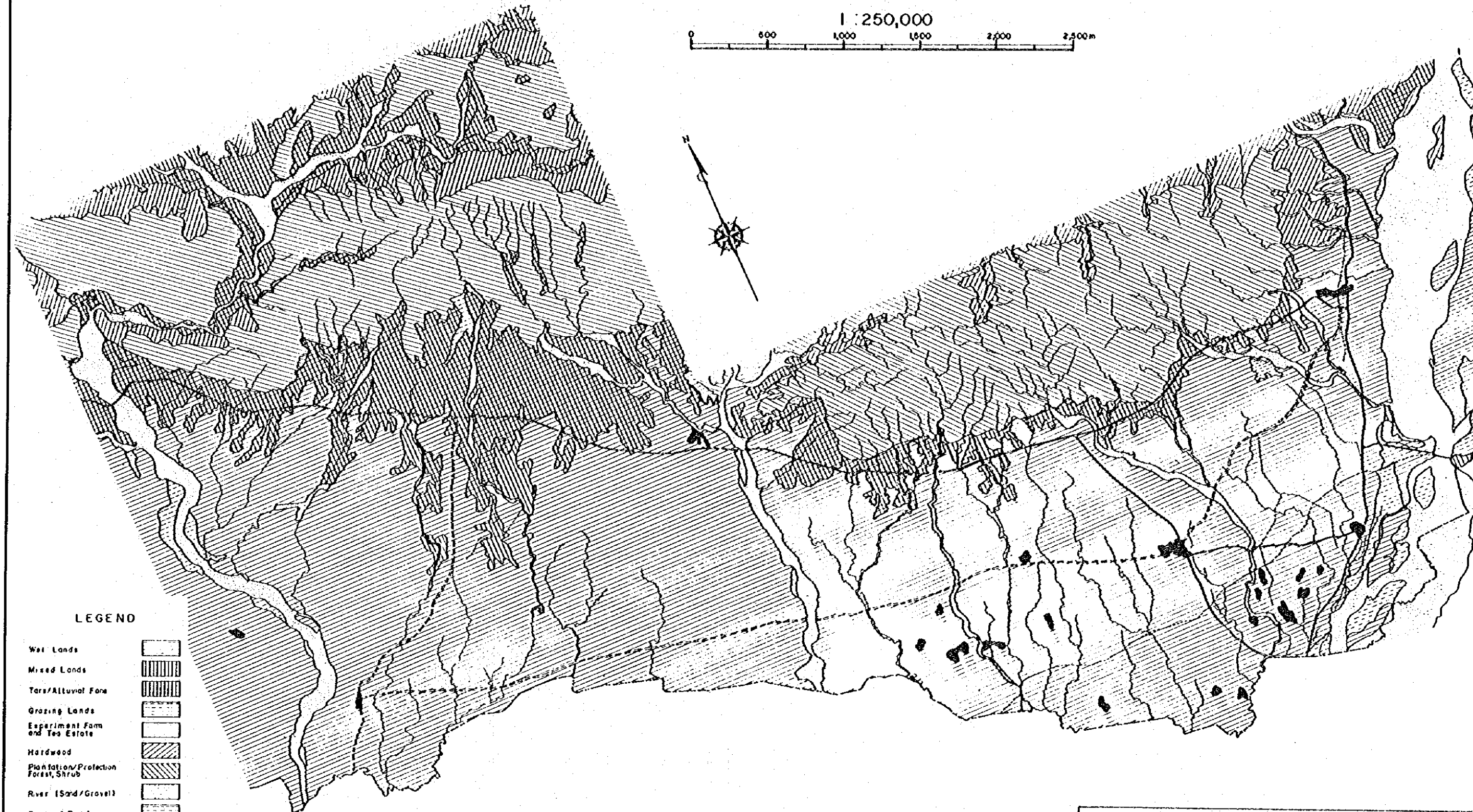
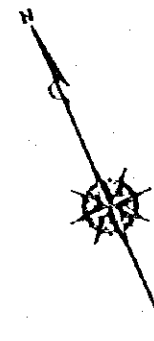
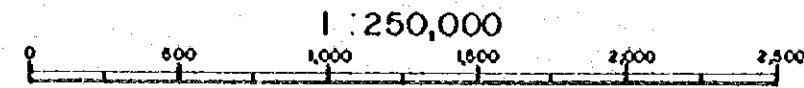
FIG. 5-1-10 LAND USE MAP (BAGMATI-KAMLA AREA)
(1 of 3) (Based on the LRMP)

