

13.3.3 Rate of Return

In general, the financial performance of an undertaking is measured by its rate of return, which is defined as the ratio of net income to the total assets in operation.

The rates of return for the Kikuletwa No. 1 and No. 2 projects, calculated for a period of 30 years from commissioning, are as follows:

(1) In case of Foreign Government Loan

a) Kikuletwa No. 1 project

	<u>Amount (US\$ thousand)</u>
Initial investment	7,198.0
Interest during construction	151.2 (Table 13.3.6)
Total	7,349.2 (Assets in operation in the 1st year)
Depreciation cost	147.0 (Table 13.3.7)
Net income	9,898.1 (Table 13.3.7)
Accumulated total assets in operation for 30 years:	

$$15 \times (2 \times 7349.2 - 29 \times 147.0) = 156,531.0$$

Rate of return:

$$9,898.1/156,531.0 = 6.32\%$$

b) Kikuletwa No. 2 project

	<u>Amount (US\$ thousand)</u>
Initial investment	49,400.0
Interest during construction	1,636.5 (Table 13.3.10)
Total	51,036.5 (Assets in operation in the 1st year)
Depreciation cost	1,020.7 (Table 13.3.11)
Net income	57,404.6 (Table 13.3.11)

Accumulated total assets in
operation for 30 years:

$$15 \times (2 \times 51036.5 - 29 \times 1020.7) = 1,087,090.5$$

Rate of return:

$$57,404.6 / 1,087,090.5 = 5.28\%$$

(2) In Case of International Financial Institution Project Loan

a) Kikuletwa No. 1 project

	<u>Amount (US\$ thousand)</u>
Initial investment	7,198.0
Interest during construction	770.0 (Table 13.3.14)
Total	7,968.0 (Assets in operation in the 1st year)
Depreciation cost	159.4 (Table 13.3.15)
Net income	5,688.3 (Table 13.3.15)

Accumulated total assets in
operation for 30 years:

$$15 \times (2 \times 7968.0 - 29 \times 159.4) = 169,701.0$$

Rate of return:

$$5,688.3/169,701.0 = 3.35\%$$

b) Kikuletwa No. 2 project

	<u>Amount (US\$ thousand)</u>
Initial investment	49,400.0
Interest during construction	8,335.0 (Table 13.3.18)
Total	57,735.0 (Assets in operation in the 1st year)
Depreciation cost	1,154.7 (Table 13.3.19)
Net income	27,041.9 (Table 13.3.19)

Accumulated total assets in
operation for 30 years:

$$15 \times (2 \times 57735.0 - 29 \times 1154.7) = 1,229,755.5$$

Rate of return:

$$27,041.9 / 1,229,755.5 = 2.2\%$$

Desirable rates of return differ according to the category of the undertaking. For the electricity supply industry, a rate of return exceeding 2% is considered desirable.

The Kikuletwa No. 1 and No. 2 projects therefore offer favorable rates of return.

Table 13.3.1

BASIC DATA ON REVENUE & EXPENSE
- Kikuletwa No.1 Project -

REVENUE ACCOUNT		EXPENSE ACCOUNT	
Energy sold (MWh)		Investment cost (US\$ thousand)	
1st 5 years	8424	1st year	6480
2nd 5 years	8529	2nd year	718
3rd 5 years	8635	3rd year	0
4th 5 years	8740	4th year	0
Last 30 years	8845		
Sales revenue (US\$ thousand):		O & M cost (US\$ thousand):	108.0
1st 5 years	669.7	Administration (US\$ thousand):	28.8
2nd 5 years	678.1		
3rd 5 years	686.5		
4th 5 years	694.8		
Last 30 years	703.2		

Table 13.3.2

BASIC DATA ON REVENUE & EXPENSE
- Kikuletwa No.2 Project -

REVENUE ACCOUNT		EXPENSE ACCOUNT	
Energy sold (MWh)		Investment cost (US\$ thousand)	
1st 5 years	53672	1st year	13952
2nd 5 years	54343	2nd year	15182
3rd 5 years	55014	3rd year	12177
4th 5 years	55685	4th year	8089
Last 30 years	56356		
Sales revenue (US\$ thousand):		O & M cost (US\$ thousand):	741.0
1st 5 years	4266.9		
2nd 5 years	4320.3	Administration (US\$ thousand):	197.6
3rd 5 years	4373.6		
4th 5 years	4426.9		
Last 30 years	4480.3		

Table 13.3.3 (A) REVENUE & EXPENSE BALANCE
- Kikuletwa No.1 Project -

Discount rate: 6.09%

PRESENT WORTH REVENUE (US\$ thousand)		PRESENT WORTH EXPENSE (US\$ thousand)	
Energy sales revenue	8678.3	Investment cost	6948.3
		O & M cost	1366.5
		Administration cost	364.4
Balance	-1.0	Total expense	8679.3

Table 13.3.3 (B) REVENUE & EXPENSE BALANCE
- Kikuletwa No.1 Project -

Discount rate: 6.08%

PRESENT WORTH REVENUE (US\$ thousand)		PRESENT WORTH EXPENSE (US\$ thousand)	
Energy sales revenue	8693.4	Investment cost	6948.7
		O & M cost	1368.9
		Administration cost	365.0
Balance	10.7	Total expense	8682.6

Table 13.3.3 (C) REVENUE & EXPENSE BALANCE
- Kikuletwa No.1 Project -

Discount rate: 6.07%

PRESENT WORTH REVENUE (US\$ thousand)		PRESENT WORTH EXPENSE (US\$ thousand)	
Energy sales revenue	8708.5	Investment cost	6949.1
		O & M cost	1371.2
		Administration cost	365.7
Balance	22.5	Total expense	8686.0

Table 13.3.4 (A) REVENUE & EXPENSE BALANCE
- Kikuletwa No.2 Project -

Discount rate: 5.92%

PRESENT WORTH REVENUE (US\$ thousand)		PRESENT WORTH EXPENSE (US\$ thousand)	
Energy sales revenue	56957.1	Investment cost	44643.9
		O & M cost	9657.7
		Administration cost	2575.4
Balance	80.1	Total expense	56877.0

Table 13.3.4 (B) REVENUE & EXPENSE BALANCE
- Kikuletwa No.2 Project -

Discount rate: 5.93%

PRESENT WORTH REVENUE (US\$ thousand)		PRESENT WORTH EXPENSE (US\$ thousand)	
Energy sales revenue	56857.0	Investment cost	44636.7
		O & M cost	9640.9
		Administration cost	2570.9
Balance	8.6	Total expense	56848.5

Table 13.3.4 (C) REVENUE & EXPENSE BALANCE
- Kikuletwa No.2 Project -

Discount rate: 5.94%

PRESENT WORTH REVENUE (US\$ thousand)		PRESENT WORTH EXPENSE (US\$ thousand)	
Energy sales revenue	56757.3	Investment cost	44629.4
		O & M cost	9624.2
		Administration cost	2566.5
Balance	-62.7	Total expense	56820.0

Table 13.3.5 (A) REPAYMENT SCHEDULE (FOREIGN CURRENCY PORTION)
- Kikuletwa No.1 Project -

Loan Amount (US\$ thousand) 6217

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1991	6217.0	93.3			
1992	6217.0	93.3			
1993	6217.0	93.3			
1994	6217.0	93.3			
1995	6217.0	93.3			
1996	6217.0	93.3			
1997	6217.0	93.3			
1998	6217.0	93.3			
1999	6217.0	93.3			
2000	6217.0	93.3			
2001	6217.0	93.3	268.9	362.1	5948.1
2002	5948.1	89.2	272.9	362.1	5675.3
2003	5675.3	85.1	277.0	362.1	5398.3
2004	5398.3	81.0	281.1	362.1	5117.1
2005	5117.1	76.8	285.4	362.1	4831.8
2006	4831.8	72.5	289.6	362.1	4542.1
2007	4542.1	68.1	294.0	362.1	4248.1
2008	4248.1	63.7	298.4	362.1	3949.8
2009	3949.8	59.2	302.9	362.1	3646.9
2010	3646.9	54.7	307.4	362.1	3339.5
2011	3339.5	50.1	312.0	362.1	3027.5
2012	3027.5	45.4	316.7	362.1	2710.8
2013	2710.8	40.7	321.5	362.1	2389.3
2014	2389.3	35.8	326.3	362.1	2063.0
2015	2063.0	30.9	331.2	362.1	1731.9
2016	1731.9	26.0	336.1	362.1	1395.7
2017	1395.7	20.9	341.2	362.1	1054.5
2018	1054.5	15.8	346.3	362.1	708.2
2019	708.2	10.6	351.5	362.1	356.7
2020	356.7	5.4	356.8	362.1	-0.0
Total		1957.8	6217.0	7242.3	

Table 13.3.5 (B) REPAYMENT SCHEDULE (LOCAL CURRENCY PORTION)
- Kikuletwa No.1 Project -

Loan Amount (US\$ thousand) 981

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1991	981.0	14.7			
1992	981.0	14.7			
1993	981.0	14.7			
1994	981.0	14.7			
1995	981.0	14.7			
1996	981.0	14.7			
1997	981.0	14.7			
1998	981.0	14.7			
1999	981.0	14.7			
2000	981.0	14.7			
2001	981.0	14.7	42.4	57.1	938.6
2002	938.6	14.1	43.1	57.1	895.5
2003	895.5	13.4	43.7	57.1	851.8
2004	851.8	12.8	44.4	57.1	807.4
2005	807.4	12.1	45.0	57.1	762.4
2006	762.4	11.4	45.7	57.1	716.7
2007	716.7	10.8	46.4	57.1	670.3
2008	670.3	10.1	47.1	57.1	623.2
2009	623.2	9.3	47.8	57.1	575.5
2010	575.5	8.6	48.5	57.1	526.9
2011	526.9	7.9	49.2	57.1	477.7
2012	477.7	7.2	50.0	57.1	427.7
2013	427.7	6.4	50.7	57.1	377.0
2014	377.0	5.7	51.5	57.1	325.5
2015	325.5	4.9	52.3	57.1	273.3
2016	273.3	4.1	53.0	57.1	220.2
2017	220.2	3.3	53.8	57.1	166.4
2018	166.4	2.5	54.6	57.1	111.8
2019	111.8	1.7	55.5	57.1	56.3
2020	56.3	0.8	56.3	57.1	-0.0
Total		308.9	981.0	1142.8	

Table 13.3.6

ANNUAL DISBURSEMENT AND IDC
- Kikuletwa No.1 Project -(Unit: US\$ thousand)

Year	Foreign loan	IDC	Local loan	IDC	Total fund	IDC
1989	5597.0	42.0	883.0	6.6	6480.0	48.6
1990	620.0	88.6	98.0	14.0	718.0	102.6
Total	6217.0	130.6	981.0	20.6	7198.0	151.2

Note: IDC --- Interest during construction

Table 13.3.7

PROFIT AND LOSS STATEMENT
- Kikuletwa No.1 Project -

(Unit: US\$ thousand)

Year	OPERATING	OPERATING EXPENSES			OPERATING	INTEREST		NET	
	REVENUE	O & M	Admin.	Deprec.	Total	INCOME	F.C.	L.C.	INCOME
1991	669.7	108.0	28.8	147.0	283.7	386.0	93.3	14.7	278.0
1992	669.7	108.0	28.8	147.0	283.7	386.0	93.3	14.7	278.0
1993	669.7	108.0	28.8	147.0	283.7	386.0	93.3	14.7	278.0
1994	669.7	108.0	28.8	147.0	283.7	386.0	93.3	14.7	278.0
1995	669.7	108.0	28.8	147.0	283.7	386.0	93.3	14.7	278.0
1996	678.1	108.0	28.8	147.0	283.7	394.3	93.3	14.7	286.4
1997	678.1	108.0	28.8	147.0	283.7	394.3	93.3	14.7	286.4
1998	678.1	108.0	28.8	147.0	283.7	394.3	93.3	14.7	286.4
1999	678.1	108.0	28.8	147.0	283.7	394.3	93.3	14.7	286.4
2000	678.1	108.0	28.8	147.0	283.7	394.3	93.3	14.7	286.4
2001	686.5	108.0	28.8	147.0	283.7	402.7	93.3	14.7	294.7
2002	686.5	108.0	28.8	147.0	283.7	402.7	89.2	14.1	299.4
2003	686.5	108.0	28.8	147.0	283.7	402.7	85.1	13.4	304.1
2004	686.5	108.0	28.8	147.0	283.7	402.7	81.0	12.8	309.0
2005	686.5	108.0	28.8	147.0	283.7	402.7	76.8	12.1	313.8
2006	694.8	108.0	28.8	147.0	283.7	411.1	72.5	11.4	327.2
2007	694.8	108.0	28.8	147.0	283.7	411.1	68.1	10.8	332.2
2008	694.8	108.0	28.8	147.0	283.7	411.1	63.7	10.1	337.3
2009	694.8	108.0	28.8	147.0	283.7	411.1	59.2	9.3	342.5
2010	694.8	108.0	28.8	147.0	283.7	411.1	54.7	8.6	347.7
2011	703.2	108.0	28.8	147.0	283.7	419.4	50.1	7.9	361.5
2012	703.2	108.0	28.8	147.0	283.7	419.4	45.4	7.2	366.9
2013	703.2	108.0	28.8	147.0	283.7	419.4	40.7	6.4	372.4
2014	703.2	108.0	28.8	147.0	283.7	419.4	35.8	5.7	378.0
2015	703.2	108.0	28.8	147.0	283.7	419.4	30.9	4.9	383.6
2016	703.2	108.0	28.8	147.0	283.7	419.4	26.0	4.1	389.4
2017	703.2	108.0	28.8	147.0	283.7	419.4	20.9	3.3	395.2
2018	703.2	108.0	28.8	147.0	283.7	419.4	15.8	2.5	401.1
2019	703.2	108.0	28.8	147.0	283.7	419.4	10.6	1.7	407.1
2020	703.2	108.0	28.8	147.0	283.7	419.4	5.4	0.8	413.3
Total	20677.2	3239.1	863.8	4409.5	8512.4	12164.9	1957.8	308.9	9898.1

Note-1: O & M --- Operation and maintenance cost

Note-2: Admin. --- Administration cost

Note-3: Deprec. --- Depreciation

Note-4: F.C. --- Foreign currency portion

Note-5: L.C. --- Local currency portion

Table 13.3.8 CASH FLOW
- Kikuletwa No,1 Project -

(Unit: US\$ thousand)

Year	CASH INFLOW			IDC	CASH OUTFLOW		Total	BALANCE
	Net income	Deprec.	Total		Pri(FC)	Pri(LC)		
1989				48.6			48.6	-48.6
1990				102.6			102.6	-102.6
1991	278.0	147.0	425.0					425.0
1992	278.0	147.0	425.0					425.0
1993	278.0	147.0	425.0					425.0
1994	278.0	147.0	425.0					425.0
1995	278.0	147.0	425.0					425.0
1996	286.4	147.0	433.3					433.3
1997	286.4	147.0	433.3					433.3
1998	286.4	147.0	433.3					433.3
1999	286.4	147.0	433.3					433.3
2000	286.4	147.0	433.3					433.3
2001	294.7	147.0	441.7		268.9	42.4	311.3	130.4
2002	299.4	147.0	446.4		272.9	43.1	316.0	130.4
2003	304.1	147.0	451.1		277.0	43.7	320.7	130.4
2004	309.0	147.0	455.9		281.1	44.4	325.5	130.4
2005	313.8	147.0	460.8		285.4	45.0	330.4	130.4
2006	327.2	147.0	474.1		289.6	45.7	335.3	138.8
2007	332.2	147.0	479.2		294.0	46.4	340.4	138.8
2008	337.3	147.0	484.3		298.4	47.1	345.5	138.8
2009	342.5	147.0	489.5		302.9	47.8	350.7	138.8
2010	347.7	147.0	494.7		307.4	48.5	355.9	138.8
2011	361.5	147.0	508.4		312.0	49.2	361.3	147.2
2012	366.9	147.0	513.9		316.7	50.0	366.7	147.2
2013	372.4	147.0	519.4		321.5	50.7	372.2	147.2
2014	378.0	147.0	524.9		326.3	51.5	377.8	147.2
2015	383.6	147.0	530.6		331.2	52.3	383.4	147.2
2016	389.4	147.0	536.4		336.1	53.0	389.2	147.2
2017	395.2	147.0	542.2		341.2	53.8	395.0	147.2
2018	401.1	147.0	548.1		346.3	54.6	400.9	147.2
2019	407.1	147.0	554.1		351.5	55.5	407.0	147.2
2020	413.3	147.0	560.2		356.8	56.3	413.1	147.2
Total	9898.1	4409.5	14307.6	151.2	6217.0	981.0	7349.2	6958.4

Note-1: Pri(FC) -- Repayment of principal (Foreign currency portion)

Note-2: Pri(LC) -- Repayment of principal (Local currency portion)

Note-3: Deprec. -- Depreciation cost

Note-4: IDC ---- Interest during construction

Table 13.3.9 (A) REPAYMENT SCHEDULE (FOREIGN CURRENCY PORTION)
- Kikuletwa No.2 Project -

