



TABLE 8-3

## SENSITIVITY ANALYSIS (CASE 3)

FIRR= 0.110408

NPV=0.006905

		Million Yen																
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)				Cost	Benefit				Benefit - Cost	
		Investment		Operation and Maintenance				Investment	Operation & Maintenance				Total	Benefit				
		Hydro	Diesel	Hydropower Plant	Diesel Power Plant				Fuel	Tax	Repair /Others			Fuel Saving	Tax Saving	Repair /Others Saving		Turn-over from Energy Sold
Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel Saving	Tax Saving	Repair /Others Saving	Turn-over from Energy Sold				
1	1986	125.40										125.40					0.00	-125.40
2	1987	769.50										769.50					0.00	-769.50
3	1988	1488.65	1200.00								1200.00	1488.65					0.00	-1488.65
4	1989	1121.95		49.15	33.67	911.86	25.65	38.94				1121.95	212.62	-49.15	-26.95	25.19	161.71	-960.24
5	1990			48.16	33.67	773.52	24.43	38.94				0.00	365.58	-48.30	-26.95	72.89	363.22	363.22
6	1991			47.18	33.67	810.00	23.22	38.94				0.00	343.91	-47.47	-26.95	86.65	356.14	356.14
7	1992			51.33	33.67	832.50	24.45	38.94				0.00	336.41	-51.81	-26.95	101.66	359.31	359.31
8	1993			50.24	33.67	843.32	23.10	38.94				0.00	340.78	-50.88	-26.95	114.70	377.65	377.65
9	1994			49.15	33.67	854.29	21.75	38.94				0.00	345.21	-49.95	-26.95	114.70	383.01	383.01
10	1995			48.06	33.67	865.39	20.39	38.94				0.00	349.70	-49.01	-26.95	114.70	388.44	388.44
11	1996			46.96	33.67	876.64	19.04	38.94				0.00	354.24	-48.07	-26.95	114.70	393.92	393.92
12	1997			45.87	33.67	888.04	17.69	38.94				0.00	358.85	-47.14	-26.95	114.70	399.46	399.46
13	1998			44.78	33.67	899.58	16.34	38.94				0.00	363.51	-46.21	-26.95	114.70	405.05	405.05
14	1999			43.69	33.67	911.28	14.99	38.94				0.00	368.24	-45.28	-26.95	114.70	410.71	410.71
15	2000			42.59	33.67	923.12	13.64	38.94				0.00	373.03	-44.35	-26.95	114.70	416.43	416.43
16	2001			41.50	33.67	935.12	12.29	38.94				0.00	377.88	-43.42	-26.95	114.70	422.21	422.21
17	2002			40.41	33.67	947.28	10.94	38.94				0.00	382.77	-42.49	-26.95	114.70	428.05	428.05
18	2003			39.32	33.67	959.60	9.59	38.94				0.00	387.79	-41.56	-26.95	114.70	433.96	433.96
19	2004			38.23	33.67	972.07	8.24	38.94				0.00	392.81	-40.63	-26.95	114.70	439.93	439.93
20	2005			37.13	33.67	984.71	6.89	38.94	1080.00			-1080.00	397.91	-39.69	-26.95	114.70	445.97	1525.97
21	2006			36.04	33.67	997.51	5.53	38.94				0.00	403.09	-13.07	-26.95	114.70	477.77	477.77
22	2007		1080.00	34.95	33.67	1010.48	4.18	38.94				1080.00	408.33	-12.14	-26.95	114.70	483.94	-596.06
23	2008			33.86	33.67	1023.61	28.50	38.94				0.00	413.63	-36.88	-26.95	114.70	464.50	464.50
24	2009			32.77	33.67	1036.92	27.15	38.94				0.00	419.01	-35.95	-26.95	114.70	470.81	470.81
25	2010			31.67	33.67	1050.40	25.80	38.94				0.00	424.46	-35.01	-26.95	114.70	477.20	477.20
26	2011			30.58	33.67	1064.05	24.45	38.94				0.00	429.98	-34.08	-26.95	114.70	483.65	483.65
27	2012			29.49	33.67	1077.89	23.10	38.94				0.00	435.57	-33.15	-26.95	114.70	490.17	490.17
28	2013			28.40	33.67	1091.90	21.75	38.94				0.00	441.23	-32.22	-26.95	114.70	496.76	496.76
29	2014			27.30	33.67	1106.09	20.39	38.94				0.00	446.96	-31.27	-26.95	114.70	503.44	503.44
30	2015			26.21	33.67	1120.47	19.04	38.94				0.00	452.78	-30.34	-26.95	114.70	510.19	510.19
31	2016			25.12	33.67	1135.04	17.69	38.94				0.00	458.66	-29.41	-26.95	114.70	517.00	517.00
32	2017			24.03	33.67	1149.79	16.34	38.94				0.00	464.62	-28.49	-26.95	114.70	523.88	523.88
33	2018			22.94	33.67	1164.74	14.99	38.94				0.00	470.66	-27.56	-26.95	114.70	530.85	530.85
34	2019			21.84	33.67	1179.88	13.64	38.94				0.00	476.78	-26.62	-26.95	114.70	537.91	537.91
35	2020			20.75	33.67	1195.22	12.29	38.94				0.00	482.98	-25.69	-26.95	114.70	545.04	545.04
36	2021			19.66	33.67	1210.76	10.94	38.94				0.00	489.26	-24.76	-26.95	114.70	552.25	552.25
37	2022			18.57	33.67	1226.50	9.59	38.94	1080.00			-1080.00	495.62	-23.83	-26.95	114.70	559.54	1639.54
38	2023			17.47	33.67	1242.44	8.24	38.94				0.00	502.06	2.79	-26.95	114.70	592.60	592.60
39	2024			16.38	33.67	1258.60	6.89	38.94				0.00	508.59	3.72	-26.95	114.70	600.06	600.06
40	2025			15.29	33.67	1274.96	5.53	38.94				0.00	515.20	4.66	-26.95	114.70	607.61	607.61
41	2026		1080.00	14.20	33.67	1291.53	4.18	38.94				1080.00	521.90	5.59	-26.95	114.70	615.24	-464.76
42	2027			13.11	33.67	1308.32	28.50	38.94				0.00	528.68	-19.15	-26.95	114.70	597.28	597.28
43	2028			12.01	33.67	1325.33	27.15	38.94				0.00	535.56	-18.21	-26.95	114.70	605.10	605.10
44	2029			10.92	33.67	1342.56	25.80	38.94				0.00	542.52	-17.28	-26.95	114.70	612.99	612.99
45	2030			9.83	33.67	1360.01	24.45	38.94				0.00	549.57	-16.35	-26.95	114.70	620.97	620.97
46	2031			8.74	33.67	1377.69	23.10	38.94				0.00	556.72	-15.42	-26.95	114.70	629.05	629.05
47	2032			7.65	33.67	1395.60	21.75	38.94				0.00	563.95	-14.49	-26.95	114.70	637.21	637.21
48	2033	-350.55	-682.12	6.55	33.67	1413.75	20.39	38.94	-381.18			-651.49	571.28	-13.54	-26.95	114.70	645.49	1296.98

TABLE 8-4

SENSITIVITY ANALYSIS (CASE 4)

FIRR= 0.115775

NPV=0.009144

		Million Yen																			
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation(w/o Hydro)			Cost	Benefit				Benefit - Cos					
		Investment		Operation and Maintenance				Invest-ment	Operation & Maintenance			Total	Benefit								
		Hydro	Diesel	Hydropower Plant		Diesel Power Plant			Fuel	Tax			Repair /Others	Fuel Saving	Tax Saving		Repair /Others Saving	Turn-over from Energy Sold			
Tax	Repair /Others			Fuel	Tax	Repair /Others	Fuel	Tax			Repair /Others										
1	1986	118.80									118.80							0.00	-118.80		
2	1987	729.00									729.00							0.00	-729.00		
3	1988	1410.30	1200.00							1200.00	1410.30							0.00	-1410.30		
4	1989	1062.90		49.15	33.67	911.86	25.65	38.94			1062.90	1124.48	25.65	45.66	0.00	212.62	-49.15	-26.95	25.19	161.71	-901.19
5	1990			48.16	33.67	773.52	24.43	38.94			0.00	1139.10	24.29	45.66	0.00	365.58	-48.30	-26.95	72.89	363.22	363.22
6	1991			47.18	33.67	810.00	23.22	38.94			0.00	1153.91	22.93	45.66	0.00	343.91	-47.47	-26.95	86.65	356.14	356.14
7	1992			51.33	33.67	832.50	24.45	38.94			0.00	1168.91	23.97	45.66	0.00	336.41	-51.81	-26.95	101.66	359.31	359.31
8	1993			50.24	33.67	843.32	23.10	38.94			0.00	1184.10	22.46	45.66	0.00	340.78	-50.88	-26.95	114.70	377.65	377.65
9	1994			49.15	33.67	854.29	21.75	38.94			0.00	1199.50	20.95	45.66	0.00	345.21	-49.95	-26.95	114.70	383.01	383.01
10	1995			48.06	33.67	865.39	20.39	38.94			0.00	1215.09	19.44	45.66	0.00	349.70	-49.01	-26.95	114.70	388.44	388.44
11	1996			46.96	33.67	876.64	19.04	38.94			0.00	1230.89	17.93	45.66	0.00	354.24	-48.07	-26.95	114.70	393.92	393.92
12	1997			45.87	33.67	888.04	17.69	38.94			0.00	1246.89	16.42	45.66	0.00	358.85	-47.14	-26.95	114.70	399.46	399.46
13	1998			44.78	33.67	899.58	16.34	38.94			0.00	1263.10	14.91	45.66	0.00	363.51	-46.21	-26.95	114.70	405.05	405.05
14	1999			43.69	33.67	911.28	14.99	38.94			0.00	1279.52	13.40	45.66	0.00	368.24	-45.28	-26.95	114.70	410.71	410.71
15	2000			42.59	33.67	923.12	13.64	38.94			0.00	1296.15	11.88	45.66	0.00	373.03	-44.35	-26.95	114.70	416.43	416.43
16	2001			41.50	33.67	935.12	12.29	38.94			0.00	1313.00	10.37	45.66	0.00	377.88	-43.42	-26.95	114.70	422.21	422.21
17	2002			40.41	33.67	947.28	10.94	38.94			0.00	1330.07	8.86	45.66	0.00	382.79	-42.49	-26.95	114.70	428.05	428.05
18	2003			39.32	33.67	959.60	9.59	38.94			0.00	1347.36	7.35	45.66	0.00	387.77	-41.56	-26.95	114.70	433.96	433.96
19	2004			38.23	33.67	972.07	8.24	38.94			0.00	1364.88	5.84	45.66	0.00	392.81	-40.63	-26.95	114.70	439.93	439.93
20	2005			37.13	33.67	984.71	6.89	38.94	1080.00		-1080.00	1382.62	4.33	45.66	0.00	397.91	-39.69	-26.95	114.70	445.97	1525.97
21	2006			36.04	33.67	997.51	5.53	38.94			0.00	1400.59	28.50	45.66	0.00	403.09	-13.07	-26.95	114.70	477.77	477.77
22	2007		1080.00	34.95	33.67	1010.48	4.18	38.94			1080.00	1418.80	26.99	45.66	0.00	408.33	-12.14	-26.95	114.70	483.94	-596.06
23	2008			33.86	33.67	1023.61	28.50	38.94			0.00	1437.25	25.48	45.66	0.00	413.63	-36.88	-26.95	114.70	464.50	464.50
24	2009			32.77	33.67	1036.92	27.15	38.94			0.00	1455.93	23.97	45.66	0.00	419.01	-35.95	-26.95	114.70	470.81	470.81
25	2010			31.67	33.67	1050.40	25.80	38.94			0.00	1474.86	22.46	45.66	0.00	424.46	-35.01	-26.95	114.70	477.20	477.20
26	2011			30.58	33.67	1064.05	24.45	38.94			0.00	1494.03	20.95	45.66	0.00	429.98	-34.08	-26.95	114.70	483.65	483.65
27	2012			29.49	33.67	1077.89	23.10	38.94			0.00	1513.45	19.44	45.66	0.00	435.57	-33.15	-26.95	114.70	490.17	490.17
28	2013			28.40	33.67	1091.90	21.75	38.94			0.00	1533.13	17.93	45.66	0.00	441.23	-32.22	-26.95	114.70	496.76	496.76
29	2014			27.30	33.67	1106.09	20.39	38.94			0.00	1553.06	16.42	45.66	0.00	446.96	-31.27	-26.95	114.70	503.44	503.44
30	2015			26.21	33.67	1120.47	19.04	38.94			0.00	1573.25	14.91	45.66	0.00	452.78	-30.34	-26.95	114.70	510.19	510.19
31	2016			25.12	33.67	1135.04	17.69	38.94			0.00	1593.70	13.40	45.66	0.00	458.66	-29.41	-26.95	114.70	517.00	517.00
32	2017			24.03	33.67	1149.79	16.34	38.94			0.00	1614.42	11.88	45.66	0.00	464.62	-28.49	-26.95	114.70	523.88	523.88
33	2018			22.94	33.67	1164.74	14.99	38.94			0.00	1635.41	10.37	45.66	0.00	470.66	-27.56	-26.95	114.70	530.85	530.85
34	2019			21.84	33.67	1179.88	13.64	38.94			0.00	1656.67	8.86	45.66	0.00	476.78	-26.62	-26.95	114.70	537.91	537.91
35	2020			20.75	33.67	1195.22	12.29	38.94			0.00	1678.20	7.35	45.66	0.00	482.98	-25.69	-26.95	114.70	545.04	545.04
36	2021			19.66	33.67	1210.76	10.94	38.94			0.00	1700.02	5.84	45.66	0.00	489.26	-24.76	-26.95	114.70	552.25	552.25
37	2022			18.57	33.67	1226.50	9.59	38.94	1080.00		-1080.00	1722.12	4.33	45.66	0.00	495.62	-23.83	-26.95	114.70	559.54	1639.54
38	2023			17.47	33.67	1242.44	8.24	38.94			0.00	1744.51	28.50	45.66	0.00	502.06	2.79	-26.95	114.70	592.60	592.60
39	2024			16.38	33.67	1258.60	6.89	38.94			0.00	1767.19	26.99	45.66	0.00	508.59	3.72	-26.95	114.70	600.06	600.06
40	2025			15.29	33.67	1274.96	5.53	38.94			0.00	1790.16	25.48	45.66	0.00	515.20	4.66	-26.95	114.70	607.61	607.61
41	2026			14.20	33.67	1291.53	4.18	38.94			1080.00	1813.43	23.97	45.66	0.00	521.90	5.59	-26.95	114.70	615.24	-464.76
42	2027		1080.00	13.11	33.67	1308.32	28.50	38.94			0.00	1837.01	22.46	45.66	0.00	528.68	-19.15	-26.95	114.70	597.28	597.28
43	2028			12.01	33.67	1325.33	27.15	38.94			0.00	1860.89	20.95	45.66	0.00	535.56	-18.21	-26.95	114.70	605.10	605.10
44	2029			10.92	33.67	1342.56	25.80	38.94			0.00	1885.08	19.44	45.66	0.00	542.52	-17.28	-26.95	114.70	612.99	612.99
45	2030			9.83	33.67	1360.01	24.45	38.94			0.00	1909.59	17.93	45.66	0.00	549.57	-16.35	-26.95	114.70	620.97	620.97
46	2031			8.74	33.67	1377.69	23.10	38.94			0.00	1934.41	16.42	45.66	0.00	556.72	-15.42	-26.95	114.70	629.05	629.05
47	2032			7.65	33.67	1395.60	21.75	38.94			0.00	1959.56	14.91	45.66	0.00	563.95	-14.49	-26.95	114.70	637.21	637.21
48	2033	-332.10	-632.12	6.55	33.67	1413.75	20.39	38.94	-381.18		-633.04	1985.03	13.40	45.66	0.00	571.28	-13.54	-26.95	114.70	645.49	1278.53

TABLE 8-5

SENSITIVITY ANALYSIS (CASE 5)

FIRR= 0.094568

NPV=0.012608

		Million Yen																	
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)			Cost	Benefit				Benefit - Co			
		Investment		Operation and Maintenance				Investment	Operation & Maintenance			Total	Benefit						
		Hydro	Diesel	Hydropower Plant		Diesel Power Plant			Fuel	Tax			Repair /Others	Fuel Saving	Tax Saving		Repair /Others Savings	Turn-over from Energy Sold	
				Tax	Repair /Others	Fuel	Tax												Repair /Others
1	1986	132.00												0.00	-132.00				
2	1987	810.00												0.00	-810.00				
3	1988	1567.00	1200.00											0.00	-1567.00				
4	1989	1181.00		49.15	33.67	893.85	25.65	38.94		1099.03	25.65	45.66	1181.00	205.18	-49.15	-26.95	25.19	154.27	-1026.73
5	1990			48.16	33.67	754.47	24.43	38.94		1104.53	24.29	45.66	0.00	350.06	-48.30	-26.95	72.89	347.70	347.70
6	1991			47.18	33.67	786.12	23.22	38.94		1110.05	22.93	45.66	0.00	323.93	-47.47	-26.95	86.65	336.16	336.16
7	1992			51.33	33.67	803.94	24.45	38.94		1115.60	23.97	45.66	0.00	311.66	-51.81	-26.95	101.66	334.56	334.56
8	1993			50.24	33.67	807.96	23.10	38.94		1121.18	22.46	45.66	0.00	313.22	-50.88	-26.95	114.70	350.09	350.09
9	1994			49.15	33.67	812.00	21.75	38.94		1126.78	20.95	45.66	0.00	314.78	-49.95	-26.95	114.70	352.58	352.58
10	1995			48.06	33.67	816.06	20.39	38.94		1132.42	19.44	45.66	0.00	316.36	-49.01	-26.95	114.70	355.10	355.10
11	1996			46.96	33.67	820.14	19.04	38.94		1138.08	17.93	45.66	0.00	317.94	-48.07	-26.95	114.70	357.62	357.62
12	1997			45.87	33.67	824.24	17.69	38.94		1143.77	16.42	45.66	0.00	319.53	-47.14	-26.95	114.70	360.14	360.14
13	1998			44.78	33.67	828.36	16.34	38.94		1149.49	14.91	45.66	0.00	321.13	-46.21	-26.95	114.70	362.67	362.67
14	1999			43.69	33.67	832.50	14.99	38.94		1155.23	13.40	45.66	0.00	322.73	-45.28	-26.95	114.70	365.20	365.20
15	2000			42.59	33.67	836.67	13.64	38.94		1161.01	11.88	45.66	0.00	324.34	-44.35	-26.95	114.70	367.74	367.74
16	2001			41.50	33.67	840.85	12.29	38.94		1166.82	10.37	45.66	0.00	325.97	-43.42	-26.95	114.70	370.30	370.30
17	2002			40.41	33.67	845.05	10.94	38.94		1172.65	8.86	45.66	0.00	327.60	-42.49	-26.95	114.70	372.86	372.86
18	2003			39.32	33.67	849.28	9.59	38.94		1178.51	7.35	45.66	0.00	329.23	-41.56	-26.95	114.70	375.42	375.42
19	2004			38.23	33.67	853.53	8.24	38.94		1184.41	5.84	45.66	0.00	330.83	-40.63	-26.95	114.70	378.00	378.00
20	2005			37.13	33.67	857.79	6.89	38.94	1080.00	1190.33	4.33	45.66	-1080.00	332.53	-39.69	-26.95	114.70	380.59	1460.59
21	2006			36.04	33.67	862.08	5.53	38.94		1196.28	28.50	45.66	0.00	334.20	-13.07	-26.95	114.70	408.88	408.88
22	2007		1080.00	34.95	33.67	866.39	4.18	38.94		1202.26	26.99	45.66	1080.00	335.87	-12.14	-26.95	114.70	411.48	-668.52
23	2008			33.86	33.67	870.72	28.50	38.94		1208.27	25.48	45.66	0.00	337.55	-36.88	-26.95	114.70	388.42	388.42
24	2009			32.77	33.67	875.08	27.15	38.94		1214.31	23.97	45.66	0.00	339.24	-35.95	-26.95	114.70	391.04	391.04
25	2010			31.67	33.67	879.45	25.80	38.94		1220.38	22.46	45.66	0.00	340.93	-35.01	-26.95	114.70	393.67	393.67
26	2011			30.58	33.67	883.85	24.45	38.94		1226.49	20.95	45.66	0.00	342.64	-34.08	-26.95	114.70	396.31	396.31
27	2012			29.49	33.67	888.27	23.10	38.94		1232.62	19.44	45.66	0.00	344.35	-33.15	-26.95	114.70	398.95	398.95
28	2013			28.40	33.67	892.71	21.75	38.94		1238.78	17.93	45.66	0.00	346.07	-32.22	-26.95	114.70	401.60	401.60
29	2014			27.30	33.67	897.17	20.39	38.94		1244.98	16.42	45.66	0.00	347.80	-31.27	-26.95	114.70	404.28	404.28
30	2015			26.21	33.67	901.66	19.04	38.94		1251.20	14.91	45.66	0.00	349.54	-30.34	-26.95	114.70	406.95	406.95
31	2016			25.12	33.67	906.17	17.69	38.94		1257.46	13.40	45.66	0.00	351.29	-29.41	-26.95	114.70	409.63	409.63
32	2017			24.03	33.67	910.70	16.34	38.94		1263.74	11.88	45.66	0.00	353.04	-28.49	-26.95	114.70	412.30	412.30
33	2018			22.94	33.67	915.25	14.99	38.94		1270.06	10.37	45.66	0.00	354.81	-27.56	-26.95	114.70	415.00	415.00
34	2019			21.84	33.67	919.83	13.64	38.94		1276.41	8.86	45.66	0.00	356.58	-26.62	-26.95	114.70	417.71	417.71
35	2020			20.75	33.67	924.43	12.29	38.94		1282.80	7.35	45.66	0.00	358.37	-25.69	-26.95	114.70	420.43	420.43
36	2021			19.66	33.67	929.05	10.94	38.94		1289.21	5.84	45.66	0.00	360.16	-24.76	-26.95	114.70	423.15	423.15
37	2022			18.57	33.67	933.70	9.59	38.94	1080.00	1295.66	4.33	45.66	-1080.00	361.96	-23.83	-26.95	114.70	425.88	1505.88
38	2023			17.47	33.67	938.36	8.24	38.94		1302.13	28.50	45.66	0.00	363.77	2.79	-26.95	114.70	454.31	454.31
39	2024			16.38	33.67	943.06	6.89	38.94		1308.64	26.99	45.66	0.00	365.59	3.72	-26.95	114.70	457.06	457.06
40	2025			15.29	33.67	947.77	5.53	38.94		1315.19	25.48	45.66	0.00	367.42	4.66	-26.95	114.70	459.83	459.83
41	2026			14.20	33.67	952.51	4.18	38.94		1321.76	23.97	45.66	1080.00	369.25	5.59	-26.95	114.70	462.59	-617.41
42	2027		1080.00	13.11	33.67	957.27	28.50	38.94		1328.37	22.46	45.66	0.00	371.10	-19.15	-26.95	114.70	439.70	439.70
43	2028			12.01	33.67	962.06	27.15	38.94		1335.01	20.95	45.66	0.00	372.96	-18.21	-26.95	114.70	442.50	442.50
44	2029			10.92	33.67	966.87	25.80	38.94		1341.69	19.44	45.66	0.00	374.82	-17.28	-26.95	114.70	445.29	445.29
45	2030			9.83	33.67	971.70	24.45	38.94		1348.40	17.93	45.66	0.00	376.69	-16.35	-26.95	114.70	448.09	448.09
46	2031			8.74	33.67	976.56	23.10	38.94		1355.14	16.42	45.66	0.00	378.58	-15.42	-26.95	114.70	450.91	450.91
47	2032			7.65	33.67	981.45	21.75	38.94		1361.92	14.91	45.66	0.00	380.47	-14.49	-26.95	114.70	453.73	453.73
48	2033	-369.00	-682.12	6.55	33.67	986.35	20.39	38.94	-381.18	1368.73	13.40	45.66	-669.94	382.37	-13.54	-26.95	114.70	456.58	1126.52

TABLE 8-6

SENSITIVITY ANALYSIS (CASE 6)