JAPAN INTERNATIONAL COOPERATION AGENCY

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LAND USE MAP (KAMLA - SAPT KOSI AREA)

(Based on the LRMP)



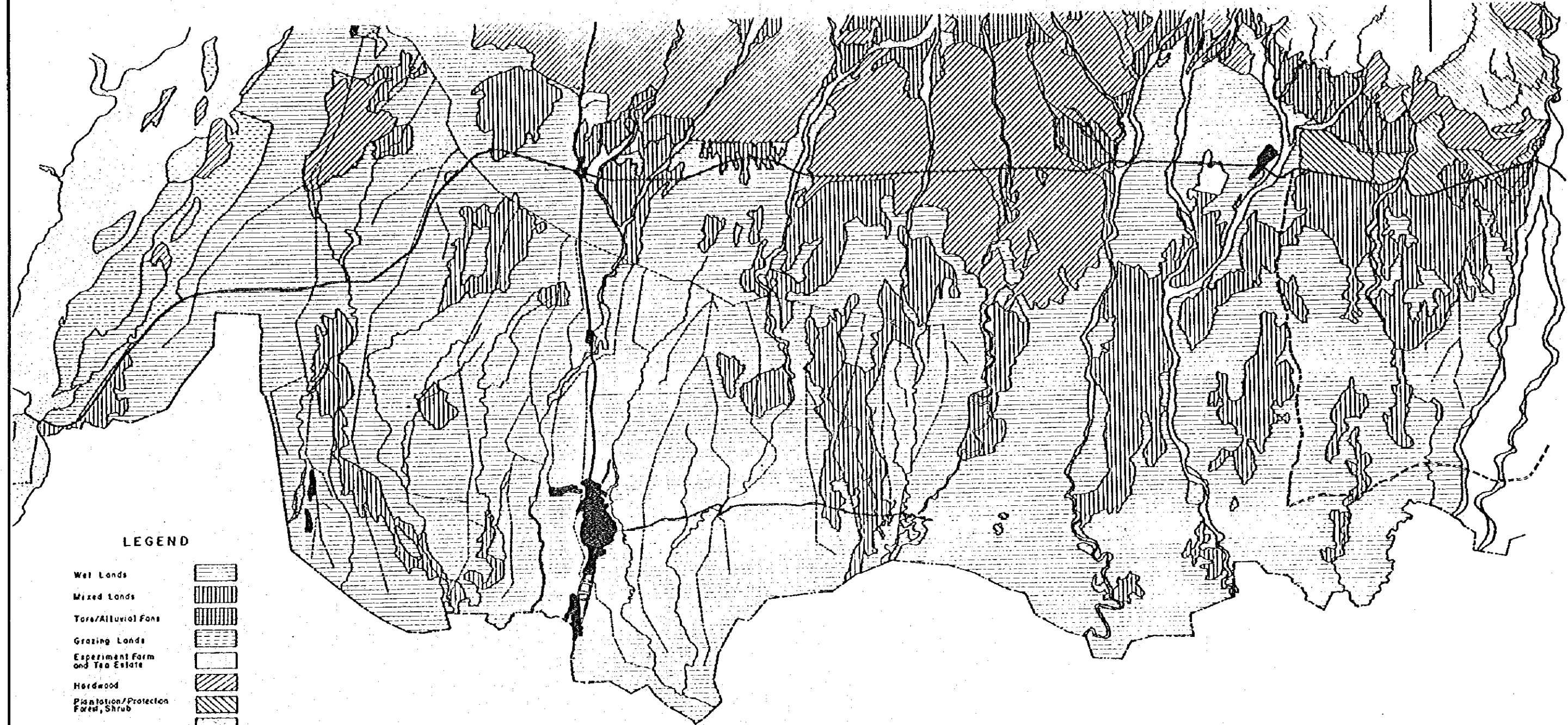
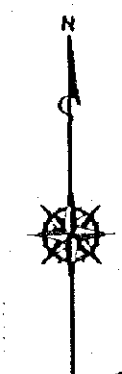
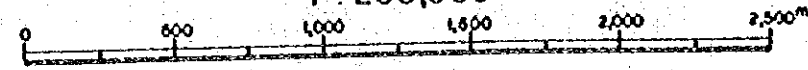
LEGEND