Loan Amount (US\$ thousand) 41903

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1994	41903.0	628.5			
1995	41903.0	628.5			
1996	41903.0	628.5			
1997	41903.0	628.5			
1998	41903.0	628.5			
1999	41903.0	628.5			
2000	41903.0	628.5			
2001	41903.0	628.5			
2002	41903.0	628.5			
2003	41903.0	628.5			
2004	41903.0	628.5	1812.1	2440.7	40090.9
2005	40090.9	601.4	1839.3	2440.7	38251.6
2006	38251.6	573.8	1866.9	2440.7	36384.7
2007	36384.7	545.8	1894.9	2440.7	34489.8
2008	34489.8	517.3	1923.3	2440.7	32566.5
2009	32566.5	488.5	1952.2	2440.7	30614.3
2010	30614.3	459.2	1981.5	2440.7	28632.8
2011	28632.8	429.5	2011.2	2440.7	26621.6
2012	26621.6	399.3	2041.4	2440.7	24580.2
2013	24580.2	368.7	2072.0	2440.7	22508.2
2014	22508.2	337.6	2103.1	2440.7	20405.1
2015	20405.1	306.1	2134.6	2440.7	18270.5
2016	18270.5	274.1	2166.6	2440.7	16103.9
2017	16103.9	241.6	2199.1	2440.7	13904.8
2018	13904.8	208.6	2232.1	2440.7	11672.7
2019	11672.7	175.1	2265.6	2440.7	9407.1
2020	9407.1	141.1	2299.6	2440.7	7107.5
2021	7107.5	106.6	2334.1	2440.7	4773.5
2022	4773.5	71.6	2369.1	2440.7	2404.4
2023	2404.4	36.1	2404.6	2440.7	-0.2
Total		13195.8	41903.1	48813.5	

Table 13.3.9 (B) REPAYMENT SCHEDULE (LOCAL CURRENCY PORTION)
- Kikuletwa No.2 Project -

Loan Amount (US\$ thousand) 7497

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1994	7497.0	112.5			
1995	7497.0	112.5			
1996	7497.0	112.5			
1997	7497.0	112.5			
1998	7497.0	112.5			
1999	7497.0	112.5			
2000	7497.0	112.5			
2001	7497.0	112.5			
2002	7497.0	112.5			
2003	7497.0	112.5			
2004	7497.0	112.5	324.2	436.7	7172.8
2005	7172.8	107.6	329.1	436.7	6843.7
2006	6843.7	102.7	334.0	436.7	6509.7
2007	6509.7	97.6	339.0	436.7	6170.7
2008	6170.7	92.6	344.1	436.7	5826.6
2009	5826.6	87.4	349.3	436.7	5477.3
2010	5477.3	82.2	354.5	436.7	5122.8
2011	5122.8	76.8	359.8	436.7	4763.0
2012	4763.0	71.4	365.2	436.7	4397.7
2013	4397.7	66.0	370.7	436.7	4027.0
2014	4027.0	60.4	376.3	436.7	3650.8
2015	3650.8	54.8	381.9	436.7	3268.9
2016	3268.9	49.0	387.6	436.7	2881.2
2017	2881.2	43.2	393.5	436.7	2487.8
2018	2487.8	37.3	399.4	436.7	2088.4
2019	2088.4	31.3	405.3	436.7	1683.1
2020	1683.1	25.2	411.4	436.7	1271.7
2021	1271.7	19.1	417.6	436.7	854.1
2022	854.1	12.8	423.9	436.7	430.2
2023	430.2	6.5	430.2	436.7	-0.0
Total		2360.9	7497.0	8733.4	

Table 13.3.10

ANNUAL DISBURSEMENT AND IDC
- Kikuletwa No.2 Project -

(Unit: US\$ thousand)

Year	Foreign loan	IDC	Local loan	IDC	Total fund	IDC
1990	11835.0	88.8	2117.0	15.9	13952.0	104.6
1991	12877.0	274.1	2305.0	49.0	15182.0	323.1
1992	10329.0	448.1	1848.0	80.2	12177.0	528.3
1993	6862.0	577.1	1227.0	103.3	8089.0	680.3
Total	41903.0	1388.1	7497.0	248.4	49400.0	1636.5

Note: IDC --- Interest during construction

Table 13.3.11

PROFIT AND LOSS STATEMENT
- Kikuletwa No.2 Project -

(Unit: US\$ thousand)

Year	OPERATING	OPERATING EXPENSES			Total	OPERATING	INTEREST		NET
	REVENUE	O & M	Admin.	Deprec.		INCOME	F.C.	L.C.	INCOME
1994	4266.9	741.0	197.6	1020.7	1959.3	2307.6	628.5	112.5	1566.6
1995	4266.9	741.0	197.6	1020.7	1959.3	2307.6	628.5	112.5	1566.6
1996	4266.9	741.0	197.6	1020.7	1959.3	2307.6	628.5	112.5	1566.6
1997	4266.9	741.0	197.6	1020.7	1959.3	2307.6	628.5	112.5	1566.6
1998	4266.9	741.0	197.6	1020.7	1959.3	2307.6	628.5	112.5	1566.6
1999	4320.3	741.0	197.6	1020.7	1959.3	2360.9	628.5	112.5	1619.9
2000	4320.3	741.0	197.6	1020.7	1959.3	2360.9	628.5	112.5	1619.9
2001	4320.3	741.0	197.6	1020.7	1959.3	2360.9	628.5	112.5	1619.9
2002	4320.3	741.0	197.6	1020.7	1959.3	2360.9	628.5	112.5	1619.9
2003	4320.3	741.0	197.6	1020.7	1959.3	2360.9	628.5	112.5	1619.9
2004	4373.6	741.0	197.6	1020.7	1959.3	2414.3	628.5	112.5	1673.3
2005	4373.6	741.0	197.6	1020.7	1959.3	2414.3	601.4	107.6	1705.3
2006	4373.6	741.0	197.6	1020.7	1959.3	2414.3	573.8	102.7	1737.8
2007	4373.6	741.0	197.6	1020.7	1959.3	2414.3	545.8	97.6	1770.9
2008	4373.6	741.0	197.6	1020.7	1959.3	2414.3	517.3	92.6	1804.4
2009	4426.9	741.0	197.6	1020.7	1959.3	2467.6	488.5	87.4	1891.7
2010	4426.9	741.0	197.6	1020.7	1959.3	2467.6	459.2	82.2	1926.2
2011	4426.9	741.0	197.6	1020.7	1959.3	2467.6	429.5	76.8	1961.3
2012	4426.9	741.0	197.6	1020.7	1959.3	2467.6	399.3	71.4	1996.8
2013	4426.9	741.0	197.6	1020.7	1959.3	2467.6	368.7	66.0	2032.9
2014	4480.3	741.0	197.6	1020.7	1959.3	2520.9	337.6	60.4	2122.9
2015	4480.3	741.0	197.6	1020.7	1959.3	2520.9	306.1	54.8	2160.1
2016	4480.3	741.0	197.6	1020.7	1959.3	2520.9	274.1	49.0	2197.9
2017	4480.3	741.0	197.6	1020.7	1959.3	2520.9	241.6	43.2	2236.2
2018	4480.3	741.0	197.6	1020.7	1959.3	2520.9	208.6	37.3	2275.1
2019	4480.3	741.0	197.6	1020.7	1959.3	2520.9	175.1	31.3	2314.5
2020	4480.3	741.0	197.6	1020.7	1959.3	2520.9	141.1	25.2	2354.6
2021	4480.3	741.0	197.6	1020.7	1959.3	2520.9	106.6	19.1	2395.3
2022	4480.3	741.0	197.6	1020.7	1959.3	2520.9	71.6	12.8	2436.5
2023	4480.3	741.0	197.6	1020.7	1959.3	2520.9	36.1	6.5	2478.4
Total	131741.0	22230.0	5928.0	30621.9	58779.9	72961.4	13195.8	2360.9	57404.6

Note-1: O & M --- Operation and maintenance cost

Note-2: Admin. --- Administration cost

Note-3: Deprec. --- Depreciation

Note-4: F.C. --- Foreign currency portion

Note-5: L.C. --- Local currency portion

Table 13.3.12

C A S H F L O W
- Kikuletwa No,2 Project -

(Unit: US\$ thousand)

Year	CASH INFLOW			IDC	CASH OUTFLOW			BALANCE
	Net income	Deprec.	Total		Pri(FC)	Pri(LC)	Total	
1990				104.6			104.6	-104.6
1991				323.1			323.1	-323.1
1992				528.3			528.3	-528.3
1993				680.3			680.3	-680.3
1994	1566.6	1020.7	2587.3					2587.3
1995	1566.6	1020.7	2587.3					2587.3
1996	1566.6	1020.7	2587.3					2587.3
1997	1566.6	1020.7	2587.3					2587.3
1998	1566.6	1020.7	2587.3					2587.3
1999	1619.9	1020.7	2640.7					2640.7
2000	1619.9	1020.7	2640.7					2640.7
2001	1619.9	1020.7	2640.7					2640.7
2002	1619.9	1020.7	2640.7					2640.7
2003	1619.9	1020.7	2640.7					2640.7
2004	1673.3	1020.7	2694.0		1812.1	324.2	2136.4	557.7
2005	1705.3	1020.7	2726.0		1839.3	329.1	2168.4	557.7
2006	1737.8	1020.7	2758.6		1866.9	334.0	2200.9	557.7
2007	1770.9	1020.7	2791.6		1894.9	339.0	2233.9	557.7
2008	1804.4	1020.7	2825.1		1923.3	344.1	2267.4	557.7
2009	1891.7	1020.7	2912.4		1952.2	349.3	2301.5	611.0
2010	1926.2	1020.7	2947.0		1981.5	354.5	2336.0	611.0
2011	1961.3	1020.7	2982.0		2011.2	359.8	2371.0	611.0
2012	1996.8	1020.7	3017.6		2041.4	365.2	2406.6	611.0
2013	2032.9	1020.7	3053.7		2072.0	370.7	2442.7	611.0
2014	2122.9	1020.7	3143.6		2103.1	376.3	2479.3	664.3
2015	2160.1	1020.7	3180.8		2134.6	381.9	2516.5	664.3
2016	2197.9	1020.7	3218.6		2166.6	387.6	2554.3	664.3
2017	2236.2	1020.7	3256.9		2199.1	393.5	2592.6	664.3
2018	2275.1	1020.7	3295.8		2232.1	399.4	2631.5	664.3
2019	2314.5	1020.7	3335.3		2265.6	405.3	2670.9	664.3
2020	2354.6	1020.7	3375.3		2299.6	411.4	2711.0	664.3
2021	2395.3	1020.7	3416.0		2334.1	417.6	2751.7	664.3
2022	2436.5	1020.7	3457.3		2369.1	423.9	2792.9	664.3
2023	2478.4	1020.7	3499.2		2404.6	430.2	2834.8	664.3
Total	57404.6	30621.9	88026.5	1636.5	41903.1	7497.0	51036.6	36989.9

Note-1: Pri(FC) -- Repayment of principal (Foreign currency portion)

Note-2: Pri(LC) -- Repayment of principal (Local currency portion)

Note-3: Deprec. -- Depreciation cost

Note-4: IDC ---- Interest during construction

Table 13.3.13 (A) REPAYMENT SCHEDULE (FOREIGN CURRENCY PORTION)
 - Kikuletwa No.1 Project -

Loan Amount (US\$ thousand) 6217

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1991	6217.0	475.0			
1992	6217.0	475.0			
1993	6217.0	475.0			
1994	6217.0	475.0			
1995	6217.0	475.0			
1996	6217.0	475.0	436.5	911.5	5780.5
1997	5780.5	441.6	469.9	911.5	5310.6
1998	5310.6	405.7	505.8	911.5	4804.8
1999	4804.8	367.1	544.4	911.5	4260.3
2000	4260.3	325.5	586.0	911.5	3674.3
2001	3674.3	280.7	630.8	911.5	3043.5
2002	3043.5	232.5	679.0	911.5	2364.4
2003	2364.4	180.6	730.9	911.5	1633.6
2004	1633.6	124.8	786.7	911.5	846.8
2005	846.8	64.7	846.8	911.5	-0.0
Total		5273.2	6217.0	9115.3	

Table 13.3.13 (B) REPAYMENT SCHEDULE (LOCAL CURRENCY PORTION)
 - Kikuletwa No.1 Project -

Loan Amount (US\$ thousand) 981

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1991	981.0	74.9			
1992	981.0	74.9			
1993	981.0	74.9			
1994	981.0	74.9			
1995	981.0	74.9			
1996	981.0	74.9	68.9	143.8	912.1
1997	912.1	69.7	74.1	143.8	838.0
1998	838.0	64.0	79.8	143.8	758.2
1999	758.2	57.9	85.9	143.8	672.2
2000	672.2	51.4	92.5	143.8	579.8
2001	579.8	44.3	99.5	143.8	480.2
2002	480.2	36.7	107.1	143.8	373.1
2003	373.1	28.5	115.3	143.8	257.8
2004	257.8	19.7	124.1	143.8	133.6
2005	133.6	10.2	133.6	143.8	-0.0
Total		832.1	981.0	1438.3	

Table 13.3.14 ANNUAL DISBURSEMENT AND IDC
 - Kikuletwa No.1 Project -

(Unit: US\$ thousand)

Year	Foreign loan	IDC	Local loan	IDC	Total fund	IDC
1989	5597.0	213.8	883.0	33.7	6480.0	247.5
1990	620.0	451.3	98.0	71.2	718.0	522.5
Total	6217.0	665.1	981.0	104.9	7198.0	770.0

Note: IDC --- Interest during construction

Table 13.3.15 PROFIT AND LOSS STATEMENT
- Kikuletwa No.1 Project -

(Unit: US\$ thousand)

Year	OPERATING	OPERATING EXPENSES			OPERATING	INTEREST		NET	
	REVENUE	O & M	Admin.	Deprec.		Total	INCOME		F.C.
1991	669.7	108.0	28.8	159.4	296.1	373.6	475.0	74.9	-176.3
1992	669.7	108.0	28.8	159.4	296.1	373.6	475.0	74.9	-176.3
1993	669.7	108.0	28.8	159.4	296.1	373.6	475.0	74.9	-176.3
1994	669.7	108.0	28.8	159.4	296.1	373.6	475.0	74.9	-176.3
1995	669.7	108.0	28.8	159.4	296.1	373.6	475.0	74.9	-176.3
1996	678.1	108.0	28.8	159.4	296.1	382.0	475.0	74.9	-168.0
1997	678.1	108.0	28.8	159.4	296.1	382.0	441.6	69.7	-129.4
1998	678.1	108.0	28.8	159.4	296.1	382.0	405.7	64.0	-87.8
1999	678.1	108.0	28.8	159.4	296.1	382.0	367.1	57.9	-43.0
2000	678.1	108.0	28.8	159.4	296.1	382.0	325.5	51.4	5.1
2001	686.5	108.0	28.8	159.4	296.1	390.3	280.7	44.3	65.3
2002	686.5	108.0	28.8	159.4	296.1	390.3	232.5	36.7	121.1
2003	686.5	108.0	28.8	159.4	296.1	390.3	180.6	28.5	181.2
2004	686.5	108.0	28.8	159.4	296.1	390.3	124.8	19.7	245.8
2005	686.5	108.0	28.8	159.4	296.1	390.3	64.7	10.2	315.4
2006	694.8	108.0	28.8	159.4	296.1	398.7			398.7
2007	694.8	108.0	28.8	159.4	296.1	398.7			398.7
2008	694.8	108.0	28.8	159.4	296.1	398.7			398.7
2009	694.8	108.0	28.8	159.4	296.1	398.7			398.7
2010	694.8	108.0	28.8	159.4	296.1	398.7			398.7
2011	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2012	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2013	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2014	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2015	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2016	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2017	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2018	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2019	703.2	108.0	28.8	159.4	296.1	407.1			407.1
2020	703.2	108.0	28.8	159.4	296.1	407.1			407.1
Total	20677.2	3239.1	863.8	4780.8	8883.7	11793.6	5273.2	832.1	5688.3

Note-1: O & M --- Operation and maintenance cost

Note-2: Admin. --- Administration cost

Note-3: Deprec. --- Depreciation

Note-4: F.C. --- Foreign currency portion

Note-5: L.C. --- Local currency portion

Table 13.3.16 CASH FLOW
- Kikuletwa No,1 Project -

(Unit: US\$ thousand)

Year	CASH INFLOW			IDC	CASH OUTFLOW		Total	BALANCE
	Net income	Deprec.	Total		Pri(FC)	Pri(LC)		
1989				247.5			247.5	-247.5
1990				522.5			522.5	-522.5
1991	-176.3	159.4	-17.0					-17.0
1992	-176.3	159.4	-17.0					-17.0
1993	-176.3	159.4	-17.0					-17.0
1994	-176.3	159.4	-17.0					-17.0
1995	-176.3	159.4	-17.0					-17.0
1996	-168.0	159.4	-8.6		436.5	68.9	505.4	-514.0
1997	-129.4	159.4	30.0		469.9	74.1	544.0	-514.0
1998	-87.8	159.4	71.6		505.8	79.8	585.6	-514.0
1999	-43.0	159.4	116.3		544.4	85.9	630.4	-514.0
2000	5.1	159.4	164.5		586.0	92.5	678.5	-514.0
2001	65.3	159.4	224.7		630.8	99.5	730.4	-505.7
2002	121.1	159.4	280.5		679.0	107.1	786.2	-505.7
2003	181.2	159.4	340.5		730.9	115.3	846.2	-505.7
2004	245.8	159.4	405.2		786.7	124.1	910.9	-505.7
2005	315.4	159.4	474.8		846.8	133.6	980.5	-505.7
2006	398.7	159.4	558.1					558.1
2007	398.7	159.4	558.1					558.1
2008	398.7	159.4	558.1					558.1
2009	398.7	159.4	558.1					558.1
2010	398.7	159.4	558.1					558.1
2011	407.1	159.4	566.4					566.4
2012	407.1	159.4	566.4					566.4
2013	407.1	159.4	566.4					566.4
2014	407.1	159.4	566.4					566.4
2015	407.1	159.4	566.4					566.4
2016	407.1	159.4	566.4					566.4
2017	407.1	159.4	566.4					566.4
2018	407.1	159.4	566.4					566.4
2019	407.1	159.4	566.4					566.4
2020	407.1	159.4	566.4					566.4
Total	5688.3	4780.8	10469.1	770.0	6217.0	981.0	7968.0	2501.1

