Table 7.2.1

* SYSTEM - G
* WATER REQUIREMENTS IN MILLIÓN CUBIC METERS
* IRRIGATION AREA : 6000 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	15	11	15	27	28	23	19	27	27	22	14	12	240	20
1951	1	10	16	21	22	23	19	24	21	17	3	4	181	15
1952	4	9	22	16	24	23	19	27	20	20	12	4	200	17
1953	7	13	19	7	29	23	18	22	25	16	4	5	188	16
1954	4	11	6	16	29	23	19	24	27	14	14	4	191	16
1955	4	11	20	16	28	23	19	27	21	24	17	13	223	19
1956	14	15	18	23	29	23	19	27	27	23	3	4	225	19
1957	11	0	22	27	27	23	19	27	24	6	3	4	193	16
1958	15	12	10	23	25	23	19	27	27	23	15	7	226	19
1959	20	18	22	21	25	20	19	27	27	16	3	4	222	19
1960	8	0	22	7	29	23	17	27	27	21	3	13	197	16
1961	10	8	11	23	29	23	19	27	27	17	3	4	201	17
1962	4	17	22	12	25	23	19	26	27	15	12	9	211	18
1963	4	6	19	7	29	23	19	27	27	19	3	4	187	16
1964	7	12	21	17	26	23	11	27	26	9	16	12	207	17
1965	18	3	16	13	22	23	19	22	27	10	3	4	180	15
1966	4	18	15	22	29	23	19	27	25	7	7	11	207	17
1967	23	11	21	19	29	23	19	27	27	6	3	13	221	18
1968	16	18	9	25	29	23	19	27	27	13	6	12	224	19
1969	12	13	22	20	29	23	19	18	27	12	15	4	214	18
1970	4	0	17	21	29	23	19	27	25	19	7	6	197	16
1971	10	8	16	16	29	23	19	19	27	22	15	0	204	17
1972	23	18	20	17	24	23	19	27	22	6	3	8	210	18
1973	23	13	22	27	29	23	19	27	26	15	6	4	234	20
1974	23	13	22	17	29	23	19	26	20	24	21	4	241	20
1975	18	14	12	25	28	23	15	27	27	24	8	8	229	19
1976	16	16	22	22	29	23	19	27	27	17	6	6	230	19
1977	17	18	21	27	28	23	19	27	24	11	6	7	228	19
TOTAL	335	316	500	534	767	641	517	721	711	448	231	190	5911	495
MEAN	12	11	18	19	27	23	18	26	25	16	8	7	211	18

Table 7.2.2

* GIRITALE TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
* IRRIGATION AREA ; 3000 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	10	11	2	4	8	15	16	11	2	5	6	8	98	8
1951	3	11	6	0	7	15	16	13	1	6	1	8	87	7
1952	3	12	6	1	9	15	16	13	0	4	7	8	94	8
1953	6	12	6	0	11	15	10	12	1	0	6	3	82	7
1954	6	13	7	0	11	15	14	13	3	3	7	3	90	8
1955	6	10	6	0	10	15	16	11	1	6	7	8	96	8
1956	9	12	6	2	11	14	16	13	3	1	3	5	95	8
1957	10	6	6	3	8	15	15	13	2	3	1	2	84	7
1958	7	10	4	3	10	15	16	9	2	5	5	7	93	8
1959	8	13	6	1	8	14	16	13	2	0	2	5	88	7
1960	5	3	6	0	5	15	12	13	0	3	1	10	73	6
1961	3	7	3	1	10	15	16	13	3	1	3	2	77	6
1962	8	11	5	2	10	15	16	11	0	4	5	7	94	8
1963	3	8	2	1	11	15	14	13	0	5	1	2	75	6
1964	9	10	4	4	8	15	14	13	2	3	8	9	99	8
1965	11	8	6	0	5	15	16	10	3	0	1	2	77	6
1966	8	13	3	1	11	15	16	12	0	0	1	7	87	7
1967	12	11	5	3	10	15	16	13	1	0	1	2	89	7
1968	9	13	3	3	11	15	16	11	0	3	5	7	96	8
1969	11	12	6	0	11	15	14	12	0	0	3	2	86	7
1970	10	7	6	0	9	15	16	11	2	6	3	3	88	7
1971	7	11	6	0	8	15	16	12	3	6	8	2	94	8
1972	11	13	6	1	7	15	16	13	0	0	1	4	87	7
1973	13	12	6	4	10	14	10	13	1	4	9	2	98	8
1974	13	12	6	2	7	15	16	13	1	7	8	2	102	9
1975	9	12	5	0	8	15	11	12	0	7	5	2	86	7
1976	12	13	6	0	11	15	16	13	3	6	2	2	99	8
1977	11	12	6	4	11	15	16	13	0	0	1	2	91	8
TOTAL	233	298	140	40	256	417	418	342	36	88	111	126	2505	207
MEAN	8	11	5	1	9	15	15	12	1	3	4	5	89	7

Table 7.2.3

* MINNERIYA TANK
* WATER REQUIREMENTS IN MILLIÓN CUBIC METERS
* IRRIGATION AREA : 9300 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	30	33	8	12	24	46	50	34	7	17	18	25	304	25
1951	9	32	19	1	21	46	50	40	2	17	3	24	264	22
1952	9	37	20	4	27	46	49	41	0	13	21	24	291	24
1953	20	37	20	0	33	46	31	36	4	0	19	7	253	21
1954	17	39	7	0	33	46	44	40	9	9	21	7	272	23
1955	18	31	18	0	31	46	50	34	2	19	22	24	295	25
1956	27	37	20	8	33	42	50	40	9	4	10	16	296	25
1957	32	19	20	10	25	46	46	40	6	8	3	7	262	22
1958	20	31	12	9	29	46	50	28	6	14	17	21	283	24
1959	26	39	20	4	25	44	50	41	6	0	5	16	276	23
1960	16	9	17	0	15	46	37	40	0	9	3	30	222	19
1961	9	22	8	3	30	46	50	41	8	2	8	7	234	20
1962	24	35	14	5	31	46	50	35	0	13	16	21	290	24
1963	9	24	6	4	33	46	44	41	0	14	3	7	231	19
1964	29	30	11	11	25	46	46	41	6	9	25	28	307	26
1965	33	26	20	0	15	46	50	32	9	0	3	7	241	20
1966	26	39	9	2	33	46	50	38	0	0	3	21	267	22
1967	38	33	14	8	31	46	50	41	4	0	3	7	275	23
1968	28	39	10	9	33	46	50	35	0	8	16	21	295	25
1969	34	36	20	0	33	46	42	37	0	0	11	7	266	22
1970	30	22	17	0	28	45	50	32	6	20	10	10	270	23
1971	21	33	18	0	24	46	49	37	9	17	24	7	285	24
1972	35	39	20	3	23	46	50	41	0	0	3	12	272	23
1973	39	37	18	11	30	42	31	41	2	13	27	7	298	25
1974	39	37	20	5	20	46	50	41	3	23	25	7	316	26
1975	29	37	16	0	23	46	33	36	0	21	14	7	262	22
1976	43	39	20	0	33	46	49	38	8	17	7	7	307	26
1977	34	38	17	12	32	46	48	39	0	0	3	7	276	23
TOTAL	724	910	439	121	773	1277	1299	1060	106	267	343	391	7710	646
MEAN	26	33	16	4	28	46	46	38	4	10	12	14	275	23

Table 7.2.4

* KANDULLA TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
* IRRIGATION AREA : 5500 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	17	20	4	7	14	27	29	20	4	10	11	15	178	15
1951	5	19	11	1	13	27	29	24	1	10	2	14	156	13
1952	5	22	12	3	16	27	29	24	0	8	13	14	173	14
1953	12	22	12	0	20	27	18	22	3	0	11	4	151	13
1954	10	23	4	0	20	27	26	24	5	5	13	4	161	13
1955	10	18	10	0	18	27	29	20	1	11	13	14	171	14
1956	16	22	12	4	20	25	29	24	5	2	6	9	174	15
1957	19	11	17	6	15	27	27	23	4	5	2	4	155	13
1958	12	19	7	5	17	27	29	17	4	8	10	12	167	14
1959	15	23	12	2	15	26	29	24	4	0	3	9	162	14
1960	10	5	10	0	9	27	22	24	0	5	2	18	132	11
1961	5	13	5	2	18	27	29	24	5	2	5	4	139	12
1962	14	21	8	3	18	27	29	21	0	7	10	12	170	14
1963	5	14	5	2	20	27	26	24	0	7	2	4	134	11
1964	17	18	7	7	15	27	26	24	3	5	15	16	180	15
1965	20	15	12	0	9	27	28	19	5	0	2	4	141	12
1966	15	23	5	1	20	27	29	22	0	0	2	12	156	13
1967	23	20	8	5	19	27	29	24	2	0	2	4	163	14
1968	17	23	6	5	20	27	29	21	0	5	9	12	174	15
1969	20	21	12	0	20	27	25	22	0	0	6	4	157	13
1970	18	13	10	0	16	26	29	19	4	12	6	6	159	13
1971	13	20	11	0	14	27	29	22	5	10	14	4	169	14
1972	21	23	12	2	13	27	29	24	0	0	2	7	160	13
1973	23	22	10	6	18	25	19	24	1	7	16	4	175	15
1974	23	22	12	3	12	27	29	24	2	14	15	4	187	16
1975	17	22	10	0	14	27	19	22	0	12	9	4	156	13
1976	23	23	12	0	20	27	29	23	5	10	4	4	180	15
1977	20	23	10	7	19	27	28	23	0	0	2	4	163	14
TOTAL	425	540	259	71	462	750	757	628	63	155	207	226	4543	381
MEAN	15	19	9	3	17	27	27	22	2	6	7	8	162	14

Table 7.2.5

* KANTALAI TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
(PADDY + UPLAND + SUGAR)
* IRRIGATION AREA ; 14300 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	43	40	38	32	19	44	71	44	32	26	10	20	439	37
1951	7	35	33	6	40	64	63	63	15	34	4	24	388	32
1952	7	50	43	7	39	64	64	67	32	46	15	33	467	39
1953	14	45	26	0	52	62	36	63	39	20	24	15	396	33
1954	10	45	23	10	50	64	44	47	35	14	28	5	375	31
1955	8	28	39	0	22	64	69	8	13	28	39	26	344	29
1956	27	46	43	15	51	49	58	53	21	1	2	29	395	33
1957	33	30	43	33	40	63	58	64	26	0	2	5	397	33
1958	37	42	17	15	50	64	64	31	29	20	30	28	427	36
1959	24	52	42	16	50	33	71	38	36	13	5	14	394	33
1960	16	12	39	0	42	64	33	67	32	27	2	41	375	31
1961	7	32	26	25	45	63	69	67	22	0	2	5	363	30
1962	14	45	39	15	33	64	68	61	28	25	21	13	426	36
1963	7	23	24	6	36	64	61	63	24	22	2	5	337	28
1964	35	50	13	27	50	64	45	41	44	7	19	35	430	36
1965	43	15	40	1	29	63	71	12	36	1	2	5	318	27
1966	15	47	28	7	52	64	70	21	21	0	2	24	351	29
1967	51	33	36	19	48	64	71	43	33	0	2	5	405	34
1968	27	54	16	13	48	63	71	50	16	29	2	8	397	33
1969	33	31	43	11	49	64	51	28	38	0	13	5	366	31
1970	23	21	33	9	34	62	71	54	25	31	3	25	391	33
1971	23	53	38	26	44	64	58	44	18	31	23	5	427	36
1972	51	48	40	27	41	56	64	67	3	0	13	18	428	36
1973	52	50	42	33	42	22	56	60	16	0	41	5	419	35
1974	55	47	43	12	30	64	57	60	22	47	34	8	479	40
1975	46	51	35	31	36	64	52	48	36	36	15	31	481	40
1976	52	54	43	24	52	56	55	51	26	25	10	5	453	38
1977	48	30	30	27	44	64	67	60	2	0	5	14	391	33
TOTAL	808	1109	955	447	1168	1680	1688	1375	720	483	370	456	11259	942
MEAN	29	40	34	16	42	60	60	49	26	17	13	16	402	34