- Wet Lands
- Mixed Lands
- Terrace/Alluvial Fan
- Grazing Lands
- Experiment Farm and Tea Estate
- Hardwood
- Plantation/Protection Forest, Shrub
- River (Sand/Gravel)
- Swamp / Pond
- Urban
- Canal
- Main Road
- Secondary Road
- River / Stream
- International Boundary

HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG. 5-1-10 LAND USE MAP (KAMLA-SAPT KOSI AREA) (2 of 3) (Based on the LRMP)	
JAPAN INTERNATIONAL COOPERATION AGENCY	
Date: February 1985	Sheet No.

LAND USE MAP (SAPT KOSI - KANKAI AREA)
(Based on the LRMP)

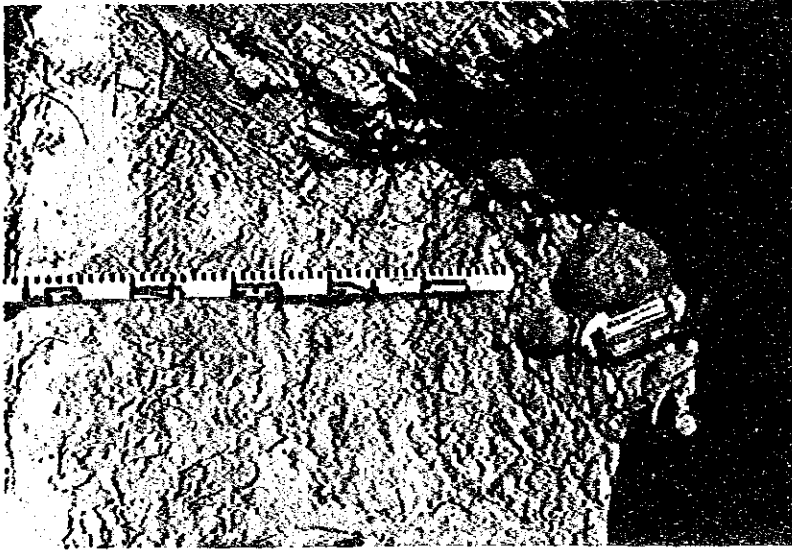
1 : 250,000



LEGEND

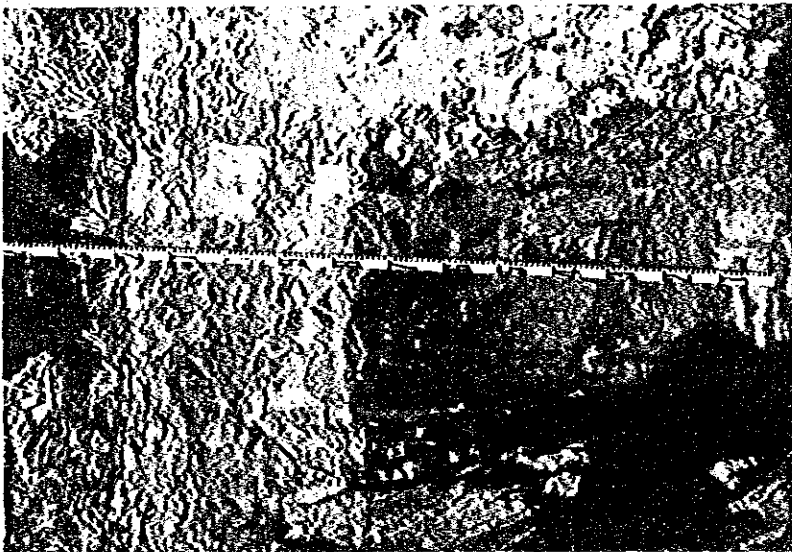
- Wet Lands
- Mixed Lands
- Terrace/Alluvial Fans
- Grazing Lands
- Experiment Farm and Tea Estate
- Hardwood
- Plantation/Protection Forest, Shrub
- River (Sand/Gravel)
- Swamp / Pond
- Urban
- Canal
- Main Road
- Secondary Road
- River / Stream
- International Boundary