FIRR= 0.090234

NPV=0.003670

		Million Yen																
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)			Cost	Benefit				Benefit - Cos		
		Investment		Operation and Maintenance				Investment	Operation & Maintenance			Total	Benefit					
		Hydro	Diesel	Hydropower Plant	Diesel Power Plant				Fuel	Tax			Repair /Others	Fuel Saving	Tax Saving		Repair /Others Saving	Turn-over from Energy Sold
1	1986	132.00									132.00					0.00	-132.00	
2	1987	810.00									810.00					0.00	-810.00	
3	1988	1567.00	1200.00					1200.00			1567.00					0.00	-1567.00	
4	1989	1181.00		49.15	33.67	865.95	25.85	38.94	1067.86	25.65	45.66	1181.00	201.91	-49.15	-26.95	25.19	151.00	-1030.00
5	1990			48.16	33.67	725.14	24.43	38.94	1067.86	24.29	45.66	0.00	342.72	-48.30	-26.95	72.89	340.36	340.36
6	1991			47.18	33.67	749.60	23.22	38.94	1067.86	22.93	45.66	0.00	318.26	-47.47	-26.95	86.65	330.49	330.49
7	1992			51.33	33.67	760.53	24.45	38.94	1067.86	23.97	45.66	0.00	307.33	-51.81	-26.95	101.66	330.23	330.23
8	1993			50.24	33.67	760.53	23.10	38.94	1067.86	22.46	45.66	0.00	307.33	-50.88	-26.95	114.70	344.20	344.20
9	1994			49.15	33.67	760.53	21.75	38.94	1067.86	20.95	45.66	0.00	307.33	-49.95	-26.95	114.70	345.13	345.13
10	1995			48.06	33.67	760.53	20.39	38.94	1067.86	19.44	45.66	0.00	307.33	-49.01	-26.95	114.70	346.07	346.07
11	1996			46.96	33.67	760.53	19.04	38.94	1067.86	17.93	45.66	0.00	307.33	-48.07	-26.95	114.70	347.01	347.01
12	1997			45.87	33.67	760.53	17.69	38.94	1067.86	16.42	45.66	0.00	307.33	-47.14	-26.95	114.70	347.94	347.94
13	1998			44.78	33.67	760.53	16.34	38.94	1067.86	14.91	45.66	0.00	307.33	-46.21	-26.95	114.70	348.87	348.87
14	1999			43.69	33.67	760.53	14.99	38.94	1067.86	13.40	45.66	0.00	307.33	-45.28	-26.95	114.70	349.80	349.80
15	2000			42.59	33.67	760.53	13.64	38.94	1067.86	11.88	45.66	0.00	307.33	-44.35	-26.95	114.70	350.73	350.73
16	2001			41.50	33.67	760.53	12.29	38.94	1067.86	10.37	45.66	0.00	307.33	-43.42	-26.95	114.70	351.66	351.66
17	2002			40.41	33.67	760.53	10.94	38.94	1067.86	8.86	45.66	0.00	307.33	-42.49	-26.95	114.70	352.59	352.59
18	2003			39.32	33.67	760.53	9.59	38.94	1067.86	7.35	45.66	0.00	307.33	-41.56	-26.95	114.70	353.52	353.52
19	2004			38.23	33.67	760.53	8.24	38.94	1067.86	5.84	45.66	0.00	307.33	-40.63	-26.95	114.70	354.45	354.45
20	2005			37.13	33.67	760.53	6.89	38.94	1067.86	4.33	45.66	-1080.00	307.33	-39.69	-26.95	114.70	355.39	1435.39
21	2006			36.04	33.67	760.53	5.53	38.94	1067.86	28.50	45.66	0.00	307.33	-13.07	-26.95	114.70	382.01	382.01
22	2007		1080.00	34.95	33.67	760.53	4.18	38.94	1067.86	26.99	45.66	1080.00	307.33	-12.14	-26.95	114.70	382.94	-697.06
23	2008			33.86	33.67	760.53	28.50	38.94	1067.86	25.48	45.66	0.00	307.33	-36.88	-26.95	114.70	358.20	358.20
24	2009			32.77	33.67	760.53	27.15	38.94	1067.86	23.97	45.66	0.00	307.33	-35.95	-26.95	114.70	359.13	359.13
25	2010			31.67	33.67	760.53	25.80	38.94	1067.86	22.46	45.66	0.00	307.33	-35.01	-26.95	114.70	360.07	360.07
26	2011			30.58	33.67	760.53	24.45	38.94	1067.86	20.95	45.66	0.00	307.33	-34.08	-26.95	114.70	361.00	361.00
27	2012			29.49	33.67	760.53	23.10	38.94	1067.86	19.44	45.66	0.00	307.33	-33.15	-26.95	114.70	361.93	361.93
28	2013			28.40	33.67	760.53	21.75	38.94	1067.86	17.93	45.66	0.00	307.33	-32.22	-26.95	114.70	362.86	362.86
29	2014			27.30	33.67	760.53	20.39	38.94	1067.86	16.42	45.66	0.00	307.33	-31.27	-26.95	114.70	363.81	363.81
30	2015			26.21	33.67	760.53	19.04	38.94	1067.86	14.91	45.66	0.00	307.33	-30.34	-26.95	114.70	364.74	364.74
31	2016			25.12	33.67	760.53	17.69	38.94	1067.86	13.40	45.66	0.00	307.33	-29.41	-26.95	114.70	365.67	365.67
32	2017			24.03	33.67	760.53	16.34	38.94	1067.86	11.88	45.66	0.00	307.33	-28.49	-26.95	114.70	366.59	366.59
33	2018			22.94	33.67	760.53	14.99	38.94	1067.86	10.37	45.66	0.00	307.33	-27.56	-26.95	114.70	367.52	367.52
34	2019			21.84	33.67	760.53	13.64	38.94	1067.86	8.86	45.66	0.00	307.33	-26.62	-26.95	114.70	368.46	368.46
35	2020			20.75	33.67	760.53	12.29	38.94	1067.86	7.35	45.66	0.00	307.33	-25.69	-26.95	114.70	369.39	369.39
36	2021			19.66	33.67	760.53	10.94	38.94	1067.86	5.84	45.66	0.00	307.33	-24.76	-26.95	114.70	370.32	370.32
37	2022			18.57	33.67	760.53	9.59	38.94	1067.86	4.33	45.66	-1080.00	307.33	-23.83	-26.95	114.70	371.25	1451.25
38	2023			17.47	33.67	760.53	8.24	38.94	1067.86	28.50	45.66	0.00	307.33	2.79	-26.95	114.70	397.87	397.87
39	2024			16.38	33.67	760.53	6.89	38.94	1067.86	26.99	45.66	0.00	307.33	3.72	-26.95	114.70	398.80	398.80
40	2025			15.29	33.67	760.53	5.53	38.94	1067.86	25.48	45.66	0.00	307.33	4.66	-26.95	114.70	399.74	399.74
41	2026		1080.00	14.20	33.67	760.53	4.18	38.94	1067.86	23.97	45.66	1080.00	307.33	5.59	-26.95	114.70	400.67	-679.33
42	2027			13.11	33.67	760.53	28.50	38.94	1067.86	22.46	45.66	0.00	307.33	-19.15	-26.95	114.70	375.93	375.93
43	2028			12.01	33.67	760.53	27.15	38.94	1067.86	20.95	45.66	0.00	307.33	-18.21	-26.95	114.70	376.87	376.87
44	2029			10.92	33.67	760.53	25.80	38.94	1067.86	19.44	45.66	0.00	307.33	-17.28	-26.95	114.70	377.80	377.80
45	2030			9.83	33.67	760.53	24.45	38.94	1067.86	17.93	45.66	0.00	307.33	-16.35	-26.95	114.70	378.73	378.73
46	2031			8.74	33.67	760.53	23.10	38.94	1067.86	16.42	45.66	0.00	307.33	-15.42	-26.95	114.70	379.66	379.66
47	2032			7.65	33.67	760.53	21.75	38.94	1067.86	14.91	45.66	0.00	307.33	-14.49	-26.95	114.70	380.59	380.59
48	2033	-369.00	-682.12	6.55	33.67	760.53	20.39	38.94	1067.86	13.40	45.66	-669.94	307.33	-13.54	-26.95	114.70	381.54	1051.48



TABLE 8-7

## SENSITIVITY ANALYSIS (CASE 7)

FIRR= 0.103144

NPV=-0.001650

		Million Yen																	
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)				Cost	Benefit				Benefit - Cost		
		Investment		Operation and Maintenance				Investment	Operation & Maintenance				Total	Benefit					
		Hydro	Diesel	Hydropower Plant		Diesel Power Plant			Fuel	Tax	Repair /Others			Fuel Saving	Tax Saving	Repair /Others Saving		Turn-over from Energy Sold	
				Tax	Repair /Others	Fuel	Tax												Repair /Others
1	1986	132.00														0.00	-132.00		
2	1987	810.00														0.00	-810.00		
3	1988	1567.00	1200.00													0.00	-1567.00		
4	1989	1181.00		49.15	33.67	911.86	25.65	38.94		1124.48	25.65	45.66	1181.00	212.62	-49.15	-26.95	22.67	159.19	-1021.81
5	1990			48.16	33.67	773.52	24.43	38.94		1139.10	24.29	45.66	0.00	365.58	-48.30	-26.95	65.60	355.93	355.93
6	1991			47.18	33.67	810.00	23.22	38.94		1153.91	22.93	45.66	0.00	343.91	-47.47	-26.95	77.99	347.47	347.47
7	1992			51.33	33.67	832.50	24.45	38.94		1168.91	23.97	45.66	0.00	336.41	-51.81	-26.95	91.49	349.14	349.14
8	1993			50.24	33.67	843.32	23.10	38.94		1184.10	22.46	45.66	0.00	340.78	-50.88	-26.95	103.23	366.18	366.18
9	1994			49.15	33.67	854.29	21.75	38.94		1199.50	20.95	45.66	0.00	345.21	-49.95	-26.95	103.23	371.54	371.54
10	1995			48.06	33.67	865.39	20.39	38.94		1215.09	19.44	45.66	0.00	349.70	-49.01	-26.95	103.23	376.97	376.97
11	1996			46.96	33.67	876.84	19.04	38.94		1230.89	17.93	45.66	0.00	354.24	-48.07	-26.95	103.23	382.45	382.45
12	1997			45.87	33.67	888.04	17.69	38.94		1246.89	16.42	45.66	0.00	358.85	-47.14	-26.95	103.23	387.99	387.99
13	1998			44.78	33.67	899.58	16.34	38.94		1263.10	14.91	45.66	0.00	363.51	-46.21	-26.95	103.23	393.58	393.58
14	1999			43.69	33.67	911.28	14.99	38.94		1279.52	13.40	45.66	0.00	368.24	-45.28	-26.95	103.23	399.24	399.24
15	2000			42.59	33.67	923.12	13.64	38.94		1296.15	11.88	45.66	0.00	373.03	-44.35	-26.95	103.23	404.96	404.96
16	2001			41.50	33.67	935.12	12.29	38.94		1313.00	10.37	45.66	0.00	377.88	-43.42	-26.95	103.23	410.74	410.74
17	2002			40.41	33.67	947.28	10.94	38.94		1330.07	8.86	45.66	0.00	382.79	-42.49	-26.95	103.23	416.58	416.58
18	2003			39.32	33.67	959.60	9.59	38.94		1347.36	7.35	45.66	0.00	387.77	-41.56	-26.95	103.23	422.49	422.49
19	2004			38.23	33.67	972.07	8.24	38.94		1364.88	5.84	45.66	0.00	392.81	-40.63	-26.95	103.23	428.46	428.46
20	2005			37.13	33.67	984.71	6.89	38.94	1080.00	1382.62	4.33	45.66	-1080.00	397.91	-39.69	-26.95	103.23	434.50	1514.50
21	2006			36.04	33.67	997.51	5.53	38.94		1400.59	28.50	45.66	0.00	403.09	-13.07	-26.95	103.23	466.30	466.30
22	2007		1080.00	34.95	33.67	1010.48	4.18	38.94		1418.80	26.99	45.66	1080.00	408.33	-12.14	-26.95	103.23	472.47	-607.53
23	2008			33.86	33.67	1023.61	28.50	38.94		1437.25	25.48	45.66	0.00	413.63	-36.88	-26.95	103.23	453.03	453.03
24	2009			32.77	33.67	1036.92	27.15	38.94		1455.93	23.97	45.66	0.00	419.01	-35.95	-26.95	103.23	459.34	459.34
25	2010			31.67	33.67	1050.40	25.80	38.94		1474.86	22.46	45.66	0.00	424.46	-35.01	-26.95	103.23	465.73	465.73
26	2011			30.58	33.67	1064.05	24.45	38.94		1494.03	20.95	45.66	0.00	429.98	-34.08	-26.95	103.23	472.18	472.18
27	2012			29.49	33.67	1077.89	23.10	38.94		1513.45	19.44	45.66	0.00	435.57	-33.15	-26.95	103.23	478.70	478.70
28	2013			28.40	33.67	1091.90	21.75	38.94		1533.13	17.93	45.66	0.00	441.23	-32.22	-26.95	103.23	485.29	485.29
29	2014			27.30	33.67	1106.09	20.39	38.94		1553.06	16.42	45.66	0.00	446.96	-31.27	-26.95	103.23	491.97	491.97
30	2015			26.21	33.67	1120.47	19.04	38.94		1573.25	14.91	45.66	0.00	452.78	-30.34	-26.95	103.23	498.72	498.72
31	2016			25.12	33.67	1135.04	17.69	38.94		1593.70	13.40	45.66	0.00	458.66	-29.41	-26.95	103.23	505.53	505.53
32	2017			24.03	33.67	1149.79	16.34	38.94		1614.42	11.88	45.66	0.00	464.62	-28.49	-26.95	103.23	512.41	512.41
33	2018			22.94	33.67	1164.74	14.99	38.94		1635.41	10.37	45.66	0.00	470.66	-27.56	-26.95	103.23	519.38	519.38
34	2019			21.84	33.67	1179.88	13.64	38.94		1656.67	8.86	45.66	0.00	476.78	-26.62	-26.95	103.23	526.44	526.44
35	2020			20.75	33.67	1195.22	12.29	38.94		1678.20	7.35	45.66	0.00	482.98	-25.69	-26.95	103.23	533.57	533.57
36	2021			19.66	33.67	1210.76	10.94	38.94		1700.02	5.84	45.66	0.00	489.26	-24.76	-26.95	103.23	540.78	540.78
37	2022			18.57	33.67	1226.50	9.59	38.94	1080.00	1722.12	4.33	45.66	-1080.00	495.62	-23.83	-26.95	103.23	548.07	1628.07
38	2023			17.47	33.67	1242.44	8.24	38.94		1744.51	28.50	45.66	0.00	502.06	2.79	-26.95	103.23	581.13	581.13
39	2024			16.38	33.67	1258.60	6.89	38.94		1767.19	26.99	45.66	0.00	508.59	3.72	-26.95	103.23	588.59	588.59
40	2025			15.29	33.67	1274.96	5.53	38.94		1790.16	25.48	45.66	0.00	515.20	4.66	-26.95	103.23	596.14	596.14
41	2026		1080.00	14.20	33.67	1291.53	4.18	38.94		1799.16	23.97	45.66	1080.00	521.90	5.59	-26.95	103.23	603.77	-476.23
42	2027			13.11	33.67	1308.32	28.50	38.94		1813.43	22.46	45.66	0.00	528.68	-19.15	-26.95	103.23	585.81	585.81
43	2028			12.01	33.67	1325.33	27.15	38.94		1837.01	20.95	45.66	0.00	535.56	-18.21	-26.95	103.23	593.63	593.63
44	2029			10.92	33.67	1342.56	25.80	38.94		1860.89	19.44	45.66	0.00	542.52	-17.28	-26.95	103.23	601.52	601.52
45	2030			9.83	33.67	1360.01	24.45	38.94		1885.08	17.93	45.66	0.00	549.57	-16.35	-26.95	103.23	609.50	609.50
46	2031			8.74	33.67	1377.69	23.10	38.94		1909.59	16.42	45.66	0.00	556.72	-15.42	-26.95	103.23	617.58	617.58
47	2032			7.65	33.67	1395.60	21.75	38.94		1934.41	14.91	45.66	0.00	563.95	-14.49	-26.95	103.23	625.74	625.74
48	2033	-369.00	-682.12	6.55	33.67	1413.75	20.39	38.94	-381.18	1985.03	13.40	45.66	-669.94	571.28	-13.54	-26.95	103.23	634.02	1303.96

TABLE 8-8

## SENSITIVITY ANALYSIS (CASE 8)

FIRR= 0.100764

NPV=-0.006988

		Million Yen																
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)			Cost	Benefit				Benefit - Cos		
		Investment		Operation and Maintenance				Invest- ment	Operation & Maintenance			Total	Fuel Saving	Tax Saving	Repair /Others Saving		Turn-over from Energy Sold	
		Hydro	Diesel	Hydropower Plant	Diesel Power Plant				Fuel	Tax								Repair /Others
				Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel	Tax	Repair /Others							
1	1986	132.00										132.00					0.00	-132.00
2	1987	810.00										810.00					0.00	-810.00
3	1988	1567.00	1200.00									1200.00					0.00	-1567.00
4	1989	1181.00		49.15	33.67	911.86	25.65	38.94	1124.43	25.65	45.66	1181.00	212.62	-49.15	-26.95	20.15	156.67	-1024.33
5	1990			48.16	33.67	773.52	24.43	38.94	1139.10	24.29	45.66	0.00	365.58	-48.30	-26.95	58.31	348.64	348.64
6	1991			47.18	33.67	810.00	23.22	38.94	1153.91	22.93	45.66	0.00	343.91	-47.47	-26.95	69.32	338.81	338.81
7	1992			51.33	33.67	832.50	24.45	38.94	1168.91	23.97	45.66	0.00	336.41	-51.81	-26.95	81.33	338.98	338.98
8	1993			50.24	33.67	843.32	23.10	38.94	1184.10	22.46	45.66	0.00	340.78	-50.88	-26.95	91.76	354.71	354.71
9	1994			49.15	33.67	854.29	21.75	38.94	1199.50	20.95	45.66	0.00	345.21	-49.95	-26.95	91.76	360.07	360.07
10	1995			48.08	33.67	865.39	20.39	38.94	1215.09	19.44	45.66	0.00	349.70	-49.01	-26.95	91.76	365.50	365.50
11	1996			46.96	33.67	876.64	19.04	38.94	1230.89	17.93	45.66	0.00	354.24	-48.07	-26.95	91.76	370.98	370.98
12	1997			45.87	33.67	888.04	17.69	38.94	1246.89	16.42	45.66	0.00	358.85	-47.14	-26.95	91.76	376.52	376.52
13	1998			44.78	33.67	899.58	16.34	38.94	1263.10	14.91	45.66	0.00	363.51	-46.21	-26.95	91.76	382.11	382.11
14	1999			43.69	33.67	911.28	14.99	38.94	1279.52	13.40	45.66	0.00	368.24	-45.28	-26.95	91.76	387.77	387.77
15	2000			42.59	33.67	923.12	13.64	38.94	1296.15	11.88	45.66	0.00	373.03	-44.35	-26.95	91.76	393.49	393.49
16	2001			41.50	33.67	935.12	12.29	38.94	1313.00	10.37	45.66	0.00	377.88	-43.42	-26.95	91.76	399.27	399.27
17	2002			40.41	33.67	947.28	10.94	38.94	1330.07	8.86	45.66	0.00	382.79	-42.49	-26.95	91.76	405.11	405.11
18	2003			39.32	33.67	959.60	9.59	38.94	1347.36	7.35	45.66	0.00	387.77	-41.56	-26.95	91.76	411.02	411.02
19	2004			38.23	33.67	972.07	8.24	38.94	1364.88	5.84	45.66	0.00	392.81	-40.63	-26.95	91.76	416.99	416.99
20	2005			37.13	33.67	984.71	6.89	38.94	1382.62	4.33	45.66	-1080.00	397.91	-39.69	-26.95	91.76	423.03	1503.03
21	2006			36.04	33.67	997.51	5.53	38.94	1400.59	28.50	45.66	0.00	403.09	-13.07	-26.95	91.76	454.83	454.83
22	2007		1080.00	34.95	33.67	1010.48	4.18	38.94	1418.80	26.99	45.66	1080.00	408.33	-12.14	-26.95	91.76	461.00	-619.00
23	2008			33.86	33.67	1023.61	28.50	38.94	1437.25	25.48	45.66	0.00	413.63	-36.88	-26.95	91.76	441.56	441.56
24	2009			32.77	33.67	1036.92	27.15	38.94	1455.93	23.97	45.66	0.00	419.01	-35.95	-26.95	91.76	447.87	447.87
25	2010			31.67	33.67	1050.40	25.80	38.94	1474.86	22.46	45.66	0.00	424.46	-35.01	-26.95	91.76	454.26	454.26
26	2011			30.58	33.67	1064.05	24.45	38.94	1494.03	20.95	45.66	0.00	429.98	-34.08	-26.95	91.76	460.71	460.71
27	2012			29.49	33.67	1077.89	23.10	38.94	1513.45	19.44	45.66	0.00	435.57	-33.15	-26.95	91.76	467.23	467.23
28	2013			28.40	33.67	1091.90	21.75	38.94	1533.13	17.93	45.66	0.00	441.23	-32.22	-26.95	91.76	473.82	473.82
29	2014			27.30	33.67	1106.09	20.39	38.94	1553.06	16.42	45.66	0.00	446.96	-31.27	-26.95	91.76	480.50	480.50
30	2015			26.21	33.67	1120.47	19.04	38.94	1573.25	14.91	45.66	0.00	452.78	-30.34	-26.95	91.76	487.25	487.25
31	2016			25.12	33.67	1135.04	17.69	38.94	1593.70	13.40	45.66	0.00	458.66	-29.41	-26.95	91.76	494.06	494.06
32	2017			24.03	33.67	1149.79	16.34	38.94	1614.42	11.88	45.66	0.00	464.62	-28.49	-26.95	91.76	500.94	500.94
33	2018			22.94	33.67	1164.74	14.99	38.94	1635.41	10.37	45.66	0.00	470.66	-27.56	-26.95	91.76	507.91	507.91
34	2019			21.84	33.67	1179.88	13.64	38.94	1656.67	8.86	45.66	0.00	476.78	-26.62	-26.95	91.76	514.97	514.97
35	2020			20.75	33.67	1195.22	12.29	38.94	1678.20	7.35	45.66	0.00	482.98	-25.69	-26.95	91.76	522.10	522.10
36	2021			19.66	33.67	1210.76	10.94	38.94	1700.02	5.84	45.66	0.00	489.26	-24.76	-26.95	91.76	529.31	529.31
37	2022			18.57	33.67	1226.50	9.59	38.94	1722.12	4.33	45.66	-1080.00	495.62	-23.83	-26.95	91.76	536.60	1616.60
38	2023			17.47	33.67	1242.44	8.24	38.94	1744.51	28.50	45.66	0.00	502.06	2.79	-26.95	91.76	569.66	569.66
39	2024			16.38	33.67	1258.60	6.89	38.94	1767.19	26.99	45.66	0.00	508.59	3.72	-26.95	91.76	577.12	577.12
40	2025			15.29	33.67	1274.96	5.53	38.94	1790.16	25.48	45.66	0.00	515.20	4.66	-26.95	91.76	584.67	584.67
41	2026		1080.00	14.20	33.67	1291.53	4.18	38.94	1813.43	23.97	45.66	1080.00	521.90	5.59	-26.95	91.76	592.30	-487.70
42	2027			13.11	33.67	1308.32	28.50	38.94	1837.01	22.46	45.66	0.00	528.68	-19.15	-26.95	91.76	574.34	574.34
43	2028			12.01	33.67	1325.33	27.15	38.94	1860.89	20.95	45.66	0.00	535.56	-18.21	-26.95	91.76	582.16	582.16
44	2029			10.92	33.67	1342.56	25.80	38.94	1885.08	19.44	45.66	0.00	542.52	-17.28	-26.95	91.76	590.05	590.05
45	2030			9.83	33.67	1360.01	24.45	38.94	1909.59	17.93	45.66	0.00	549.57	-16.35	-26.95	91.76	598.03	598.03
46	2031			8.74	33.67	1377.69	23.10	38.94	1934.41	16.42	45.66	0.00	556.72	-15.42	-26.95	91.76	606.11	606.11
47	2032			7.65	33.67	1395.60	21.75	38.94	1959.56	14.91	45.66	0.00	563.95	-14.49	-26.95	91.76	614.27	614.27
48	2033	-369.00	-682.12	6.55	33.67	1413.75	20.39	38.94	1985.03	13.40	45.66	-669.94	571.28	-13.54	-26.95	91.76	622.55	1292.49