Table 7.2.6

★ PARAKRAMA SAMUDRA TANK
★ WATER REQUIREMENTS IN MILLION CUBIC METERS
★ IRRIGATION AREA : 10100 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	32	40	8	13	32	50	54	38	9	16	22	26	340	28
1951	9	35	17	2	36	50	51	42	0	21	3	17	283	24
1952	9	33	20	3	29	50	51	44	1	10	21	21	292	24
1953	23	37	17	0	36	48	40	43	0	2	15	8	269	22
1954	16	36	4	5	36	50	48	40	10	8	21	8	282	24
1955	20	35	21	3	34	50	54	33	0	11	29	29	319	27
1956	33	39	18	5	36	42	54	41	10	6	9	14	307	26
1957	34	15	22	9	26	50	48	44	9	10	3	8	278	23
1958	26	36	14	8	32	50	54	31	9	7	17	8	292	24
1959	16	43	22	6	36	50	54	44	9	0	6	18	304	25
1960	18	10	16	0	22	50	43	44	8	17	13	31	272	23
1961	9	20	14	4	24	50	54	44	9	13	5	8	254	21
1962	25	39	17	6	31	50	54	44	0	11	19	22	318	27
1963	9	20	14	0	35	50	52	44	0	9	3	8	244	20
1964	29	24	0	8	35	50	46	42	5	19	25	28	311	26
1965	35	10	22	0	23	50	54	31	10	4	3	8	250	21
1966	21	43	9	0	36	50	54	35	7	0	3	18	276	23
1967	39	33	19	7	36	50	54	44	9	2	3	8	304	25
1968	32	43	12	6	36	50	54	44	9	9	9	23	327	27
1969	34	41	21	0	36	50	47	38	9	1	28	8	313	26
1970	27	16	22	0	25	43	54	36	8	6	3	12	252	21
1971	28	35	9	0	35	50	42	19	10	8	22	8	266	22
1972	41	43	22	2	25	50	54	44	0	0	3	8	292	24
1973	42	34	20	12	30	46	23	42	0	9	3	8	269	22
1974	42	40	21	1	32	50	54	44	0	25	20	20	349	29
1975	31	28	4	0	27	50	21	37	10	7	11	8	234	20
1976	23	43	22	10	36	48	54	39	1	15	3	8	302	25
1977	30	40	10	0	26	50	40	38	0	2	3	8	247	21
TOTAL	733	911	437	110	883	1377	1362	1109	152	248	325	399	8046	670
MEAN	26	33	16	4	32	49	49	40	5	9	12	14	287	24

Table 7.2.7 Irrigation Water Deficit Without Dam Condition
(Irrigable area 48,300 ha)

Million cu-m

YEAR	YALA SEASON			MAHA SEASON		
	IR/*	Deficit	% of Deficit	IR	Deficit	% of Deficit
1950	935	120.46	12.9	560	-	
1951	864	56.14	6.5	519	-	
1952	897	33.84	3.8	641	-	
1953	826	301.27	36.5	433	-	
1954	906	55.46	6.1	498	-	
1955	792	0.28	0.4	753	-	
1956	934	440.12	47.1	492	-	
1957	947	123.75	13.1	404	-	
1958	901	-	-	673	-	
1959	905	84.91	9.4	340	-	
1960	789	-	-	459	-	
1961	964	71.81	7.4	453	3.0	0.7
1962	903	7.45	0.8	441	-	
1963	885	41.26	4.7	443	-	
1964	913	73.16	8.0	641	11.41	1.8
1965	788	-	-	399	-	
1966	882	67.15	7.6	547	-	
1967	968	79.57	8.2	435	-	
1968	941	123.79	13.2	617	-	
1969	856	43.59	5.1	414	-	
1970	867	-	-	547	-	
1971	856	-	-	710	-	
1972	872	157.67	18.1	565	-	
1973	827	222.18	26.9	661	47.56	7.2
1974	874	285.15	32.6	718	73.04	10.2
1975	857	248.44	29.0	678	6.72	1.0
1976	888	424.54	47.8	578	-	
1977	905	83.79	9.3		-	
Total	24,742	3,145.78		1,461.9	141.73	
Average	883.6	112.3	12.7	522.1	5.2	

/* IR: Irrigation Requirements

Table 7.2.8

* SYSTEM - G
* WATER REQUIREMENTS IN MILLION CUBIC METERS
* IRRIGATION AREA : 6000 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	15	11	15	27	28	23	19	27	27	22	14	12	240	20
1951	1	10	16	21	22	23	19	24	21	17	3	4	181	15
1952	4	9	22	16	24	23	19	27	20	20	12	4	200	17
1953	7	13	19	7	29	23	18	22	25	16	4	5	188	16
1954	4	11	6	16	29	23	19	24	27	14	14	4	191	16
1955	4	11	20	16	28	23	19	27	21	24	17	13	223	19
1956	14	15	18	23	29	23	19	27	27	23	3	4	225	19
1957	11	0	22	27	27	23	19	27	24	6	3	4	193	16
1958	15	12	10	23	25	23	19	27	27	23	15	7	226	19
1959	20	18	22	21	25	20	19	27	27	16	3	4	222	19
1960	8	0	22	7	29	23	17	27	27	21	3	13	197	16
1961	10	8	11	23	29	23	19	27	27	17	3	4	201	17
1962	4	17	22	12	25	23	19	26	27	15	12	9	211	18
1963	4	6	19	7	29	23	19	27	27	19	3	4	187	16
1964	7	12	21	17	26	23	11	27	26	9	16	12	207	17
1965	18	3	16	13	22	23	19	22	27	10	3	4	180	15
1966	4	18	15	22	29	23	19	27	25	7	7	11	207	17
1967	23	11	21	19	29	23	19	27	27	6	3	13	221	18
1968	16	18	9	25	29	23	19	27	27	13	6	12	224	19
1969	12	13	22	20	29	23	19	18	27	12	15	4	214	18
1970	4	0	17	21	29	23	19	27	25	19	7	6	197	16
1971	10	8	16	16	29	23	19	19	27	22	15	0	204	17
1972	23	18	20	17	24	23	19	27	22	6	3	8	210	18
1973	23	13	22	27	29	23	19	27	26	15	6	4	234	20
1974	23	13	22	17	29	23	19	26	20	24	21	4	241	-20
1975	18	14	12	25	28	23	15	27	27	24	8	8	229	19
1976	16	16	22	22	29	23	19	27	27	17	6	6	230	19
1977	17	18	21	27	28	23	19	27	24	11	6	7	228	19
TOTAL	335	316	500	534	767	641	517	721	711	448	231	190	5911	495
MEAN	12	11	18	19	27	23	18	26	25	16	8	7	211	18

Table 7.2.9

* GIRITALE TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
* IRRIGATION AREA ; 3000 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	10	11	3	5	7	15	15	10	3	5	6	8	98	8
1951	3	11	6	1	6	15	15	13	1	5	1	8	85	7
1952	3	12	6	2	8	15	15	13	0	4	7	8	93	8
1953	6	12	7	0	11	15	8	11	2	0	6	2	80	7
1954	6	13	2	0	11	15	13	13	4	2	7	2	88	7
1955	6	10	6	0	10	15	16	11	1	6	7	8	96	8
1956	9	12	7	3	11	13	16	13	4	1	3	5	97	8
1957	10	6	7	4	8	15	14	13	3	2	1	2	85	7
1958	7	10	4	4	9	15	15	8	3	4	5	7	91	8
1959	8	13	7	2	8	14	15	13	3	0	2	5	90	8
1960	5	3	6	0	4	15	10	13	0	3	1	10	70	6
1961	3	7	3	1	10	15	15	13	3	1	3	2	76	6
1962	8	11	5	2	10	15	16	11	0	4	5	7	94	8
1963	3	8	2	2	11	15	13	13	0	4	1	2	74	6
1964	9	10	4	5	8	15	12	13	2	3	8	9	98	8
1965	11	8	7	0	4	15	15	10	4	0	1	2	77	6
1966	8	13	3	1	11	15	15	12	0	0	1	7	86	7
1967	12	11	5	3	10	15	16	13	2	0	1	2	90	8
1968	9	13	3	4	11	15	16	11	0	2	5	7	96	8
1969	11	12	7	0	11	15	12	12	0	0	3	2	85	7
1970	10	7	6	0	9	14	16	10	3	6	3	3	87	7
1971	7	11	6	0	8	15	15	12	4	5	8	2	93	8
1972	11	13	7	1	7	15	16	13	0	0	1	4	88	7
1973	13	12	6	4	10	13	8	13	1	4	9	2	95	8
1974	13	12	7	2	6	15	16	13	1	7	8	2	102	9
1975	9	12	5	0	7	15	9	11	0	6	4	2	80	7
1976	12	13	7	0	11	15	15	12	3	5	2	2	97	8
1977	11	12	6	5	11	15	14	13	0	0	1	2	90	8
TOTAL	233	298	150	51	248	414	391	336	47	79	110	124	2481	208
MEAN	8	11	5	2	9	15	14	12	2	3	4	4	89	7

Table 7.2.10

* MINNERIYA TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
* IRRIGATION AREA : 9300 HA.
(EXISTING AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	30	33	8	15	22	46	47	32	8	16	18	25	300	25
1951	9	32	19	2	19	46	47	39	3	16	2	11	245	20
1952	9	37	20	6	26	46	46	41	0	12	21	23	287	24
1953	20	37	20	0	34	46	25	35	6	0	18	7	248	21
1954	17	39	7	0	34	46	40	39	12	8	21	7	270	23
1955	18	31	18	0	31	46	48	33	2	18	21	24	290	24
1956	27	37	20	10	34	40	48	40	12	3	10	16	297	25
1957	32	19	20	12	24	46	42	39	8	7	2	7	258	22
1958	20	31	12	11	29	46	47	26	8	13	16	21	280	23
1959	26	39	20	6	24	42	47	41	8	0	4	16	273	23
1960	16	9	17	0	12	46	32	40	0	8	2	30	212	18
1961	9	22	8	4	30	46	47	41	10	2	8	7	234	20
1962	24	35	14	7	31	46	48	33	0	12	16	21	287	24
1963	9	24	6	5	34	46	40	40	0	13	2	7	226	19
1964	29	30	11	14	24	46	38	40	7	8	25	28	300	25
1965	33	26	20	0	12	46	47	29	12	0	2	7	234	20
1966	26	39	9	3	34	46	47	37	0	0	2	21	264	22
1967	38	33	14	10	31	46	48	41	5	0	2	7	275	23
1968	28	39	10	11	34	46	48	33	0	7	15	21	292	24
1969	34	36	20	1	34	46	38	36	0	0	10	7	262	22
1970	30	22	17	0	27	43	48	30	8	19	10	10	264	22
1971	21	33	18	0	23	46	46	36	11	16	23	7	280	23
1972	35	39	20	4	21	46	48	41	0	0	2	12	268	22
1973	39	37	18	13	30	39	26	41	3	12	27	7	292	24
1974	39	37	20	7	18	46	48	41	4	22	25	7	314	26
1975	38	39	20	1	34	46	46	38	11	16	6	7	302	25
1976	29	37	17	0	21	46	27	35	0	20	14	7	253	21
1977	34	38	17	15	33	46	44	39	0	0	2	7	275	23
TOTAL	719	910	440	157	760	1268	1203	1036	138	248	326	377	7582	633
MEAN	26	33	16	6	27	45	43	37	5	9	12	13	271	23