Note-1: Pri(FC) -- Repayment of principal (Foreign currency portion)

Note-2: Pri(LC) -- Repayment of principal (Local currency portion)

Note-3: Deprec. -- Depreciation cost

Note-4: IDC ---- Interest during construction

Table 13.3.17 (A) REPAYMENT SCHEDULE (FOREIGN CURRENCY PORTION)
 - Kikuletwa No.2 Project -

Loan Amount (US\$ thousand) 41903

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1994	41903.0	3201.4			
1995	41903.0	3201.4			
1996	41903.0	3201.4			
1997	41903.0	3201.4			
1998	41903.0	3201.4			
1999	41903.0	3201.4	2942.4	6143.8	38960.6
2000	38960.6	2976.6	3167.2	6143.8	35793.4
2001	35793.4	2734.6	3409.2	6143.8	32384.3
2002	32384.3	2474.2	3669.6	6143.8	28714.7
2003	28714.7	2193.8	3950.0	6143.8	24764.7
2004	24764.7	1892.0	4251.7	6143.8	20513.0
2005	20513.0	1567.2	4576.6	6143.8	15936.4
2006	15936.4	1217.5	4926.2	6143.8	11010.2
2007	11010.2	841.2	5302.6	6143.8	5707.6
2008	5707.6	436.1	5707.7	6143.8	-0.1
Total		35541.5	41903.1	61437.6	

Table 13.3.17 (B) REPAYMENT SCHEDULE (LOCAL CURRENCY PORTION)
 - Kikuletwa No.2 Project -

Loan Amount (US\$ thousand) 7497

Year	Outstanding debt (Year-beginning)	Interest	Principal	Annuity	Outstanding debt (Year-end)
1994	7497.0	572.8			
1995	7497.0	572.8			
1996	7497.0	572.8			
1997	7497.0	572.8			
1998	7497.0	572.8			
1999	7497.0	572.8	526.4	1099.2	6970.6
2000	6970.6	532.6	566.6	1099.2	6403.9
2001	6403.9	489.3	609.9	1099.2	5794.0
2002	5794.0	442.7	656.5	1099.2	5137.4
2003	5137.4	392.5	706.7	1099.2	4430.7
2004	4430.7	338.5	760.7	1099.2	3670.1
2005	3670.1	280.4	818.8	1099.2	2851.2
2006	2851.2	217.8	881.4	1099.2	1969.9
2007	1969.9	150.5	948.7	1099.2	1021.2
2008	1021.2	78.0	1021.2	1099.2	-0.0
Total		6358.9	7497.0	10992.0	

Table 13.3.18

ANNUAL DISBURSEMENT AND IDC
- Kikuletwa No.2 Project -(Unit: US\$ thousand)

Year	Foreign loan	IDC	Local loan	IDC	Total fund	IDC
1990	11835.0	452.1	2117.0	80.9	13952.0	533.0
1991	12877.0	1396.1	2305.0	249.8	15182.0	1645.9
1992	10329.0	2282.6	1848.0	408.4	12177.0	2691.0
1993	6862.0	2939.3	1227.0	525.9	8089.0	3465.2
Total	41903.0	7070.0	7497.0	1265.0	49400.0	8335.0

Note: IDC --- Interest during construction

Table 13.3.19

PROFIT AND LOSS STATEMENT
- Kikuletwa No.2 Project -

(Unit: US\$ thousand)

Year	OPERATING	OPERATING EXPENSES			OPERATING	INTEREST		NET	
	REVENUE	O & M	Admin.	Deprec.	Total	INCOME	F.C.	L.C.	INCOME
1994	4266.9	741.0	197.6	1154.7	2093.3	2173.6	3201.4	572.8	-1600.5
1995	4266.9	741.0	197.6	1154.7	2093.3	2173.6	3201.4	572.8	-1600.5
1996	4266.9	741.0	197.6	1154.7	2093.3	2173.6	3201.4	572.8	-1600.5
1997	4266.9	741.0	197.6	1154.7	2093.3	2173.6	3201.4	572.8	-1600.5
1998	4266.9	741.0	197.6	1154.7	2093.3	2173.6	3201.4	572.8	-1600.5
1999	4320.3	741.0	197.6	1154.7	2093.3	2227.0	3201.4	572.8	-1547.2
2000	4320.3	741.0	197.6	1154.7	2093.3	2227.0	2976.6	532.6	-1282.2
2001	4320.3	741.0	197.6	1154.7	2093.3	2227.0	2734.6	489.3	-996.9
2002	4320.3	741.0	197.6	1154.7	2093.3	2227.0	2474.2	442.7	-689.9
2003	4320.3	741.0	197.6	1154.7	2093.3	2227.0	2193.8	392.5	-359.3
2004	4373.6	741.0	197.6	1154.7	2093.3	2280.3	1892.0	338.5	49.8
2005	4373.6	741.0	197.6	1154.7	2093.3	2280.3	1567.2	280.4	432.7
2006	4373.6	741.0	197.6	1154.7	2093.3	2280.3	1217.5	217.8	844.9
2007	4373.6	741.0	197.6	1154.7	2093.3	2280.3	841.2	150.5	1288.6
2008	4373.6	741.0	197.6	1154.7	2093.3	2280.3	436.1	78.0	1766.2
2009	4426.9	741.0	197.6	1154.7	2093.3	2333.6			2333.6
2010	4426.9	741.0	197.6	1154.7	2093.3	2333.6			2333.6
2011	4426.9	741.0	197.6	1154.7	2093.3	2333.6			2333.6
2012	4426.9	741.0	197.6	1154.7	2093.3	2333.6			2333.6
2013	4426.9	741.0	197.6	1154.7	2093.3	2333.6			2333.6
2014	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2015	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2016	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2017	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2018	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2019	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2020	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2021	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2022	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
2023	4480.3	741.0	197.6	1154.7	2093.3	2387.0			2387.0
Total	131741.0	22230.0	5928.0	34641.0	62799.0	68942.3	35541.5	6358.9	27041.9

Note-1: O & M --- Operation and maintenance cost

Note-2: Admin. --- Administration cost

Note-3: Deprec. --- Depreciation

Note-4: F.C. --- Foreign currency portion

Note-5: L.C. --- Local currency portion

Table 13.3.20

C A S H F L O W
- Kikuletwa No,2 Project -

(Unit: US\$ thousand)

Year	CASH INFLOW			CASH OUTFLOW			BALANCE	
	Net income	Deprec.	Total	IDC	Pri(FC)	Pri(LC)		Total
1990				533.0			533.0	-533.0
1991				1645.9			1645.9	-1645.9
1992				2691.0			2691.0	-2691.0
1993				3465.2			3465.2	-3465.2
1994	-1600.5	1154.7	-445.8					-445.8
1995	-1600.5	1154.7	-445.8					-445.8
1996	-1600.5	1154.7	-445.8					-445.8
1997	-1600.5	1154.7	-445.8					-445.8
1998	-1600.5	1154.7	-445.8					-445.8
1999	-1547.2	1154.7	-392.5		2942.4	526.4	3468.8	-3861.3
2000	-1282.2	1154.7	-127.5		3167.2	566.6	3733.8	-3861.3
2001	-996.9	1154.7	157.8		3409.2	609.9	4019.1	-3861.3
2002	-689.9	1154.7	464.8		3669.6	656.5	4326.1	-3861.3
2003	-359.3	1154.7	795.4		3950.0	706.7	4656.7	-3861.3
2004	49.8	1154.7	1204.5		4251.7	760.7	5012.4	-3808.0
2005	432.7	1154.7	1587.4		4576.6	818.8	5395.4	-3808.0
2006	844.9	1154.7	1999.6		4926.2	881.4	5807.6	-3808.0
2007	1288.6	1154.7	2443.3		5302.6	948.7	6251.3	-3808.0
2008	1766.2	1154.7	2920.9		5707.7	1021.2	6728.9	-3808.0
2009	2333.6	1154.7	3488.3					3488.3
2010	2333.6	1154.7	3488.3					3488.3
2011	2333.6	1154.7	3488.3					3488.3
2012	2333.6	1154.7	3488.3					3488.3
2013	2333.6	1154.7	3488.3					3488.3
2014	2387.0	1154.7	3541.7					3541.7
2015	2387.0	1154.7	3541.7					3541.7
2016	2387.0	1154.7	3541.7					3541.7
2017	2387.0	1154.7	3541.7					3541.7
2018	2387.0	1154.7	3541.7					3541.7
2019	2387.0	1154.7	3541.7					3541.7
2020	2387.0	1154.7	3541.7					3541.7
2021	2387.0	1154.7	3541.7					3541.7
2022	2387.0	1154.7	3541.7					3541.7
2023	2387.0	1154.7	3541.7					3541.7
Total	27041.9	34641.0	61682.9	8335.0	41903.1	7497.0	57735.1	3947.9

Note-1: Pri(FC) -- Repayment of principal (Foreign currency portion)

Note-2: Pri(LC) -- Repayment of principal (Local currency portion)

Note-3: Deprec. -- Depreciation cost

Note-4: IDC ---- Interest during construction

CHAPTER 14
ENVIRONMENTAL IMPACT

CHAPTER 14 ENVIRONMENTAL IMPACT

	<u>Page</u>
14.1 GENERAL SITUATION	14-1
14.2 NATURAL ECOSYSTEM	14-1
14.3 SOCIAL-CULTURAL ENVIRONMENT AND ECONOMIC ACTIVITY	14-3
14.4 EXISTING WATER RIGHTS	14-5
14.5 LAND ACQUISITION AND COMPENSATION	14-5
14.6 ENVIRONMENTAL IMPACT	14-7

CHAPTER 14 ENVIRONMENTAL IMPACT

14.1 GENERAL SITUATION

The 6.5-km stretch of the Kikuletwa River mainstream between the Kikuletwa No. 1 Power Station's existing intake dam (which will continue in use following the rehabilitation) and the proposed Kikuletwa No. 2 Power Station, flows eastward, cutting deep escarpments in the volcanic plateau.

The plateau on the left bank belongs to the Hai District of the Kilimanjaro Region, and part of it is being used as agricultural land. The right bank belongs to the Kiteto District of the Arusha Region, and is a wilderness covered by shrubbery.

In order to understand the natural and socio-economic situations and to assess the impact of project implementation, the JICA team conducted field investigations and interviews with residents. The results suggest that hydropower station construction will have virtually no negative impact on the natural and socio-economic environments of these zones.

On the other hand, the implementation of the stations, and the subsequent improvement in electric power supply condition, can be expected to enhance the social and cultural conditions of these regions, while also bringing about increased economic activity.

14.2 NATURAL ECOSYSTEM

(1) Topography and Vegetation

Both banks of the Kikuletwa River are volcanic plateaus, located on Mt. Kilimanjaro's southern slope, which is an area of vast, gently undulating plains. The plateau on the left bank, which is part of Rundugai Village in the Hai District, is - except in areas used for paddies and crop fields - covered by thorny plants and bushes, known as "kikwata" and "mwerera". There is no agricultural activity on the right bank, which is part of the Kiteto District of the Arusha Region; this bank is wild and uninhabited, and covered by the same bushes found on the left bank.

(2) Water Resources

There is an annual average discharge of approximately 13 cu.m/sec at the runoff gauging station (No. 1DD-54) on the Kikuletwa River. Because the base-flow discharge is large, the runoff duration of the river is very advantageous for a water-use project. Groups of springs (Chemka, Ngulu, Rundugai, etc.), having abundant water, are distributed along the Kikuletwa River mainstream and the tributaries, including the Kware River. Particularly in the dry season, this spring water contributes greatly to the discharge of the Kikuletwa River.

For the Kikuletwa No. 1 Hydropower Project, water will be diverted - similar to the situation at the presently existing station - from the Kikuletwa River mainstream and the tributary Kware River. The water will be conducted to the power station by open canals of lengths 370 m and 1,677 m, respectively. The water used for power generation will be released into the Kikuletwa River immediately upstream of its confluence with the Kware River. The section of the river where the discharge will be decreased by the power generation is very short. In addition, there is no conflicting authorized water-use project involving water rights. The Kikuletwa No. 1 Hydropower Station will therefore have no negative impact on the water resources of the Kikuletwa River.

For the Kikuletwa No. 2 Hydropower Project, the water for power generation will be diverted by an intake dam to be constructed approximately 2 km downstream from the Kikuletwa No. 1 Power Station, and will be returned to the Kikuletwa River via a 3,300-m headrace and an 835-m penstock. Parts of this 4.5-km long section along the river are used by some residents for bathing or for small-scale, primitive fishing. Other than this, there are no authorized water rights or established water-use projects for this section.

Constructing a 13-m high intake dam for the Kikuletwa No. 2 Hydropower Project will raise the water level between the dam and the existing TANESCO power station. No housing or important land, however, will become submerged by the raised water level.

(3) Biological Environment

Wild pigs, deer, lions, and hyenas frequently appear on the right bank plateau, and it is reported that people and livestock are sometimes endangered from attack. There are fish inhabiting the Kikuletwa River in the vicinity of the project area. The main plants growing on the right-bank plateau are "kikwata", "mwerera", "ubindu", and "mkoche"; "kikwata", "mwerera", and "mgunga" predominate on the left bank. The grass, scrub brush, and trees are common types. No species requiring special preservation have been seen. Plant life at borrow areas, disposal areas, access roads, and other such areas may temporarily suffer negative impact due to construction.

(4) Atmospheric Pollution and Noise

At present, there is no prominent atmospheric noise pollution in the area. During the preparatory work and the construction period, the use of vehicles, heavy equipment, and internal combustion engines will cause a certain amount of such pollution over a limited area. Because the affected area will be very small, the time period short, there will be no adverse effect on the atmospheric environment.

14.3 SOCIAL-CULTURAL ENVIRONMENT AND ECONOMIC ACTIVITY

(1) Social-Cultural Environment

The population density of the left bank plateau, part of the Hai District is 50 to 60 per square kilometer. The residents are engaged in agriculture and livestock raising. Each village has one or two primary schools and one or two dispensaries. Major diseases seen in this district include malaria, diarrhea, schistosomiasis (local name: kichocho), and pneumonia. According to an interview at Kaway Dispensary, that Dispensary sees an average of 800 new patients a month, with a reexamination or reattendance ratio of approximately 50 percent.

It is reported that there are two or three thousand people living on the right bank plateau in very scattered villages of the Masai. In

the vicinity of the project area, in Kambi ya Chocka Village, a primary school and a dispensary are being operated by a missionary group. If hydropower projects are realized and electricity supply becomes available, the public facilities of both districts will be much improved.

(2) Economic Activity

At Rundugai Village, on the left bank plateau, the ratio of land used for agriculture is high, and crops are of corn, soya bean, sugar cane, paddy rice, and vegetables. On the plateaus on both banks, residents raise livestock and poultry - beef cattle, dairy cattle, goats, sheep, and chickens. A limited number of residents utilize primitive fishing methods to catch mudfish (kambale), tilapia (perago), "kuyu", and "pau" from the Kikuletwa River. On the right bank, charcoal is being produced from the "mgunga" tree.

The majority of the residents, then, are engaged in agriculture and livestock raising. In general, the produce and fish are sufficient for subsistence. When there are surpluses, they are traded at neighboring villages. Improvement and expansion of electric power to the region will induce the formation of small-scale, agricultural-based cottage industries, along with which various linkage activities will also appear. This in turn will work to stimulate the general economic activity in the region.

(3) Job and Employment Opportunity

As described above, the majority of residents are engaged in agriculture and livestock raising, and few other employment opportunities exist. Construction of small hydropower projects in the region will of course require a considerable labor force; following construction, a smaller amount of long-term employment opportunities will exist.

(4) Road and Transportation

The network of unpaved roads in the region seems unsystematically arranged, while road density is also insufficient. Bridges over rivers and streams are particularly inadequate, producing transpor-

tation bottlenecks during the flood season. The residents therefore have a strong interest in improvement of the infrastructure.

In order to implement the hydropower projects, construction roads will be built; in order to maintain the projects, roads would be carefully maintained. These roads will be open to public use. The transportation conditions of the region will thus be greatly improved.

(5) Tourism

Groups of clear springs with abundant water, such as the Chemka Springs, are scattered in the vicinity of the existing TANESCO power station. These springs have potential as convenient tourist spots. While hydropower development project will have no direct qualitative or quantitative effect on the springs, the improved road conditions should help to increase tourism in the area.