TABLE 8-9

## SENSITIVITY ANALYSIS (CASE 9)

FIRR= 0.082886

NPV=0.011504

		Million Yen																
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)			Cost	Benefit				Benefit - Cos		
		Investment		Operation and Maintenance				Investment	Operation & Maintenance			Total	Benefit					
		Hydro	Diesel	Hydropower Plant	Diesel Power Plant				Fuel	Tax			Repair /Others	Fuel Saving	Tax Saving		Repair /Others Saving	Turn-over from Energy Sold
1	1986	138.60									138.60					0.00	-138.60	
2	1987	850.50									850.50					0.00	-850.50	
3	1988	1645.35	1260.00							1236.00	1669.35					0.00	-1669.35	
4	1989	1240.05		49.15	33.67	865.95	25.65	38.94	1067.86	25.65	45.66	1240.05	201.91	-49.15	-26.95	22.67	148.48	-1091.57
5	1990			48.16	33.67	725.14	24.43	38.94	1067.86	24.29	45.66	0.00	342.72	-48.30	-26.95	65.60	333.07	333.07
6	1991			47.18	33.67	749.60	23.22	38.94	1067.86	22.93	45.66	0.00	318.26	-47.47	-26.95	77.99	321.83	321.83
7	1992			51.33	33.67	760.53	24.45	38.94	1067.86	23.97	45.66	0.00	307.33	-51.81	-26.95	91.49	320.06	320.06
8	1993			50.24	33.67	760.53	23.10	38.94	1067.86	22.46	45.66	0.00	307.33	-50.88	-26.95	103.23	332.73	332.73
9	1994			49.15	33.67	760.53	21.75	38.94	1067.86	20.95	45.66	0.00	307.33	-49.95	-26.95	103.23	333.66	333.66
10	1995			48.06	33.67	760.53	20.39	38.94	1067.86	19.44	45.66	0.00	307.33	-49.01	-26.95	103.23	334.60	334.60
11	1996			46.96	33.67	760.53	19.04	38.94	1067.86	17.93	45.66	0.00	307.33	-48.07	-26.95	103.23	335.54	335.54
12	1997			45.87	33.67	760.53	17.69	38.94	1067.86	16.42	45.66	0.00	307.33	-47.14	-26.95	103.23	336.47	336.47
13	1998			44.78	33.67	760.53	16.34	38.94	1067.86	14.91	45.66	0.00	307.33	-46.21	-26.95	103.23	337.40	337.40
14	1999			43.89	33.67	760.53	14.99	38.94	1067.86	13.40	45.66	0.00	307.33	-45.28	-26.95	103.23	338.33	338.33
15	2000			42.59	33.67	760.53	13.64	38.94	1067.86	11.88	45.66	0.00	307.33	-44.35	-26.95	103.23	339.26	339.26
16	2001			41.50	33.67	760.53	12.29	38.94	1067.86	10.37	45.66	0.00	307.33	-43.42	-26.95	103.23	340.19	340.19
17	2002			40.41	33.67	760.53	10.94	38.94	1067.86	8.86	45.66	0.00	307.33	-42.49	-26.95	103.23	341.12	341.12
18	2003			39.32	33.67	760.53	9.59	38.94	1067.86	7.35	45.66	0.00	307.33	-41.56	-26.95	103.23	342.05	342.05
19	2004			38.23	33.67	760.53	8.24	38.94	1067.86	5.84	45.66	0.00	307.33	-40.63	-26.95	103.23	342.98	342.98
20	2005			37.13	33.67	760.53	6.89	38.94	1067.86	4.33	45.66	-1134.00	307.33	-39.69	-26.95	103.23	343.92	1477.92
21	2006			36.04	33.67	760.53	5.53	38.94	1067.86	28.50	45.66	0.00	307.33	-13.07	-26.95	103.23	370.54	370.54
22	2007		1134.00	34.95	33.67	760.53	4.18	38.94	1067.86	26.99	45.66	1134.00	307.33	-12.14	-26.95	103.23	371.47	-762.53
23	2008			33.86	33.67	760.53	28.50	38.94	1067.86	25.48	45.66	0.00	307.33	-36.88	-26.95	103.23	346.73	346.73
24	2009			32.77	33.67	760.53	27.15	38.94	1067.86	23.97	45.66	0.00	307.33	-35.95	-26.95	103.23	347.66	347.66
25	2010			31.67	33.67	760.53	25.80	38.94	1067.86	22.46	45.66	0.00	307.33	-35.01	-26.95	103.23	348.60	348.60
26	2011			30.58	33.67	760.53	24.45	38.94	1067.86	20.95	45.66	0.00	307.33	-34.08	-26.95	103.23	349.53	349.53
27	2012			29.49	33.67	760.53	23.10	38.94	1067.86	19.44	45.66	0.00	307.33	-33.15	-26.95	103.23	350.46	350.46
28	2013			28.40	33.67	760.53	21.75	38.94	1067.86	17.93	45.66	0.00	307.33	-32.22	-26.95	103.23	351.39	351.39
29	2014			27.30	33.67	760.53	20.39	38.94	1067.86	16.42	45.66	0.00	307.33	-31.27	-26.95	103.23	352.34	352.34
30	2015			26.21	33.67	760.53	19.04	38.94	1067.86	14.91	45.66	0.00	307.33	-30.34	-26.95	103.23	353.27	353.27
31	2016			25.12	33.67	760.53	17.69	38.94	1067.86	13.40	45.66	0.00	307.33	-29.41	-26.95	103.23	354.20	354.20
32	2017			24.03	33.67	760.53	16.34	38.94	1067.86	11.88	45.66	0.00	307.33	-28.49	-26.95	103.23	355.12	355.12
33	2018			22.94	33.67	760.53	14.99	38.94	1067.86	10.37	45.66	0.00	307.33	-27.56	-26.95	103.23	356.05	356.05
34	2019			21.84	33.67	760.53	13.64	38.94	1067.86	8.86	45.66	0.00	307.33	-26.62	-26.95	103.23	356.99	356.99
35	2020			20.75	33.67	760.53	12.29	38.94	1067.86	7.35	45.66	0.00	307.33	-25.69	-26.95	103.23	357.92	357.92
36	2021			19.66	33.67	760.53	10.94	38.94	1067.86	5.84	45.66	0.00	307.33	-24.76	-26.95	103.23	358.85	358.85
37	2022			18.57	33.67	760.53	9.59	38.94	1067.86	4.33	45.66	-1134.00	307.33	-23.83	-26.95	103.23	359.78	1493.78
38	2023			17.47	33.67	760.53	8.24	38.94	1067.86	28.50	45.66	0.00	307.33	2.79	-26.95	103.23	386.40	386.40
39	2024			16.38	33.67	760.53	6.89	38.94	1067.86	26.99	45.66	0.00	307.33	3.72	-26.95	103.23	387.33	387.33
40	2025			15.29	33.67	760.53	5.53	38.94	1067.86	25.48	45.66	0.00	307.33	4.66	-26.95	103.23	388.27	388.27
41	2026		1134.00	14.20	33.67	760.53	4.18	38.94	1067.86	23.97	45.66	1134.00	307.33	5.59	-26.95	103.23	389.20	-744.80
42	2027			13.11	33.67	760.53	28.50	38.94	1067.86	22.46	45.66	0.00	307.33	-19.15	-26.95	103.23	364.46	364.46
43	2028			12.01	33.67	760.53	27.15	38.94	1067.86	20.95	45.66	0.00	307.33	-18.21	-26.95	103.23	365.40	365.40
44	2029			10.92	33.67	760.53	25.80	38.94	1067.86	19.44	45.66	0.00	307.33	-17.28	-26.95	103.23	366.33	366.33
45	2030			9.83	33.67	760.53	24.45	38.94	1067.86	17.93	45.66	0.00	307.33	-16.35	-26.95	103.23	367.26	367.26
46	2031			8.74	33.67	760.53	23.10	38.94	1067.86	16.42	45.66	0.00	307.33	-15.42	-26.95	103.23	368.19	368.19
47	2032			7.65	33.67	760.53	21.75	38.94	1067.86	14.91	45.66	0.00	307.33	-14.49	-26.95	103.23	369.12	369.12
48	2033	-387.45	-716.23	6.55	33.67	760.53	20.39	38.94	-400.24	1067.86	13.40	-703.44	307.33	-13.54	-26.95	103.23	370.07	1073.51



TABLE 8-10

## SENSITIVITY ANALYSIS (CASE 10)

RR= 0.096402

NPV=-0.005165

		Million Yen																		
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)			Cost	Benefit				Benefit - Cost				
		Investment		Operation and Maintenance				Investment	Operation & Maintenance			Total	Benefit							
		Hydro	Diesel	Hydro Power Plant	Diesel Power Plant				Fuel	Tax			Repair /Others	Fuel Saving	Tax Saving		Repair /Others Saving	Turn-over from Energy Sold		
1	1986	136.62									136.62					0.00	-136.62			
2	1987	867.69									867.69					0.00	-867.69			
3	1988	1737.36	1330.46							1330.46	1737.36					0.00	-1737.36			
4	1989	1355.22		49.15	33.67	911.86	25.65	38.94			1124.48	25.65	45.66	1355.22	212.62	-49.15	-26.95	25.19	161.71	-1193.51
5	1990			48.16	33.67	773.52	24.43	38.94			1139.10	24.29	45.66	0.00	365.58	-48.30	-26.95	72.89	363.22	363.22
6	1991			47.18	33.67	810.00	23.22	38.94			1153.91	22.93	45.66	0.00	343.91	-47.47	-26.95	86.65	356.14	356.14
7	1992			51.33	33.67	832.50	24.45	38.94			1168.91	23.97	45.66	0.00	336.41	-51.81	-26.95	101.66	359.31	359.31
8	1993			50.24	33.67	843.32	23.10	38.94			1184.10	22.46	45.66	0.00	340.78	-50.88	-26.95	114.70	377.65	377.65
9	1994			49.15	33.67	854.29	21.75	38.94			1199.50	20.95	45.66	0.00	345.21	-49.95	-26.95	114.70	383.01	383.01
10	1995			48.06	33.67	865.39	20.39	38.94			1215.09	19.44	45.66	0.00	349.70	-49.01	-26.95	114.70	388.44	388.44
11	1996			46.96	33.67	876.64	19.04	38.94			1230.89	17.93	45.66	0.00	354.24	-48.07	-26.95	114.70	393.92	393.92
12	1997			45.87	33.67	888.04	17.69	38.94			1246.89	16.42	45.66	0.00	358.85	-47.14	-26.95	114.70	399.46	399.46
13	1998			44.78	33.67	899.58	16.34	38.94			1263.10	14.91	45.66	0.00	363.51	-46.21	-26.95	114.70	405.05	405.05
14	1999			43.69	33.67	911.28	14.99	38.94			1279.52	13.40	45.66	0.00	368.24	-45.28	-26.95	114.70	410.71	410.71
15	2000			42.59	33.67	923.12	13.64	38.94			1296.15	11.88	45.66	0.00	373.03	-44.35	-26.95	114.70	416.43	416.43
16	2001			41.50	33.67	935.12	12.29	38.94			1313.00	10.37	45.66	0.00	377.88	-43.42	-26.95	114.70	422.21	422.21
17	2002			40.41	33.67	947.28	10.94	38.94			1330.07	8.86	45.66	0.00	382.79	-42.49	-26.95	114.70	428.05	428.05
18	2003			39.32	33.67	959.60	9.59	38.94			1347.36	7.35	45.66	0.00	387.77	-41.56	-26.95	114.70	433.96	433.96
19	2004			38.23	33.67	972.07	8.24	38.94			1364.88	5.84	45.66	0.00	392.81	-40.63	-26.95	114.70	439.93	439.93
20	2005			37.13	33.67	984.71	6.89	38.94	1197.42		1382.62	4.33	45.66	-1197.42	397.91	-39.69	-26.95	114.70	445.97	1643.39
21	2006			36.04	33.67	997.51	5.53	38.94			1400.59	28.50	45.66	0.00	403.09	-13.07	-26.95	114.70	477.77	477.77
22	2007		1197.42	34.95	33.67	1010.48	4.18	38.94			1418.80	26.99	45.66	1197.42	408.33	-12.14	-26.95	114.70	483.94	-713.48
23	2008			33.86	33.67	1023.61	28.50	38.94			1437.25	25.48	45.66	0.00	413.63	-36.88	-26.95	114.70	464.50	464.50
24	2009			32.77	33.67	1036.92	27.15	38.94			1455.93	23.97	45.66	0.00	419.01	-35.95	-26.95	114.70	470.81	470.81
25	2010			31.67	33.67	1050.40	25.80	38.94			1474.86	22.46	45.66	0.00	424.46	-35.01	-26.95	114.70	477.20	477.20
26	2011			30.58	33.67	1064.05	24.45	38.94			1494.03	20.95	45.66	0.00	429.98	-34.08	-26.95	114.70	483.65	483.65
27	2012			29.49	33.67	1077.89	23.10	38.94			1513.45	19.44	45.66	0.00	435.57	-33.15	-26.95	114.70	490.17	490.17
28	2013			28.40	33.67	1091.90	21.75	38.94			1533.13	17.93	45.66	0.00	441.23	-32.22	-26.95	114.70	496.76	496.76
29	2014			27.30	33.67	1106.09	20.39	38.94			1553.06	16.42	45.66	0.00	446.96	-31.27	-26.95	114.70	503.44	503.44
30	2015			26.21	33.67	1120.47	19.04	38.94			1573.25	14.91	45.66	0.00	452.78	-30.34	-26.95	114.70	510.19	510.19
31	2016			25.12	33.67	1135.04	17.69	38.94			1593.70	13.40	45.66	0.00	458.66	-29.41	-26.95	114.70	517.00	517.00
32	2017			24.03	33.67	1149.79	16.34	38.94			1614.42	11.88	45.66	0.00	464.62	-28.49	-26.95	114.70	523.88	523.88
33	2018			22.94	33.67	1164.74	14.99	38.94			1635.41	10.37	45.66	0.00	470.66	-27.56	-26.95	114.70	530.85	530.85
34	2019			21.84	33.67	1179.88	13.64	38.94			1656.67	8.86	45.66	0.00	476.78	-26.62	-26.95	114.70	537.91	537.91
35	2020			20.75	33.67	1195.22	12.29	38.94			1678.20	7.35	45.66	0.00	482.98	-25.69	-26.95	114.70	545.04	545.04
36	2021			19.66	33.67	1210.76	10.94	38.94			1700.02	5.84	45.66	0.00	489.26	-24.76	-26.95	114.70	552.25	552.25
37	2022			18.57	33.67	1226.50	9.59	38.94	1197.42		1722.12	4.33	45.66	-1197.42	495.62	-23.83	-26.95	114.70	559.54	1756.96
38	2023			17.47	33.67	1242.44	8.24	38.94			1744.51	28.50	45.66	0.00	502.06	2.79	-26.95	114.70	592.60	592.60
39	2024			16.38	33.67	1258.60	6.89	38.94			1767.19	26.99	45.66	0.00	508.59	3.72	-26.95	114.70	600.06	600.06
40	2025			15.29	33.67	1274.96	5.53	38.94			1790.16	25.48	45.66	0.00	515.20	4.66	-26.95	114.70	607.61	607.61
41	2026		1197.42	14.20	33.67	1291.53	4.18	38.94			1790.16	25.48	45.66	1197.42	521.90	5.59	-26.95	114.70	615.24	-582.18
42	2027			13.11	33.67	1308.32	28.50	38.94			1813.43	23.97	45.66	0.00	528.68	-19.15	-26.95	114.70	597.28	597.28
43	2028			12.01	33.67	1325.33	27.15	38.94			1837.01	22.46	45.66	0.00	535.56	-18.21	-26.95	114.70	605.10	605.10
44	2029			10.92	33.67	1342.56	25.80	38.94			1860.89	20.95	45.66	0.00	542.52	-17.28	-26.95	114.70	612.99	612.99
45	2030			9.83	33.67	1360.01	24.45	38.94			1885.08	19.44	45.66	0.00	549.57	-16.35	-26.95	114.70	620.97	620.97
46	2031			8.74	33.67	1377.69	23.10	38.94			1909.59	17.93	45.66	0.00	556.72	-15.42	-26.95	114.70	629.05	629.05
47	2032			7.65	33.67	1395.60	21.75	38.94			1934.41	16.42	45.66	0.00	563.95	-14.49	-26.95	114.70	637.21	637.21
48	2033	-409.69	-756.28	6.55	33.67	1413.75	20.39	38.94	-422.62		1959.56	14.91	45.66	-743.35	571.28	-13.54	-26.95	114.70	645.49	1388.84



TABLE 8-12

SENSITIVITY ANALYSIS (CASE 12)

RR= 0.092917

NPV=-0.003647

		Million Yen																
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)			Cost	Benefit				Benefit - Cost		
		Investment		Operation and Maintenance				Investment	Operation & Maintenance			Total	Benefit					
		Hydro	Diesel	Hydropower Plant	Diesel Power Plant				Fuel	Tax			Repair /Others	Fuel Saving	Tax Saving		Repair /Others Saving	Turn-over from Energy Sold
Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel Saving	Tax Saving	Repair /Others Saving	Turn-over from Energy Sold				
1	1986	142.56										142.56					0.00	-142.56
2	1987	885.36										885.36					0.00	-885.36
3	1988	1767.72	1296.00								1296.00	1767.72					0.00	-1767.72
4	1989	1476.20		49.15	33.67	911.86	25.65	38.94				1476.20	212.62	-49.15	-26.95	25.19	161.71	-1314.49
5	1990			48.16	33.67	773.52	24.43	38.94				0.00	365.58	-48.30	-26.95	72.89	363.22	363.22
6	1991			47.18	33.67	810.00	23.22	38.94				0.00	343.91	-47.47	-26.95	86.65	356.14	356.14
7	1992			51.33	33.67	832.50	24.45	38.94				0.00	336.41	-51.81	-26.95	101.66	359.31	359.31
8	1993			50.24	33.67	843.32	23.10	38.94				0.00	340.78	-50.88	-26.95	114.70	377.65	377.65
9	1994			49.15	33.67	854.29	21.75	38.94				0.00	345.21	-49.95	-26.95	114.70	383.01	383.01
10	1995			48.06	33.67	865.39	20.39	38.94				0.00	349.70	-49.01	-26.95	114.70	388.44	388.44
11	1996			46.98	33.67	876.64	19.04	38.94				0.00	354.24	-48.07	-26.95	114.70	393.92	393.92
12	1997			45.87	33.67	888.04	17.69	38.94				0.00	358.85	-47.14	-26.95	114.70	399.46	399.46
13	1998			44.78	33.67	899.58	16.34	38.94				0.00	363.51	-46.21	-26.95	114.70	405.05	405.05
14	1999			43.69	33.67	911.28	14.99	38.94				0.00	368.24	-45.28	-26.95	114.70	410.71	410.71
15	2000			42.59	33.67	923.12	13.64	38.94				0.00	373.03	-44.35	-26.95	114.70	416.43	416.43
16	2001			41.50	33.67	935.12	12.29	38.94				0.00	377.88	-43.42	-26.95	114.70	422.21	422.21
17	2002			40.41	33.67	947.28	10.94	38.94				0.00	382.79	-42.49	-26.95	114.70	428.05	428.05
18	2003			39.32	33.67	959.60	9.59	38.94				0.00	387.77	-41.56	-26.95	114.70	433.96	433.96
19	2004			38.23	33.67	972.07	8.24	38.94				0.00	392.81	-40.63	-26.95	114.70	439.93	439.93
20	2005			37.13	33.67	984.71	6.89	38.94	1166.40		-1166.40	397.91	-39.69	-26.95	114.70	445.97	1612.37	
21	2006			36.04	33.67	997.51	5.53	38.94			0.00	403.09	-13.07	-26.95	114.70	477.77	477.77	
22	2007		1166.40	34.95	33.67	1010.48	4.18	38.94			1166.40	408.33	-12.14	-26.95	114.70	483.94	-682.46	
23	2008			33.86	33.67	1023.61	28.50	38.94			0.00	413.63	-36.88	-26.95	114.70	464.50	464.50	
24	2009			32.77	33.67	1036.92	27.15	38.94			0.00	419.01	-35.95	-26.95	114.70	470.81	470.81	
25	2010			31.67	33.67	1050.40	25.80	38.94			0.00	424.46	-35.01	-26.95	114.70	477.20	477.20	
26	2011			30.58	33.67	1064.05	24.45	38.94			0.00	429.98	-34.08	-26.95	114.70	483.65	483.65	
27	2012			29.49	33.67	1077.89	23.10	38.94			0.00	435.57	-33.15	-26.95	114.70	490.17	490.17	
28	2013			28.40	33.67	1091.90	21.75	38.94			0.00	441.23	-32.22	-26.95	114.70	496.76	496.76	
29	2014			27.30	33.67	1106.09	20.39	38.94			0.00	446.96	-31.27	-26.95	114.70	503.44	503.44	
30	2015			26.21	33.67	1120.47	19.04	38.94			0.00	452.78	-30.34	-26.95	114.70	510.19	510.19	
31	2016			25.12	33.67	1135.04	17.69	38.94			0.00	458.66	-29.41	-26.95	114.70	517.00	517.00	
32	2017			24.03	33.67	1149.79	16.34	38.94			0.00	464.62	-28.49	-26.95	114.70	523.88	523.88	
33	2018			22.94	33.67	1164.74	14.99	38.94			0.00	470.66	-27.56	-26.95	114.70	530.85	530.85	
34	2019			21.84	33.67	1179.88	13.64	38.94			0.00	476.78	-26.62	-26.95	114.70	537.91	537.91	
35	2020			20.75	33.67	1195.22	12.29	38.94			0.00	482.98	-25.69	-26.95	114.70	545.04	545.04	
36	2021			19.66	33.67	1210.76	10.94	38.94			0.00	489.26	-24.76	-26.95	114.70	552.25	552.25	
37	2022			18.57	33.67	1226.50	9.59	38.94	1166.40		-1166.40	495.62	-23.83	-26.95	114.70	559.54	1725.94	
38	2023			17.47	33.67	1242.44	8.24	38.94			0.00	502.06	2.79	-26.95	114.70	592.60	592.60	
39	2024			16.38	33.67	1258.60	6.89	38.94			0.00	508.59	3.72	-26.95	114.70	600.06	600.06	
40	2025			15.29	33.67	1274.96	5.53	38.94			0.00	515.20	4.66	-26.95	114.70	607.61	607.61	
41	2026		1166.40	14.20	33.67	1291.53	4.18	38.94			1166.40	521.90	5.59	-26.95	114.70	615.24	-551.16	
42	2027			13.11	33.67	1308.32	28.50	38.94			0.00	528.68	-19.15	-26.95	114.70	597.28	597.28	
43	2028			12.01	33.67	1325.33	27.15	38.94			0.00	535.56	-18.21	-26.95	114.70	605.10	605.10	
44	2029			10.92	33.67	1342.56	25.80	38.94			0.00	542.52	-17.28	-26.95	114.70	612.99	612.99	
45	2030			9.83	33.67	1360.01	24.45	38.94			0.00	549.57	-16.35	-26.95	114.70	620.97	620.97	
46	2031			8.74	33.67	1377.69	23.10	38.94			0.00	556.72	-15.42	-26.95	114.70	629.05	629.05	
47	2032			7.65	33.67	1395.80	21.75	38.94			0.00	563.95	-14.49	-26.95	114.70	637.21	637.21	
48	2033	-427.18	-736.69	6.55	33.67	1413.75	20.39	38.94	-411.67		-752.20	571.28	-13.54	-26.95	114.70	645.49	1397.69	

SENSITIVITY ANALYSIS (CASE 13)

RR= 0.087376

NPV=0.019297

		Million Yen																
Project Year	Year	Generation by Hydro and Diesel Power Plants						Diesel Power Generation (w/o Hydro)			Cost	Benefit				Benefit - Cos		
		Investment		Operation and Maintenance				Investment	Operation & Maintenance			Total	Fuel Saving	Tax Saving	Repair /Others Saving		Turn-over from Energy Sold	
		Hydro	Diesel	Hydropower Plant	Diesel Power Plant				Fuel	Tax								Repair /Others
				Tax	Repair /Others	Fuel	Tax	Repair /Others	Fuel	Tax	Repair /Others							
1	1986	144.68										144.68					0.00	-144.68
2	1987	927.23										927.23					0.00	-927.23
3	1988	1901.48	1408.96									1408.96					0.00	-1901.48
4	1989	1605.05		49.15	33.67	911.86	25.65	38.94	1124.48	25.65	45.66	1605.05	212.62	-49.15	-26.95	25.19	161.71	-1443.34
5	1990			48.16	33.67	773.52	24.43	38.94	1139.10	24.29	45.66	0.00	365.58	-48.30	-26.95	72.89	363.22	363.22
6	1991			47.18	33.67	810.00	23.22	38.94	1153.91	22.93	45.66	0.00	343.91	-47.47	-26.95	86.65	356.14	356.14
7	1992			51.33	33.67	832.50	24.45	38.94	1168.91	23.97	45.66	0.00	336.41	-51.81	-26.95	101.66	359.31	359.31
8	1993			50.24	33.67	843.32	23.10	38.94	1184.10	22.46	45.66	0.00	340.78	-50.88	-26.95	114.70	377.65	377.65
9	1994			49.15	33.67	854.29	21.75	38.94	1199.50	20.95	45.66	0.00	345.21	-49.95	-26.95	114.70	383.01	383.01
10	1995			48.06	33.67	865.39	20.39	38.94	1215.09	19.44	45.66	0.00	349.70	-49.01	-26.95	114.70	388.44	388.44
11	1996			46.96	33.67	876.64	19.04	38.94	1230.89	17.93	45.66	0.00	354.24	-48.07	-26.95	114.70	393.92	393.92
12	1997			45.87	33.67	888.04	17.69	38.94	1246.89	16.42	45.66	0.00	358.85	-47.14	-26.95	114.70	399.46	399.46
13	1998			44.78	33.67	899.58	16.34	38.94	1263.10	14.91	45.66	0.00	363.51	-46.21	-26.95	114.70	405.05	405.05
14	1999			43.69	33.67	911.28	14.99	38.94	1279.52	13.40	45.66	0.00	368.24	-45.28	-26.95	114.70	410.71	410.71
15	2000			42.59	33.67	923.12	13.64	38.94	1296.15	11.88	45.66	0.00	373.03	-44.35	-26.95	114.70	416.43	416.43
16	2001			41.50	33.67	935.12	12.29	38.94	1313.00	10.37	45.66	0.00	377.88	-43.42	-26.95	114.70	422.21	422.21
17	2002			40.41	33.67	947.28	10.94	38.94	1330.07	8.86	45.66	0.00	382.79	-42.49	-26.95	114.70	428.05	428.05
18	2003			39.32	33.67	959.60	9.59	38.94	1347.36	7.35	45.66	0.00	387.77	-41.56	-26.95	114.70	433.96	433.96
19	2004			38.23	33.67	972.07	8.24	38.94	1364.88	5.84	45.66	0.00	392.81	-40.63	-26.95	114.70	439.93	439.93
20	2005			37.13	33.67	984.71	6.89	38.94	1382.62	4.33	45.66	-1268.06	397.91	-39.69	-26.95	114.70	445.97	1714.04
21	2006			36.04	33.67	997.51	5.53	38.94	1400.59	28.50	45.66	0.00	403.09	-13.07	-26.95	114.70	477.77	477.77
22	2007		1268.06	34.95	33.67	1010.48	4.18	38.94	1418.80	26.99	45.66	1268.06	408.33	-12.14	-26.95	114.70	483.94	-784.13
23	2008			33.86	33.67	1023.61	28.50	38.94	1437.25	25.48	45.66	0.00	413.63	-36.88	-26.95	114.70	464.50	464.50
24	2009			32.77	33.67	1036.92	27.15	38.94	1455.93	23.97	45.66	0.00	419.01	-35.95	-26.95	114.70	470.81	470.81
25	2010			31.67	33.67	1050.40	25.80	38.94	1474.86	22.46	45.66	0.00	424.46	-35.01	-26.95	114.70	477.20	477.20
26	2011			30.58	33.67	1064.05	24.45	38.94	1494.03	20.95	45.66	0.00	429.98	-34.08	-26.95	114.70	483.65	483.65
27	2012			29.49	33.67	1077.89	23.10	38.94	1513.45	19.44	45.66	0.00	435.57	-33.15	-26.95	114.70	490.17	490.17
28	2013			28.40	33.67	1091.90	21.75	38.94	1533.13	17.93	45.66	0.00	441.23	-32.22	-26.95	114.70	496.76	496.76
29	2014			27.30	33.67	1106.09	20.39	38.94	1553.06	16.42	45.66	0.00	446.96	-31.27	-26.95	114.70	503.44	503.44
30	2015			26.21	33.67	1120.47	19.04	38.94	1573.25	14.91	45.66	0.00	452.78	-30.34	-26.95	114.70	510.19	510.19
31	2016			25.12	33.67	1135.04	17.69	38.94	1593.70	13.40	45.66	0.00	458.66	-29.41	-26.95	114.70	517.00	517.00
32	2017			24.03	33.67	1149.79	16.34	38.94	1614.42	11.88	45.66	0.00	464.62	-28.49	-26.95	114.70	523.88	523.88
33	2018			22.94	33.67	1164.74	14.99	38.94	1635.41	10.37	45.66	0.00	470.66	-27.56	-26.95	114.70	530.85	530.85
34	2019			21.84	33.67	1179.88	13.64	38.94	1656.67	8.86	45.66	0.00	476.78	-26.62	-26.95	114.70	537.91	537.91
35	2020			20.75	33.67	1195.22	12.29	38.94	1678.20	7.35	45.66	0.00	482.98	-25.69	-26.95	114.70	545.04	545.04
36	2021			19.66	33.67	1210.76	10.94	38.94	1700.02	5.84	45.66	0.00	489.26	-24.76	-26.95	114.70	552.25	552.25
37	2022			18.57	33.67	1226.50	9.59	38.94	1722.12	4.33	45.66	-1268.06	495.62	-23.83	-26.95	114.70	559.54	1827.60
38	2023			17.47	33.67	1242.44	8.24	38.94	1744.51	28.50	45.66	0.00	502.06	2.79	-26.95	114.70	592.60	592.60
39	2024			16.38	33.67	1258.60	6.89	38.94	1767.19	26.99	45.66	0.00	508.59	3.72	-26.95	114.70	600.06	600.06
40	2025			15.29	33.67	1274.96	5.53	38.94	1790.16	25.48	45.66	0.00	515.20	4.66	-26.95	114.70	607.61	607.61
41	2026		1268.06	14.20	33.67	1291.53	4.18	38.94	1813.43	23.97	45.66	1268.06	521.90	5.59	-26.95	114.70	615.24	-652.82
42	2027			13.11	33.67	1308.32	28.50	38.94	1837.01	22.46	45.66	0.00	528.68	-19.15	-26.95	114.70	597.28	597.28
43	2028			12.01	33.67	1325.33	27.15	38.94	1860.89	20.95	45.66	0.00	535.56	-18.21	-26.95	114.70	605.10	605.10
44	2029			10.92	33.67	1342.56	25.80	38.94	1885.08	19.44	45.66	0.00	542.52	-17.28	-26.95	114.70	612.99	612.99
45	2030			9.83	33.67	1360.01	24.45	38.94	1909.59	17.93	45.66	0.00	549.57	-16.35	-26.95	114.70	620.97	620.97
46	2031			8.74	33.67	1377.69	23.10	38.94	1934.41	16.42	45.66	0.00	556.72	-15.42	-26.95	114.70	629.05	629.05
47	2032			7.65	33.67	1395.60	21.75	38.94	1959.56	14.91	45.66	0.00	563.95	-14.49	-26.95	114.70	637.21	637.21
48	2033	-457.84	-800.90	6.55	33.67	1413.75	20.39	38.94	1985.03	13.40	45.66	-811.18	571.28	-13.54	-26.95	114.70	645.49	1456.68