Table 7.2.11

* KAUDULLA TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
* IRRIGATION AREA : 14600 HA.
(INCLUDING EXTENSION AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	46	52	12	15	35	72	74	50	13	25	28	39	461	38
1951	13	51	30	3	30	72	74	62	5	25	4	37	406	34
1952	12	57	31	15	37	70	58	67	3	14	30	36	430	36
1953	31	59	32	0	60	70	0	49	15	0	26	10	352	29
1954	27	60	11	0	54	72	86	61	19	12	32	11	445	37
1955	28	48	28	0	48	70	64	44	8	24	30	37	429	36
1956	42	59	31	15	54	72	75	62	18	5	15	25	473	39
1957	50	30	31	19	37	72	66	65	13	11	4	11	409	34
1958	32	49	19	17	44	72	74	40	13	20	25	33	438	37
1959	40	62	31	9	37	72	74	64	13	0	6	25	433	36
1960	23	18	24	3	28	72	59	64	6	11	6	40	354	30
1961	18	39	15	8	47	72	75	30	10	5	15	15	349	29
1962	37	55	22	10	48	72	75	52	1	18	25	33	448	37
1963	13	38	9	8	53	72	63	63	0	21	4	11	355	30
1964	45	47	17	22	37	72	60	63	11	13	38	43	468	39
1965	52	40	31	0	19	72	74	46	19	0	4	11	368	31
1966	40	62	13	5	54	72	74	60	0	0	4	32	416	35
1967	60	52	22	16	49	72	74	64	9	0	4	11	433	36
1968	44	62	16	17	53	72	75	52	0	11	23	32	457	38
1969	53	56	31	1	53	72	60	57	0	0	16	11	410	34
1970	48	34	27	0	42	67	75	47	13	29	15	16	413	34
1971	33	52	29	0	36	71	71	57	17	25	37	11	439	37
1972	54	62	31	7	33	72	74	64	0	0	4	19	420	35
1973	61	57	28	21	47	61	40	63	5	18	42	11	454	38
1974	61	57	31	10	28	72	74	64	7	34	39	11	488	41
1975	45	57	26	1	34	72	42	55	1	31	22	11	397	33
1976	60	62	31	1	53	72	71	59	16	25	10	11	471	39
1977	53	60	27	24	51	72	69	60	0	0	4	11	431	36
TOTAL	1121	1437	686	247	1201	1993	1850	1584	235	377	512	604	11847	988
MEAN	40	51	25	9	43	71	66	57	8	13	18	22	423	35

Table 7.2.12

* KANTALAI TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
(PADDY + UPLAND + SUGAR)
* IRRIGATION AREA : 17000 HA.
(INCLUDING EXTENSION AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	53	50	43	39	23	77	83	51	35	29	13	24	520	43
1951	9	44	38	7	48	77	73	74	15	38	5	29	457	38
1952	9	61	49	8	47	77	74	79	34	52	19	40	549	46
1953	20	55	30	0	63	75	22	74	44	22	29	19	453	38
1954	13	56	27	12	61	77	69	55	38	16	34	7	465	39
1955	11	37	45	0	27	77	81	10	13	31	47	32	411	34
1956	36	57	49	18	62	59	67	62	21	1	3	35	470	39
1957	42	38	49	40	48	76	68	75	28	0	3	7	474	40
1958	46	52	20	18	61	77	74	35	31	22	36	35	507	42
1959	32	63	48	20	61	40	83	44	40	14	6	17	468	39
1960	22	17	45	0	51	77	37	79	35	29	3	49	444	37
1961	9	41	30	31	55	76	80	79	23	0	3	7	434	36
1962	19	56	45	18	39	77	79	72	30	28	25	16	504	42
1963	9	31	28	7	43	77	71	74	25	25	3	7	400	33
1964	44	61	15	32	61	77	51	48	49	8	38	42	526	44
1965	53	21	46	1	34	76	83	13	40	1	3	7	378	32
1966	20	57	32	9	63	77	82	23	21	0	3	30	417	35
1967	62	42	42	23	58	77	83	52	32	13	3	8	495	41
1968	36	65	19	16	58	77	83	58	16	33	3	10	474	40
1969	42	40	49	14	59	77	58	32	42	0	17	7	437	36
1970	30	29	38	10	41	75	83	63	26	34	3	30	462	39
1971	30	64	43	31	53	77	68	51	19	34	28	7	505	42
1972	62	59	46	33	49	67	74	79	3	0	17	22	511	43
1973	63	59	48	40	51	25	65	71	16	0	49	7	494	41
1974	66	57	49	14	35	77	66	71	23	53	40	10	561	47
1975	56	62	40	37	43	77	60	56	40	40	19	37	567	47
1976	63	65	49	28	63	68	55	60	28	28	13	7	527	44
1977	58	32	35	32	53	77	78	71	2	0	6	18	462	39
TOTAL	1015	1371	1097	538	1410	2023	1950	1611	769	551	471	566	13372	1116
MEAN	36	49	39	19	50	72	70	58	27	20	17	20	478	40

Table 7.2.13

* PARAKRAMA SAMUDRA TANK
* WATER REQUIREMENTS IN MILLION CUBIC METERS
* IRRIGATION AREA : 12300 HA.
(INCLUDING EXTENSION AREA)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	MEAN
1950	39	49	10	17	39	61	63	45	16	18	26	31	414	35
1951	11	42	21	4	45	61	58	51	0	24	3	21	341	28
1952	11	40	24	5	34	61	58	54	3	11	25	26	352	29
1953	28	45	21	0	46	56	41	52	0	2	18	9	318	27
1954	20	44	5	8	46	61	52	47	16	8	25	9	341	28
1955	24	43	26	5	41	61	63	32	0	12	34	30	371	31
1956	40	48	23	9	46	50	62	49	15	6	10	17	375	31
1957	41	18	26	13	31	61	53	53	15	11	3	9	334	28
1958	32	44	17	12	39	61	63	33	14	7	20	9	351	29
1959	23	52	26	10	44	60	63	52	15	0	7	22	374	31
1960	22	12	20	0	24	61	45	53	12	20	15	37	321	27
1961	11	24	17	7	27	60	63	54	15	15	5	9	307	26
1962	30	47	21	10	37	61	63	53	1	12	22	26	383	32
1963	11	25	17	0	42	61	58	54	0	10	3	9	290	24
1964	36	29	0	12	42	61	50	50	7	22	29	34	372	31
1965	42	12	26	0	25	60	63	34	16	4	3	9	294	25
1966	26	52	11	0	45	61	63	39	10	0	3	22	332	28
1967	47	41	23	11	45	61	63	54	15	2	3	8	373	31
1968	39	52	15	10	46	61	63	54	13	9	10	27	399	33
1969	42	50	26	0	46	61	52	44	13	1	34	9	378	32
1970	33	20	26	0	28	49	63	42	13	6	3	14	297	25
1971	34	43	11	1	44	61	44	19	16	8	25	9	315	26
1972	50	52	26	4	29	61	62	54	0	0	3	9	350	29
1973	52	41	24	18	35	53	23	50	0	10	3	9	318	27
1974	52	48	26	3	39	61	63	54	0	29	24	25	424	35
1975	37	35	5	0	32	61	21	43	16	7	13	9	279	23
1976	27	52	26	15	46	56	62	45	3	17	3	9	361	30
1977	31	49	12	0	30	61	42	45	0	2	3	9	284	24
TOTAL	891	1109	531	174	1073	1664	1539	1309	244	273	375	466	9648	805
MEAN	32	40	19	6	38	59	55	47	9	10	13	17	345	29

Table 7.2.14 Irrigation Water Deficit With Dam Condition (Irrigable area 62,200 ha, irrigation purpose only, without Kotmale)

Million cu-m

YEAR	YALA SEASON			MAHA SEASON		
	IR/*	Deficit	% of Deficit	IR	Deficit	% of Deficit
1950	1,184	-		725	-	
1951	1,096	-		669	-	
1952	1,131	-		826	-	
1953	984	263.99	26.8	561	-	
1954	1,199	-		647	-	
1955	991	-		959	-	
1956	1,208	444.11	36.8	637	-	
1957	1,208	330.66	27.4	525	-	
1958	1,143	-		868	-	
1959	1,163	-		436	-	
1960	1,008	-		586	-	
1961	1,195	-		593	-	
1962	1,149	-		568	-	
1963	1,122	-		575	-	
1964	1,159	-		850	-	
1965	995	-		519	-	
1966	1,124	-		709	-	
1967	1,242	-		579	-	
1968	1,203	-		802	-	
1969	1,082	-		546	-	
1970	1,089	-		702	-	
1971	1,085	-		910	-	
1972	1,109	-		726	-	
1973	1,036	39.02	3.8	868	48.39	5.6
1974	1,112	485.22	43.6	915	220.2	24.1
1975	1,054	396.43	37.6	874	0.88	0.1
1976	1,133	510.60	45.1	733	-	
1977	1,150	5.66	0.5		-	
Total	31,354	2,475.69		18,908	269.47	
Average	1,119.8	88.4	7.9	700.3	10.0	1.4

/* IR: Irrigation Requirements

Table 7.2.15 Summary of Water Balance Studies

1.	Case	Case a	Case b	Case c
2.	H.W.L.	MSL 200 m	MSL 195 m	MSL 188 m
3.	L.W.L.	MSL 175 m	MSL 170 m	MSL 154 m
4.	Total Capacity	1,110 million cu-m	900 million cu-m	658 million cu-m
5.	Effective Capacity	802 million cu-m	686 million cu-m	618 million cu-m
6.	Irrigable Area	62,200 ha	62,200 ha	62,200 ha
7.	Firm Power Potential	10 MW	6 MW	0
8.	Average Annual Power Output Installed Capacity			
	66 MW	183.0 GWH	- GWH	- GWH
	50 MW	179.7	-	-
	45 MW	178.5	-	-
	40 MW	176.9	159.6	-
	35 MW	174.7	157.7	-
	30 MW	170.8	154.7	-
	25 MW	162.2	148.9	-
	20 MW	144.3	135.4	-
	22 MW			104.4*
9.	Average Reservoir Water Level	MSL 190.60 m	MSL 184.77 m	MSL 173.77 m

* Generated under reservoir water level higher than MSL 165 m, and potential below this water level not counted because of limitation of turbine design.