14.4 EXISTING WATER RIGHTS

The mountainsides of Mt. Kilimanjaro and Mt. Pare have developed, over the centuries, into fertile agricultural zones, and there are small-scale irrigation canal networks - traditional furrow systems - laid out to distribute irrigation water in the region. A number of these furrow systems have formal river water rights registered at the water resource office in Moshi. Most of the systems, however, are customarily operated for agriculture under the local communities.

As mentioned before, there are no officially authorized water rights existing downstream of the intake sites for the Kikuletwa No. 1 and No. 2 power stations. The results of a survey on registered water rights at sites on the Kikuletwa, Himo, Yongoma, Hingilili and Sesseni rivers at which potential hydro-power stations were proposed are given in App. IV.

14.5 LAND ACQUISITION AND COMPENSATION

The Kikuletwa No. 1 and No. 2 Hydropower Projects consist of the following new construction and rehabilitation work.

	<u>Kikuletwa No. 1</u>	<u>Kikuletwa No. 2</u>
Intake dam and intake facilities	yes (rehabilitation)	yes
Headrace	yes (rehabilitation)	yes
Head tank	yes (rehabilitation)	yes
Penstock	yes	yes
Powerhouse	yes	yes

For the Kikuletwa No. 1 Project, the existing intake facilities and headrace canals will be improved, then used. The head tank, penstock, and powerhouse will be newly constructed adjacent to the existing TANESCO power station. It is therefore not necessary to prepare or acquire new land. For the Kikuletwa No. 2 Project, various power generation facilities will be constructed on the left bank plateau. Construction sites for the intake facilities, headraces, head tank, penstock, and powerhouse are located in a shrub-covered wilderness. No farmland or houses are in place, so there will be no need to pay compensation for such.

Both projects will improve the existing road, which will be used for construction. There may be cases in which cultivated land at roadsides will be slightly affected. In Tanzania, compensation terms per hectare have been established by type of crop, as shown in App. V. In the event of necessity, these terms will be applied. The standard rate ranges established in 1985-86 are summarized below:

<u>Crop</u>	<u>Rate (T/Sh/ha)</u>
Vegetables, greens and root crops	20,000 (carrot, cabbage) to 50,000 (tomato)
Legunes	3,360 to 7,740
Grains	3,000 (maizes) to 12,000 (paddy rice)
Spices	33,700 (cardamom) to 330,000 (ginger)
Cash crops (tea, coffee, sisal, etc.)	45,000 (wottle) to 560,000 (tea)
Fruit	16,000 (guava) to 168,750 (banana)

Source: Viwango Vipya (1985/86) vya Fdia ya Mazao na Miti ya Misitu Iliyopandwa

14.6 ENVIRONMENTAL IMPACT

The development of Kikuletwa No. 1 and No. 2 Hydropower Projects involves stages of investigation, construction, and operation and maintenance. Actions at the different stages will have both positive or negative environmental impacts, as described above. These actions are correlated with the impact areas in the relevance matrix shown in Table 14.6.1. The construction period involves a negligible amount of adverse impact, while the benefits following project completion will include improvements in the social-cultural environment and economic activity.

Table 14.6.1. RELEVANCE MATRIX FOR ENVIRONMENTAL IMPACT STUDY

IMPACT AREA	Preparation Phase				Construction Phase										Operation Phase				
	1. Externing Study	2. Field Investigation & Drilling Works	3. Access Road	4. Resettlement & Relocation	1. Construction Road	2. Storage & Disposal of Crst. Materials	3. Quarry & Aggregates	4. Diversion Facilities	5. Head Tank	6. Perforck Line	7. Powerhouse	8. Trans. Line & Sub Stations	1. Energy Production	2. Operation of Goods & Persons	3. Transport of River Water	4. Public Infra Structure	5. Diversion of River Water		
Natural Ecosystem Area	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
1. Topography & Land Scope	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
2. Water Resource	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
3. Fauna Ecosystem	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
4. Air & Noise	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
Social & Cultural Area																			
1. Population Structure																			
2. Health																			
3. Institution																			
4. Public Service	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
5. Transportation and Communication	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
6. Infrastructure																			
7. Tourism	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
Economic Area																			
1. Agriculture																			
2. Cattle Raising																			
3. Fishing																			
4. Industry																			
5. Trade & Business																			
6. Job Opportunity	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		
Authorized and/or Habitual Water Rights																			
Land Acquisition and/or Compensation	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖		

- ⊖ Same as before
- ⊙ Slightly improved
- ⊗ Considerably enhanced
- ⊕ Trivially affected
- ⊖ Slightly affected
- ⊗ Considerably affected

DRAWINGS

LIST OF DRAWINGS

- DWG. NO. 1 KIKULETWA HYDROPOWER PROJECT
GENERAL PLAN AND PROFILE
- DWG. NO. 2 KIKULETWA NO. 1 EXISTING HYDROPOWER PROJECT
(REHABILITATION PROJECT)

KIKULETWA CANAL
PLAN, PROFILE AND SECTION
- DWG. NO. 3 KIKULETWA NO. 1 EXISTING HYDROPOWER PROJECT
(REHABILITATION PROJECT)

KIKULETWA CANAL & PLAN
PROFILE AND SECTION
- DWG. NO. 4 KIKULETWA NO. 1 EXISTING HYDROPOWER PROJECT
(REHABILITATION PROJECT)

HEAD TANK & POWERHOUSE
PLAN, PROFILE AND SECTION
- DWG. NO. 5 KIKULETWA NO. 1 EXISTING HYDROPOWER PROJECT
(REHABILITATION PROJECT)

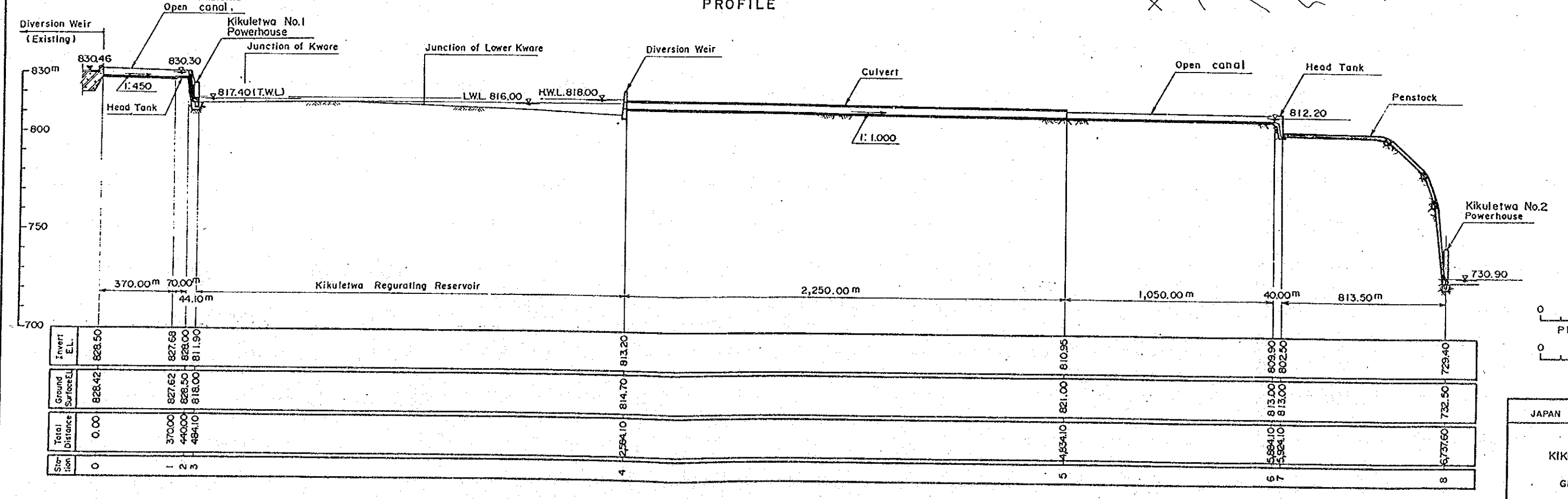
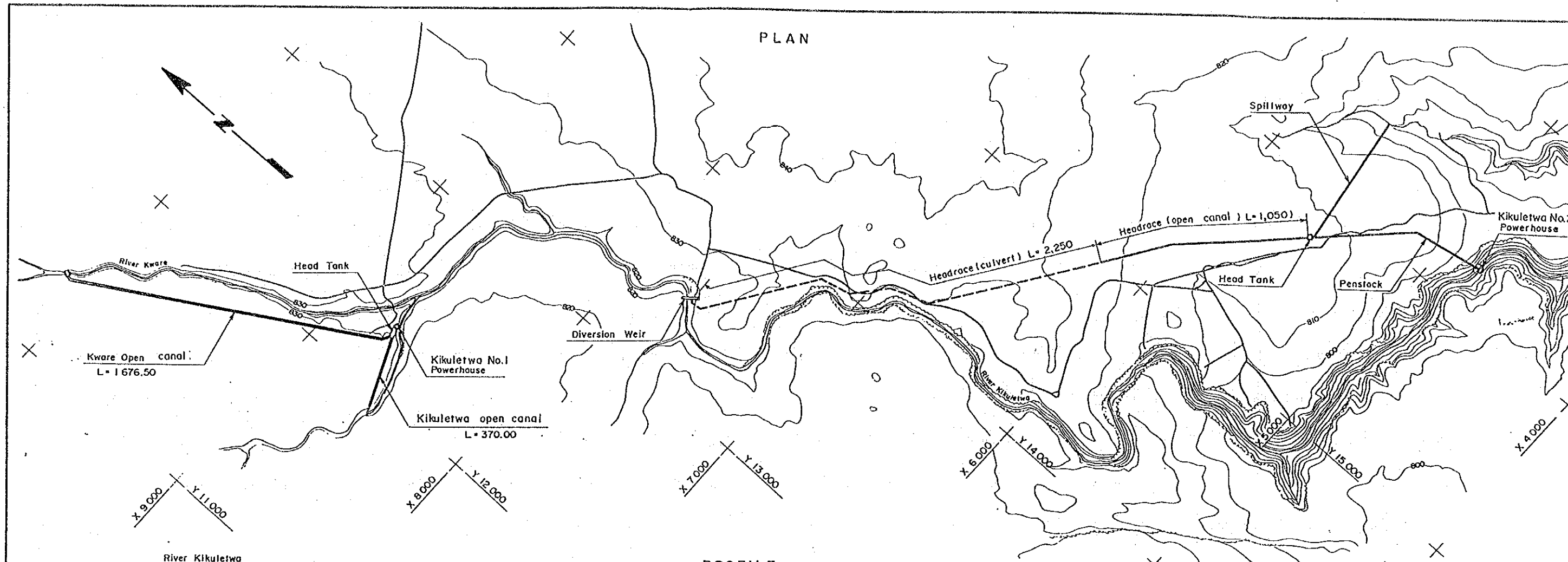
PENSTOCK & POWERHOUSE
PLAN, PROFILE AND SECTION
- DWG. NO. 6 KIKULETWA NO. 2 HYDROPOWER PROJECT
WATER WAY

CULVERT & OPEN CHANNEL
PLAN, PROFILE AND SECTION
- DWG. NO. 7 KIKULETWA NO. 2 HYDROPOWER PROJECT
WATER WAY

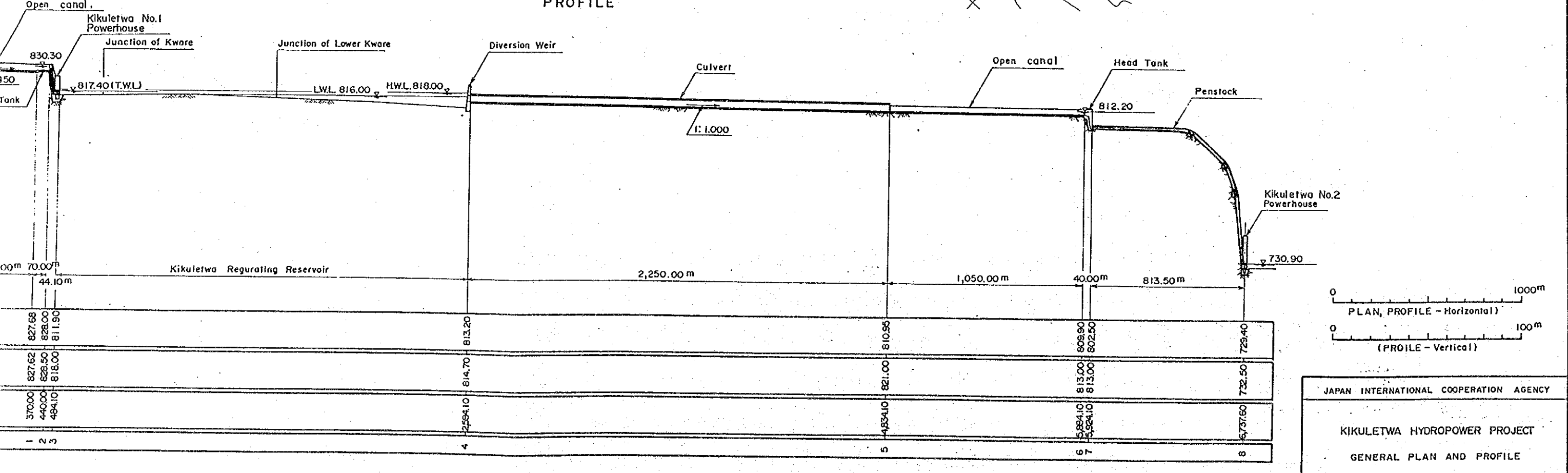
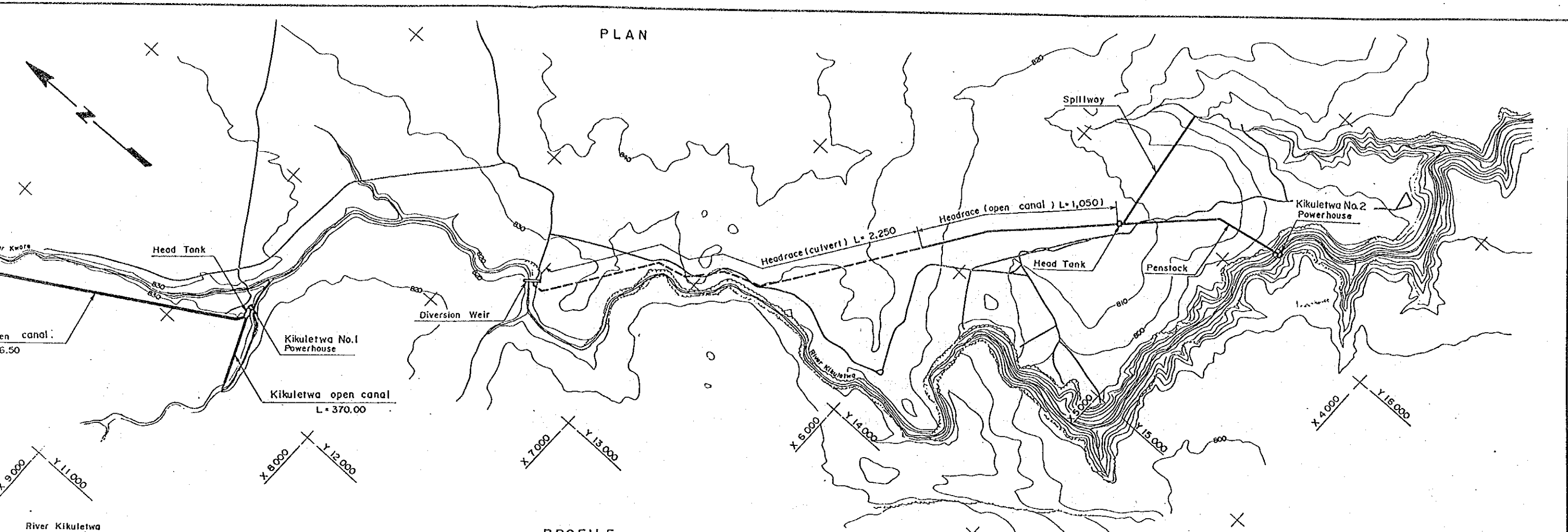
HEAD TANK & PENSTOCK
PLAN AND SECTION
- DWG. NO. 8 KIKULETWA NO. 2 HYDROPOWER PROJECT
WATER WAY