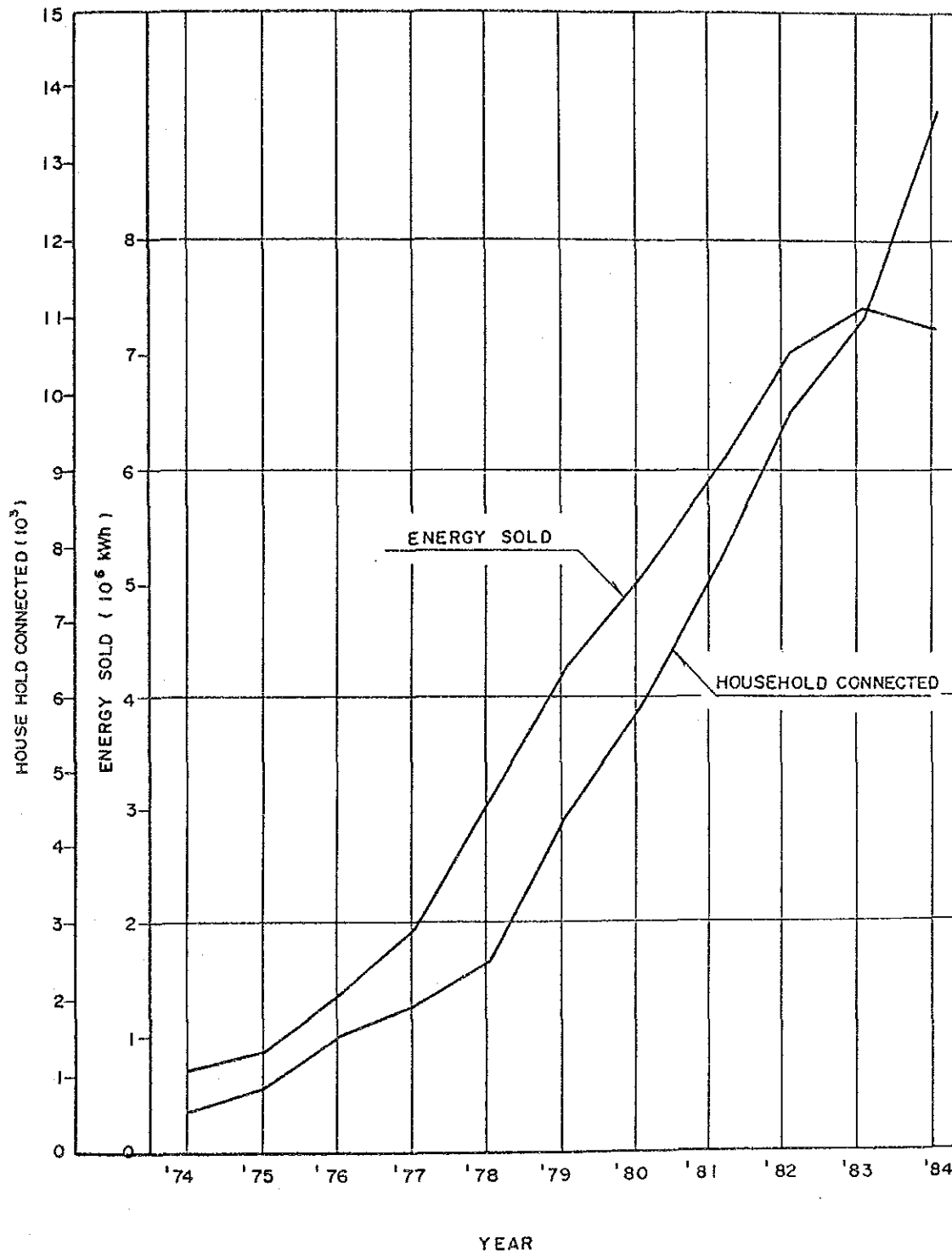




FIGURES



### HOUSEHOLDS CONNECTED AND ENERGY SOLD BY PALECO



RIO TUBA MINE EXISTING SINGLE LINE DIAGRAM

PLANT SITE SINGLE LINE DIAGRAM

PIER SITE SINGLE LINE DIAGRAM

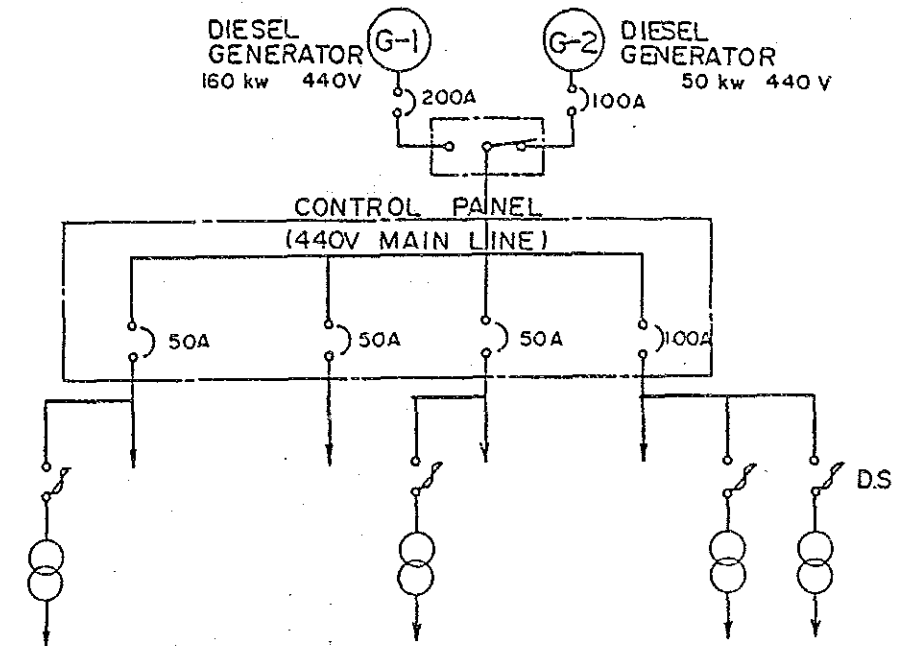
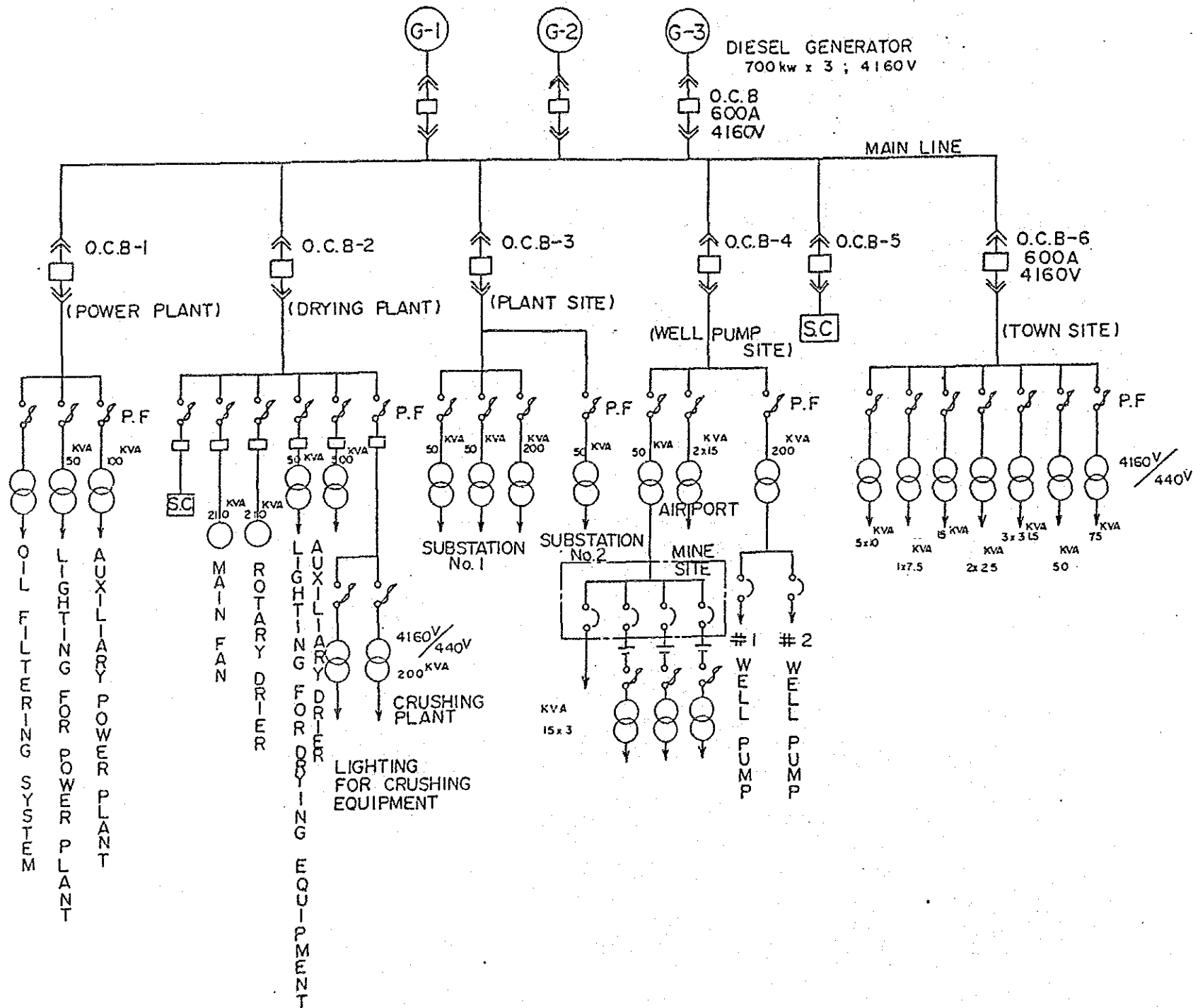








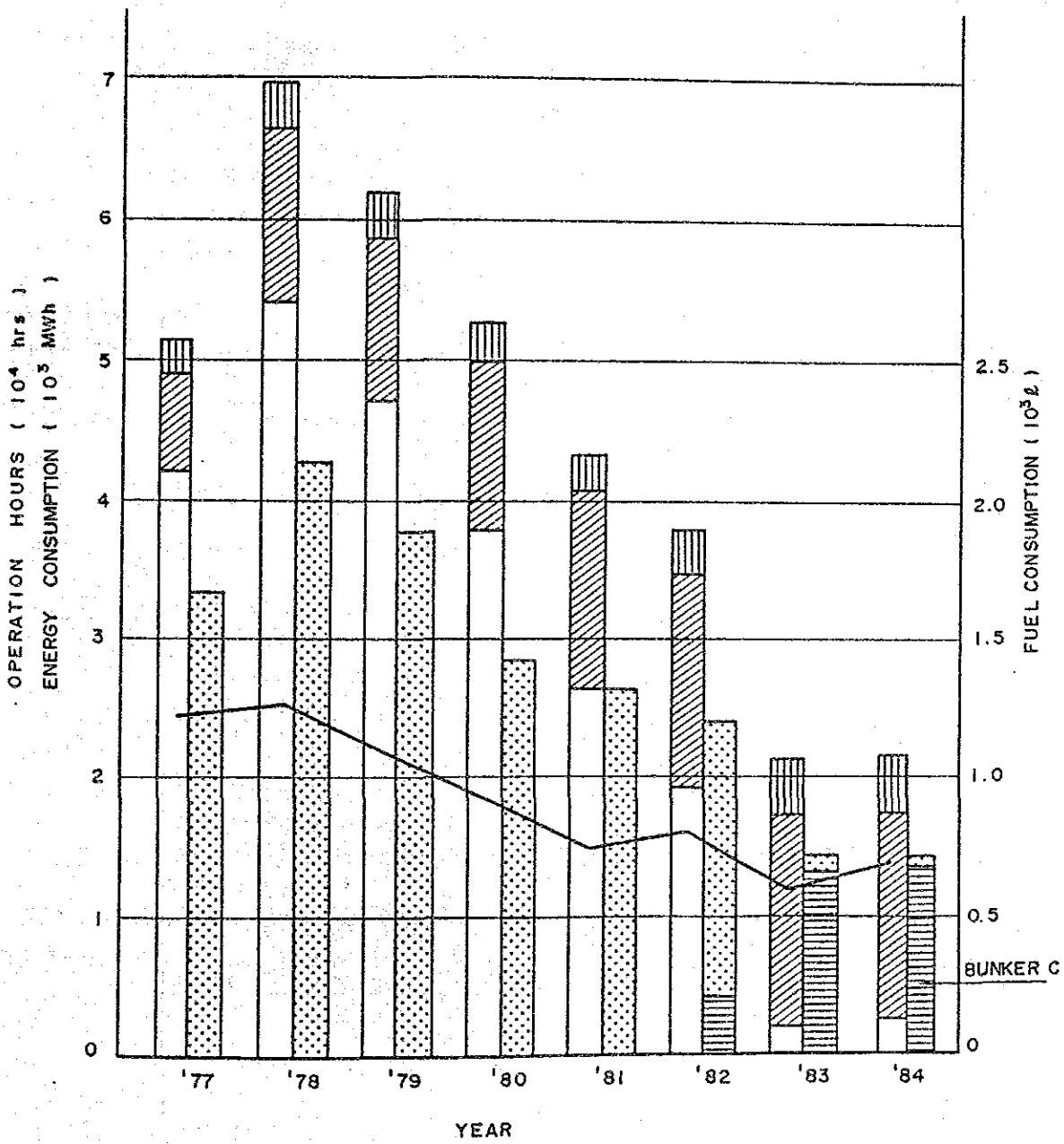




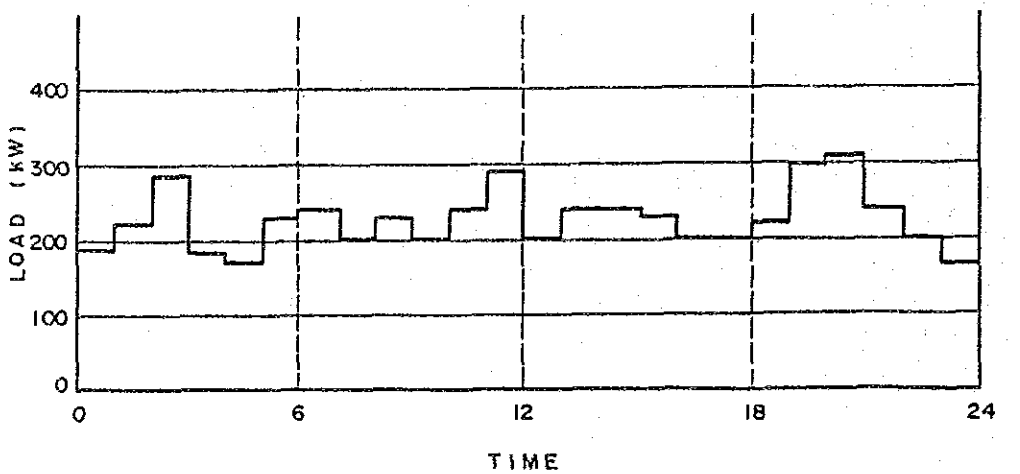
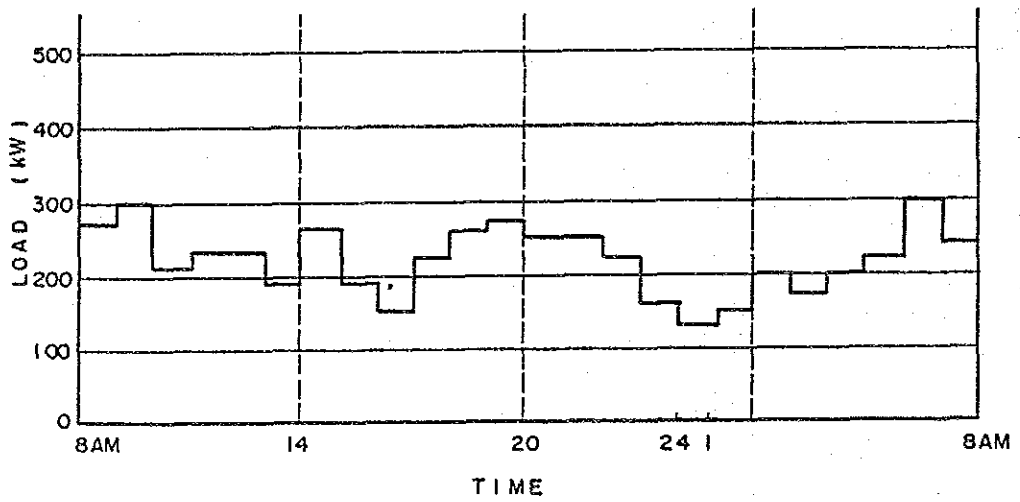
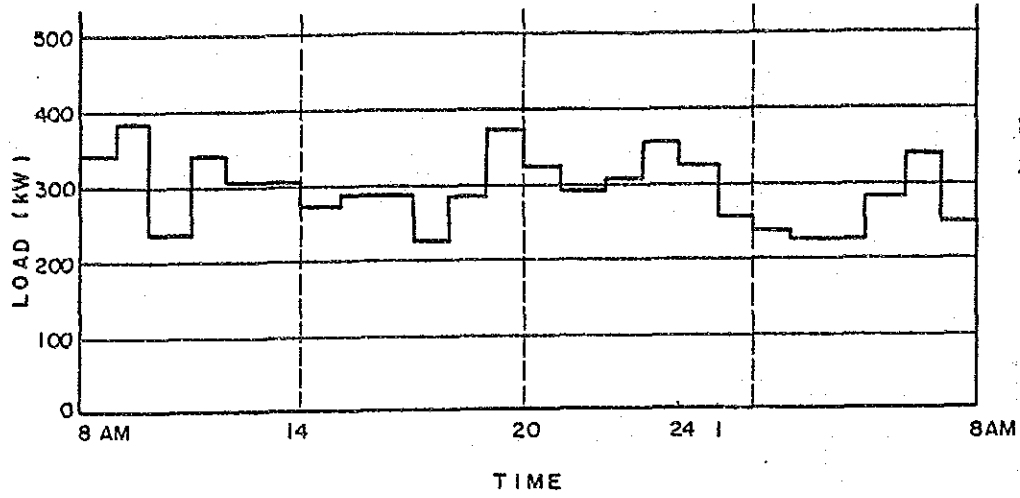
FIG. 3-2

# ENERGY STATUS OF RIO TUBA MINE

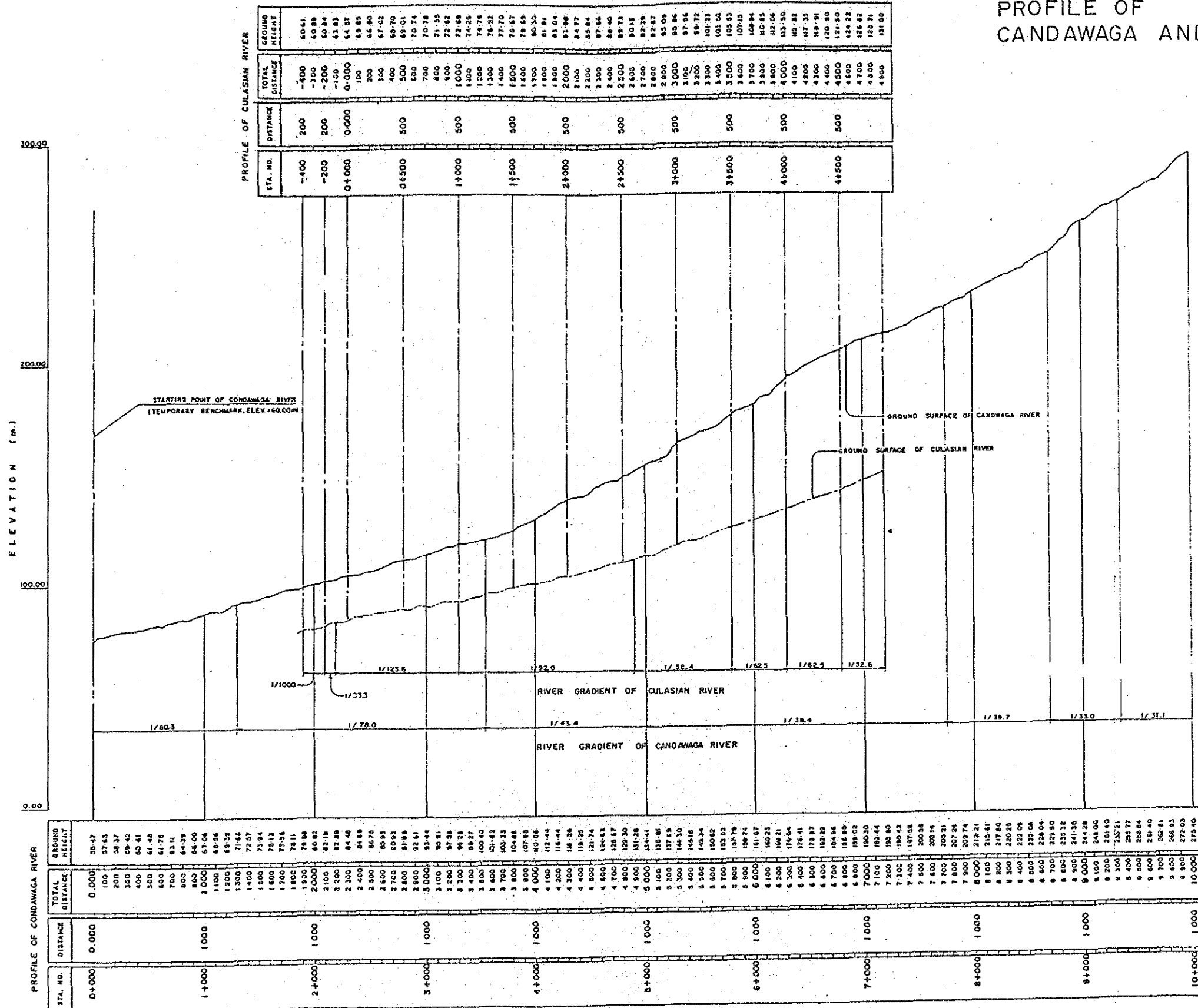
-  DRYING & CRUSHING
-  POWER PLANT
-  PLANT SITE ETC.
-  DIESEL FUEL
-  BUNKER C
-  OPERATION HOURS