Table 7.2.16 Results of Reservoir Operation Study When Impounding, Satisfying the Water Requirement from Existing Farm Land of 40,000 ha under the Project

No.	Commencement of storage	Time necessary up to L.W.L. (Month)	Reached at L.W.L.	Time necessary up to H.W.L. (Month)	Reached at H.W.L.
1	Oct. 1950	3	Jan. 1951	15	Jan. 1952
2	Oct. 1951	2	Dec. 1951	30	Apr. 1954
3	Oct. 1952	16	Jan. 1954	26	Jan. 1955
4	Oct. 1953	3	Jan. 1954	14	Dec. 1954
5	Oct. 1954	2	Dec. 1954	6	Apr. 1955
6	Oct. 1955	25	Nov. 1957	27	Jan. 1958
7	Oct. 1956	13	Nov. 1957	15	Jan. 1958
8	Oct. 1957	1	Nov. 1957	3	Jan. 1958
9	Oct. 1958	13	Nov. 1959	16	Feb. 1960
10	Oct. 1959	1	Nov. 1959	4	Feb. 1960
11	Oct. 1960	1	Nov. 1960	3	Jan. 1962
12	Oct. 1961	2	Dec. 1961	14	Dec. 1962
13	Oct. 1962	2	Dec. 1962	6	Apr. 1963
14	Oct. 1963	2	Dec. 1963	5	Mar. 1964
15	Oct. 1964	11	Oct. 1965	14	Jan. 1966
16	Oct. 1965	1	Nov. 1965	13	Nov. 1966
17	Oct. 1966	1	Nov. 1966	14	Dec. 1967
18	Oct. 1967	1	Nov. 1967	14	Dec. 1968
19	Oct. 1968	2	Dec. 1968	15	Jan. 1970
20	Oct. 1969	2	Dec. 1969	4	Feb. 1970
21	Oct. 1970	2	Dec. 1970	12	Oct. 1971
22	Oct. 1971	2	Dec. 1971	73	Oct. 1977
23	Oct. 1972	1	Nov. 1972	59	Oct. 1977
24	Oct. 1973	25	Dec. 1975	47	Oct. 1977
25	Oct. 1974	13	Dec. 1975	35	Oct. 1977
26	Oct. 1975	2	Dec. 1975	25	Oct. 1977
27	Oct. 1976	1	Nov. 1976	13	Nov. 1977
	Total	150		522	
	Mean	5.5		19.3	

Table 7.2.17 Results of Reservoir Operation Study when Impounding, Satisfying the Water Requirements from Beneficial Area of 62,200 ha under the Project

No.	Commencement of storage	Time necessary up to L.W.L. (Month)	Reached at L.W.L.	Time necessary up to H.W.L. (Month)	Reached at H.W.L.
1	Oct. 1950	3	Jan. 1951	51	Jan. 1955
2	Oct. 1951	2	Dec. 1951	39	Jan. 1955
3	Oct. 1952	16	Jan. 1954	31	Apr. 1955
4	Oct. 1953	3	Jan. 1954	18	Mar. 1955
5	Oct. 1954	2	Dec. 1954	39	Dec. 1957
6	Oct. 1955	25	Nov. 1957	28	Jan. 1958
7	Oct. 1956	13	Nov. 1957	16	Jan. 1958
8	Oct. 1957	1	Nov. 1957	4	Jan. 1958
9	Oct. 1958	13	Nov. 1959	17	Feb. 1960
10	Oct. 1959	1	Nov. 1959	5	Feb. 1960
11	Oct. 1960	1	Nov. 1960	28	Jan. 1963
12	Oct. 1961	2	Dec. 1961	16	Jan. 1963
13	Oct. 1962	2	Dec. 1962	7	Apr. 1963
14	Oct. 1963	2	Dec. 1963	28	Jan. 1966
15	Oct. 1964	13	Nov. 1965	39	Dec. 1967
16	Oct. 1965	1	Nov. 1965	27	Dec. 1967
17	Oct. 1966	1	Nov. 1966	40	Jan. 1970
18	Oct. 1967	1	Nov. 1967	28	Jan. 1970
19	Oct. 1968	2	Dec. 1968	16	Jan. 1970
20	Oct. 1969	2	Dec. 1969	5	Feb. 1970
21	Oct. 1970	2	Dec. 1970	12	Dec. 1971
22	Oct. 1971	2	Dec. 1971	74	Nov. 1977
23	Oct. 1972	1	Nov. 1972	62	Nov. 1977
24	Oct. 1973	25	Dec. 1975	50	Nov. 1977
25	Oct. 1974	13	Dec. 1975	38	Nov. 1977
26	Oct. 1975	2	Dec. 1975	26	Nov. 1977
27	Oct. 1976	1	Nov. 1976	14	Nov. 1977
	Total	152		758	
	Mean	5.6		28	

Table 7.3.1 Irrigation Dam and Power Schemes taken up in Optimal Scale Study

Description	Scheme No.	1	2	3	4	5	6
H.W.L. elevation	(m)		188		195		200
L.W.L. elevation			154		170		175
Effective capacity	(mcm)		606		686		802
Dam crest elevation	(m)						
First saddle dam			190.7		197.5		202.5
Main and 2nd Saddle dams			192.2		199.0		204.0
Power installation							
Nos. of unit-unit capacity	(MW)	None	1 - 22.5	1 - 26	2 - 20	1 - 28.5	2 - 33
Available power							
Dependable peak	(MW)	-	-	16.71	29.12	17.96	49.24
Dependable energy	(GWh/year)	-	-	66.53	66.53	93.13	93.13
Average energy	(")	-	105.10	150.16	159.71	168.33	182.76

Notes:

Scheme No.1: Irrigation Dam of minimum scale to meet irrigation requirements, without power installation, but with intake facilities for water release.

Scheme No.2: To harness potential obtained by Irrigation Dam. Power generation is planned to be made with irrigation water released at water level more than El.165 m. No dependable peak power nor energy are expected.

Scheme No.3: Maximum discharge of turbine is limited as much as to 56.6 m^3/s corresponding to maximum conveyance of existing Elahera-Minneriya Canal so that afterbay is not required.

Scheme No.4: Peak powerstation to be operated for not less than 4 hours (maximum scale conceivable). Afterbay pond, 2.45 mcm in net capacity shall be provided.

Scheme No.5: Maximum discharge of turbine is limited to 56.6 m^3 so that afterbay is not required.

Scheme No.6: Peak powerstation designed to be operated for not less than 4 hours. Afterbay of 3.14 mcm in net capacity shall be provided.

Table 7.3.2 APPROXIMATE COST OF DAM AND POWER STATION

(on 1978 December basis, unit in million Rupees)

Description	H.W.L. 188		H.W.L. 195		H.W.L. 200	
	Scheme No.1 NO POWER	Scheme No.2 22.5 MW	Scheme No.3 20.0 MW	Scheme No.4 40.0 MW	Scheme No.5 28.5 MW	Scheme No. 6 66.0 MW
LAND & RIGHT OF WAY	6.0	6.0	10.7	10.7	12.0	12.0
HIGHWAY RELOCATION	24.1	24.1	24.1	24.1	24.1	24.1
ADMINISTRATOR'S QUARTER	5.6	5.6	5.6	5.6	5.6	5.6
TOTAL	35.7	35.7	40.4	40.4	41.7	41.7
CONSTRUCTION WORKS						
Preparatory works	30.1	30.1	30.1	30.1	30.1	30.1
Care of river	60.9	60.9	60.9	60.9	60.9	60.9
Main dam	388.6	388.6	450.6	450.6	506.9	506.9
First saddle dam	309.7	309.7	425.6	425.6	495.8	495.8
Second saddle dam	88.7	88.7	134.1	134.1	166.5	166.5
Spillway & basin	97.6	97.6	100.2	100.2	101.9	101.9
Irrigation intake	12.0	12.0	-	-	-	-
Power intake	-	11.3	11.3	18.9	15.0	25.9
Powerhouse	-	56.2	56.2	62.4	58.2	68.6
Miscellaneous	6.9	6.9	6.8	6.8	6.8	6.8
SUB-TOTAL	994.5	1,062.0	1,275.8	1,289.6	1,442.1	1,463.4
CONTINGENCY	99.4	106.2	127.6	129.0	144.2	146.1
GENERATING EQUIPMENT	-	125.6	134.2	183.0	122.3	257.0
ADMINISTRATION & ENGINEERING	87.5	103.5	122.2	128.1	136.7	149.1
TOTAL	1,271.1	1,411.3	1,659.8	1,770.1	1,887.0	2,057.7
AFTERBAY WEIR	-	-	-	218.8	-	256.7
GRAND TOTAL	1,217.1	1,411.3	1,659.8	1,988.9	1,887.0	2,225.7
MILLION US$ EQUIVALENT OF TOTAL COST	81.14	95.31	111.99	132.59	125.80	134.29

NOTES: 1. No taxes and duties levied on [illegible]
2. No price escalation contingency [illegible]
3. Exchange rate applied [illegible]

Table 7.3.3 Tentative Financial Evaluation of Power Scheme

Scheme No.	2	3	4	5	6
H.W.L. & Power installation	188 m	195 m		200 m	
Description	22.5 MW	26	40	28.5	66
Present worth of total cost (million US$)					
Capital cost	6.58	22.72	35.24	32.60	57.65
O & M cost	0.84	1.71	2.57	2.10	3.55
Total cost	7.42	24.43	37.81	34.70	54.20
Present worth of total benefit (million US$)					
KW benefit	-	10.82	18.88	11.64	31.93
KWh benefit	8.93	16.89	17.73	19.95	21.23
Total benefit	8.93	27.71	36.61	31.59	53.16
Net benefit	1.51	3.28	-1.20	-3.11	-1.04
B/C ratio	1.20	1.13	0.97	0.91	0.98

Conditions:

1. Discount rate: 10 %, Base year: 1980, Period 50 years.
2. Economic life: 50 years for dam, intake, powerhouse and afterbay weir, 35 years for hydro-turbine, generator and transmission facilities and 25 years for alternative thermal plant.
3. Power benefit to be expected from 1987 while dam construction is planned to be commenced in 1981.
4. All secondary energy to come consumable in CEB system in 5 years after completion of hydropower plant.

Table 7.3.4 Cost-benefit Analysis for Stage Development

Stage	26 MW one unit	26 MW + 26 MW	26 MW (Future unit will not be installed)
Present worth of total cost (million US$)			
Capital cost	23.64	30.45	25.21
O & M cost	1.86	2.58	2.06
Total cost	25.50	33.03	27.27
Present worth of total benefit (million US$)			
kW benefit	11.50	18.61	11.50
kWh benefit	18.12	20.05	18.12
Total benefit	29.62	38.66	29.62
Net benefit	4.12	5.63	2.35
B/C ratio	1.16	1.17	1.09

Conditions;

1. Discount rate: 10 %, Base year: 1980, Period 50 years.
2. Economic life: 50 years for dam, intake, power house and afterbay weir, 35 years for hydro-turbine, generator and transmission facilities and 25 years for alternative thermal plant.
3. Power benefit to be expected from 1986 while dam construction is planned to be commenced in 1981.
4. All secondary energy to come consumable in CEB system in 5 years after completion of hydropower plant.

Table 7.3.5 Required Major Plant and Equipment

Main equipment	Capacity	Quantity
Concrete plant	1.5 m^3 x 3	1 set
Potable concrete plant	0.5 m^3 x 1	1 set
Crushing plant	200 t/h	1 set
Bulldozer	32 t	9 nos.
Bulldozer	21 t	15 nos.
Power shovel	1.2 m^3	8 nos.
Wheel loader	2 m^3	5 nos.
Dump truck	20 t	40 nos.
Ordinary truck	8 t	50 nos.
Crawler drill	15 m^3/m	24 nos.
Air compressor	34 m^3/m	12 nos.
Jib crane	14.5 t	2 nos.
Concrete pump	60 - 85 m^3/hr	1 no.
Agitator truck	3 m^3	4 nos.
Tamping roller	15 t	4 nos.
Vibrating roller	8 t	4 nos.
Pump dredger	600 ps	2 nos.
Fuel tanker	5,000 ℓ	18 nos.
Grout pump	7.5 kW	3 nos.
Grout pump	3.7 kW	8 nos.
Grout mixer	5.5 kW	11 nos.
Boring machine	5.5 kW	18 nos.
Diesel generator	750 kW	3 nos.
Water pump for water supply	ϕ200, 37 kW	6 nos.