HIS MAJESTY'S GOVERNMENT OF NEPAL MINISTRY OF WATER RESOURCES	
KOSI RIVER WATER RESOURCES DEVELOPMENT MASTER PLAN STUDY	
FIG. 5-1-10 LAND USE MAP (SAPT KOSI-KANKAI AREA) (3 of 3) (Based on the LRMP)	
JAPAN INTERNATIONAL COOPERATION AGENCY	
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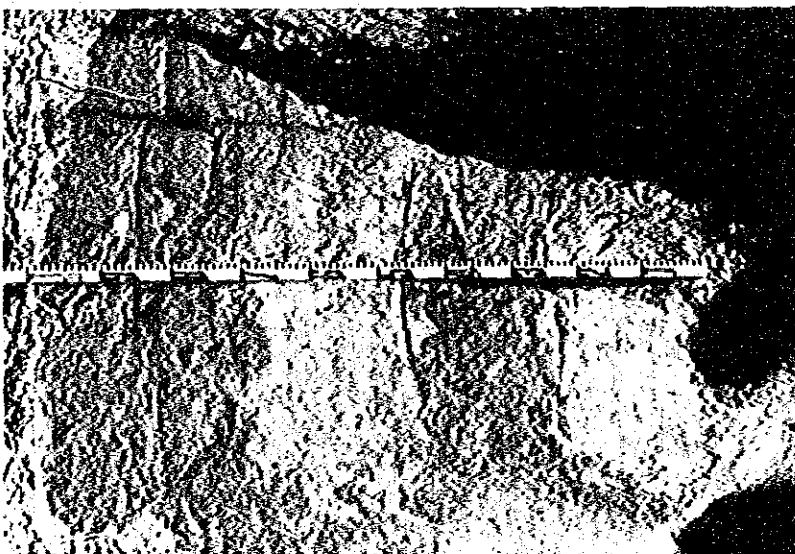
-1385-547122