### RIO TUBA MINE DAILY LOAD CURVE

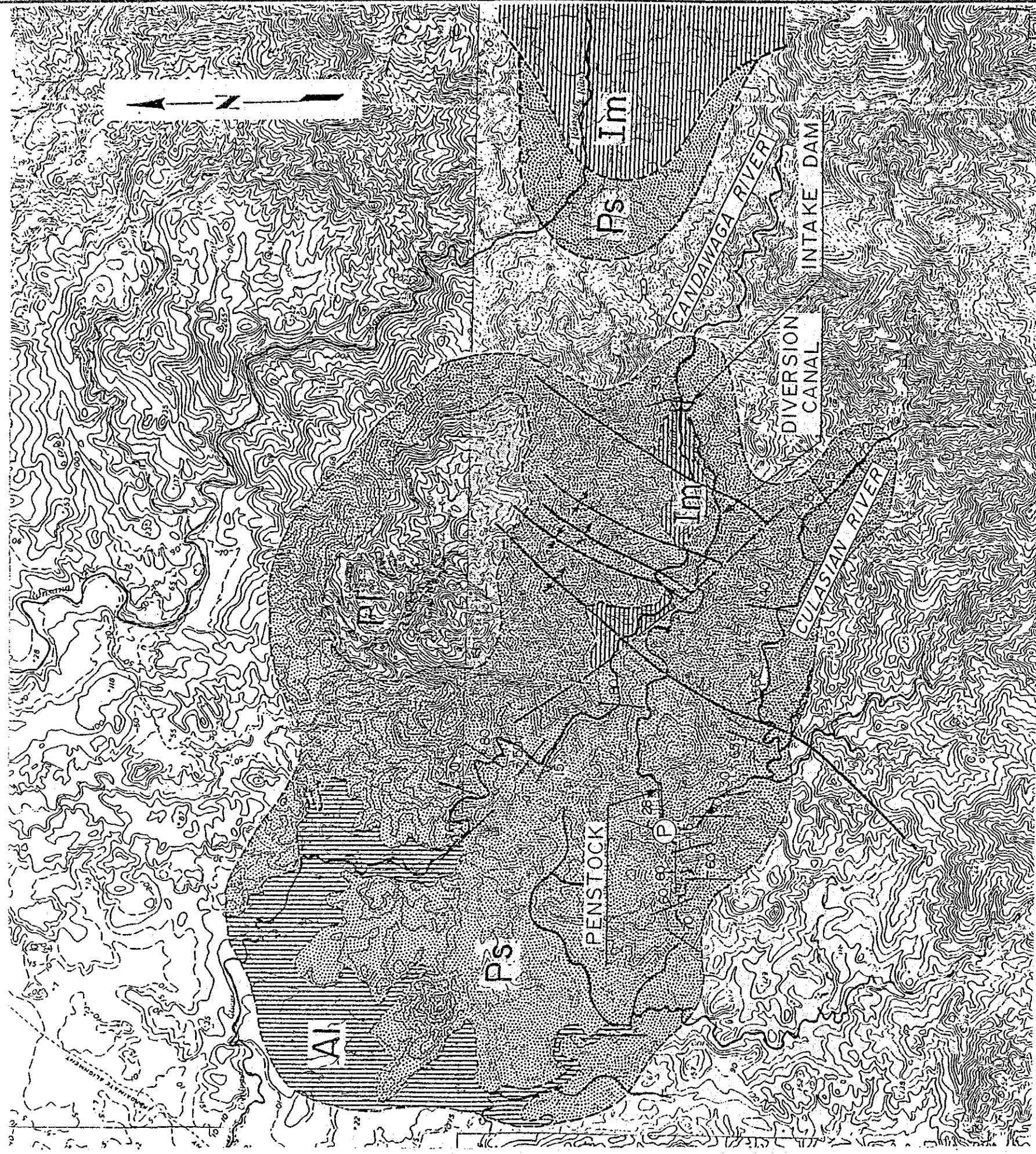


PROFILE OF CANDAWAGA AND CULASIAN RIVERS



SCALE:  
 HORIZONTAL 1:40,000  
 VERTICAL 1:2,000

GENERAL GEOLOGICAL MAP OF PROJECT AREA



Scale : 1 / 50,000

LEGEND

GEOLOGICAL AGE	FORMATION	LITHOLOGY
QUATERNARY	ALLUVIUM (AI)	CLAY, SAND, GRAVEL
EARLY MIOCENE OR LATE OLILOCENE	RANSANG LIMESTONE (RI)	LIMESTONE
EARLY EOCENE	PANDIAN FORMATION (Pd)	MASSIVE SANDSTONE WITH INTERBEDDED MUDSTONE AND SHALE
PALEOCENE	FOVWATION (Ps)	INTERBEDDED SANDSTONE AND SHALE WITH LIMESTONE
PRE-TERTIARY	IRAHUAN - METAVOLCANICS (Im)	BASALTIC COMPLEX PYROCLASTICS AND LAVA (ALMOST PILLOW TYPE)

- STRIKE AND INCLINATION OF STRATUM.
- STRIKE AND INCLINATION OF FAULT
- INFERRED GEOLOGICAL BORDER LINE
- ANTICLINE STRUCTURE
- SYNCLINE STRUCTURE

FIG. 5 - 2





# CANDAWAGA RIVER 1975-'85 AVERAGE FLOW DURATION CURVE

STATION : INTAKE DAM SITE (RIVER BED EL.255.0m)  
 CATCHMENT AREA : 30.8km<sup>2</sup>

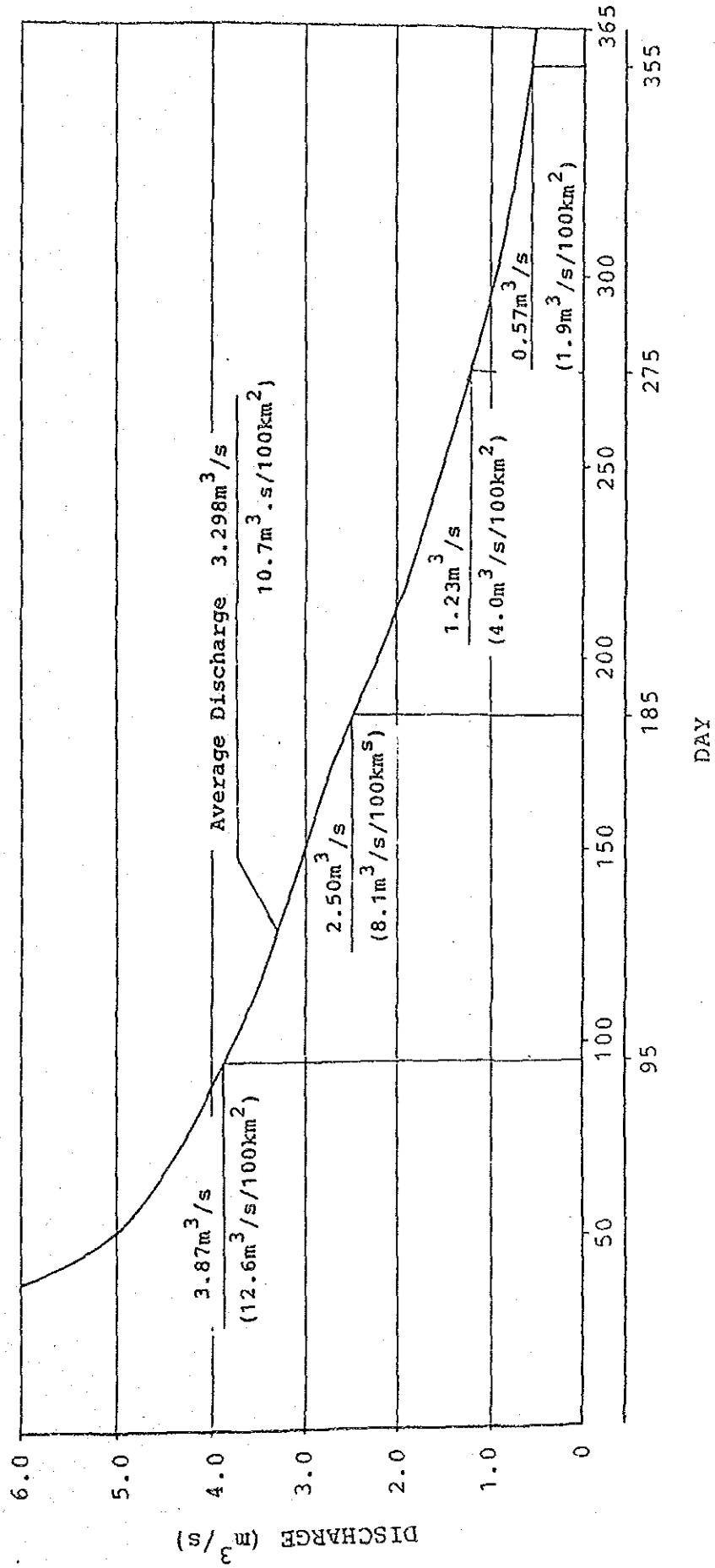


FIG. 5-3

### POSSIBLE HYDROPOWER DEVELOPMENT ALTERNATIVES

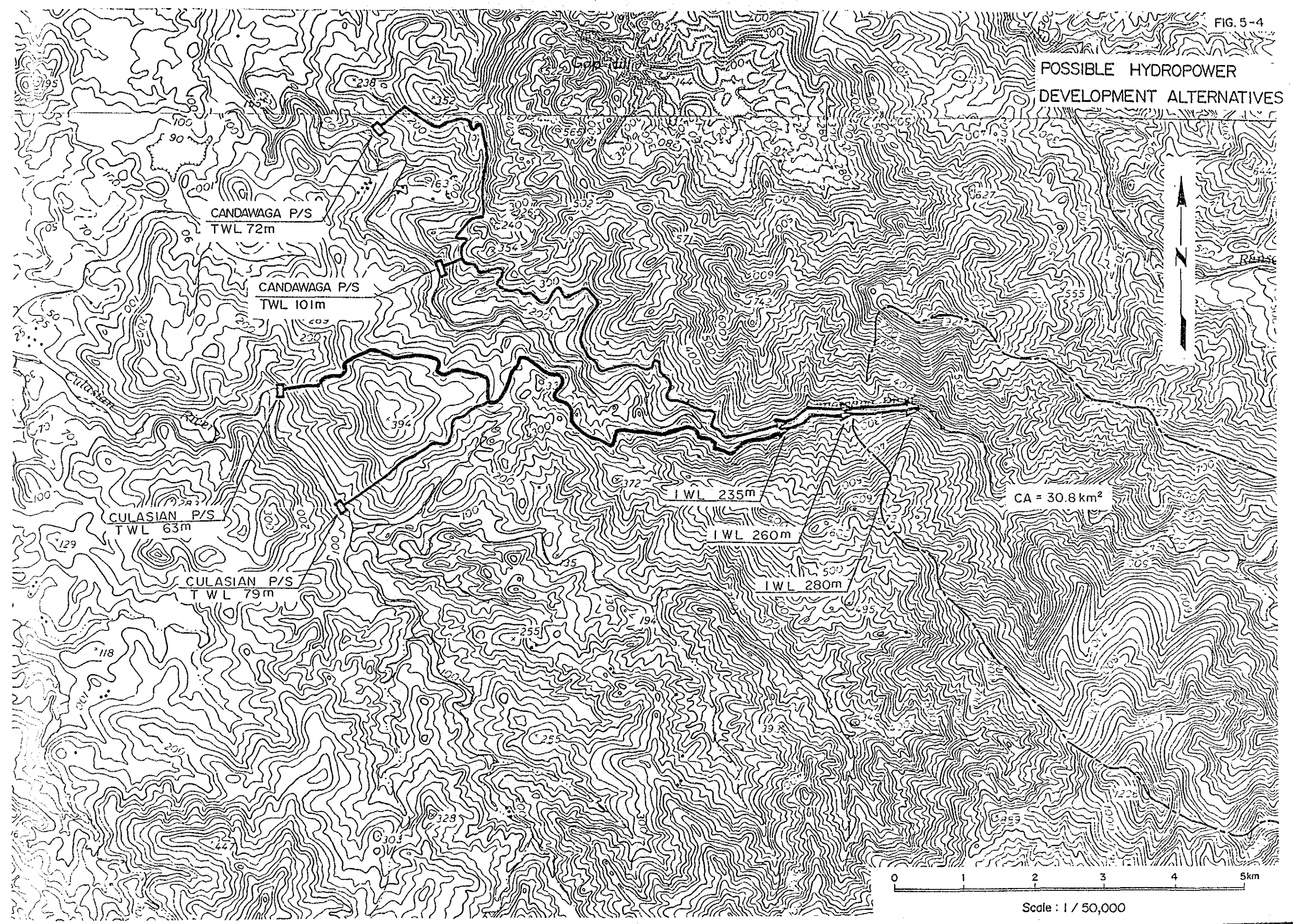


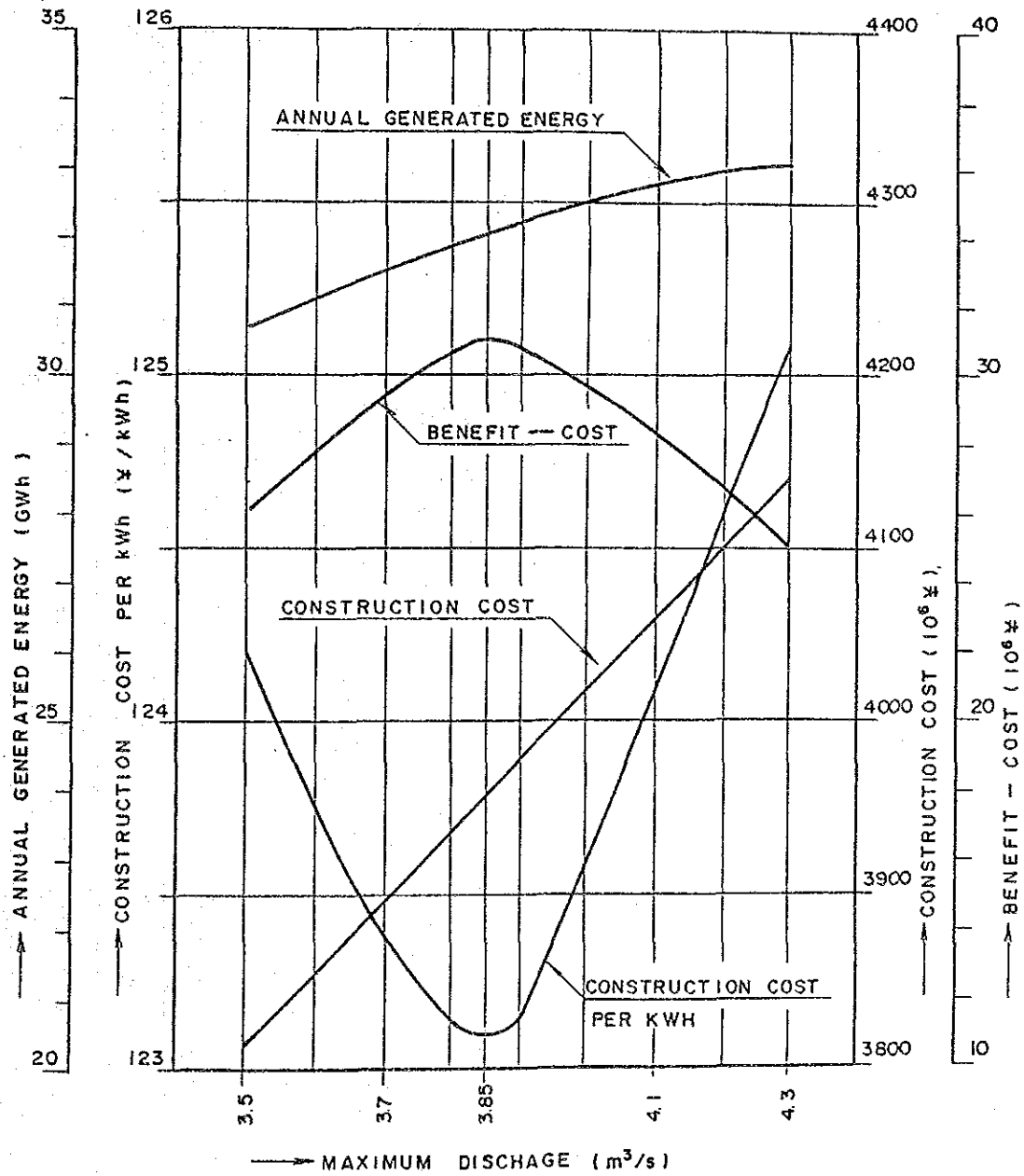


FIG. 5-5

OPTIMIZATION STUDY FOR MAXIMUM DISCHARGE  
( CULASIAN P/S SCHEME )

Intake water level : EL. 260m

Tailrace water level : EL. 63 m



## OPTIMIZATION STUDY FOR MAXIMUM DISCHARGE (ALTERNATIVE CANDAWAGA P/S SCHEME)

Intake water level : EL. 260 m

Tailrace water level : EL. 101 m

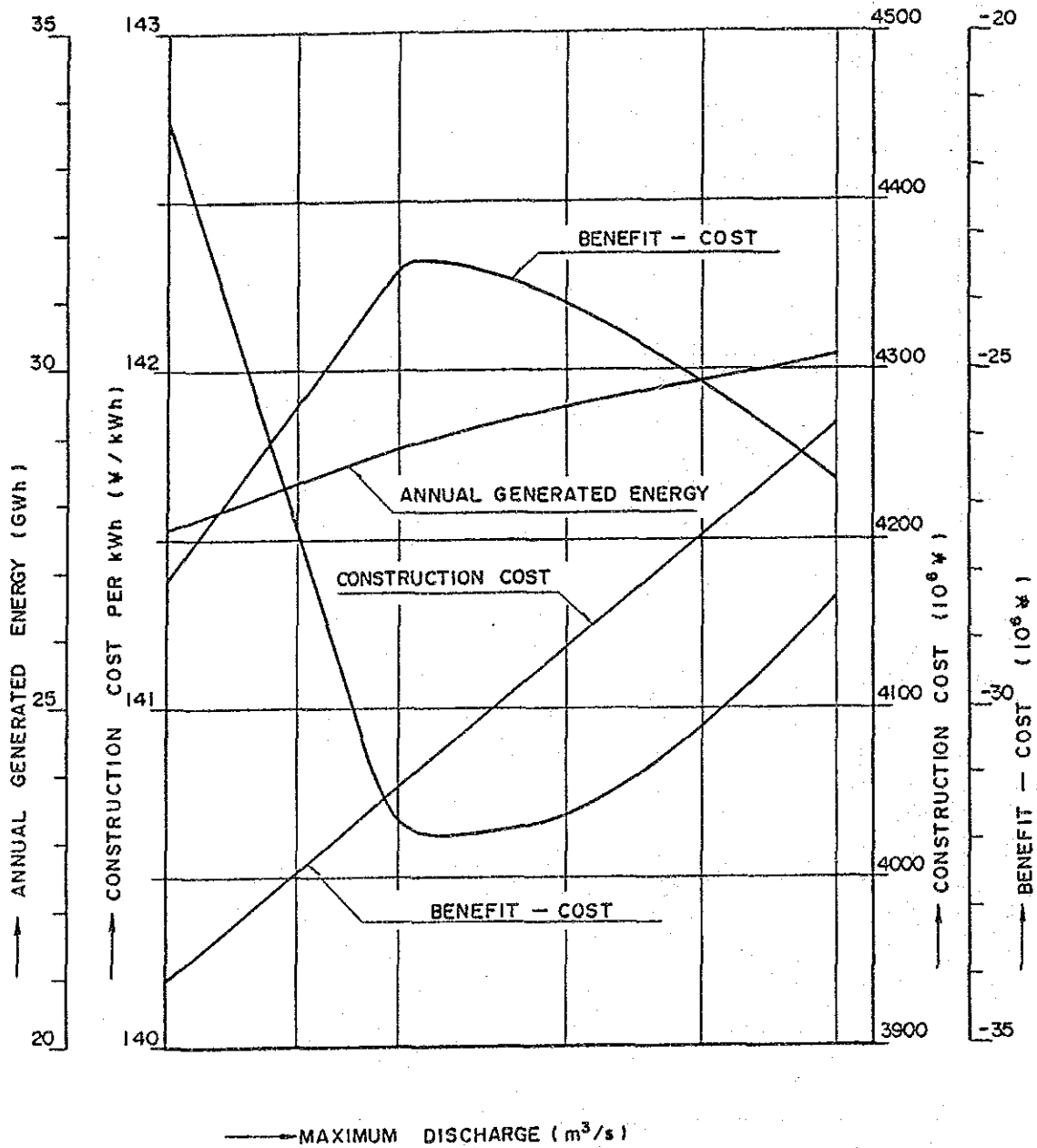
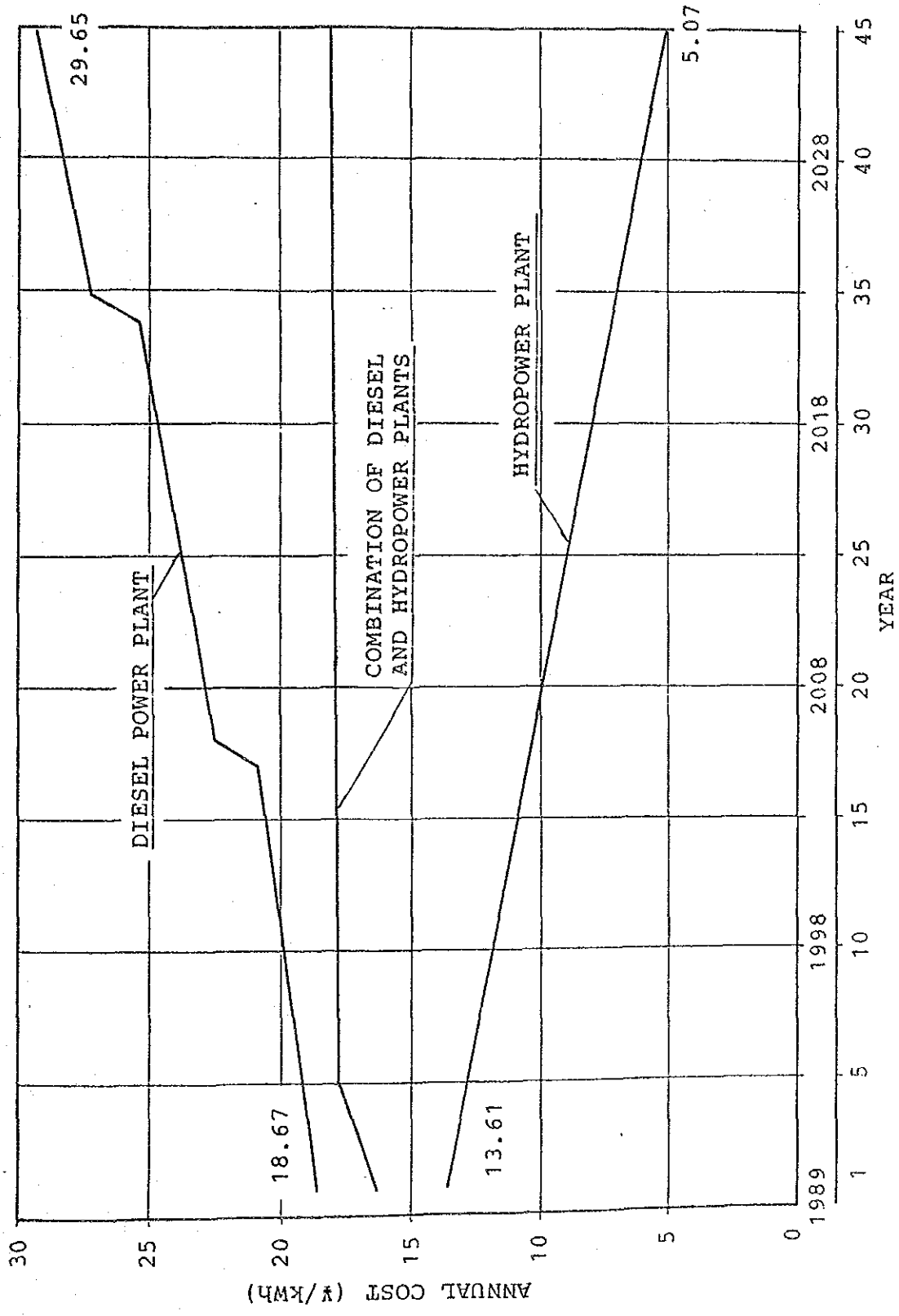