Table 7.3.6 Main Construction Materials

Cement	100,000 tons
Reinforcement bars	1,500 tons
Structural steel	2,200 tons
Explosives	700 tons
Diesel (high speed diesel)	28,000 kl
Timber	8,200 m^3
Fine aggregate for concrete	150,000 m^3
Coarse aggregate for concrete	400,000 m^3

Table 7.3.7 Summary of Construction Cost of Moragahakanda Dam and Powerstation

(UNIT IN MILLION)

DESCRIPTION	CONSTRUCTION COST		
	YEN PORTION	RUPEE PORTION	TOTAL RUPEES
LAND AND RIGHT OF WAY		10.7	10.7
RELOCATION OF HIGHWAY		24.1	24.1
ADMINISTRATOR'S RESIDENCE & OFFICE		5.6	5.6
Sub-Total		40.4	40.4
CONSTRUCTION WORKS	15,062	262.4	1,421.1
1. Preparatory works	416	7.4	39.4
2. Care of river	549	7.9	50.1
3. Main dam	4,617	66.2	421.4
4. First saddle dam	4,297	97.2	427.7
5. Spillway & stilling basin	434	15.4	48.8
6. Intake structure & anchor blocks	29	1.4	3.6
7. Second saddle dam	1,210	12.1	105.2
8. Powerhouse & switchyard	547	16.2	58.3
9. Miscellaneous	75	0.6	6.4
10. Hydromechanical works	1,474	20.3	133.7
11. Generating equipment & transmission	1,414	17.7	126.5
PHYSICAL CONTINGENCIES	1,365	24.5	129.5
ENGINEERING & ADMINISTRATION	1,314	23.0	124.1
TOTAL	17,741	309.9	1,674.7
GRAND TOTAL	17,741	350.3	1,715.1
		(US$114.34 million)	

Table 7.3.8 DISBURSEMENT SCHEDULE OF INVESTMENT COST TO DAM AND POWERSTATION

(UNIT IN MILLION RUPEES)

CLASSIFICATION	1981	1982	1983	1984	1985
Civil, Metal and G/E cost including Physical Contaıngencies	110.1	320.6	308.8	443.3	367.7
Engineering Cost	38.8/1	22.4	22.3	22.3	22.4
Sub-Total	114.9	343.0	331.1	465.6	390.1
Land compensation & others	40.4	-	-	-	-
Total	185.3	343.0	331.1	465.6	390.1

Note: /1 : Including disbursement in earlier years

Remarks:

1. No conditions such as advance payment to the contractors, detention money and premiam of performance bond are considered herein.
2. Total of 1,715.1 million Rupees corresponds to estimated cost on 1978 price basis.

Table 7.4.1 Annual Energy Generation and Consumption (GWH)

Description	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Consumption										
Industries	272	302	329.2	373.2	436.2	466.4	477.2	519.2	513.6	515
Commercial	81	82	85.6	92.8	96.8	107.6	118.1	122.5	139.6	154
Bulk Supply for Local Authorities	138.5	151	167.1	180.4	193.1	198.4	201.9	226.3	237.3	257
Street Lighting	9.5	10	10.5	11.0	11.5	12.0	12.5	13	13.5	14.7
Domestic	55	59	62.5	64.6	72.5	81.5	82.6	85	93	104
Total	556	604	654.9	722	810.1	865.9	892.3	965	997	1,044.7
Generation	648	695	785.8	845.2	944.3	979.5	1,011.4	1,078.8	1,132.8	1,216.6
Transmission and Distribution Efficiency (%)	85.8	86.9	83.3	85.4	85.8	88.4	88.2	89.5	88.0	85.9
Peak Demand (MW)	134.7	146.7	163.1	173.4	185.3	198.8	215.6	218.9	240.3	261
Annual Load Factor (%)	53.1	54.1	55.0	55.6	58.2	56.2	53.6	56.3	53.8	53.2

Table 7.4.2 Installed Capacities of Hydropower Stations

Name of Power Station	Type of Development	Installed Capacity (MW)	Firm Peak output (MW)	Annual Energy Output (GWH) Firm	Mean
Old Laxapana	Pondage	50 (3x8.333, 2x12.5)	50	221	284.4
Wimalasurendra	Reservoir	50 (2x25)	50	99	101.4
Polpitiya	Pondage	75 (2x37.5)	75	420	420.
New Laxapana	Pondage	100 (2x50)	100	490	490.
Ukuwela	Run of river	40 (2x20)	20	180	226.
Udawalawe	Reservoir	5.94 (3x1.98)	-	-	7.67
Inginiyagala	Reservoir	11.25 (2x2.475, 2x3.15)	-	-	33.
Total		332.19	295	1,410	1,562.47

Udawalawe and Inginiyagala power station are operated according to the irrigation water requirements. And therefore their firm energies are not expected.

Table 7.4.3 Installed Capacities of Thermal Power Stations

Name of Power Station	Installed Capacity (MW)
Kelanitissa (Steam)	50 (2x25)
Chunnagam (Diesel)	13.6 (2x2.0, 3x1.11, 3x2.092)
Pettah (Diesel)	6.27 (3x2.092)
Total	69.87

Table 7.4.4 Hydropower Stations under Construction

Name of Power Station	Type of Development	Installed Capacity (MW)	Firm Peak Output (MW)	Annual Energy Output (GWH)	
				Firm	Mean
Bowatenna	Pondage	40 (1x40)	36	108	143
Canyon	Reservoir	30 (1x30)	28	144	169
Samanalawewa	Reservoir	120 (2x60)	111	420	600
Total		190	175	672	912

Table 7.4.5 Hydropower Stations under Planning

Name of Power Station	Type of Development	Installed Capacity (MW)	Firm Peak Output (MW)	Annual Energy Output (GWH)	
				Firm	Mean
Kotmale	Reservoir	150 (3x50)	117	380	411
Randenigala	"	75 (3x25)	58	264	350
Victoria	"	120 (4x30)	92	528	649
Moragahakanda	"	26 (1x26)	16	66.6	145
Total		371	283	1,238.6	1,555

Table 7.4.6 Promising Sites for Hydropower Development

Name of Site	Name of River	Capacity (MW)	Annual Firm Energy Output (GWH)
Taldena	Badulu Oya	14.5	48
Upper Uma Oya	Uma Oya	25.5	95.5
Lower Uma Oya	Uma Oya	30.	113.3
Maduru Oya	Maduru Oya	4.5	-
Kalu Ganga	Kalu Ganga	1.9	-
Pallewela	Loggol Oya	10.	34.5
Heen Ganga	Heen Ganga	7.1	25.5 (mean)

The Maduru Oya Project is the one of the five large projects in the Accelerated Mahaweli Ganga Development Programe.

Table 7.4.7 Power Demand Forecast

Year	Energy Consumption (GWH)	Energy Generation (GWH)	Maximum Demand (MW)
1978	1157	1322	274
79	1287	1471	305
1980	1428	1632	339
81	1579	1805	375
82	1742	1991	413
83	1918	2192	455
84	2107	2408	500
85	2311	2641	548
86	2530	2891	600
87	2766	3161	656
88	3021	3453	717
89	3295	3766	782
1990	3591	4104	852
91	3909	4467	927
92	4252	4859	1009
93	4622	5282	1096
94	5020	5737	1191
95	5449	6227	1293

Table 7.4.8 Balance of Peak Demand

Year	Peak Demand (MW)	Required Capacity (MW)	Firm Peak Capacity (MW)	Balance (MW)		
1978	274	324	364	40		
79	305	355	364	9		
80	339	390	399	9	Bowatenna	(35 MW)
81	375	431	427	-4	Canyon	(28 MW)
82	413	475	"	-48		
83	455	523	"	-96		
84	500	575	538	-37	Samanalawewa	(111 MW)
85	548	630	630	0	Victoria	(92 MW)
86	600	690	747	57	Kotmale	(117 MW)
87	656	754	763	9	Moragahakanda	(16 MW)
88	717	825	821	-4	Randenigala	(58 MW)
89	782	899	"	-78		
90	852	980	"	-159		
91	927	1,066	"	-245		

Table 7.4.9 Balance of Energy Demand and Firm Energy Supply

Year	Demand (GWH)	Available Energy Generation (GWH)			Balance (GWH)	Actual Thermal Generation (GWH)		
		Hydro	Thermal	Total				
1978	1,322	1,410	220	1,630	308	0		
79	1,471	1,410	"	"	159	61		
80	1,632	1,518	"	1.738	106	114	Bowatenna	(108 GWH)
81	1,805	1,662	"	1,882	77	143	Canyon	(144 GWH)
82	1,991	"	520	2,182	191	329	New Thermal	(300 GWH)
83	2,192	"	820	2,482	290	530	"	"
84	2,408	2,082	"	2,902	494	326	Samanalawewa	(420 GWH)
85	2,641	2,610	"	3,430	789	31	Victoria	(528 GWH)
86	2,891	2,990	"	3,810	919	0	Kotmale	(380 GWH)
87	3,161	3,056	"	3,876	715	105	Moragahakanda	(66 GWH)
88	3,453	3,320	"	4.140	687	133	Randenigala	(264 GWH)
89	3,766	"	"	"	374	446		
90	4,104	"	"	"	36	784		
91	4,467	"	"	"	-327	820		

Table 7.4.10 Balance of Annual Energy Demand and Mean Energy Supply

Year	Demand (GWH)	Available Energy Generation (GWH)			Balance (GWH)	Actual Thermal Generation (GWH)		
		Hydro	Thermal	Total				
1978	1,322	1,562	220	1,782	460	0		
79	1,471	"	"	1,782	311	0		
80	1,632	1,705	"	1,925	293	0	Bowatenna	(143 GWH)
81	1,805	1,874	"	2,094	289	0	Canyon	(169 GWH)
82	1,991	"	520	2,394	403	117	New Thermal	(300 GWH)
83	2,192	"	820	2,694	502	318	"	"
84	2,408	2,474	"	3,294	886	0	Samanalawewa	(600 GWH)
85	2,641	3,123	"	3,943	1,536	0	Victoria	(649 GWH)
86	2,891	3,534	"	4,354	1,463	0	Kotmale	(411 GWH)
87	3,161	3,679	"	4,499	1,338	0	Moragahakanda	(145 GWH)
88	3,453	4,029	"	4,849	1,396	0	Randenigala	(350 GWH)
89	3,766	"	"	"	1,083	0		
90	4,104	"	"	"	745	75		
91	4,467	"	"	"	382	438		
92	4,859	"	"	"	-10	820		
93	5,282	"	"	"	-433	820		

Table 7.4.11 Main Parameters of Scheme No.3

Reservoir water level:		
	maximum	195 m
	minimum	170 m
	mean	184.8 m
	operation	174.4 m
Tailrace water level:		
	At a discharge of 0 m^3/s	139.0 m
	At a discharge of 100 m^3/s	139.3 m
Maximum output		26 MW
Annual effective energy output		66.6 GWH
Annual mean energy output		145.1 "
Effective peak output		16.1 MW
Turbine:	No. of unit	1
	Design head	43 m
	Maximum discharge	56.6 m^3/s
	Speed	214.3 r.p.m.
Generator	No. of unit:	1
	Capacity	30.5 MVA
	Voltage	11 kV
	Speed	214.3 r.p.m.
Main transformer:		
	No. of unit	1
	Capacity	30.5 MVA
	Voltage	132/11 kV

Table 7.4.12 132 kV Transmission Line

Route length	about 16 km
No. of circuit	1
Voltage	132 kV
Conductor	ACSR (A 30/2.794 St 7/2.794)
Earth wire	Galvanized stranded steel (7/3.5)
Steel tower	Galvanized angle steel
Insulator string	11 pieces of 10" suspension insulator

Table 7.4.13 Annual Disbursement of Station Equipments (10^6Rs)

	1984	1985	Total
Equipment	71.69	21.69	93.38
Freight and insurance	2.89	0.88	3.77
Installation	1.18	4.73	5.91
Inland transportation	1.41	0.43	1.84
Installation	2.76	11.03	13.79
Total	79.93	38.76	118.69

Table 7.4.14 Annual Disbursement of the Line Cost (10^6Rs)

	1984	1985	Total
Survey and design	1.15	-	1.15
Materials (Tower, Conductor etc.)	-	4.18	4.18
Erection	-	0.74	0.74
Erection	-	1.74	1.74
Total	1.15	6.66	7.81