Location: Birdipur
Sample No.: 13



-1385-547121

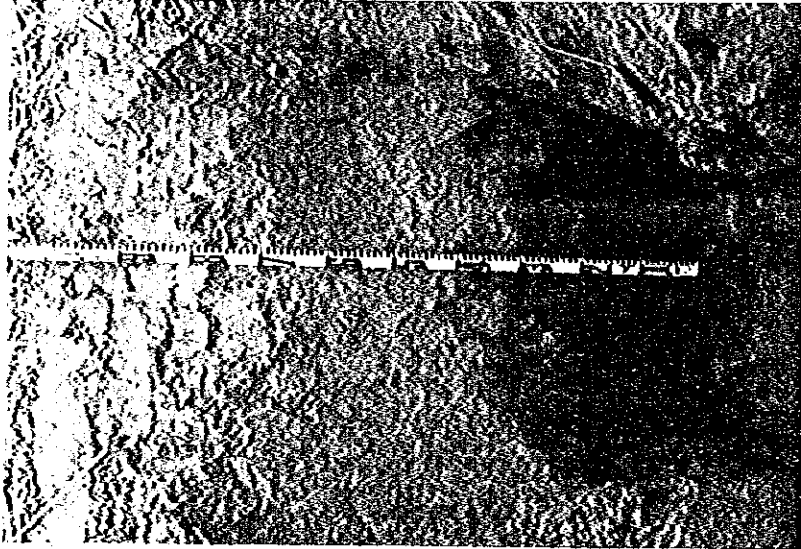
Location: Hathmura
Sample No.: 9



-1385-547124

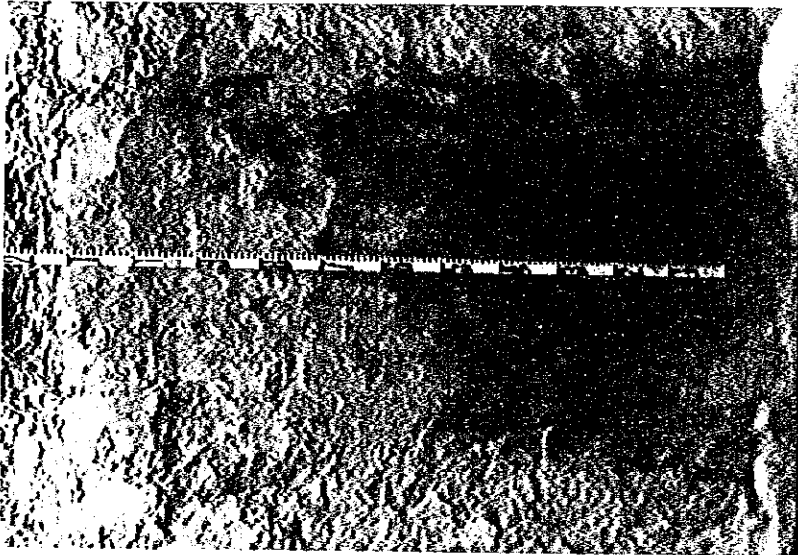
Location: Gauradah
Sample No.: 2

PHOTO 5-1-1 SOIL PROFILE
(1 of 2)



-1985-547112

Location:Hathler
Sample No.:21



-1985-547112

Location:Banauli
Sample No.:20

PHOTO 5-1-1 SOIL PROFILE
(2 of 2)