FIG. 7-1

# ANNUAL COST VARIATION FOR DIESEL AND HYDROPOWER

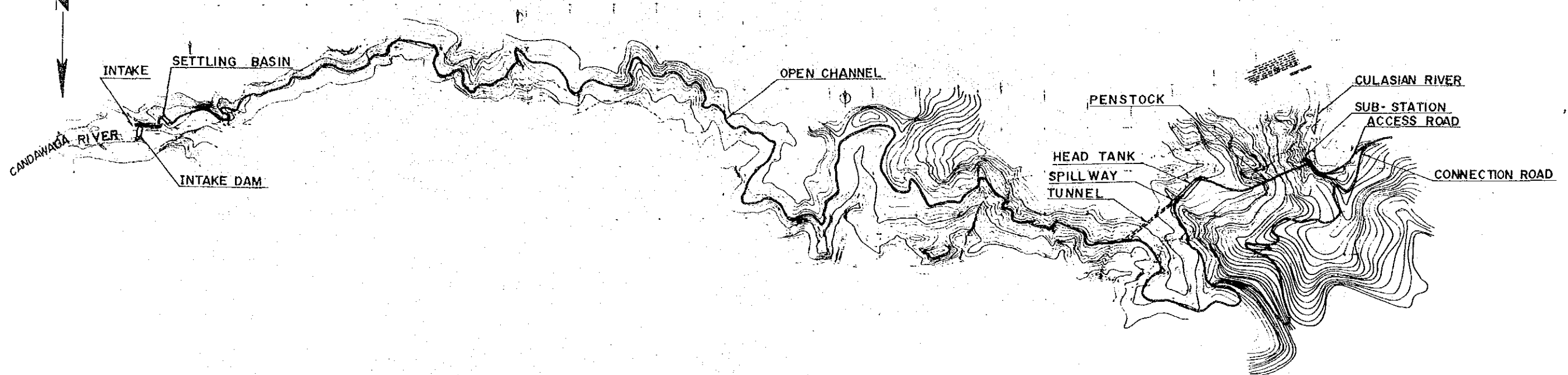




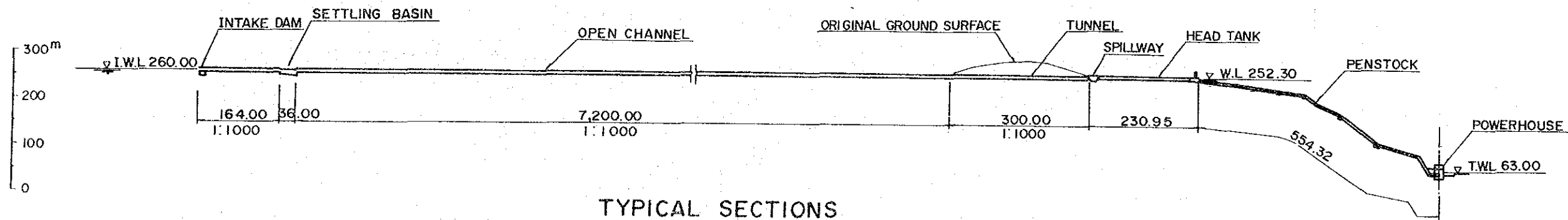


**DRAWINGS**

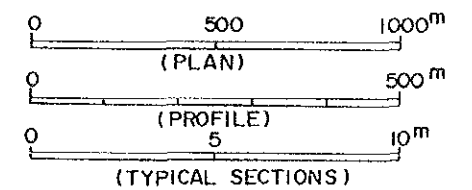
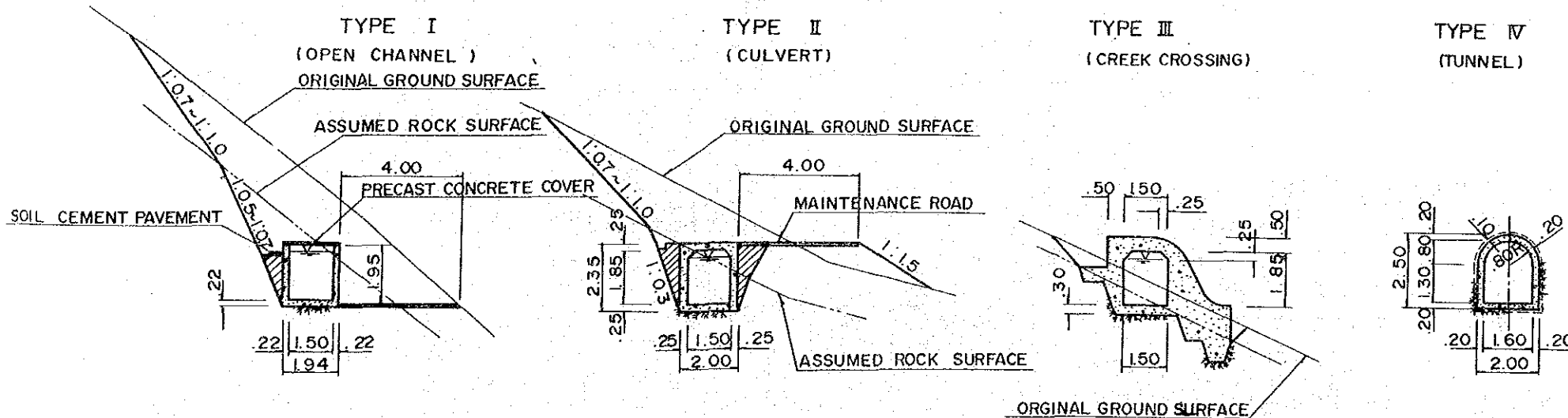
# PLAN



# PROFILE



# TYPICAL SECTIONS

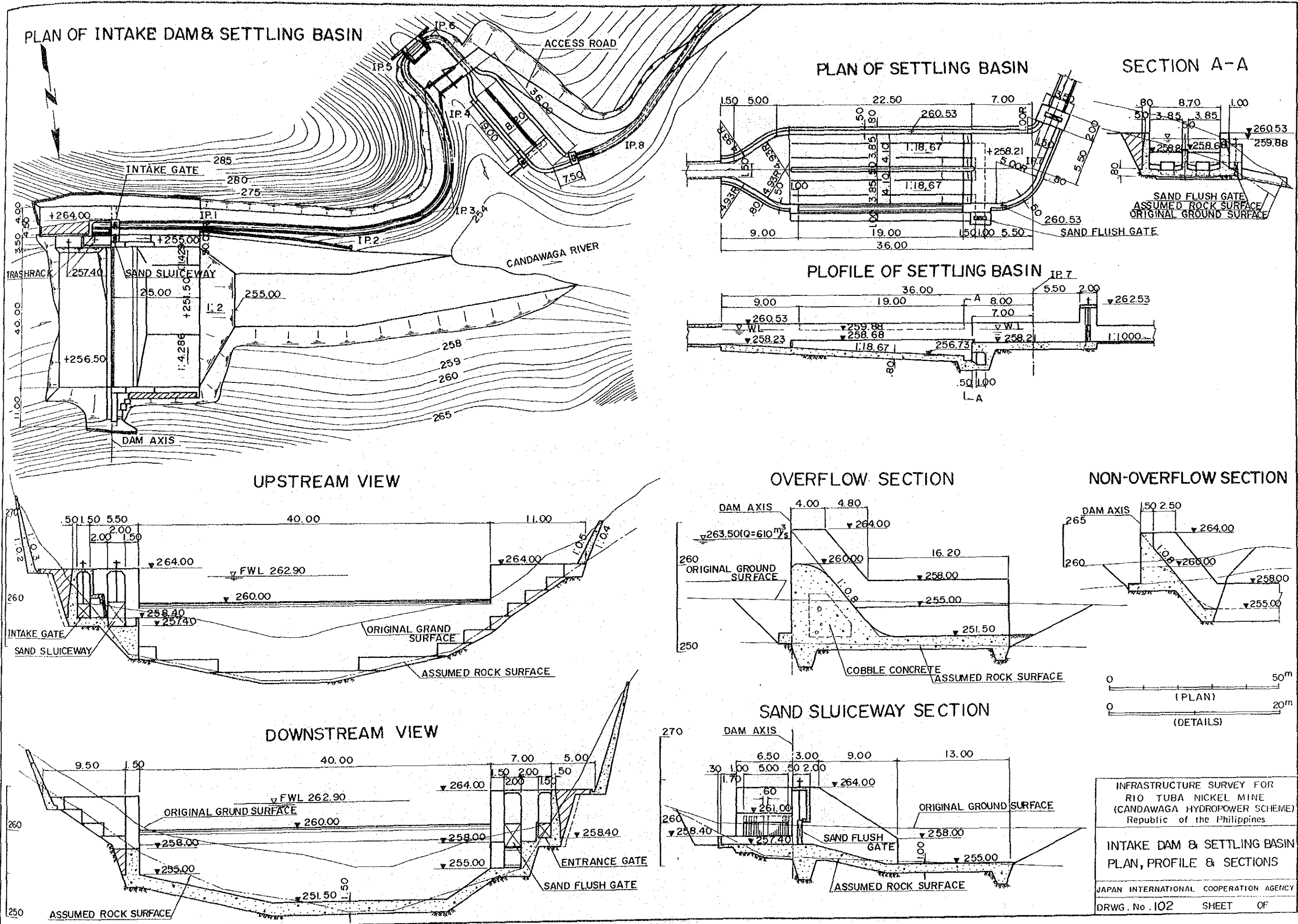


INFRASTRUCTURE SURVEY FOR  
RIO TUBA NICKEL MINE  
(CANDAWAGA HYDROPOWER SCHEME)  
Republic of the Philippines

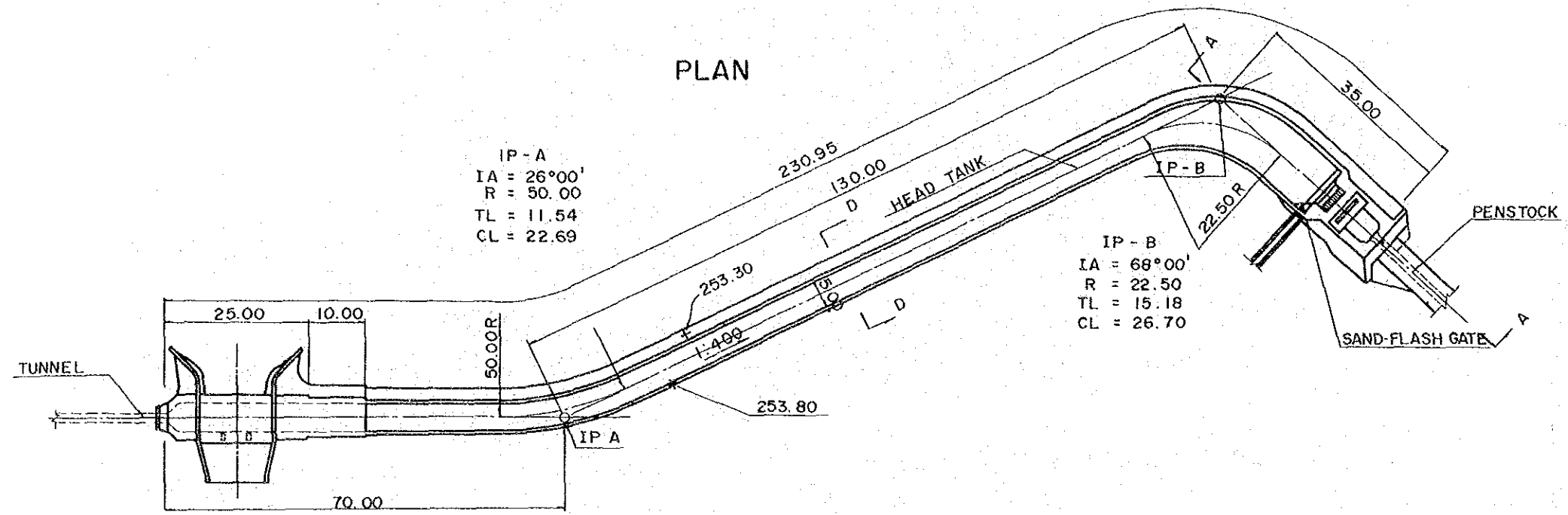
WATERWAY PLAN  
PROFILE & SECTIONS

JAPAN INTERNATIONAL COOPERATION AGENCY

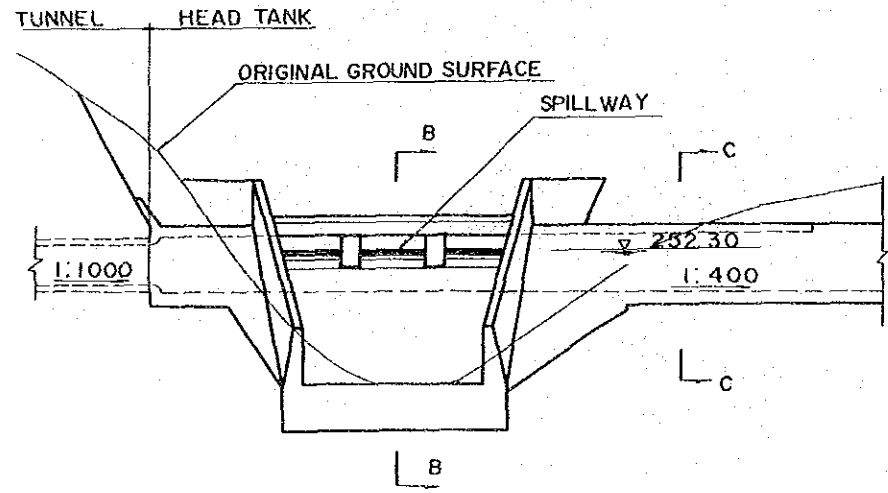
DRWG. No. 101 SHEET OF



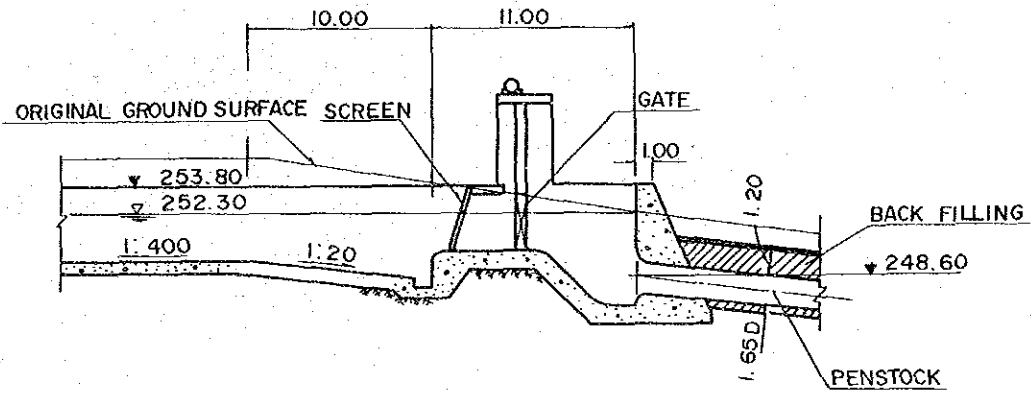
PLAN



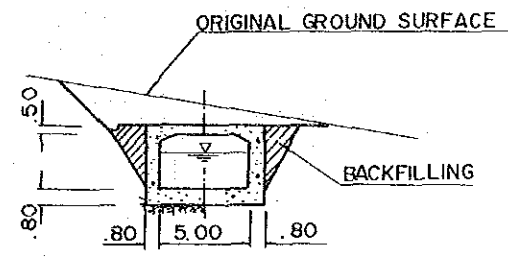
DOWN STREAM VIEW OF SPILLWAY



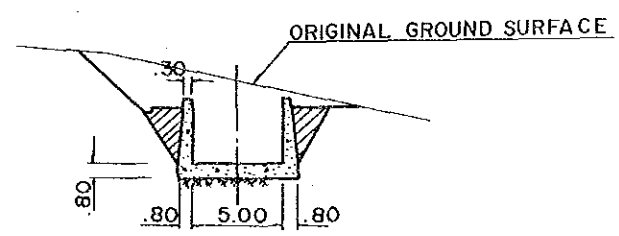
SECTION A-A



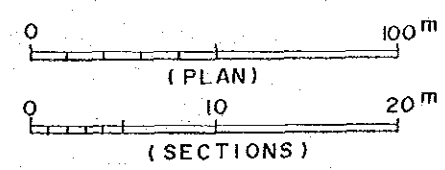
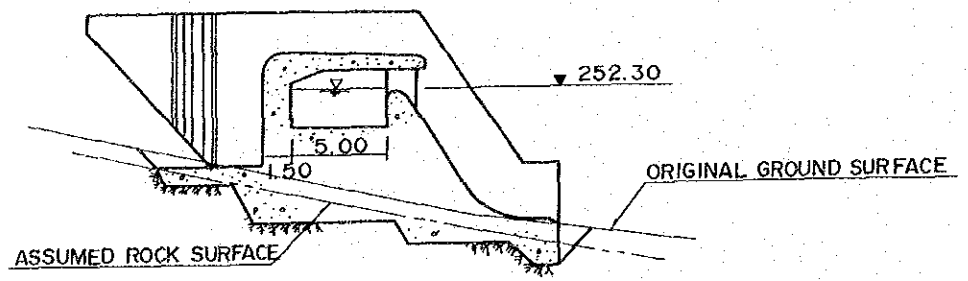
SECTION C-C



SECTION D-D



SECTION B-B

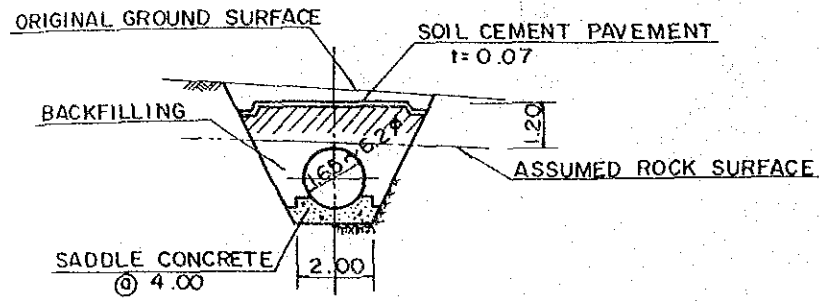


INFRASTRUCTURE SURVEY FOR  
 RIO TUBA NICKEL MINE  
 (CANDAWAGA HYDROPOWER SCHEME)  
 Republic of the Philippines

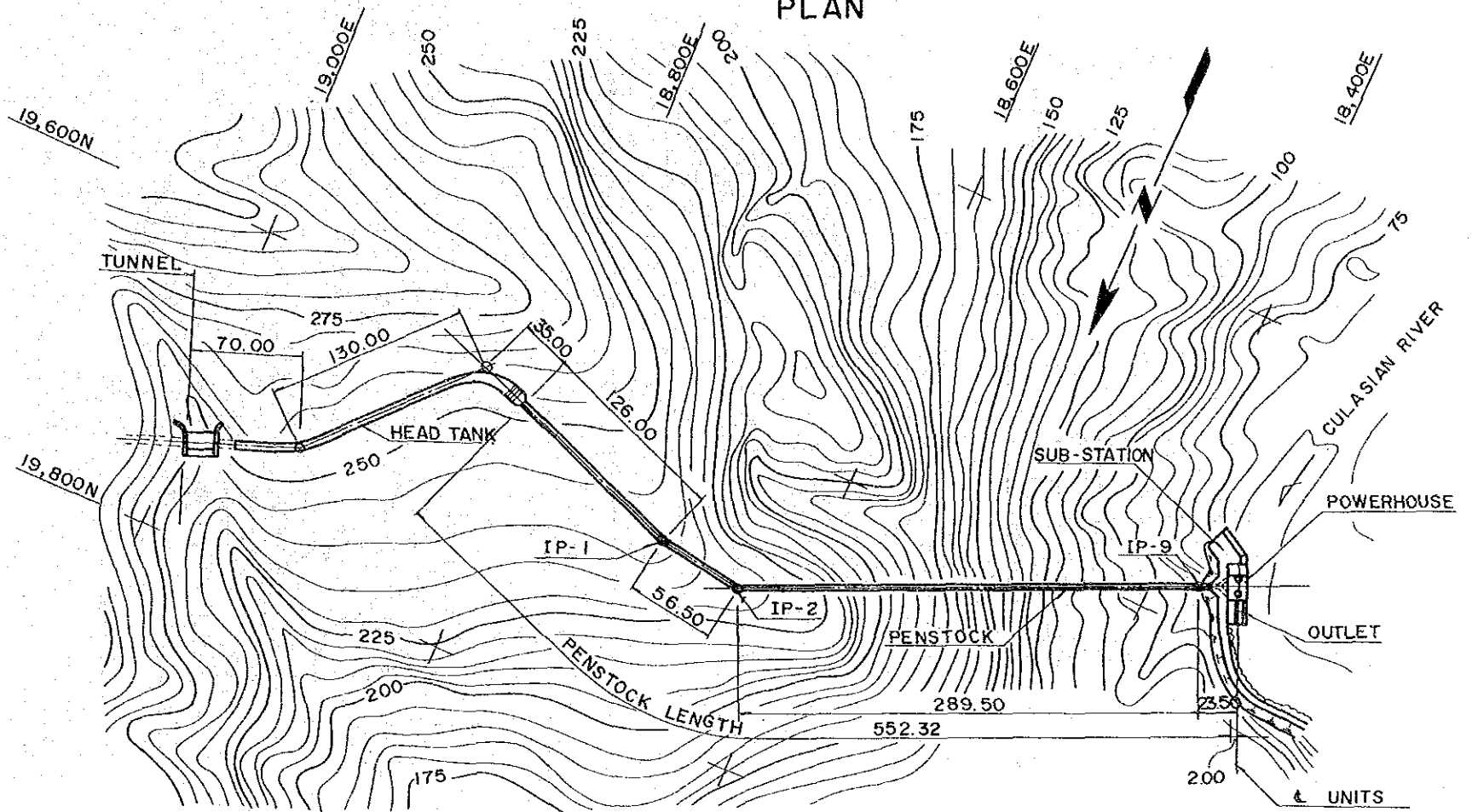
**HEAD TANK  
 PLAN, SECTIONS & DETAIL**

JAPAN INTERNATIONAL COOPERATION AGENCY  
 DRWG. No. 103 SHEET OF

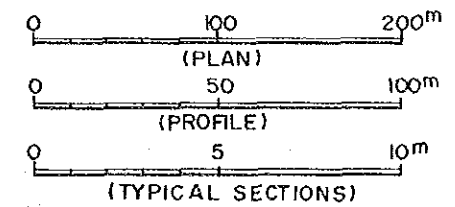
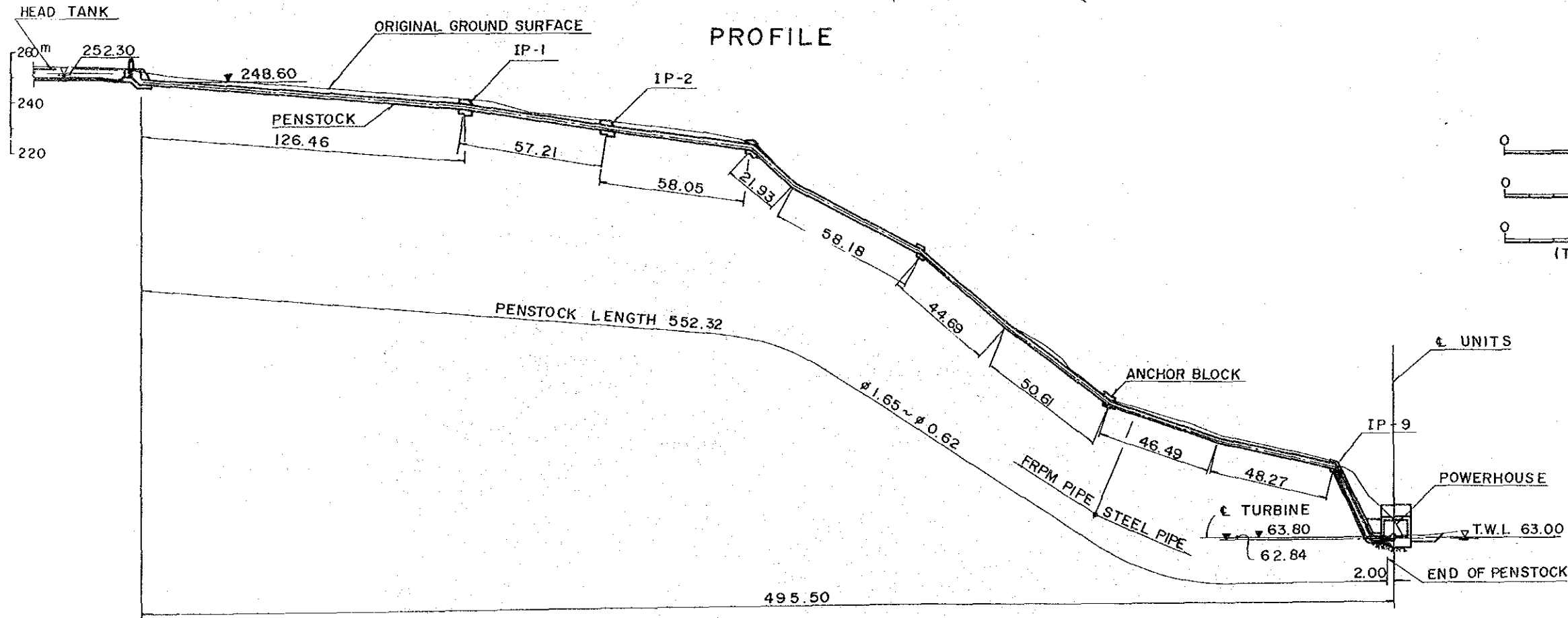
### TYPICAL CROSS SECTION