DAM & INTAKE,
PLAN, UPSTREAM ELEVATION AND SECTION
- DWG. NO. 9 KIKULETWA NO. 2 HYDROPOWER PROJECT
WATER WAY

POWERHOUSE & PLAN
PROFILE AND SECTION



0
 PL
 0
 JAPAN I
 KIKU
 GE
 DWG. No.



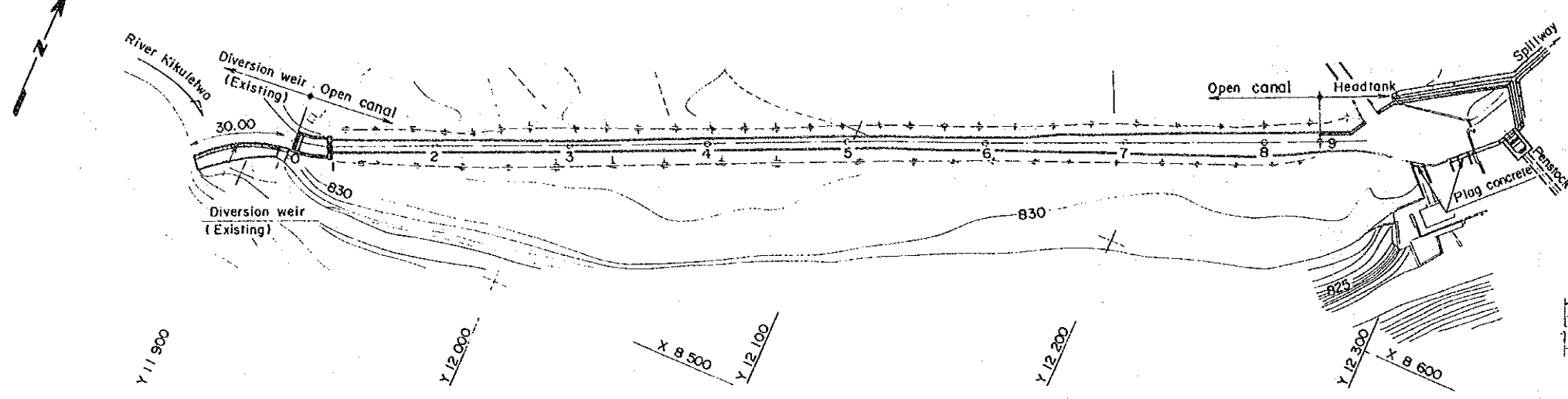
JAPAN INTERNATIONAL COOPERATION AGENCY

KIKULETWA HYDROPOWER PROJECT

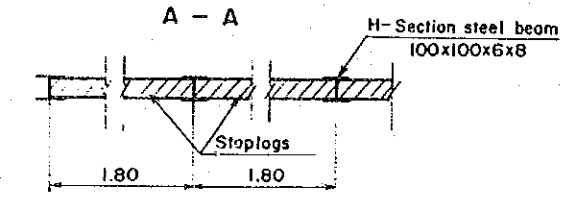
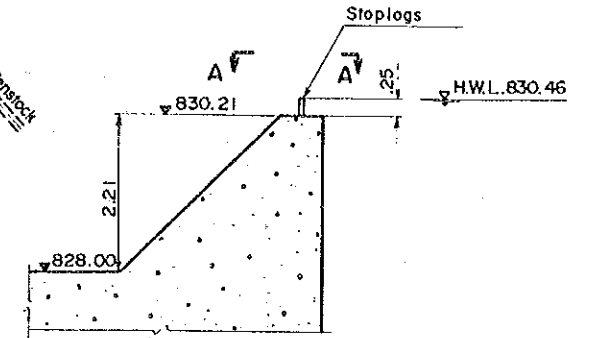
GENERAL PLAN AND PROFILE

DWG. No. 1

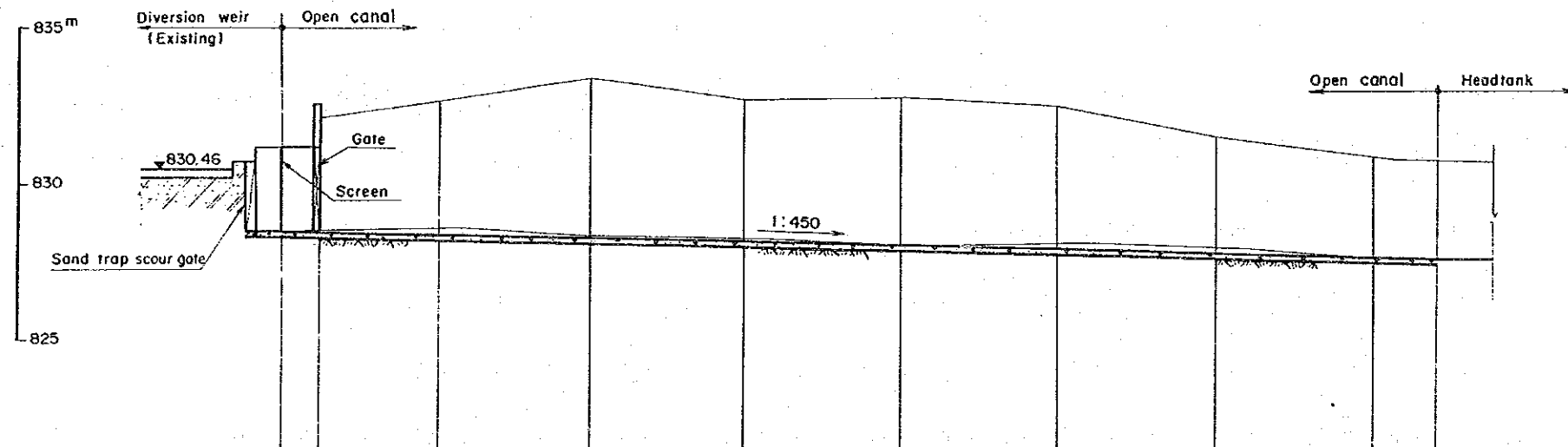
PLAN OF KIKULETWA CANAL



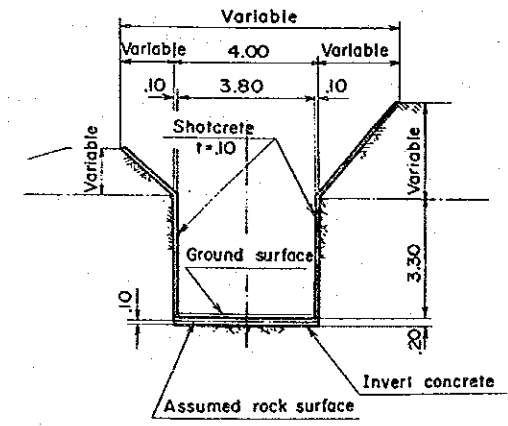
DIVERSION WEIR (Existing)



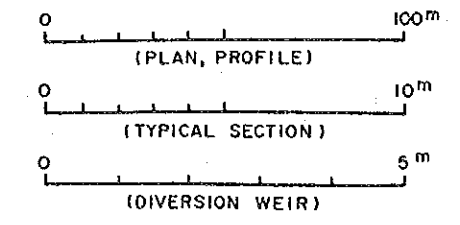
PROFILE OF KIKULETWA CANAL



TYPICAL SECTION

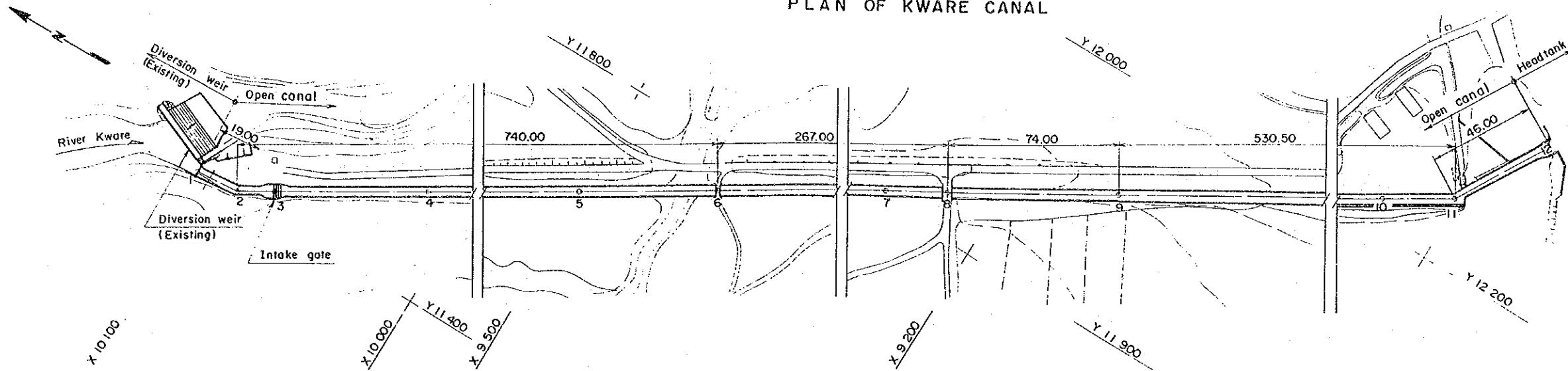


Station	0	1	2	3	4	5	6	7	8	9	
Invert E.L.		828.50	828.47	828.39	828.28	828.17	828.06	827.94	827.83	827.72	827.68
Ground Surface E.L.		828.42	828.53	828.61	828.38	828.24	828.00	828.17	827.98	827.62	827.62
Total Distance	0.00	12.00	50.00	100.00	150.00	200.00	250.00	300.00	350.00	370.00	
Distance	0	12.00	36.00	50.00	50.00	50.00	50.00	50.00	50.00	20.00	

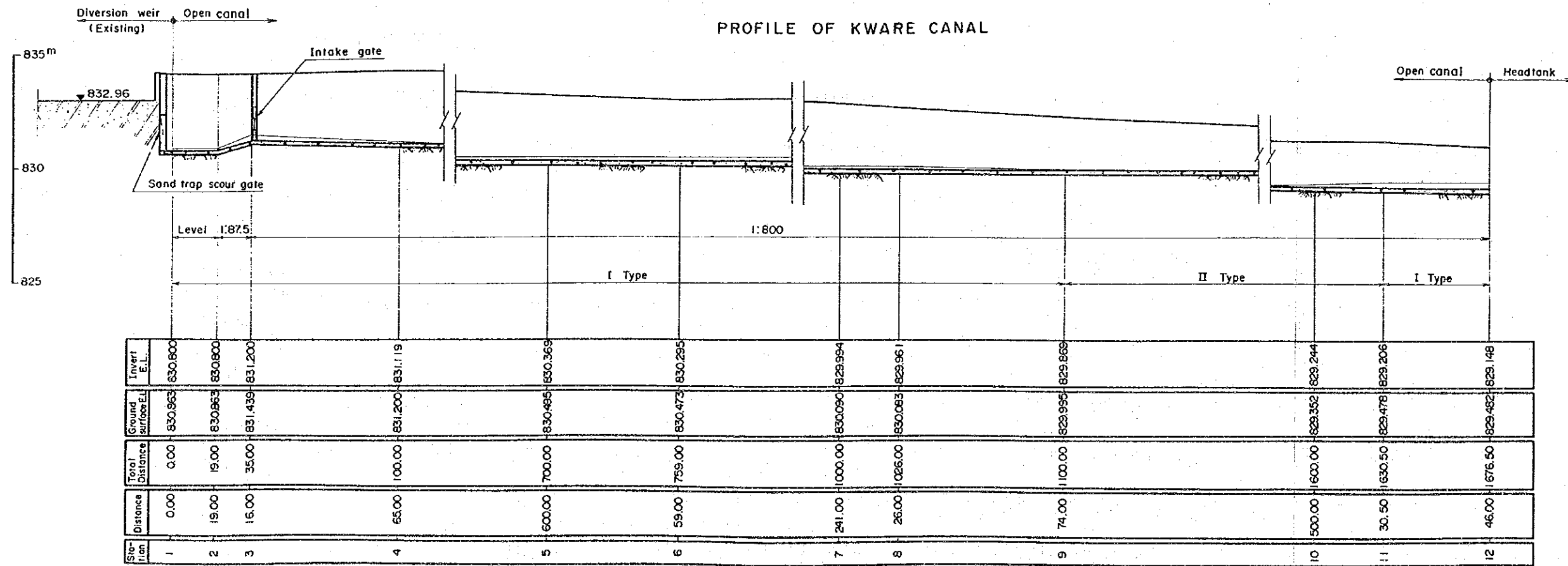


JAPAN INTERNATIONAL COOPERATION AGENCY
 KIKULETWA NO.1 EXISTING HYDROPOWER STATION
 (REHABILITATION PROJECT)
 KIKULETWA CANAL, PLAN, PROFILE
 AND SECTION
 DWG. No. 2

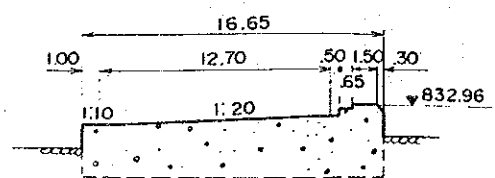
PLAN OF KWARE CANAL



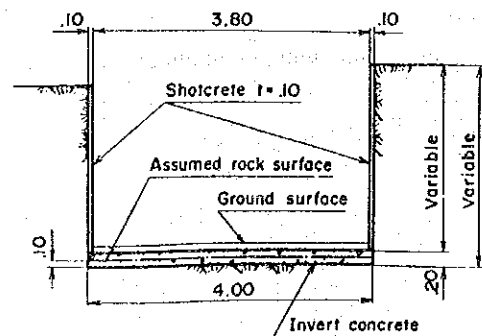
PROFILE OF KWARE CANAL



DIVERSION WEIR

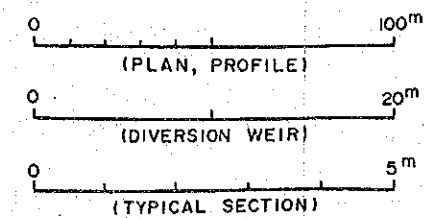
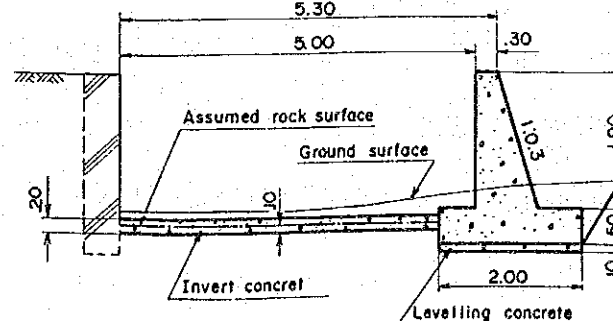