Table 7.4.15 Disbursement Schedule of the 26 MW Steam Power Station (10^6Rs)

	1983	1984	1985	Total
Generating equipment		151.82	26.8	178.62
Civil work	38.6	4.3	-	42.9
Erection	-	10.76	25.12	35.88
Total	38.6	166.88	51.92	257.40

Table 7.5.1

Proposed Project Area

(unit : ac)

System	Tanks or Canals (Head Work)	UNDP/FAO 1968 Report			1977 NOV MDV Report				Result of Field Survey by F/S Team							Proposed Area						
													Gross Area				Irrigable Area					
		Existing	New	Total	Existing	Unauthorised & Pol Comp.	New	Total	Existing under spec	Existing outside spec	Other sheme	New	Total	Existing	Other sheme	New	Total	Existing under spec	Existing outside spec	Other sheme	New	Total
G	Erahera-Minneriya Yoda Ela	4,800	6,200	11,000	4,800	6,200	-	11,000	4,800	-	10,000	-	14,800	8,000	21,200	-	31,200	4,800	-	10,000	-	14,800
	Giritale	4,400	-	4,400					6,200	1,300	-	-	7,500	11,200	-	-	11,200	6,200	1,300	-	-	7,500
	Minneriya	14,325	-	14,325					13,500	4,500	-	-	18,000	26,300	-	-	26,300	13,500	4,500	-	-	18,000
	Kaudulla	10,230							10,500	2,500	-	22,400	35,400	25,600	-	55,700	81,300	10,500	2,500	-	22,400	35,400
	Kantalai				49,400	13,800	28,000	91,200														
D_1	Vendarasan Kulam	22,230	29,200	61,660					20,800	3,100	9,500 1,000	-	34,400	42,800	18,700	-	61,500	20,800	3,100	10,500	-	34,400
	Paravipan-cham																					
	Galamuna Ani (Minneri Oya	-	-	-					3,300	1,700	-	-	5,000	6,500	-	-	6,500	3,300	1,700	-	-	5,000
	Kahambiliya Oya Ani	-	-	-					500	100	-	-	600	1,100	-	-	1,100	500	100	-	-	600
	Wan Ela	-	-	-					1,000	100	-	-	1,100	2,200	-	-	2,200	1,000	100	-	-	1,100
	Sub-Total	51,185	29,200	80,385	49,400	13,800	28,000	91,200	55,800	13,300	10,500	22,400	102,000	115,700	18,700	55,700	190,100	55,800	13,300	10,500	22,400	102,000
D_2	Parakrama Samudra	18,200	9,100	27,300	19,000	-	9,100	28,100	19,600	5,400	-	5,400	30,400	42,000	-	12,000	54,000	19,600	5,400	-	5,400	30,400
A/D	Kantalai	-	-	-	-	-	9,100	9,100	-	-	2,500	4,100	6,600	-	-	14,400	14,400	-	-	-	6,600	6,600
	Total	74,185	44,500	118,685	73,200	20,000	46,200	139,400	80,200	18,700	23,000	31,900	152,800	165,700	41,900	82,100	289.700	80,200	18,700	20,500	34,400	153,800

Table 7.5.2 Monthly Mean Diversion Requirement under the Project

(Unit: ac.ft)

Tank	Irrigable Area (ac)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Parakrama Samudra	30,400	25,755	32,109	15,426	4,979	32,259	48,034	44,526	37,914	6,671	7,870	10,953	13,550	279,134
Minneriya	23,000	19,734	26,421	12,745	4,520	22,051	36,642	34,796	30,002	4,101	7,158	9,530	10,629	219,507
Giritale	7,500	6,754	8,616	4,156	1,474	7,190	11,985	11,346	9,428	1,337	2,334	3,108	3,648	69,595
Kaudulla	36,000	32,419	39,819	19,938	7,113	34,816	57,028	53,534	45,885	6,822	10,968	14,794	17,365	342,223
Kantalai (Paddy)	24,200	22,253	28,596	14,743	6,128	25,365	37,738	36,314	28,082	3,582	7,452	9,915	11,632	231,798
Kantalai (Sugar)	17,900	7,109	11,552	16,941	9,507	15,488	20,868	20,181	18,570	18,809	8,461	3,616	4,761	136,758
System G	14,800	9,600	9,120	14,400	15,386	22,113	18,227	15,127	20,846	20,355	12,929	7,204	5,607	170,534
Total	153,800													1,449,549

Table 7.5.3 Success Percentage and Irrigable Area without and with Project

		Without Project (Post-Polgolla)		With Project
		Existing	Post-Polgolla (after improvement of inflastructures)	
Success Percentage		84.2%	82.9%	90.5%
Irrigable Area	Existing D_1 & D_2	94,100 ac	94,100 ac	94,100 ac
	" G	4,800 "	4,800 "	4,800 "
	New land G	-	10,000 "	10,000 "
	" Sugar Estate	-	(9,500 " 1,000 "	(9,500 " 1,000 "
	" D_1	-	-	22,400 "
	" D_2	-	-	5,400 "
	" A/D	-	-	6,600 "
	Total	98,900 ac	119,400 ac	153,800 ac

Table 7.5.4 Summary of Construction Cost of Downstream Development

Unit 1000 Rs

Item	Total	Foreign	Local
A. Civil Works	403,959	157,387	246,572
1. Existing Land (Improvements)			
Existing canal	21,203	8,576	12,447
Rehavilitation on farm	120,280	36,532	83,748
Angamedilla Anicat	22,531	13,374	9,157
Sub. Total	164,014	58,662	105,352
2. New Land (Development)			
Preparatory works	15,360	7,680	7,680
Diversion works (A/D)	37,256	25,941	11,315
Irrigation canal	46,635	26,543	20,092
Drainage canal	17,323	3,709	13,614
Land development	123,371	34,852	88,519
Sub. Total	239,945	98,725	141,220
B. Construction Machinery	271,533	175,744	95,789
1. Existing Land	14,681	9,716	4,965
2. New Land	256,852	166,028	90,824
C. Land Settlement (Only new land)	68,800	34,400	34,400
D. Engineering, Administration (A+B+C) x 10%	74,428	44,656	29,772
1. Existing Land	17,869	10,721	7,148
2. New Land	56,559	33,935	22,624
E. Physical Contingency (A-D) x 10%	81,871	41,219	40,652
1. Existing Land	19,656	7,910	11,746
2. New Land	62,215	33,309	28,906
Total	900,591	453,406	447,185
(Existing Land	216,220	87,009	129,211
New Land	684,371	366,397	317,974

Table 7.5.5 Annual Disbursement of Cost

Unit: 1000 Rs

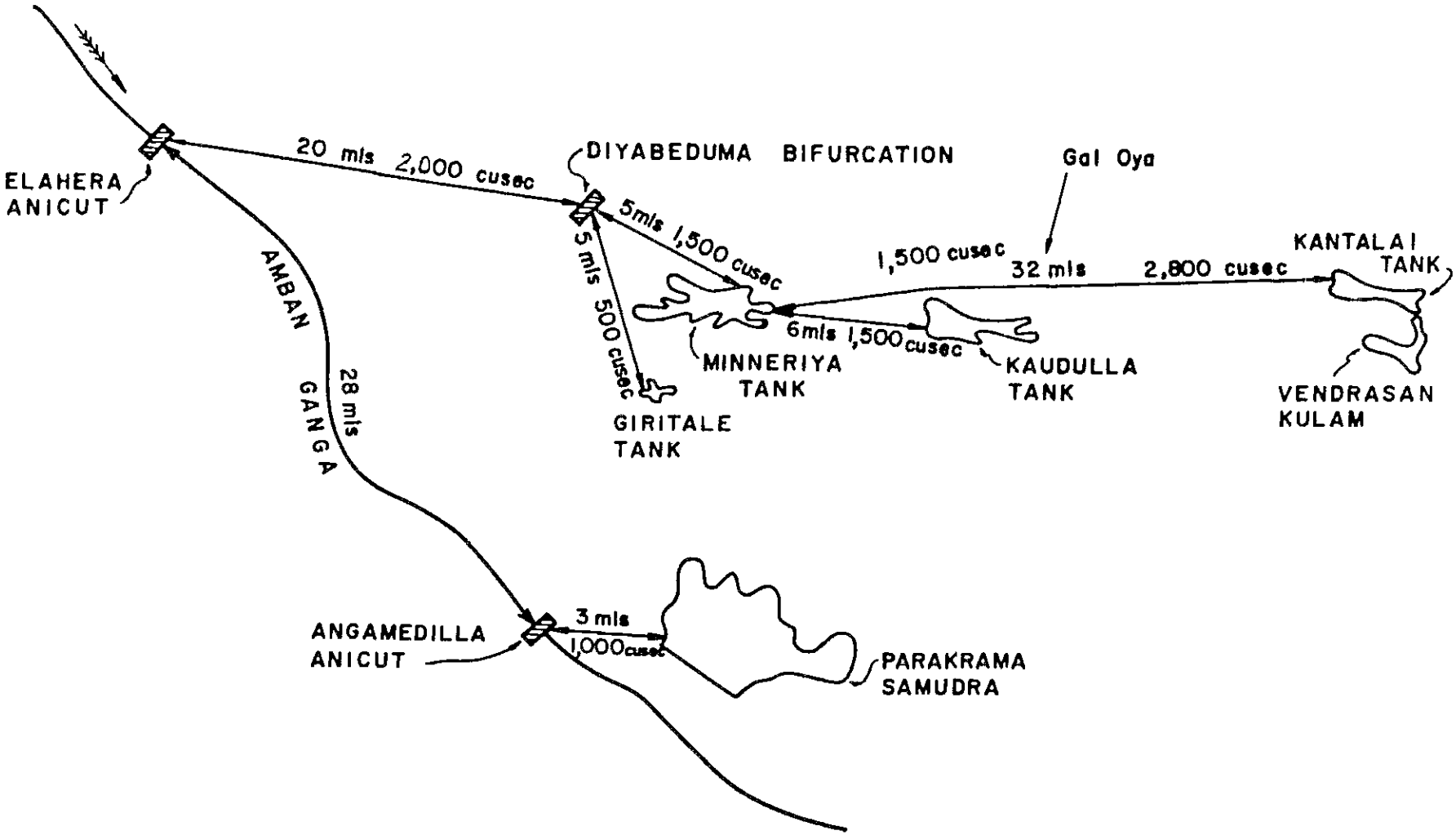
Item	Cost	Year 1980	1981	1982	1983	1984	1985	1986	1987	1988
Detailed Design	34,000	14,000	20,000							
	(F/C 25,000	(10,000	(15,000							
	(L/C 9,000	(4,000	(5,000							
Machinery & Equipment	271,533			85,380	100,082	21,518	21,518	21,518	16,138	5,379
	(F/C 175,744			(80,590	(85,714	(2,360	(2,360	(2,360	(1,770	(590
	(L/C 95,789			(4,790	(14,368	(19,158	(19,158	(19,158	(14,368	(4,789
Existing Land Improvement	164,014			8,746	49,204	49,205	56,859			
	(F/C 58,662			(4,425	(17,600	(17,600	(19,037			
	(L/C 105,352			(4,321	(31,604	(31,605	(37,822			
New Land Development	239,945			15,360	23,623	51,382	55,107	40,205	40,199	14,069
	(F/C 98,725			(7,680	(13,759	(21,601	(24,196	(13,819	(13,814	(3,856
	(L/C 141,220			(7,680	(9,864	(29,781	(30,911	(26,386	(26,385	(10,213
Land Settlement	68,800						17,200	17,200	17,200	17,200
	(F/C 34,400						(8,600	(8,600	(8,600	(8,600
	(L/C 34,400						(8,600	(8,600	(8,600	(8,600
Engineering Survies Supervision	40,428			5,778	5,775	5,775	5,775	5,775	5,775	5,775
	(F/C 19,656			(2,808	(2,808	(2,808	(2,808	(2,808	(2,808	(2,808
	(L/C 20,772			(2,970	(2,967	(2,967	(2,967	(2,967	(2,967	(2,967
Sub Total	818,720	14,000	20,000	115,264	178,684	127,880	156,459	84,698	79,312	42,423
	(F/C 412,187	(10,000	(15,000	(95,503	(119,881	(44,369	(57,001	(27,587	(26,992	(15,854
	(L/C 406,533	(4,000	(5,000	(19,761	(58,803	(83,511	(99,458	(57,111	(52,320	(26,569
Physical Contingency	81,871	1,400	2,000	11,526	17,868	12,788	15,645	8,470	7,931	4,243
	(F/C 41,219	(1,000	(1,500	(9,550	(11,988	(4,437	(5,700	(2,759	(2,699	(1,586
	(L/C 40,652	(400	500	(1,976	(5,880	(8,351	(9,945	(5,711	(5,232	(2,657
Total	900,591	15,400	22,000	126,790	196,552	140,668	172,104	93,168	87,243	46,666
	(F/C 453,406	(11,000	(16,500	(105,053	(131,869	(48,806	(62,701	(30,346	(29,691	(17,440
	(L/C 447,185	(4,400	(5,500	(21,737	(64,683	(91,862	(109,403	(62,822	(57,552	(29,226