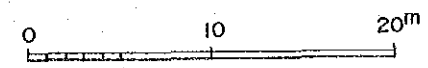
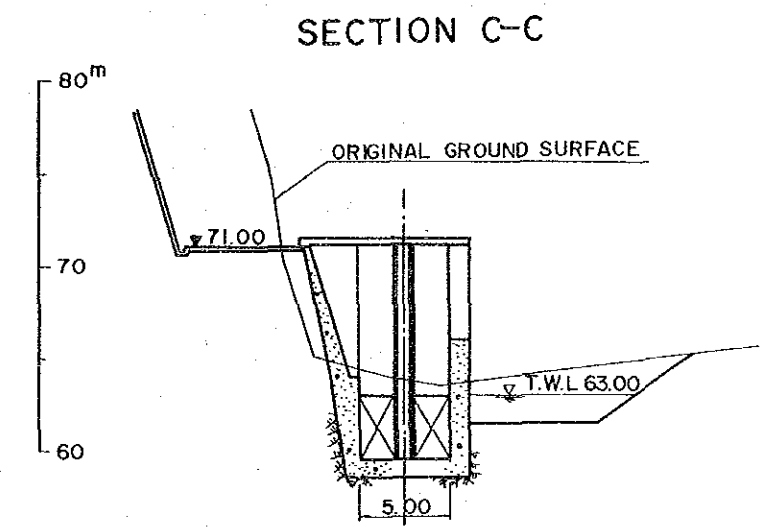
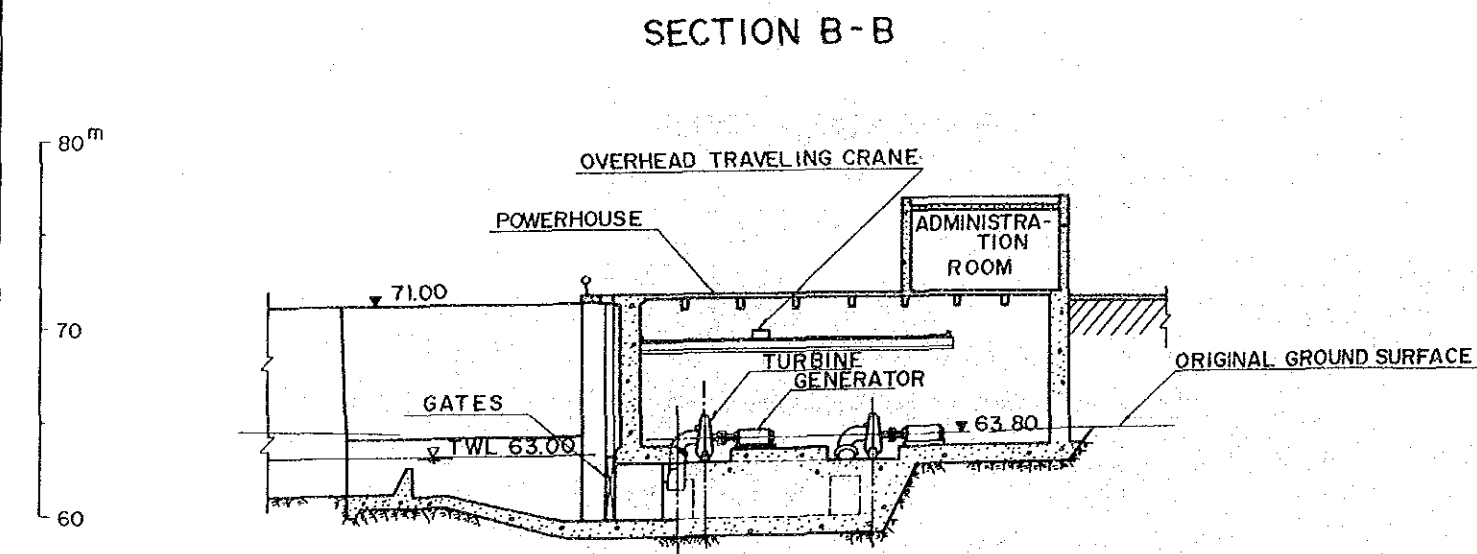
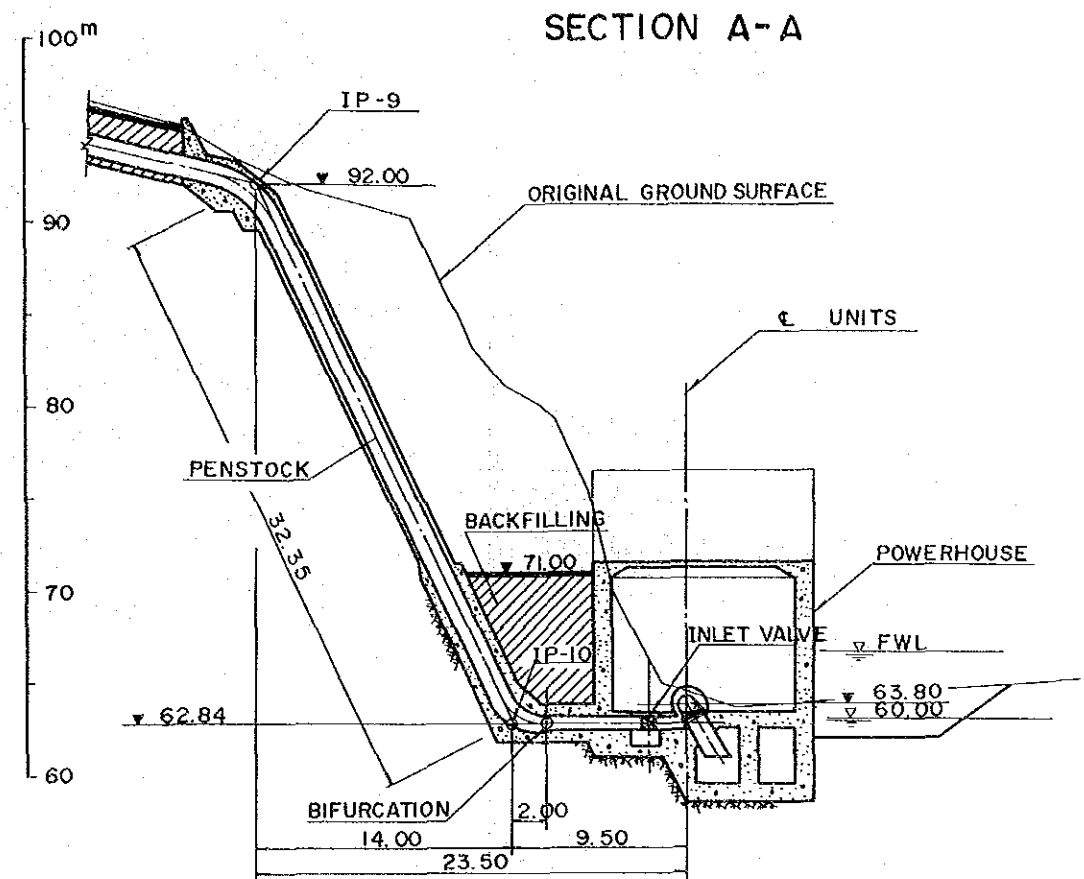
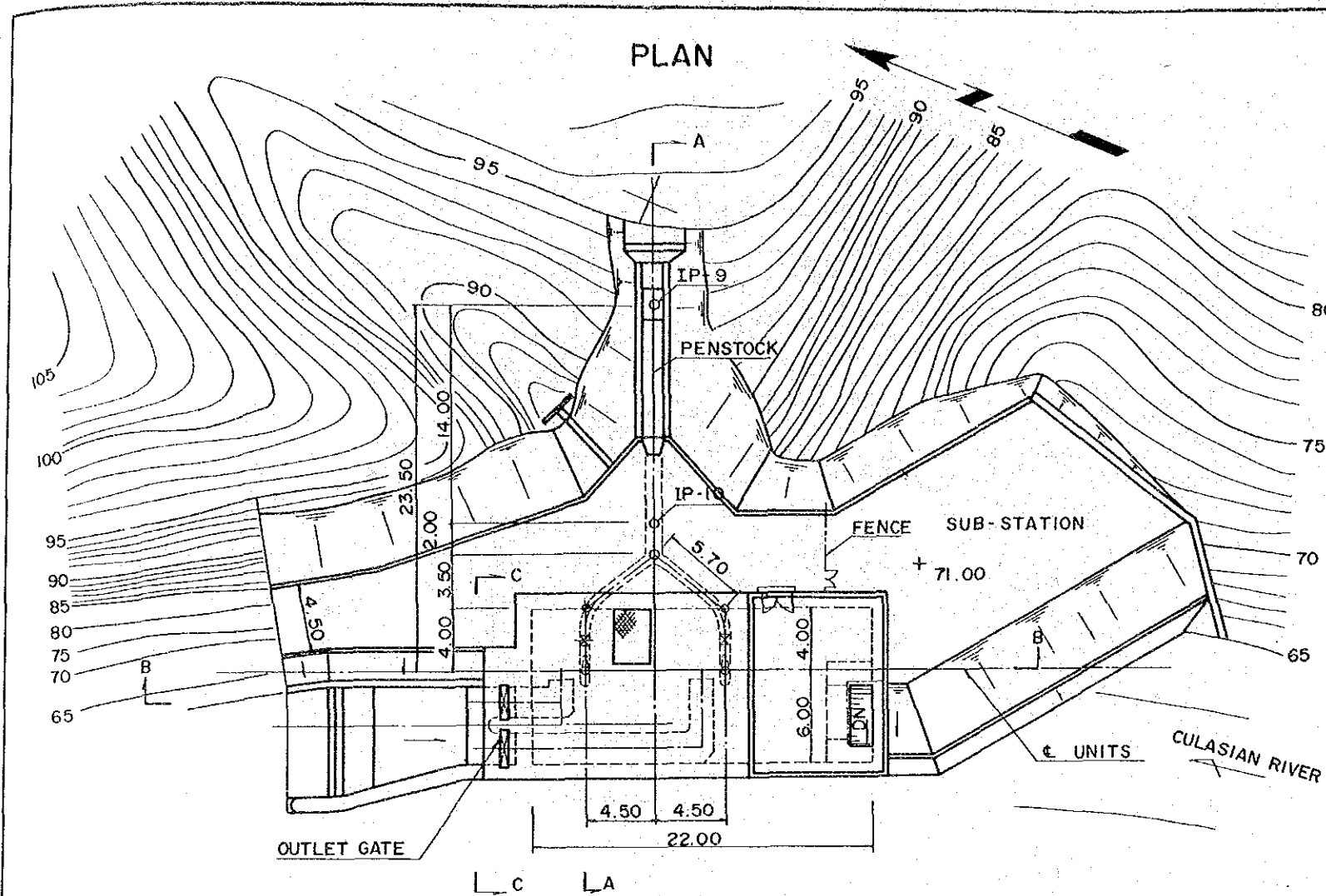
### PLAN



### PROFILE



INFRASTRUCTURE SURVEY FOR RIO TUBA NICKEL MINE (CANDAWAGA HYDROPOWER SCHEME) Republic of the Philippines	
PENSTOCK PLAN, PROFILE & SECTION	
JAPAN INTERNATIONAL COOPERATION AGENCY	
DRWG. No. 104	SHEET OF

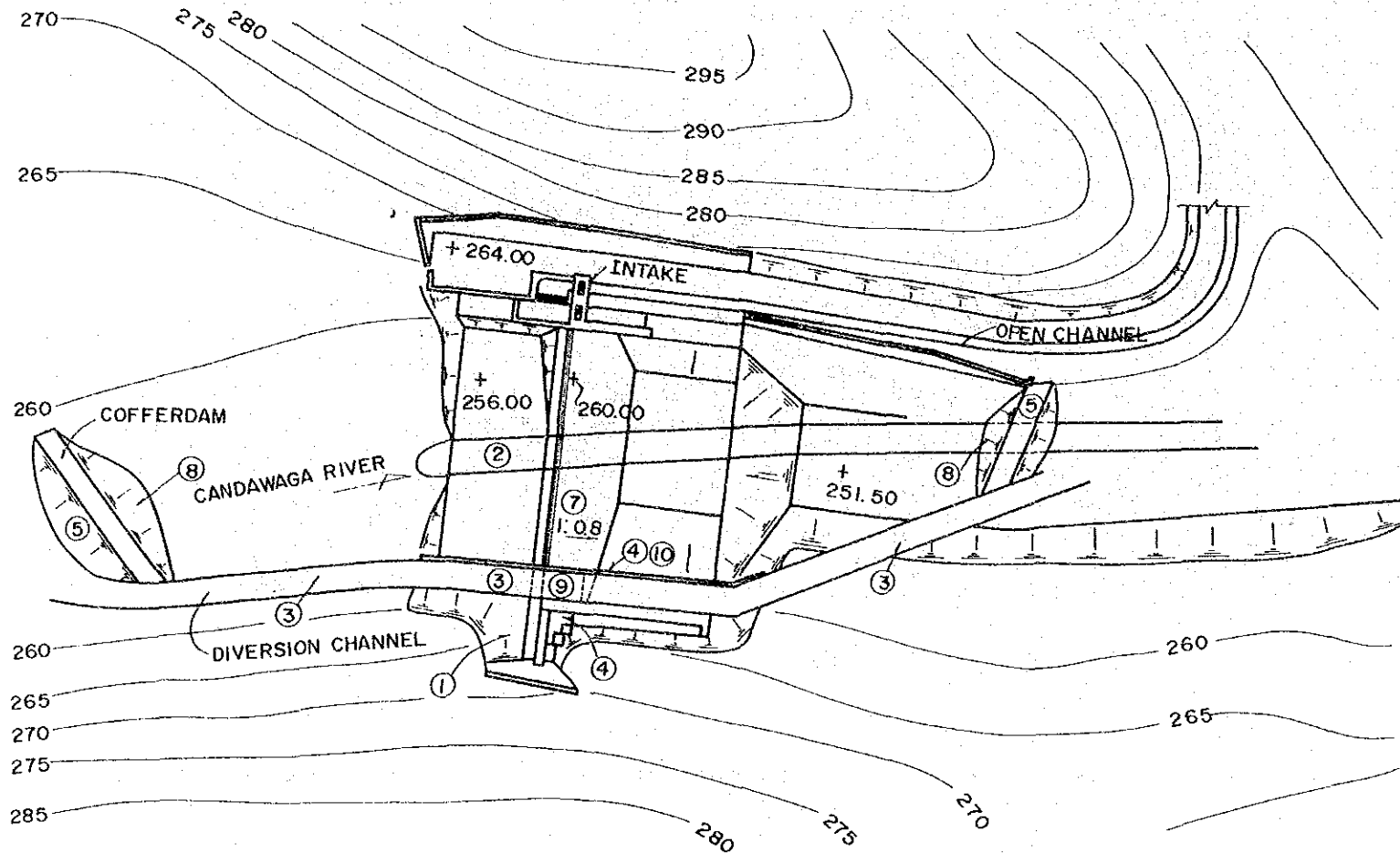


INFRASTRUCTURE SURVEY FOR  
 RIO TUBA NICKEL MINE  
 (CANDAWAGA HYDROPOWER SCHEME)  
 Republic of the Philippines

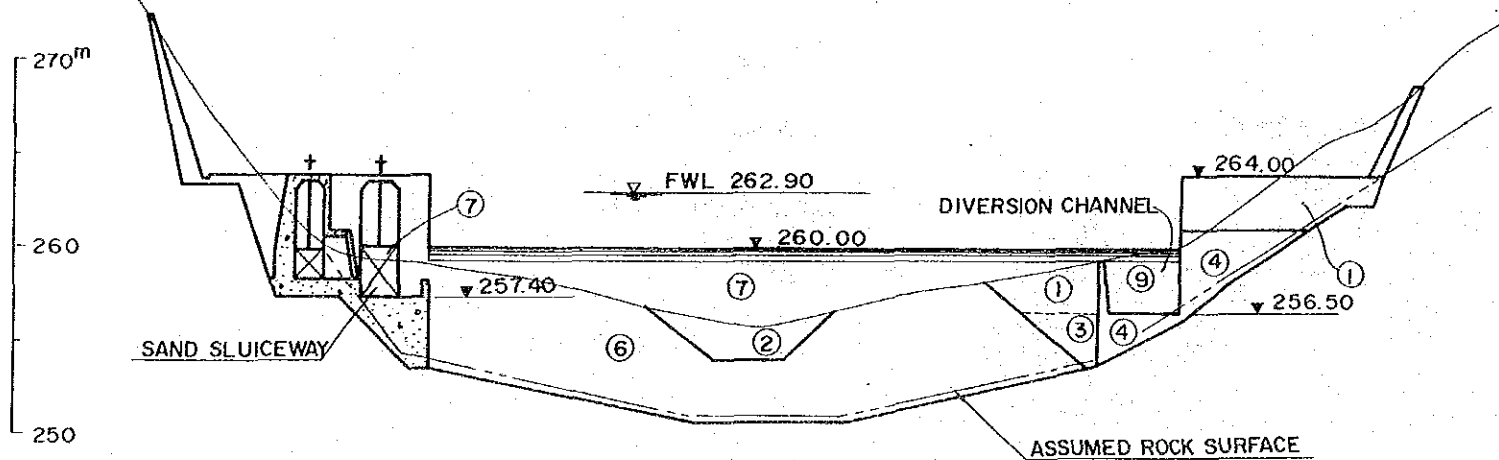
**POWERHOUSE PLAN & SECTIONS**

JAPAN INTERNATIONAL COOPERATION AGENCY  
 DRWG. No. 105 SHEET OF

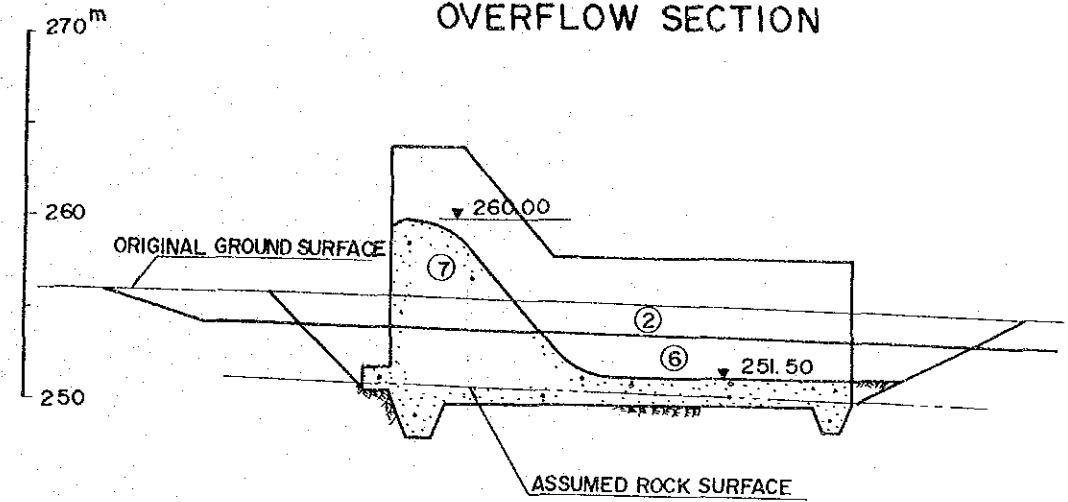
### PLAN



### UPSTREAM VIEW

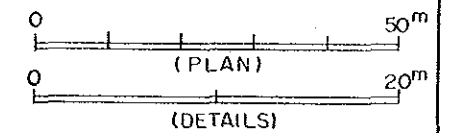


### OVERFLOW SECTION



### WORK PROCEDURE

- ① EXCAVATION OF DAM FOUNDATION (RIGHT BANK, ABOVE EL 256.50)
- ② EXCAVATION OF RIVER BED
- ③ EXCAVATION FOR DIVERSION CHANNEL AND DAM FOUNDATION
- ④ PLACING OF CONCRETE FOR DAM AND DIVERSION CHANNEL
- ⑤ COFFERDAM CONSTRUCTION AND DIVERSION OF THE RIVER
- ⑥ EXCAVATION OF DAM FOUNDATION.
- ⑦ PLACING OF DAM CONCRETE ETC. AND INSTALLATION OF SAND FLUSH GATE
- ⑧ REMOVAL OF COFFERDAM, DEWATERING THROUGH SAND FLUSHING CHANNEL
- ⑨ PLACING OF DAM CONCRETE ON THE DIVERSION CHANNEL
- ⑩ DEMOLISHING OF DIVERSION CHANNEL CONCRETE



INFRASTRUCTURE SURVEY FOR  
RIO TUBA NICKEL MINE  
(CANDAWAGA HYDROPOWER SCHEME)  
Republic of the Philippines

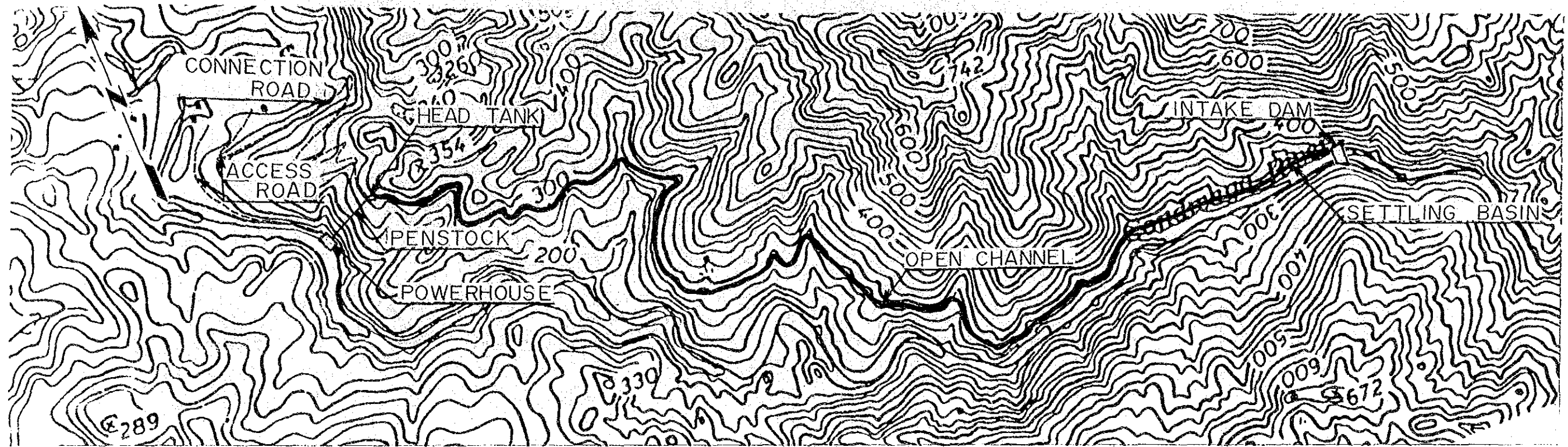
INTAKE DAM DIVERSION WORKS

JAPAN INTERNATIONAL COOPERATION AGENCY

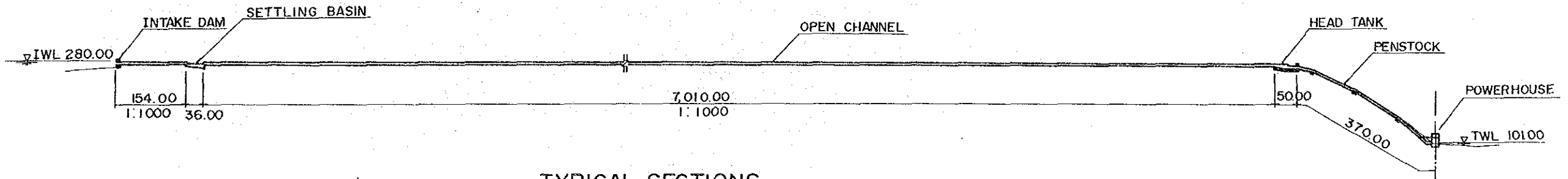
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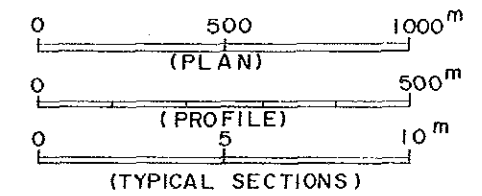
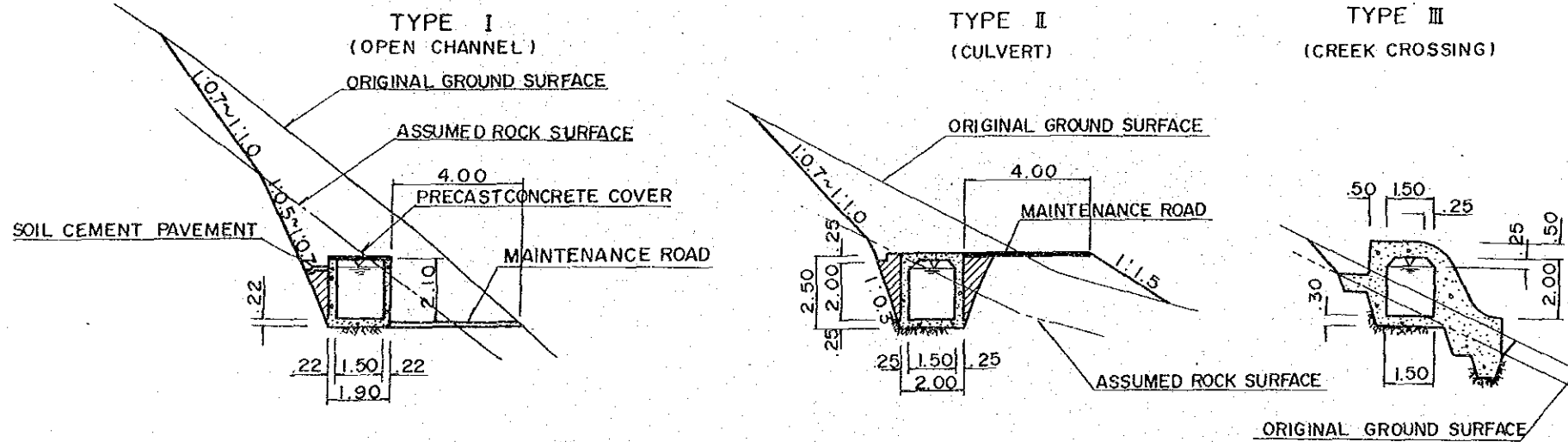
PLAN