I Type

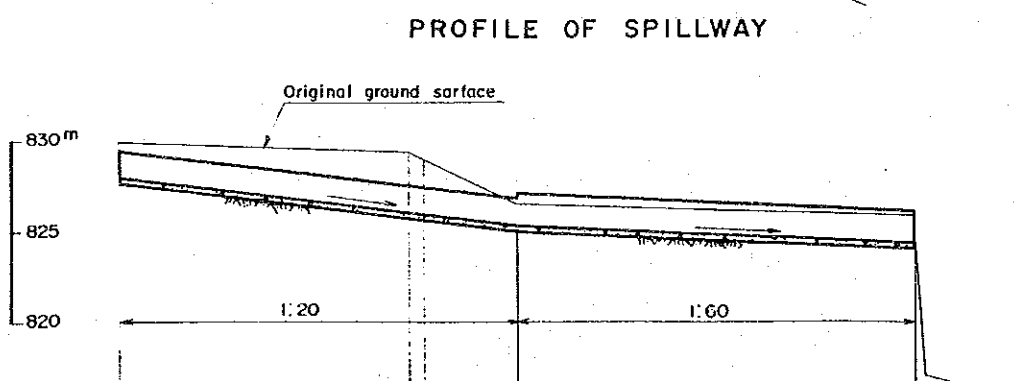
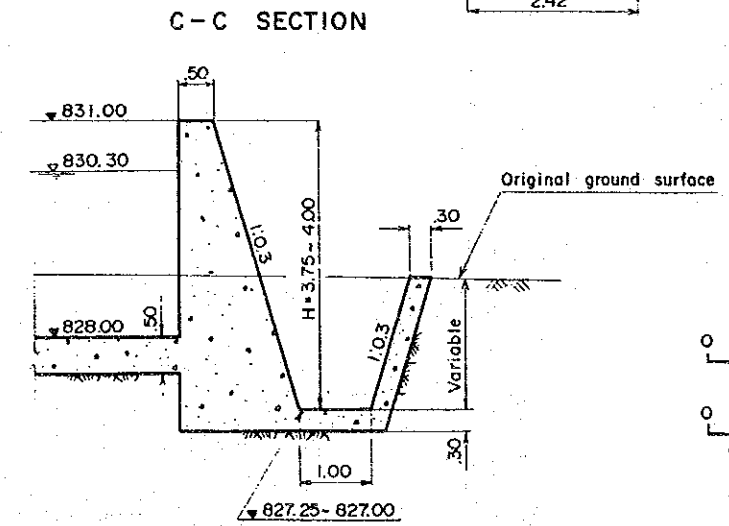
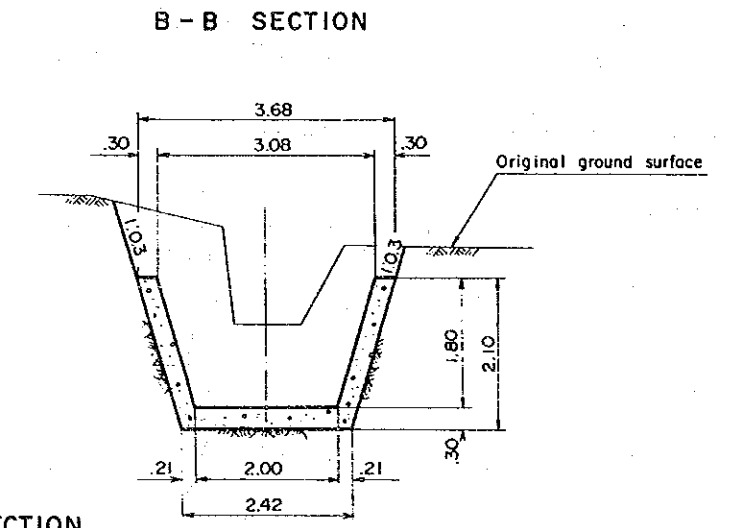
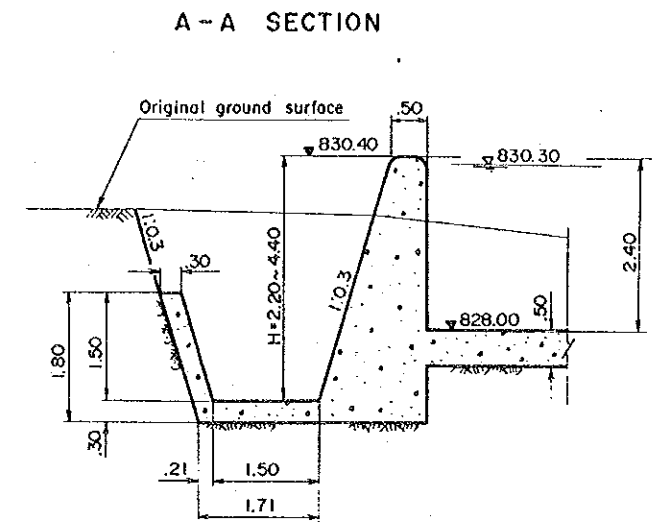
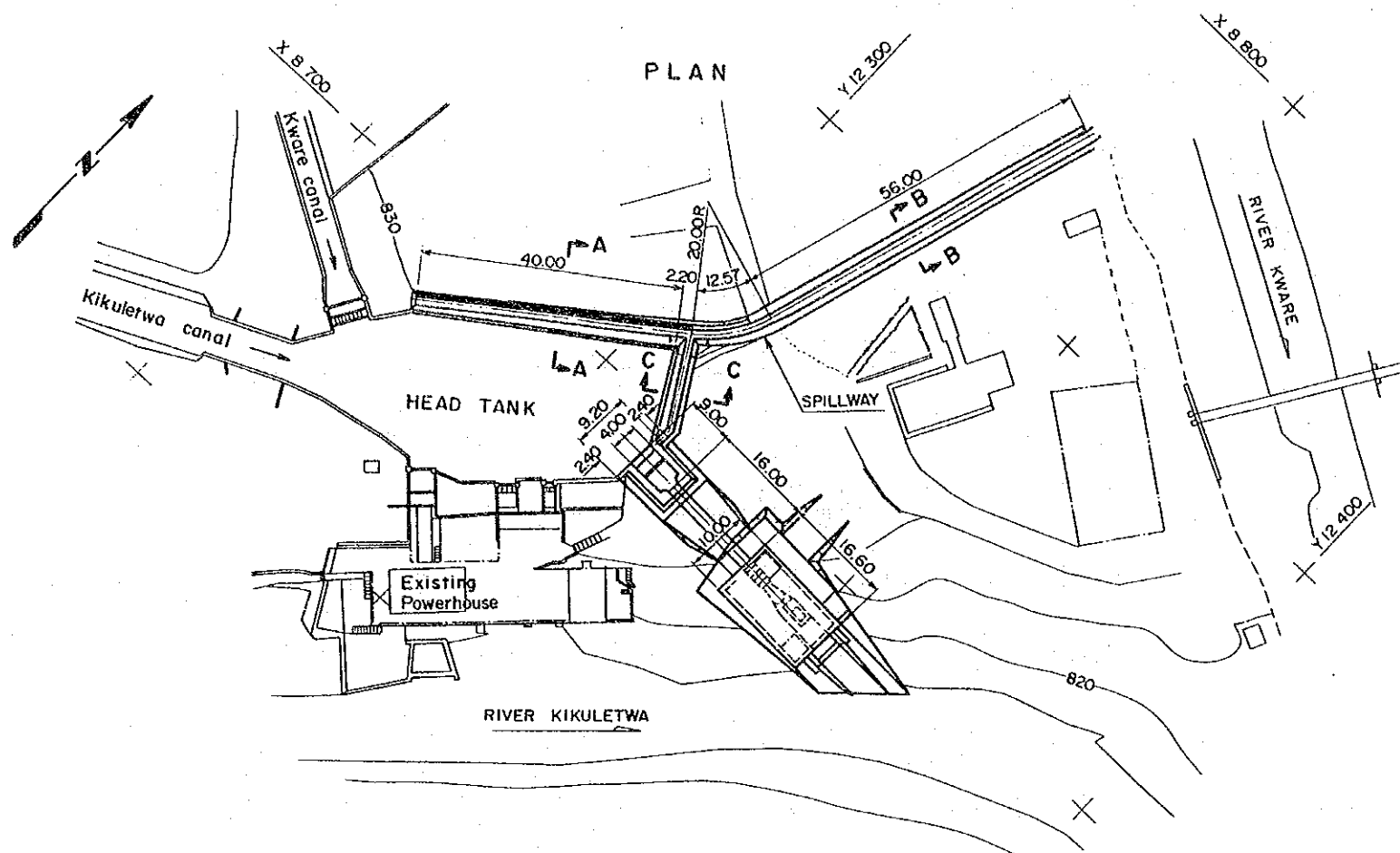


TYPICAL SECTION

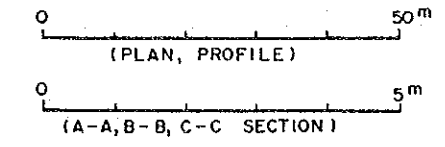
II Type



JAPAN INTERNATIONAL COOPERATION AGENCY
 KIKULETWA NO.1 EXISTING HYDROPOWER PROJECT
 (REHABILITATION PROJECT)
 KWARE CANAL, PLAN, PROFILE
 AND SECTION
 DWG. No. 3



Station	Distance	Total Distance	Original Ground EL.	Invert E.L.
1	0.00	0.00	830.00	828.00
2	4.00	4.00	829.40	826.00
3	2.20	42.20	825.89	825.89
4	12.57	54.77	826.50	825.26
5	56.00	110.77	825.90	824.33

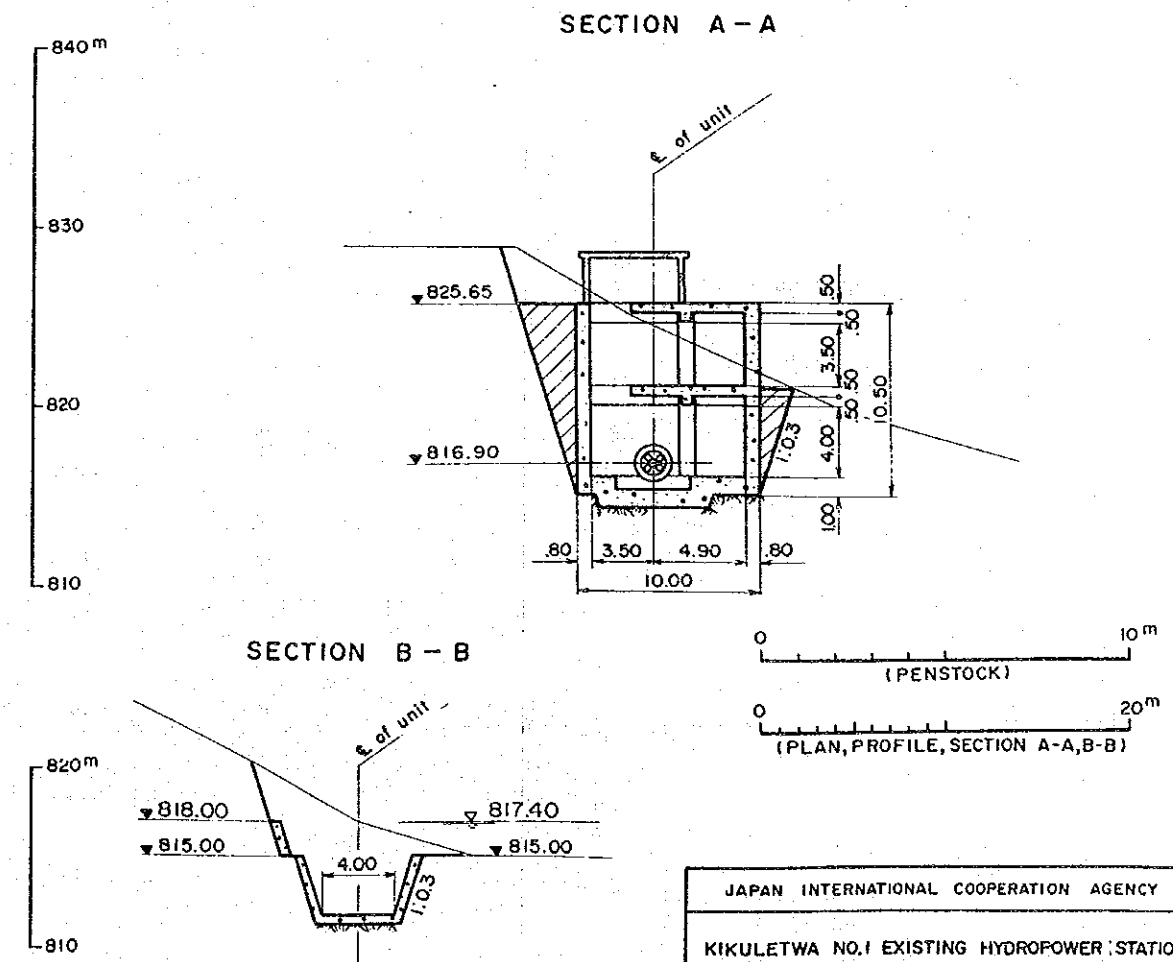
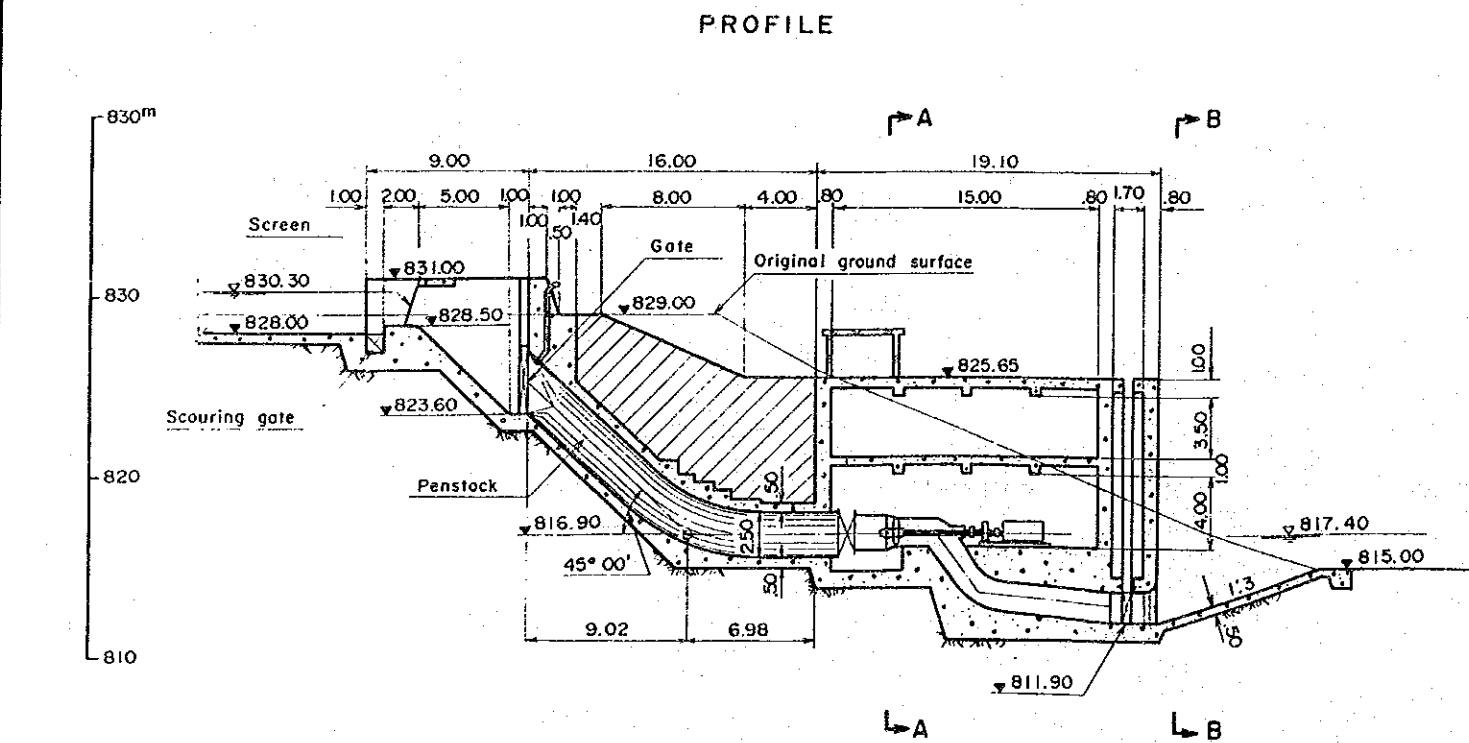
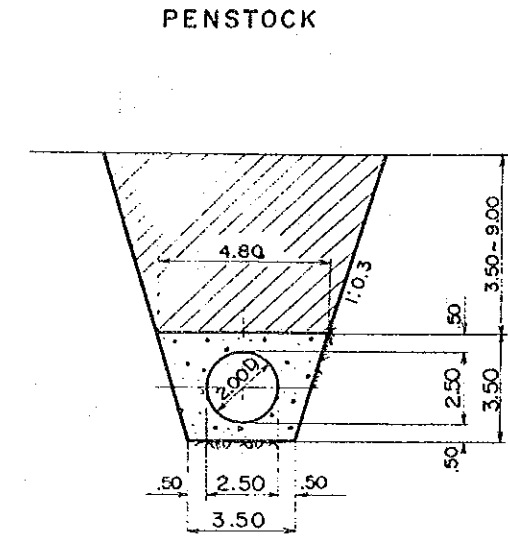
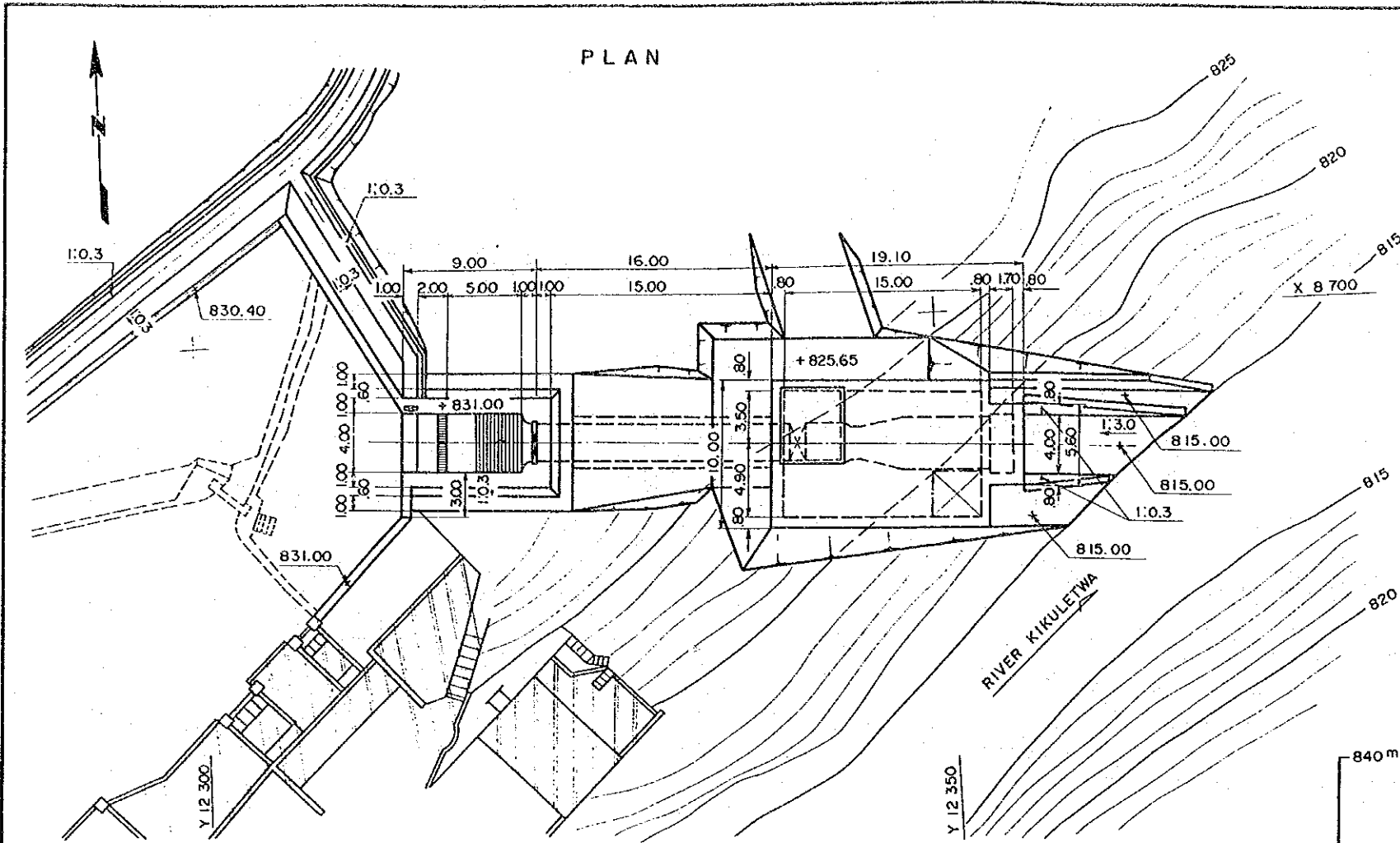