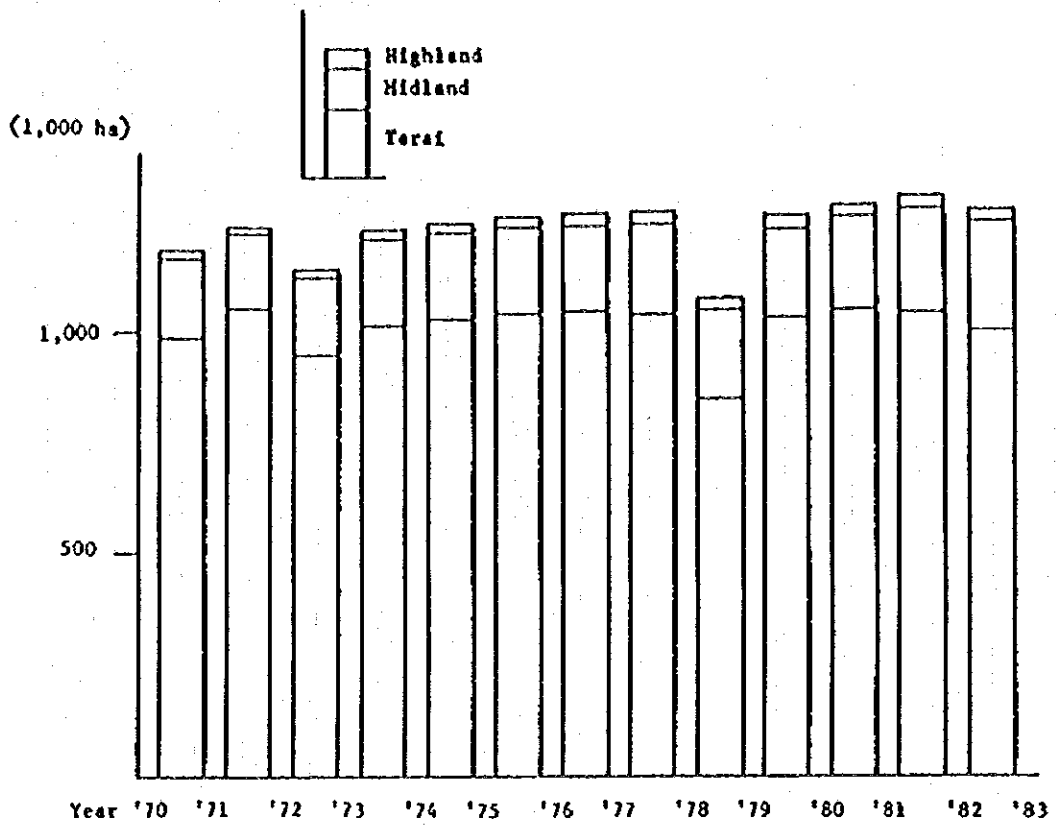


FIG. 5-2-1 CULTIVATED PADDY AREA FOR EACH ZONE

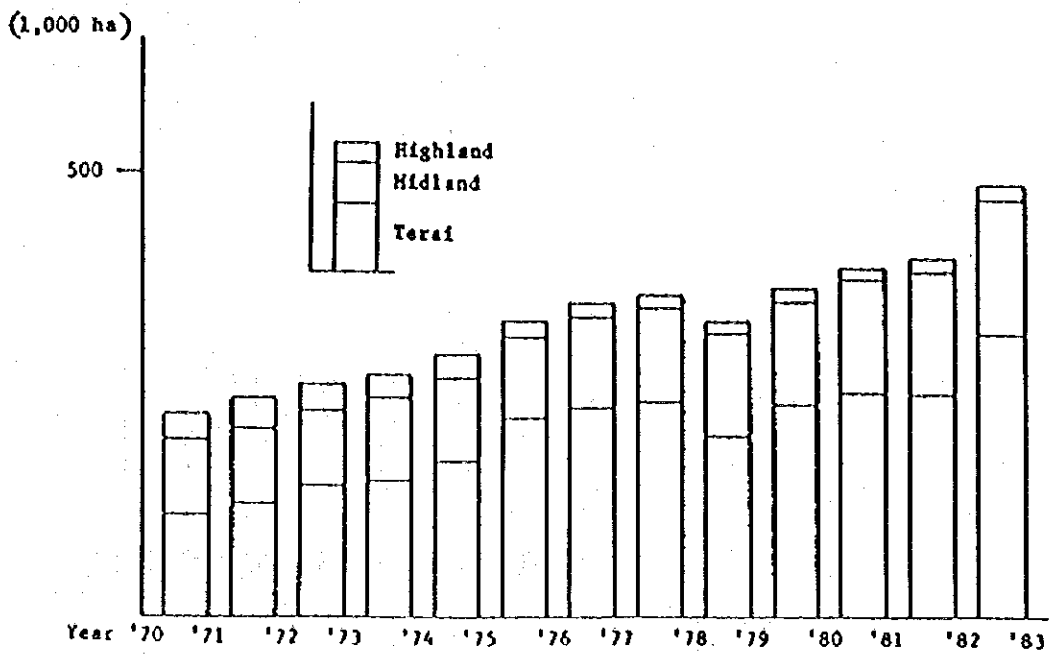


FIG. 5-2-2 CULTIVATED WHEAT AREA FOR EACH ZONE

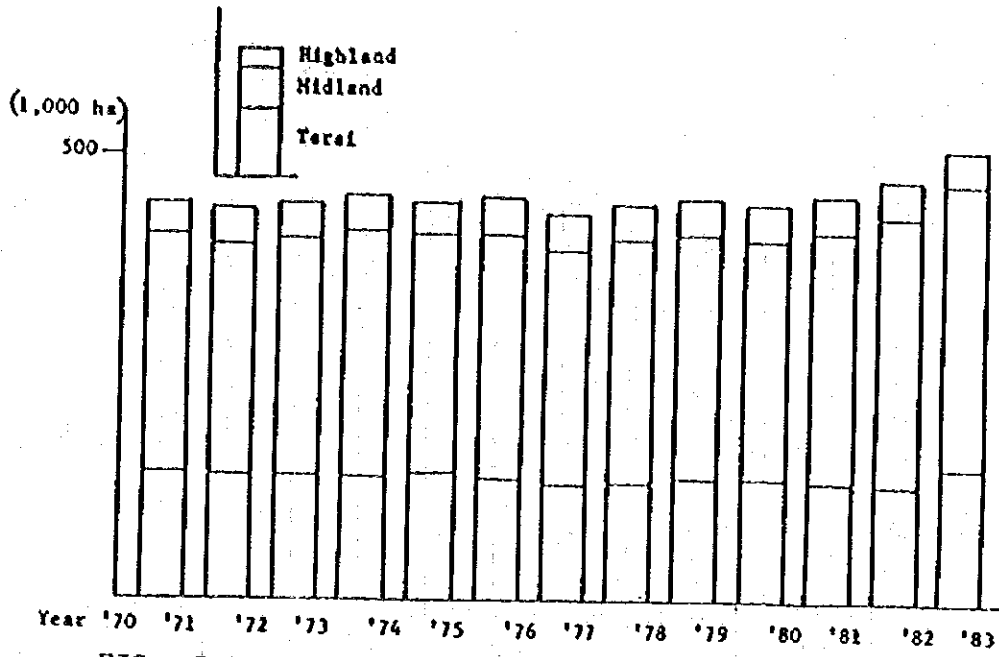