PROFILE



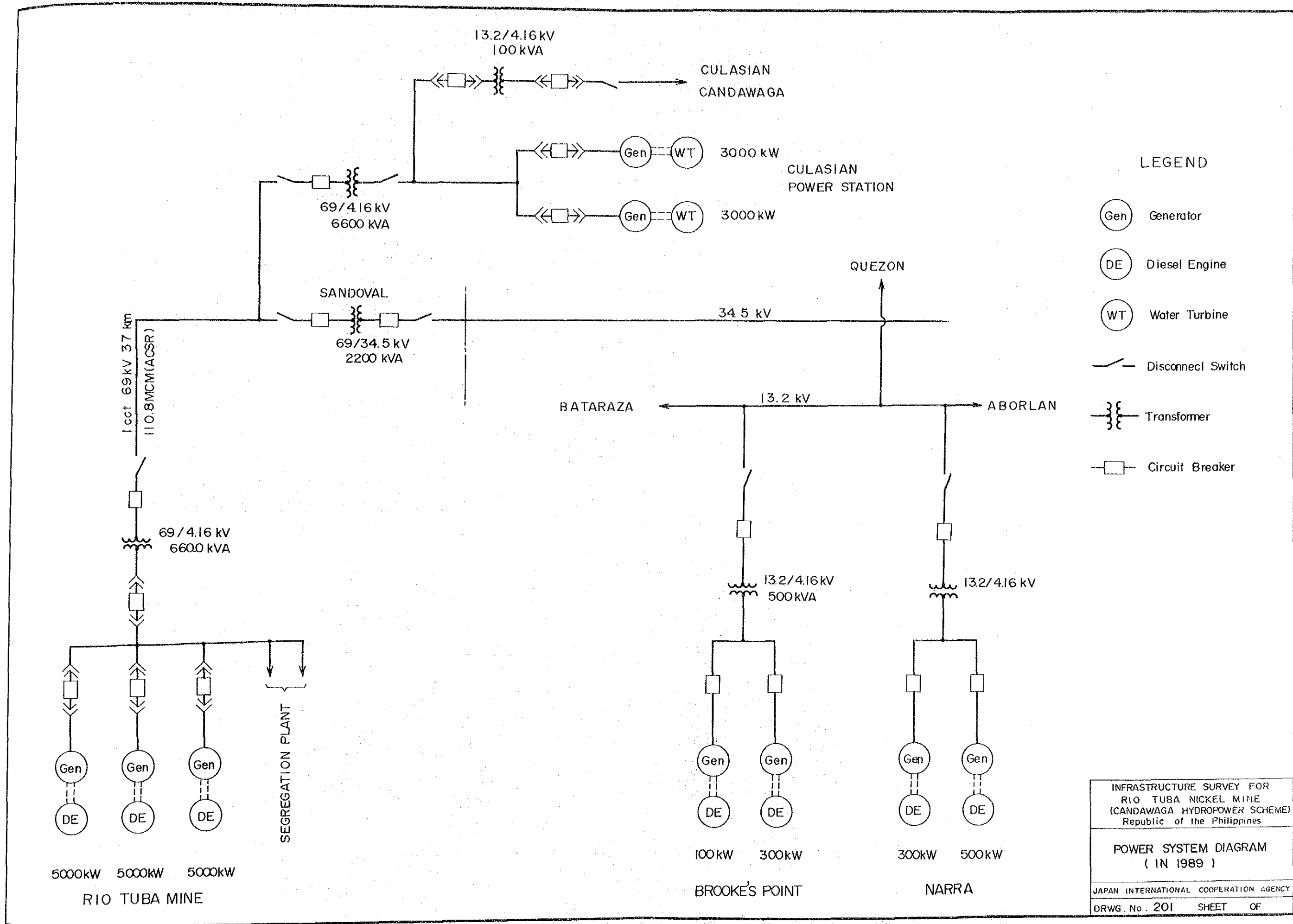
TYPICAL SECTIONS







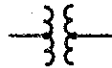

INFRASTRUCTURE SURVEY FOR  
 RIO TUBA NICKEL MINE  
 (CANDAWAGA HYDROPOWER SCHEME)  
 Republic of the Philippines

GENERAL PLAN FOR ALTERNATIVE  
 CANDAWAGA P/S SCHEME

JAPAN INTERNATIONAL COOPERATION AGENCY  
 DRWG. No. 107 SHEET OF



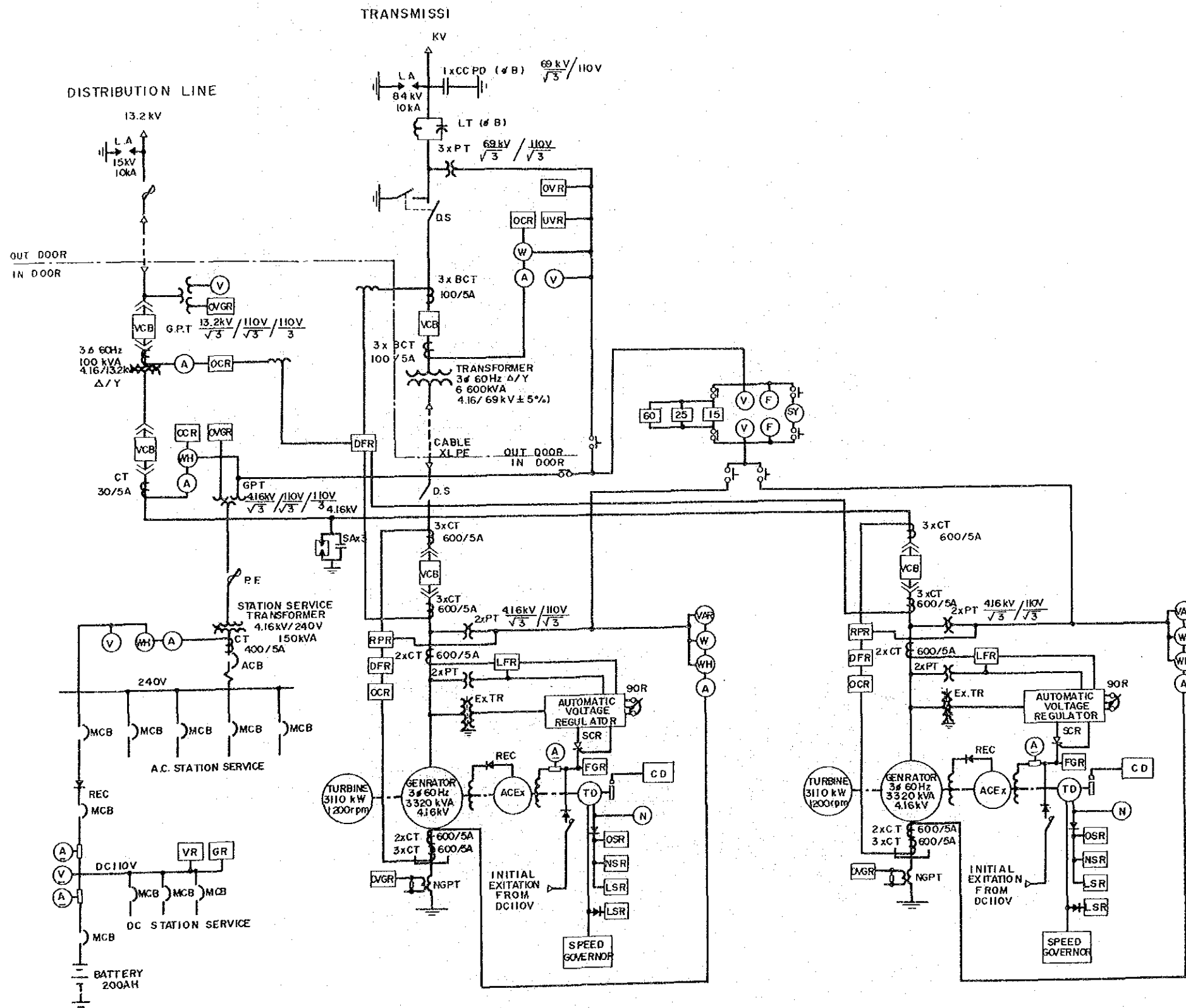
LEGEND

-  Generator
-  Diesel Engine
-  Water Turbine
-  Disconnect Switch
-  Transformer
-  Circuit Breaker

INFRASTRUCTURE SURVEY FOR  
 RIO TUBA NICKEL MINE  
 (CANDAWAGA HYDROPOWER SCHEME)  
 Republic of the Philippines

POWER SYSTEM DIAGRAM  
 ( IN 1989 )

JAPAN INTERNATIONAL COOPERATION AGENCY  
 DRWG. No. 201 SHEET OF



LEGEND

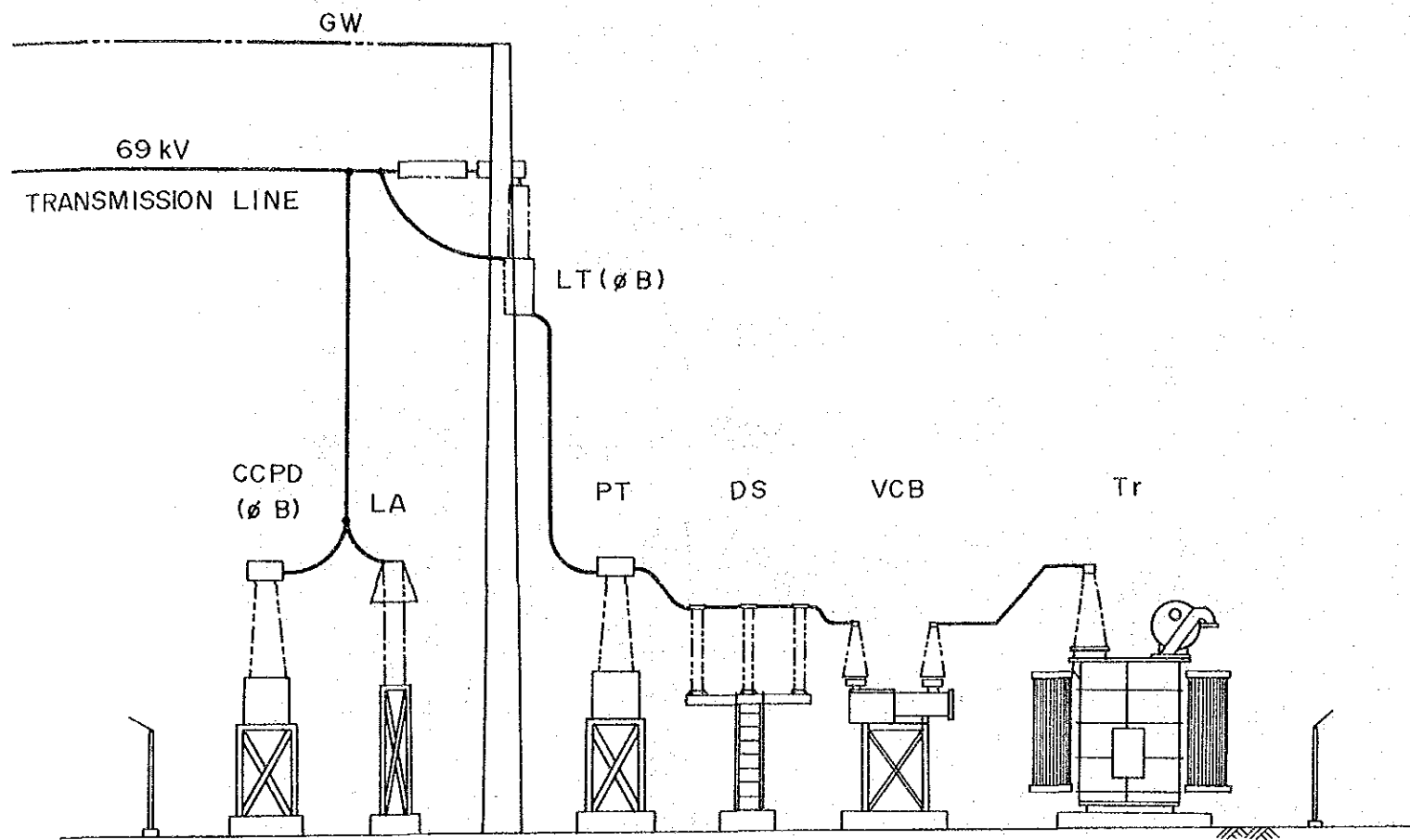
- |                               |                            |  |
|-------------------------------|----------------------------|--|
| OCR Over Current Relay        | 60 Voltage Matcher         | SA Surge Absorber                            |
| OVR Overvoltage Relay         | 15 Speed Maker             | Ex. TR Existing Transformer                  |
| UVR Undervoltage Relay        | 25 Synchronizer            | TD Tachometer Dynamo                         |
| DGR Directional Ground Relay  | CD Crawling Detector       | NGPT Neutral Grounding Potential Transformer |
| DFR Differential Relay        | W Wattmeter                | AC Ex. AC Exciter                            |
| LFR Loss-of-field Relay       | WH Watt-hourmeter          |  |
| RFR Reverse Power Relay       | VAR Var-meter              |  |
| FGR Field Ground Relay        | N Speed Meter              |  |
| DGR Over Voltage Ground Relay | Rectifier                  |  |
| VR Voltage Relay              | Styristor                  |  |
| GR Ground Relay               | Current Transformer        |  |
| OSR Over Speed Relay          | Potential Transformer      |  |
| NSR Nominal Speed Relay       | VCB Vacuum Circuit Breaker |  |
| LSR Low Speed Relay           | CB Circuit Breaker         |  |
| V Voltmeter                   | MCB Molded Circuit Breaker |  |
| Vo Grounding Voltmeter        | DS Disconnecting Switch    |  |
| A Ammeter                     | PF Power Fuse              |  |
| A D.C. Ammeter                | LA Lightning Arrester      |  |
| V D.C. Voltmeter              | PT Potential Transformer   |  |
| F Frequency meter             | CT Current Transformer     |  |
| SY Synchroscope               | BCT Bushing Type C.T.      |  |

INFRASTRUCTURE SURVEY FOR  
RIO TUBA NICKEL MINE  
(CANDAWAGA HYDROPOWER SCHEME)  
Republic of the Philippines

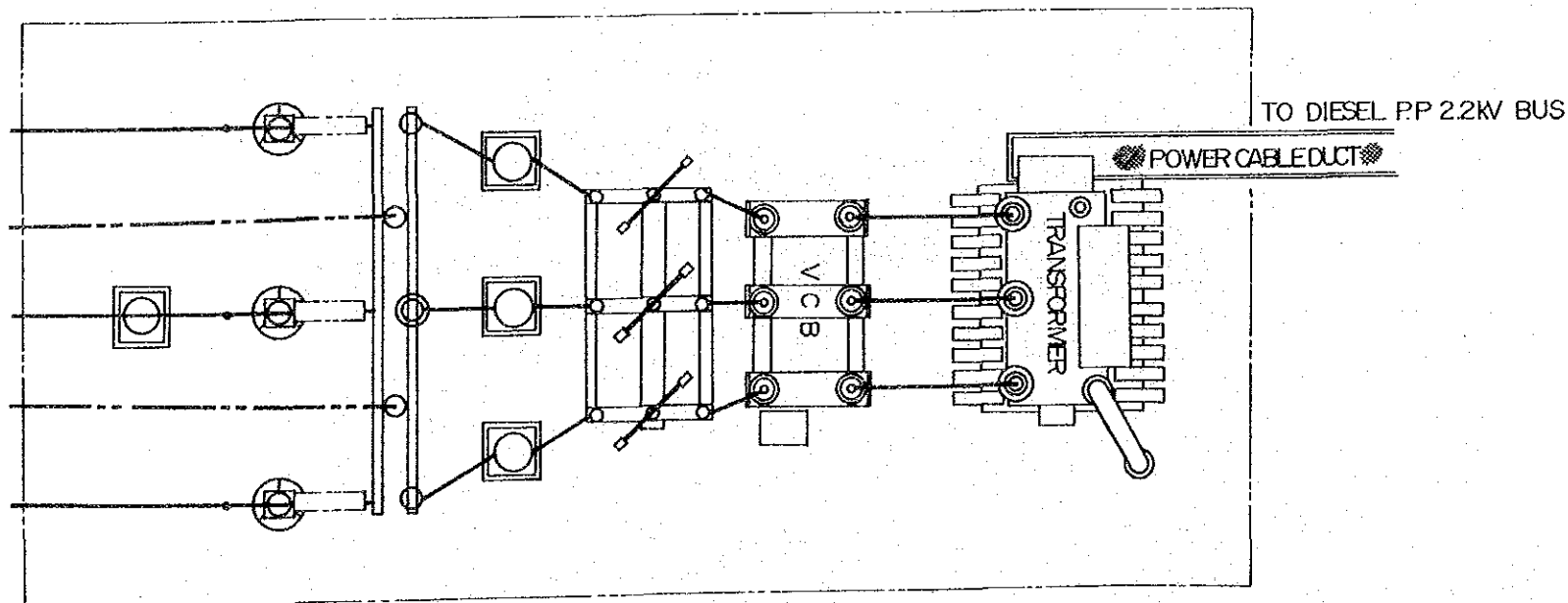
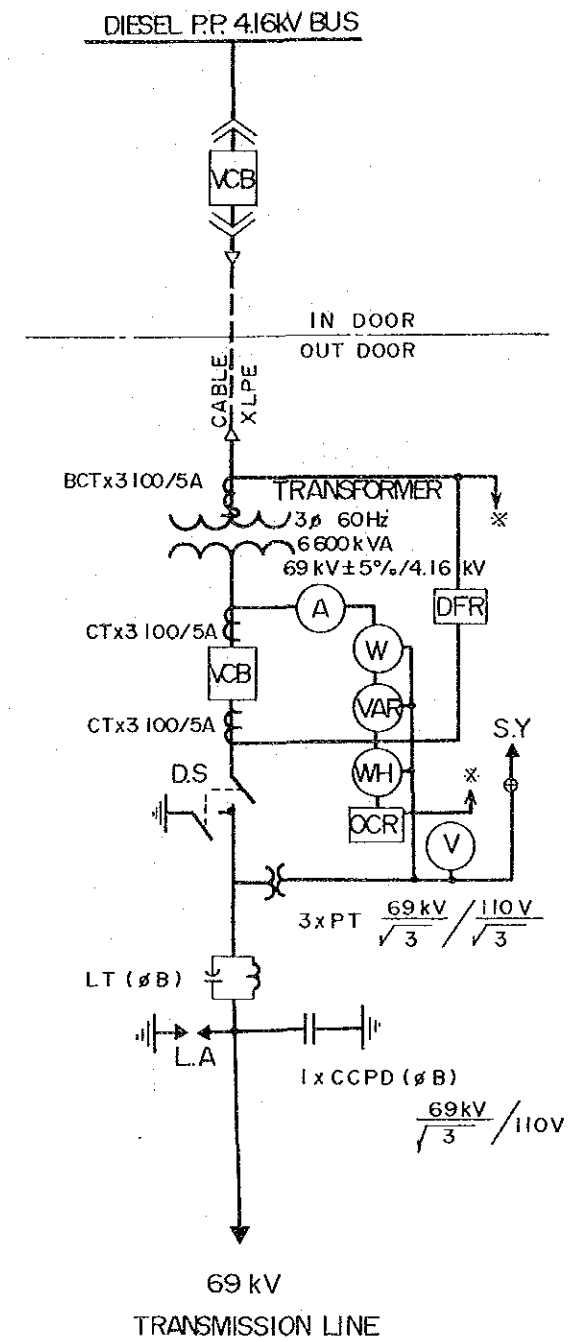
SINGLE LINE DIAGRAM

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SINGLE LINE DIAGRAM  
(RIO TUB MINE SIDE)



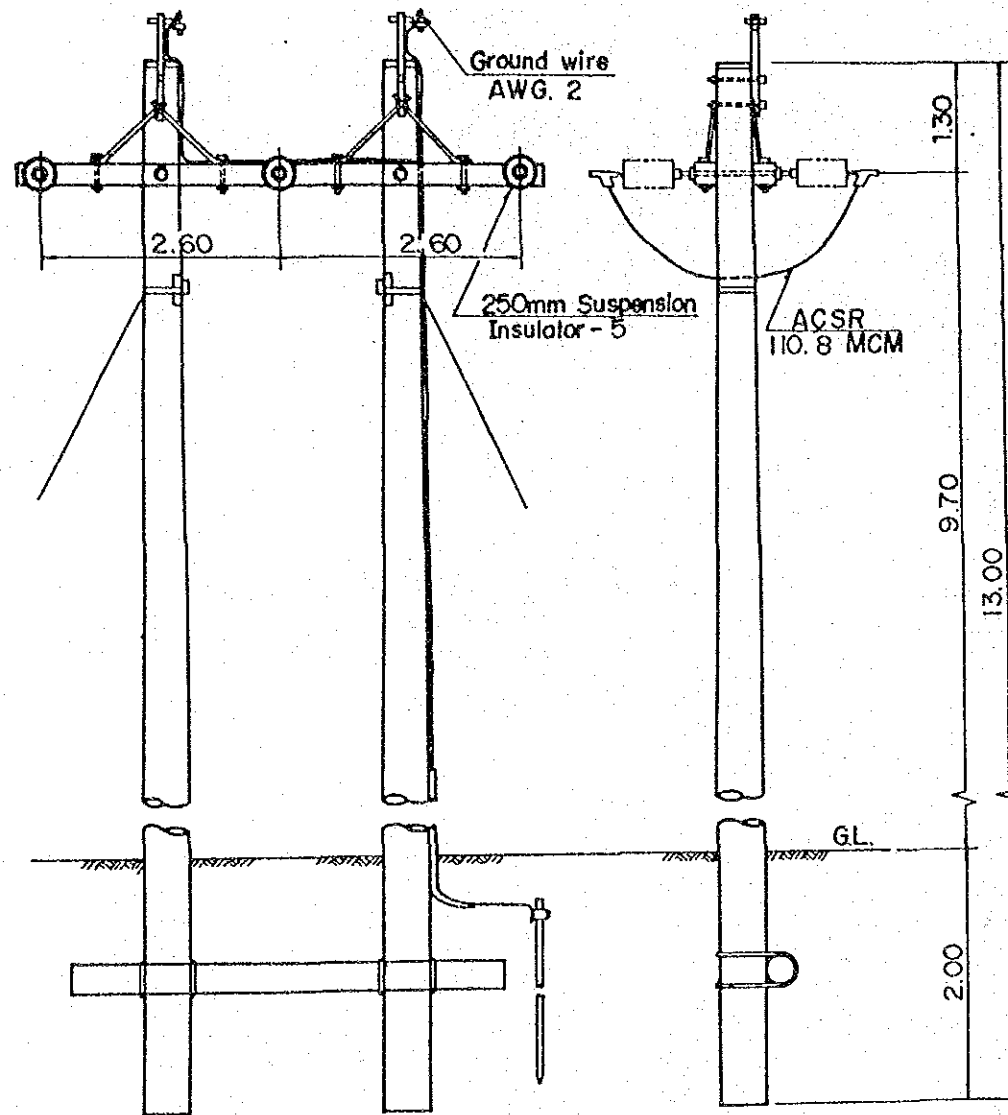
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SUBSTATION

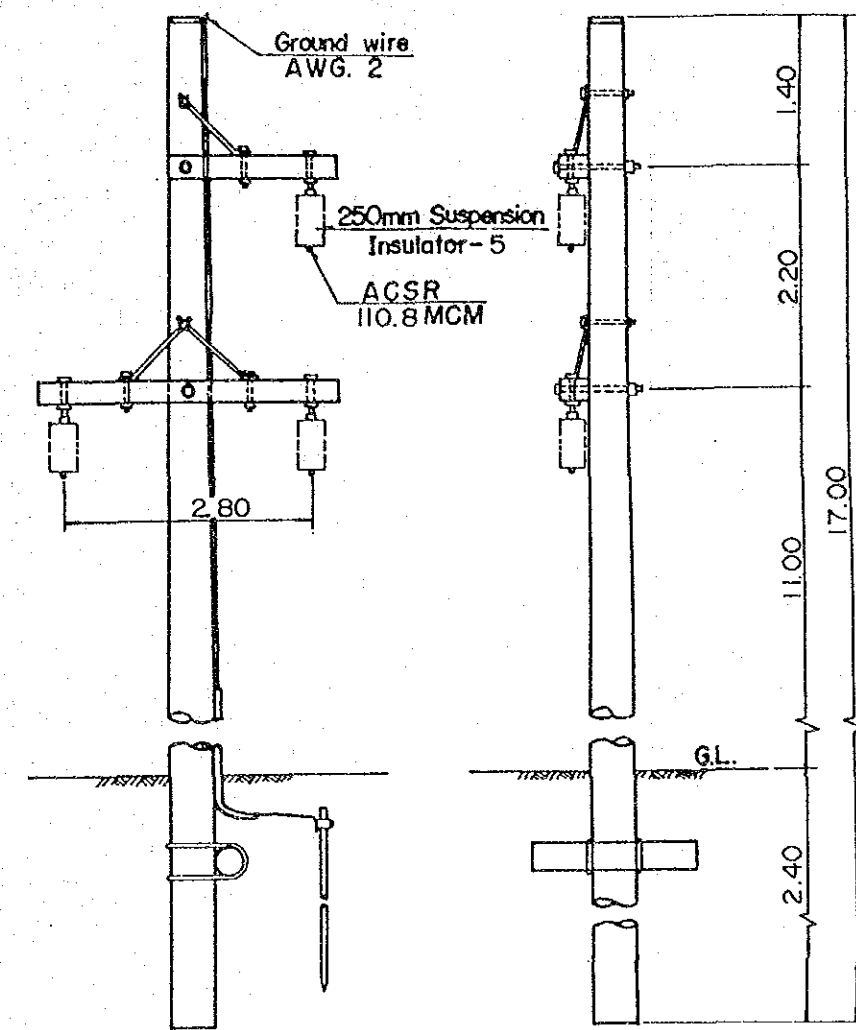
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TENSION



SUSPENSION



INFRASTRUCTURE SURVEY FOR  
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 Republic of the Philippines

STANDARD WOODEN POLE  
 FOR 69KV TRANSMISSION LINE

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