JAPAN INTERNATIONAL COOPERATION AGENCY

KIKULETWA NO.1 EXISTING HYDROPOWER PROJECT
(REHABILITATION PROJECT)

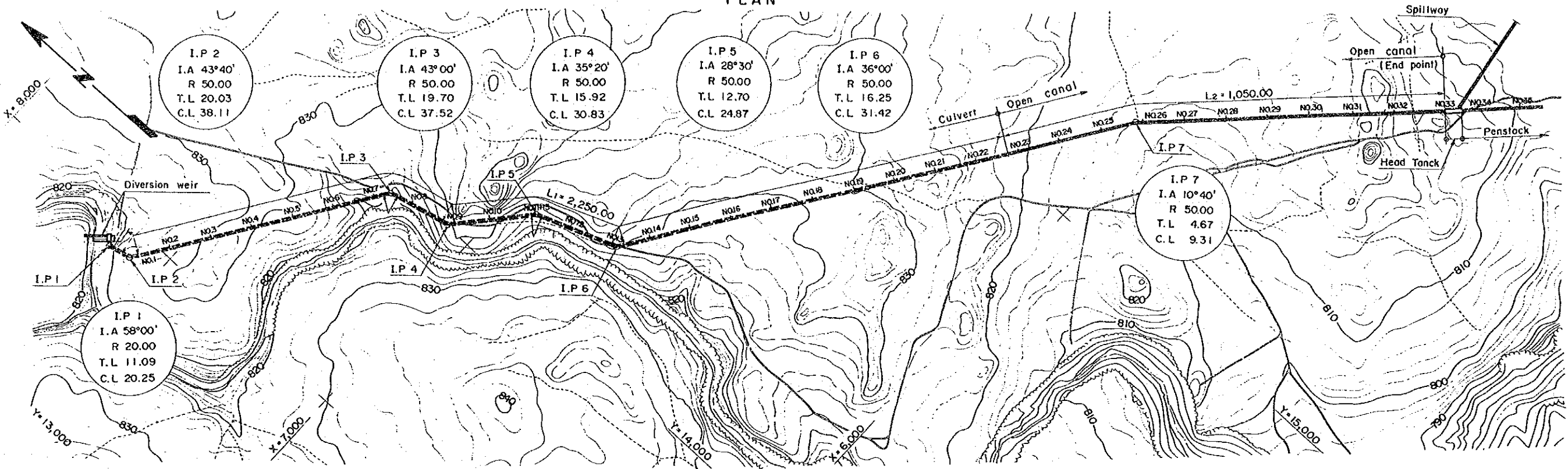
HEADTANK, POWERHOUSE, PLAN, PROFILE
AND SECTION

DWG. No.4

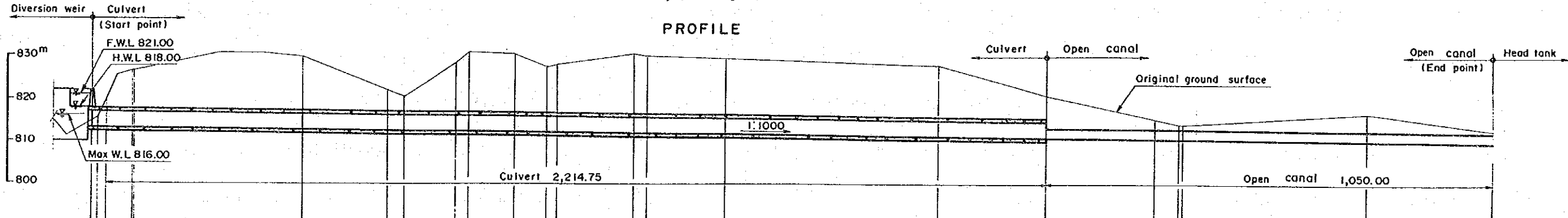


JAPAN INTERNATIONAL COOPERATION AGENCY
 KIKULETWA NO.1 EXISTING HYDROPOWER STATION
 (REHABILITATION PROJECT)
 PENSTOCK, POWERHOUSE, PLAN, PROFILE
 AND SECTION
 DWG. No. 5

PLAN

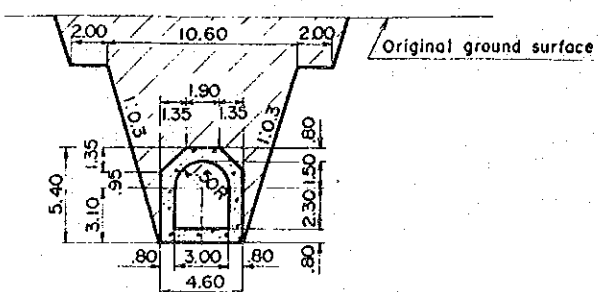


PROFILE

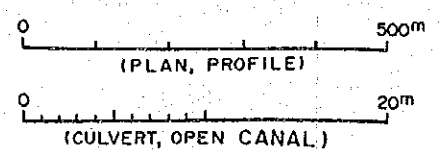
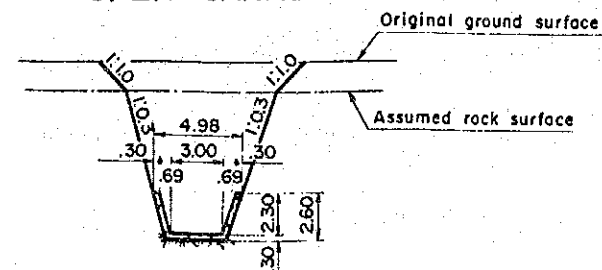


Station	Curve	Distance	Total Distance	Original Ground E.L.	Invert E.L.
0	I.P. 1	0.00	0.00	814.70	813.20
1	I.P. 1	15.00	15.00	815.50	813.19
2	I.P. 2	23.25	38.25	819.70	813.18
3	I.P. 2	23.00	61.25	825.40	813.14
4	I.P. 3	38.11	99.36	826.75	813.10
5	I.P. 3	1.64	101.00	826.80	813.10
5		400.00	501.00	829.50	812.70
6	I.P. 4	203.36	704.36	822.00	812.50
7	I.P. 4	37.52	741.88	820.50	812.46
8	I.P. 5	120.00	861.88	828.50	812.34
9	I.P. 5	30.83	892.71	831.00	812.31
10		108.29	1001.00	830.50	812.20
11	I.P. 6	76.71	1077.71	827.50	812.12
12	I.P. 6	24.87	1102.58	828.00	812.10
13		180.00	1282.58	830.50	811.92
14	I.P. 7	31.42	1314.00	830.00	811.89
15		187.00	1501.00	829.00	811.70
20		500.00	2001.00	828.00	811.20
22		250.00	2251.00	821.00	810.95
25		250.00	2501.00	815.50	810.70
26	I.P. 7	58.00	2559.00	814.20	810.64
27	I.P. 7	9.31	2568.31	814.20	810.63
30		432.69	3001.00	816.90	810.20
33		300.00	3301.00	813.00	809.90

CULVERT

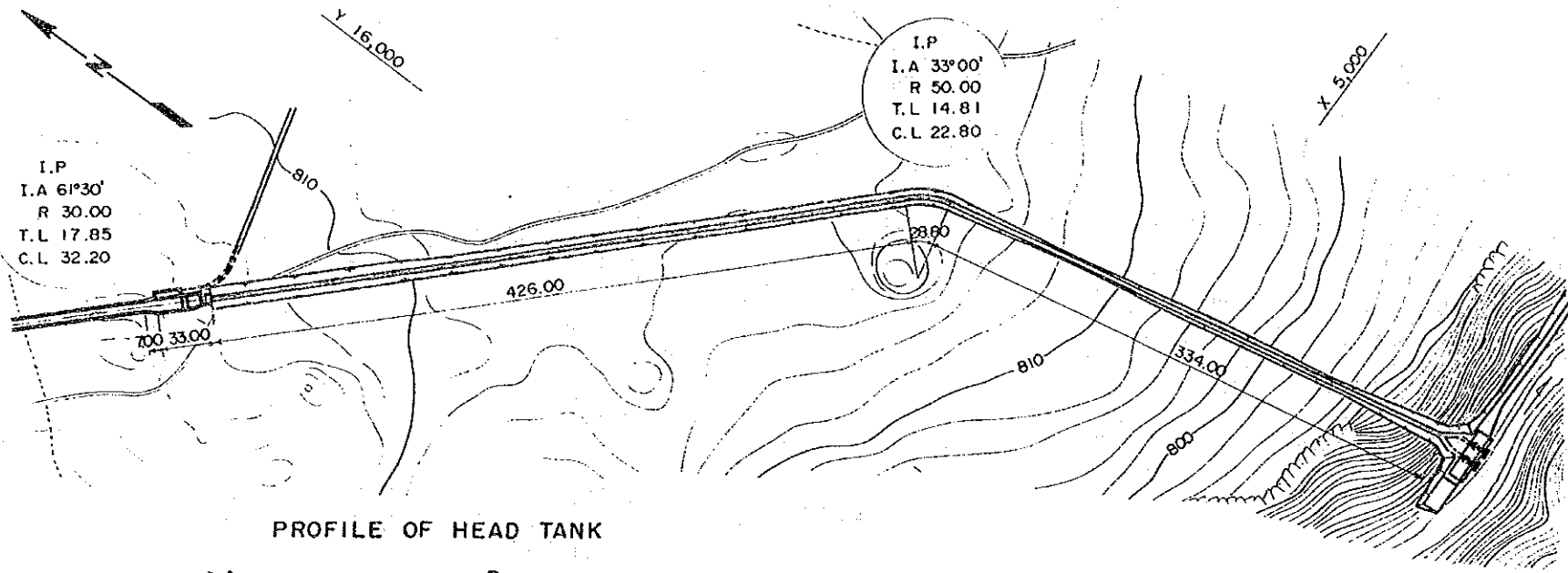


OPEN CANAL

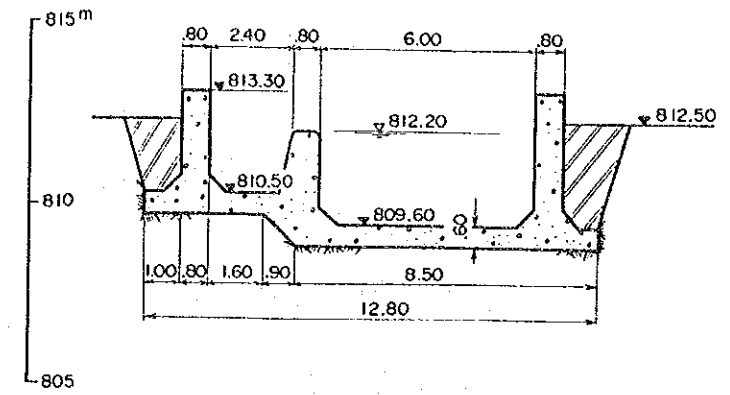


JAPAN INTERNATIONAL COOPERATION AGENCY
 KIKULETWA NO.2 HYDROPOWER PROJECT
 WATERWAY
 CULVERT, OPEN CHANNEL PLAN, PROFILE AND SECTION
 DWG. No. 6

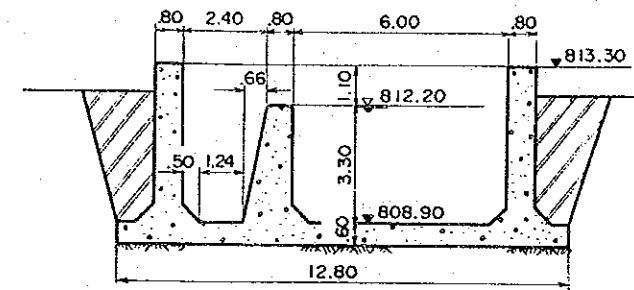
PLAN OF PENSTOCK



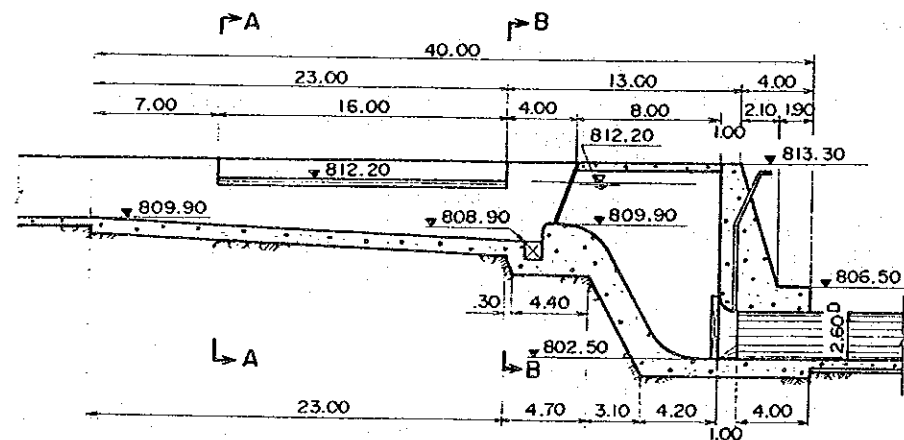
SECTION A - A



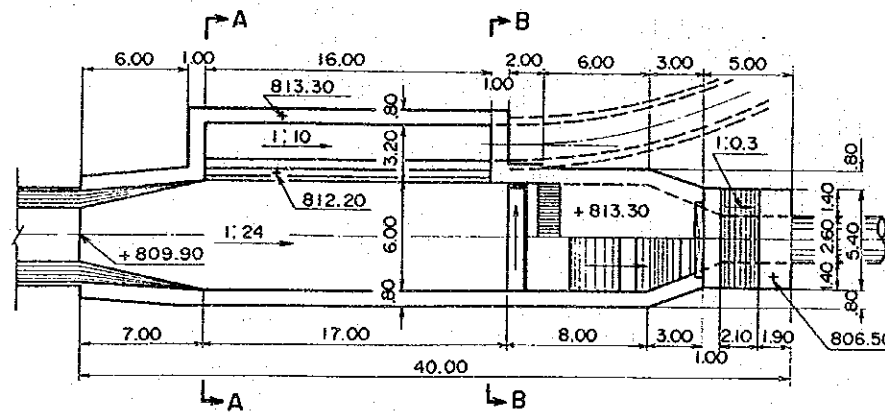
SECTION B - B



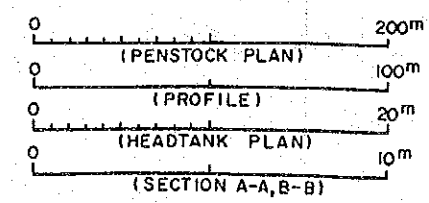
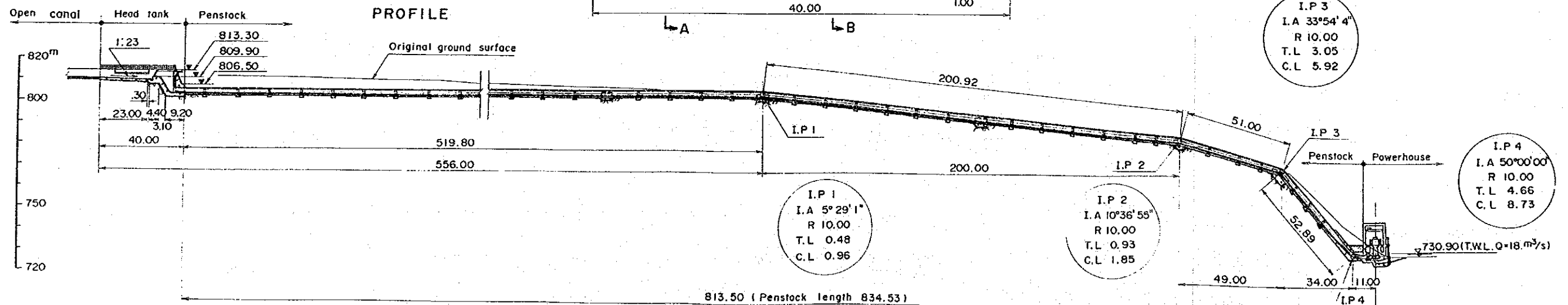
PROFILE OF HEAD TANK