Table 7.5.6

C.I.F. Prices (Dec. 1978 of Machinery and Equipment

Equipment & Machinary	Size & Capacity	Quantity	C.I.F. Prices	Amounts
1. Crawler Tractor	180 to 200 H.P.	6	95,000	570,000
2. - do -	300 H.P.	16	150,000	2,400,000
3. Attachments to Crawler Tractor				
a. Straight Blade Dozer	Av for both classes of Tract	14	13,000	182,000
b. Ripper	"	6	17,600	105,600
c. Pusher Cup		1	3,900	3,900
d. Sheep Foot Roller	Twin drum	2	8,500	17,000
4. Motorized Scraper	14/20 cu. yd.	1	165,000	165,000
5. Water Truck with Sprinkler	1200 gls	2	25,000	50,000
6. Crawler Mounted Crane (15T) with Drag Line Bucket	3/4 cu. yd.	17	115,000	1,955,000
7. Rear Dump	15 T	3	50,000	150,000
8. Farm Tractor (60H.P.) with Trailer (5T)		3	8,000	24,000
9. Lorry	5T	1	13,000	13,000
10. Motor Grader	120 to 150 H.P.	2	80,000	160,000
11. Air Compressor	600 C.F.M.	5	20,000	100,000
12. - do -	365 C.F.M.	5	17,000	85,000
14. Pneumatic Jack Hammers	50 lb.	5	500	2,500
15. Wheeld Crushing and Screening Plant	1/2" to 2.1/2"	1	33,800	33,800
16. Concrete Mixer	14/10 cft.	9	9,000	81,000
17. Engine Mounted Vibrator		18	725	13,050
18. Road Roller	8 to 10T	1	22,500	22,500
19. Front End Loader	130 H.P.	2	50,000	100,000
Total				$6,233,350 Rs93,500,250

Fig. 7.2.1 Existing Canal Layout



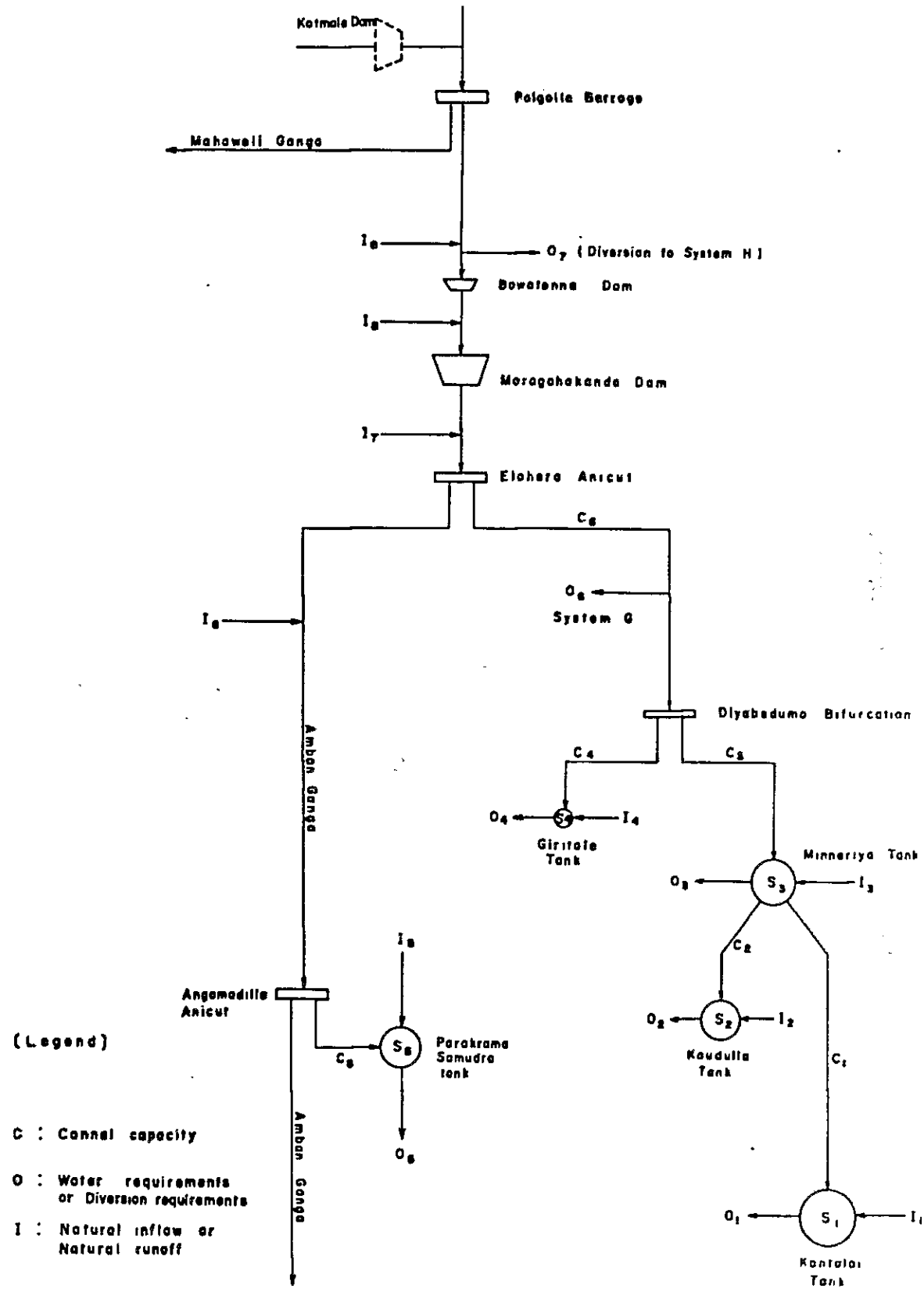
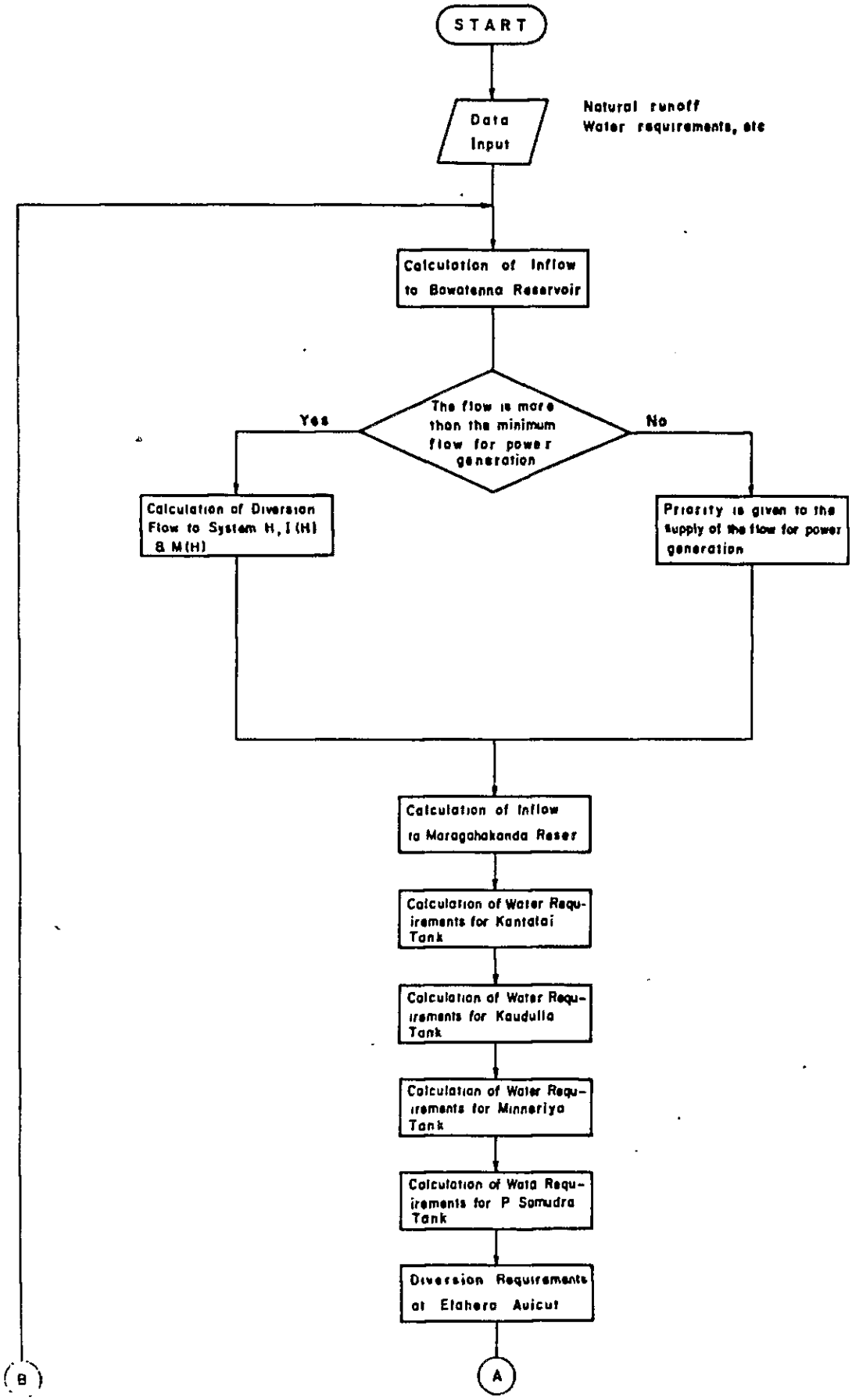