FIG. 5-2-3 CULTIVATED MAIZE AREA FOR EACH ZONE

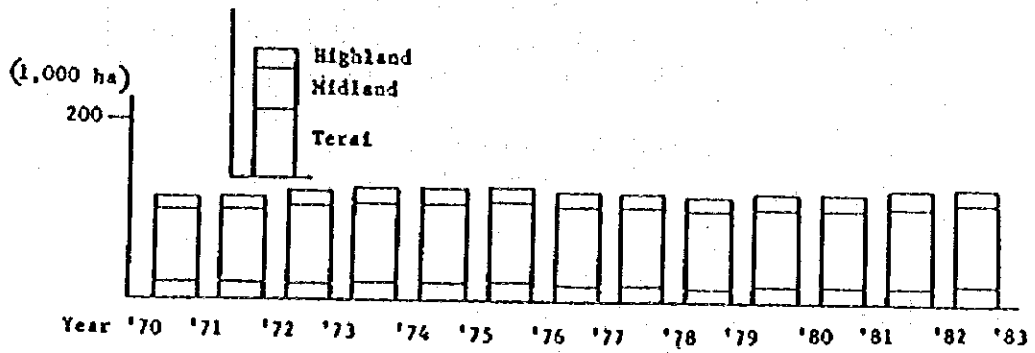


FIG. 5-2-4 CULTIVATED MILLET AREA FOR EACH ZONE

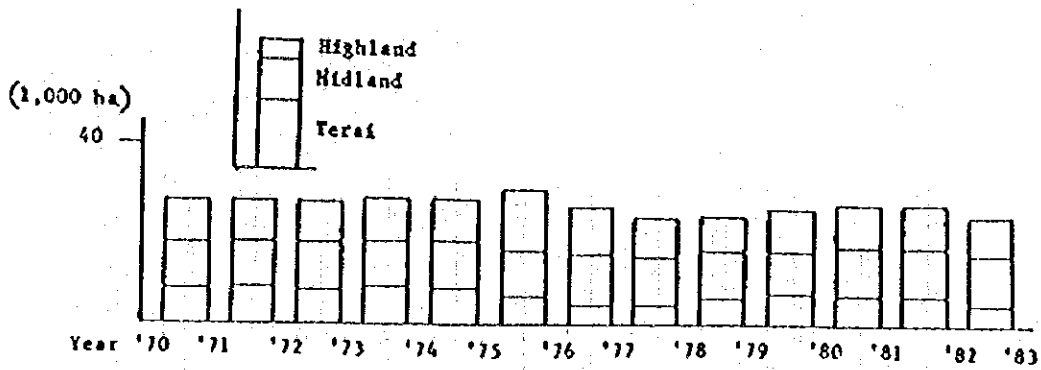


FIG. 5-2-5 CULTIVATED BARLEY AREA FOR EACH ZONE