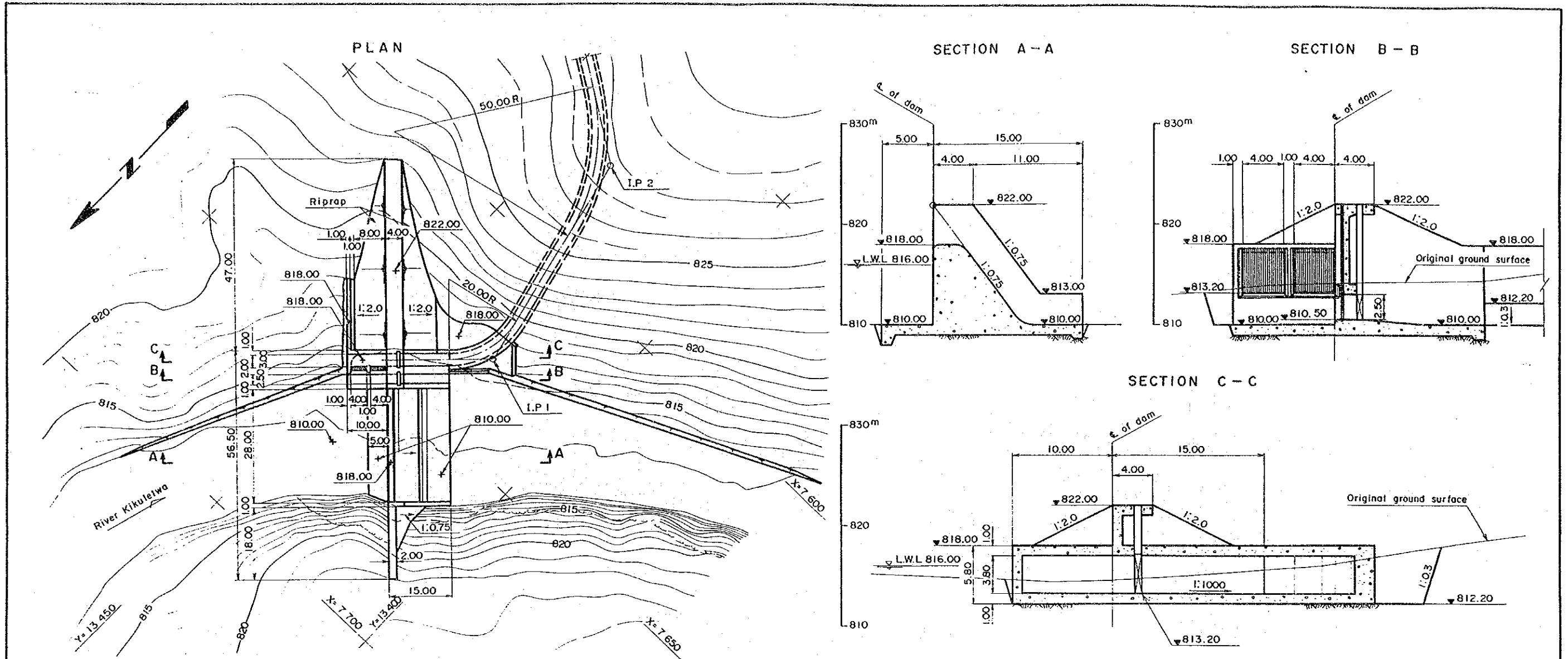
PLAN OF HEAD TANK



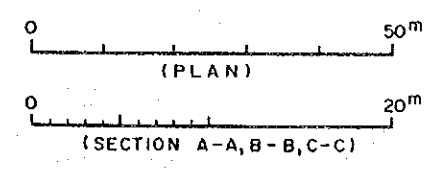
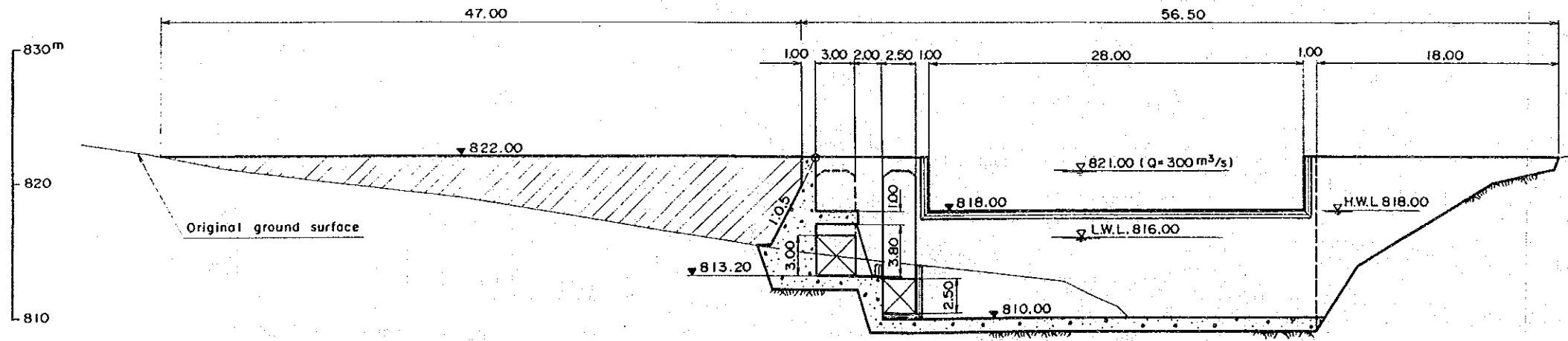
PROFILE



JAPAN INTERNATIONAL COOPERATION AGENCY
 KIKULETWA NO.2 HYDROPOWER PROJECT
 HEAD TANK, PENSTOCK, PLAN, PROFILE AND SECTION
 DWG. No. 7



UPSTREAM ELEVATION

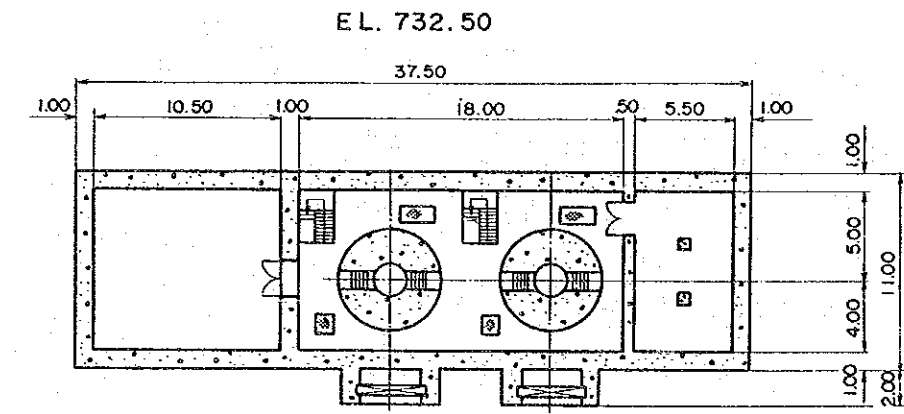
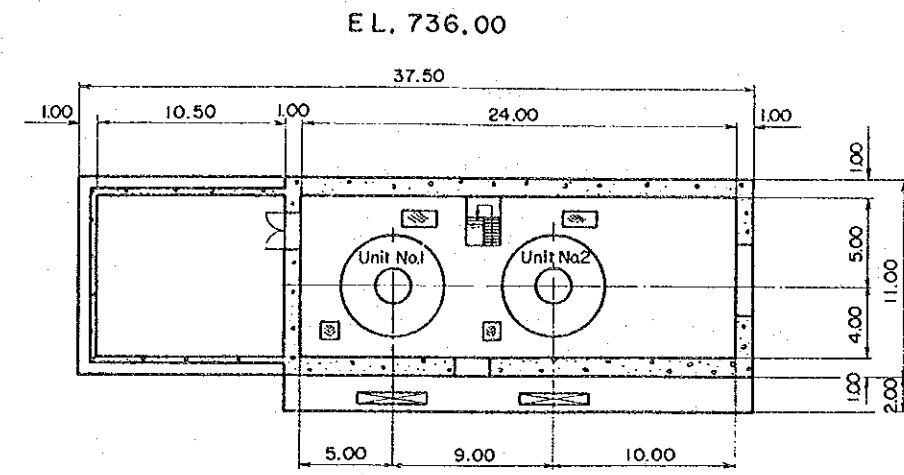
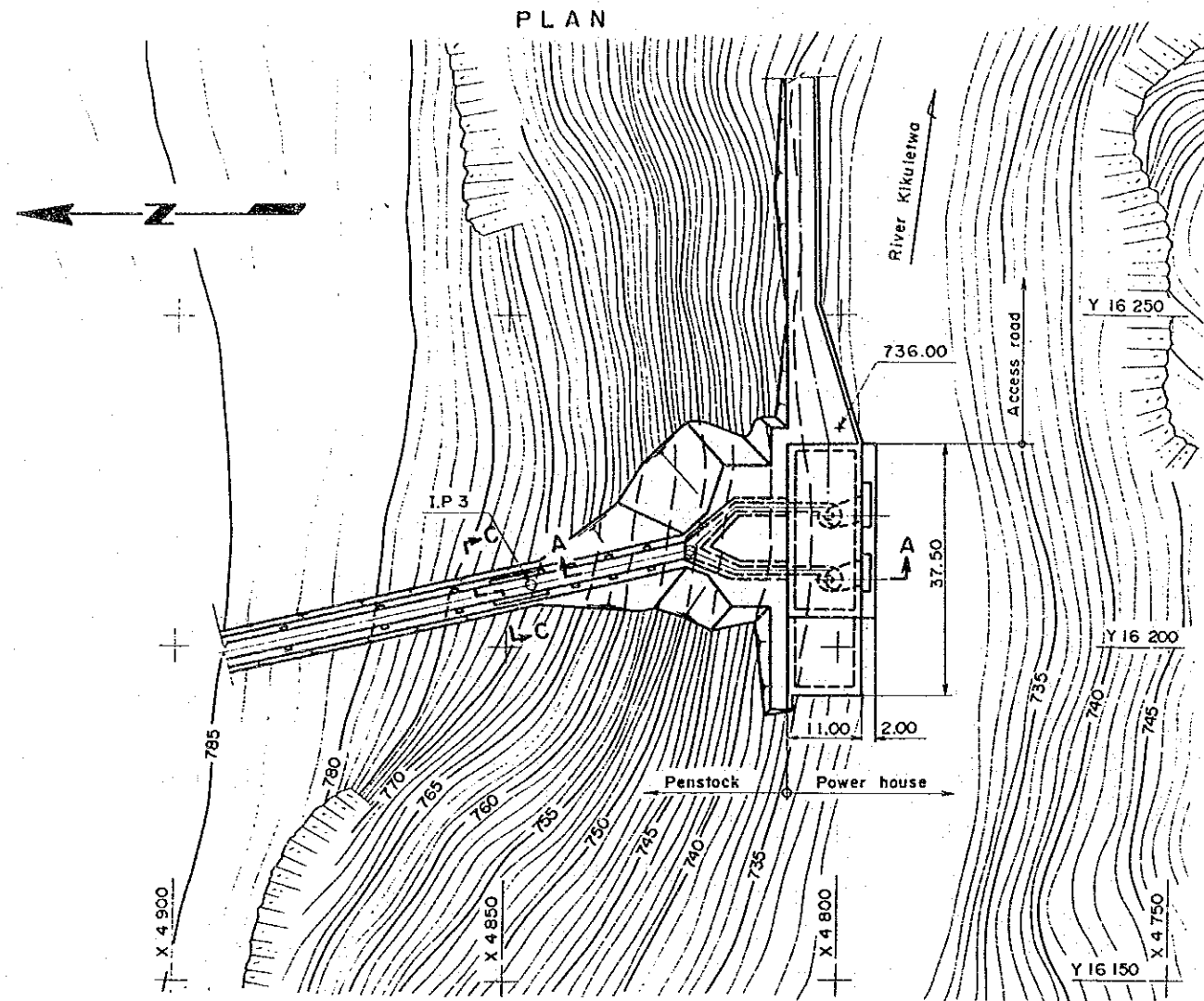


JAPAN INTERNATIONAL COOPERATION AGENCY

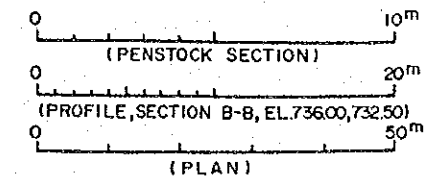
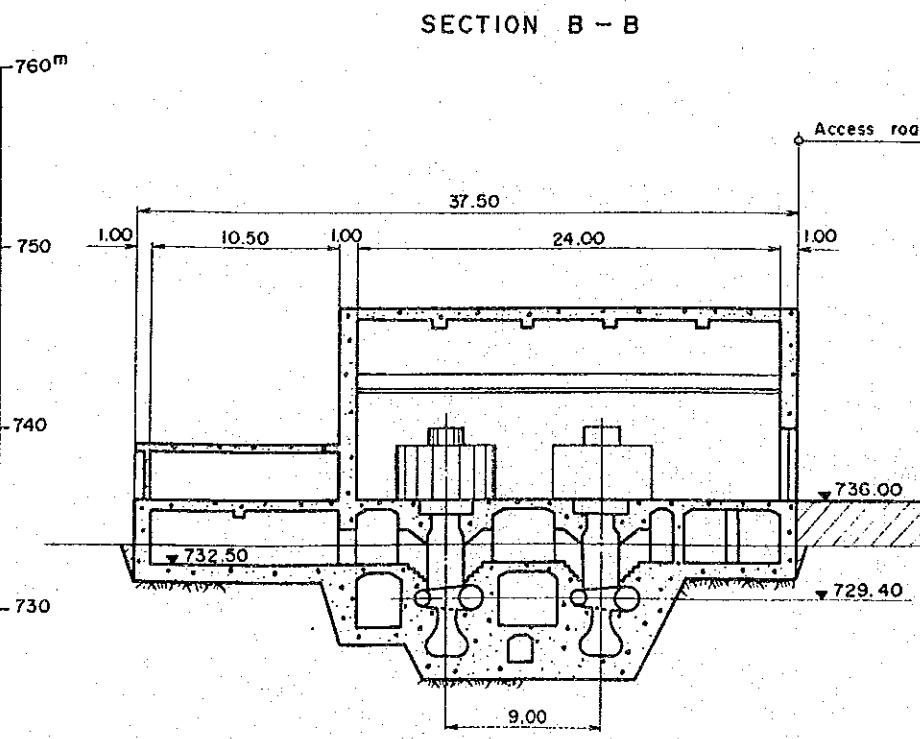
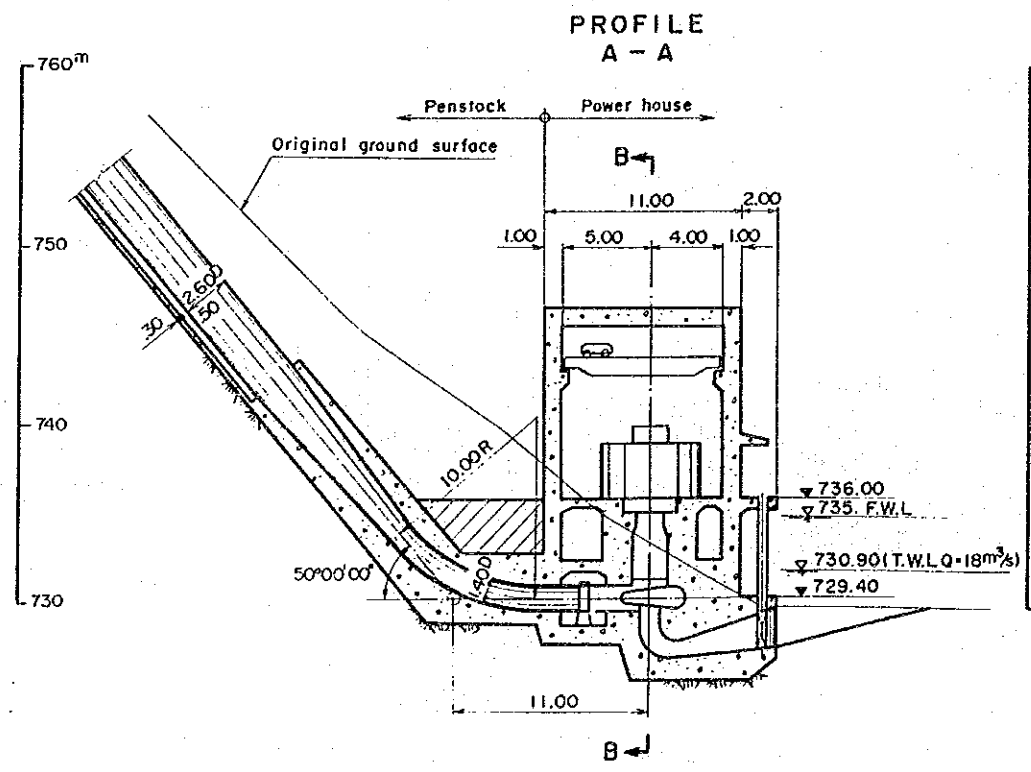
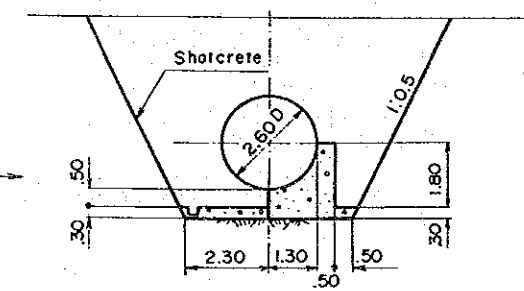
KIKULETWA NO.2 HYDROPOWER PROJECT

DAM, INTAKE, PLAN, UPSTREAM ELEVATION AND SECTION

DWG. No.8



PENSTOCK SECTION C-C



JAPAN INTERNATIONAL COOPERATION AGENCY
 KIKULETWA NO.2 HYDROPOWER PROJECT
 POWERHOUSE, PLAN, PROFILE AND SECTION
 DWG. No.9