Fig. 7.2.2 Flow Diagram

Fig. 7.2.3 Flow Chart of Computation Procedures



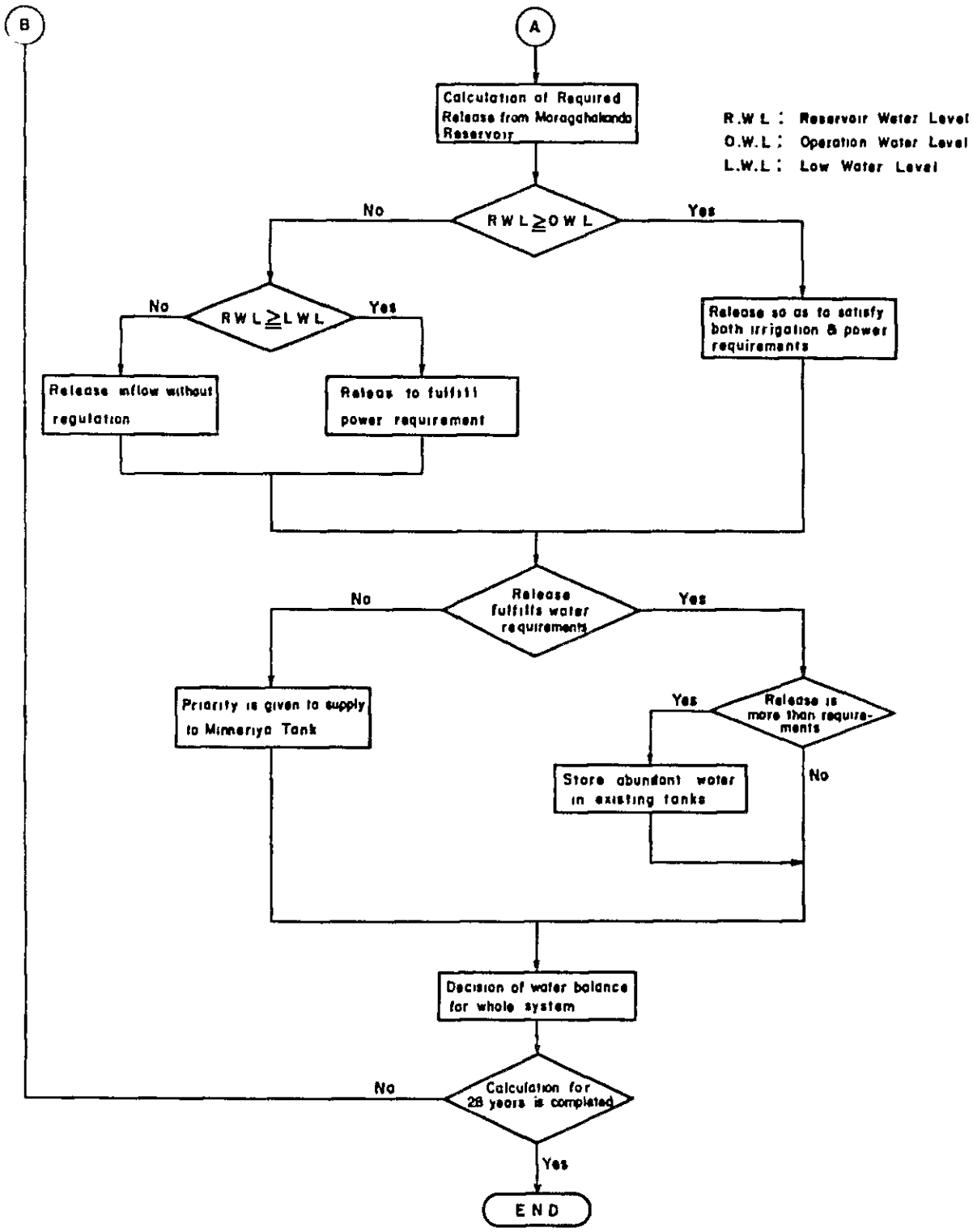

B
A
Calculation of Required Release from Moragahakanda Reservoir
R.W.L : Reservoir Water Level
O.W.L : Operation Water Level
L.W.L : Low Water Level
No
R W L ≧ O W L
Yes
No
R W L ≧ L W L
Yes
Release so as to satisfy both irrigation & power requirements
Release inflow without regulation
Releas to fulfill power requirement
No
Release fulfills water requirements
Yes
Priority is given to supply to Minneriya Tank
Yes
Release is more than requirements
No
Store abundant water in existing tanks
Decision of water balance for whole system
No
Calculation for 28 years is completed
Yes
END

Fig 7.2.4 RULE CURVE

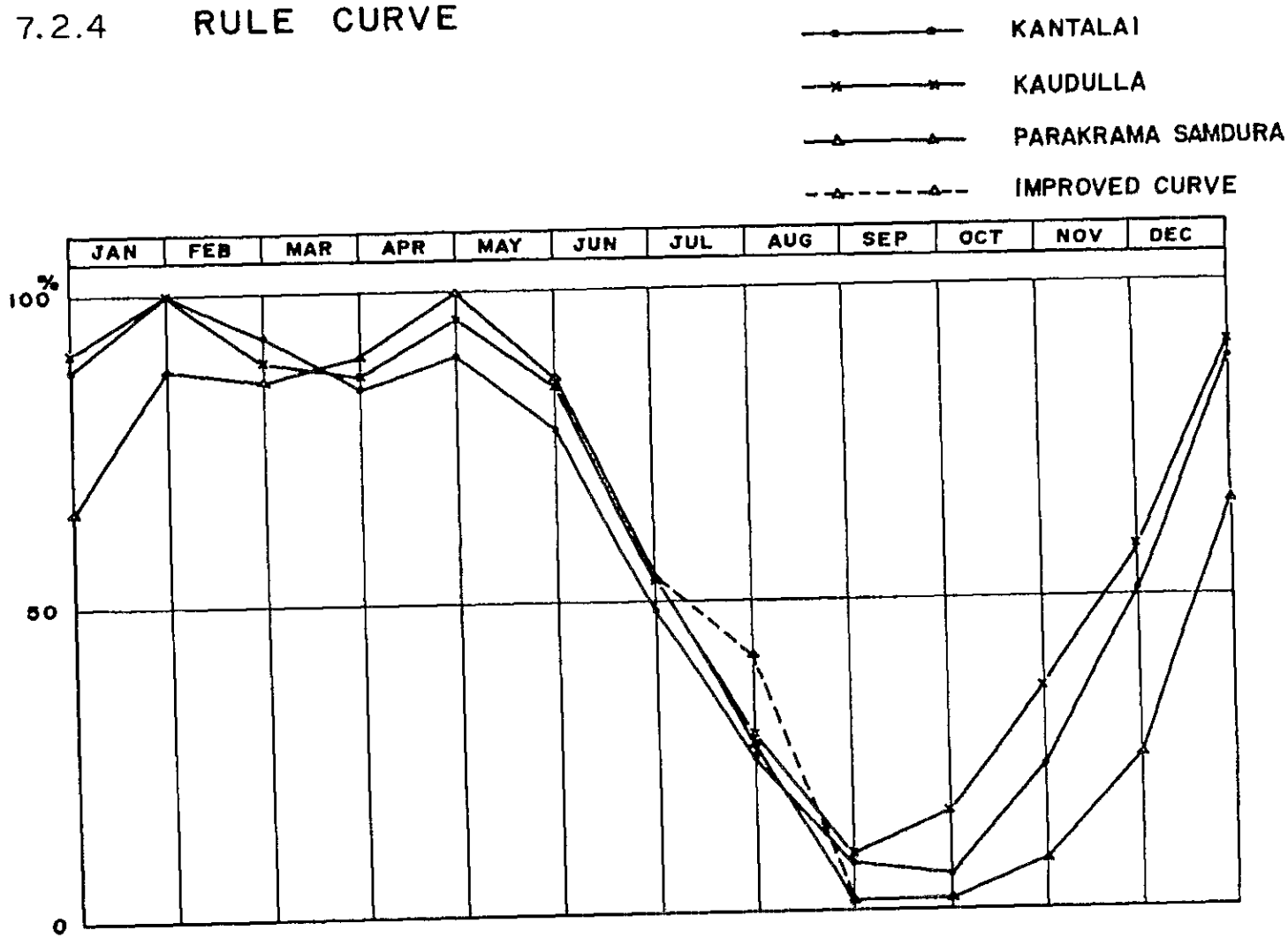
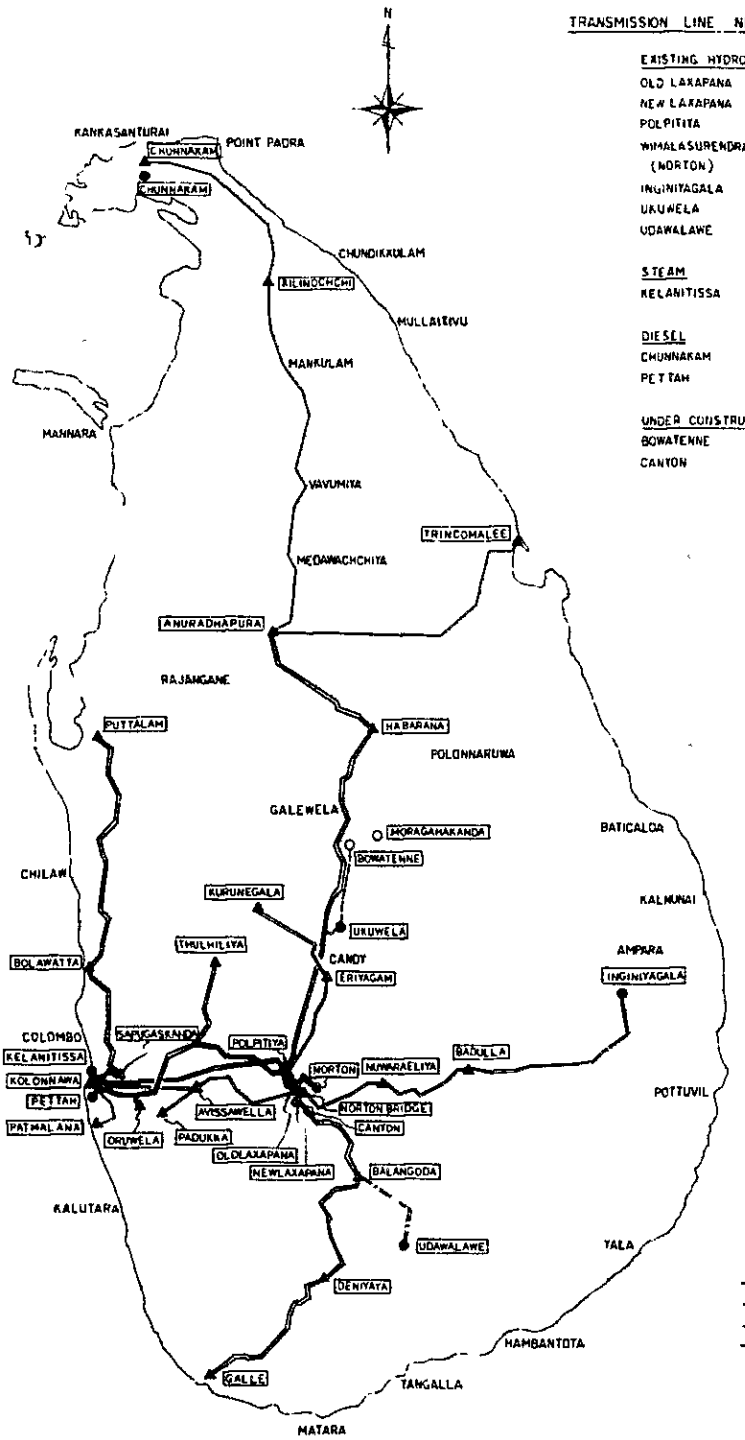


Fig 7.4.1

TRANSMISSION LINE NETWORK



EXISTING HYDRO

OLD LAXAPANA	49 9MW
NEW LAXAPANA	100 0MW
POLPITIYA	75 0MW
WIMALASURENDRA (NORTON)	50.0MW
INGINITAGALA	11 25MW
UKUWELA	40 0MW
UDAWALAWE	5 94MW

STEAM

KELANITISSA	50 0MW

DIESEL

CHUNNAKAM	13 6MW
PETTAH	6 27MW

UNDER CONSTRUCTION HYDRO

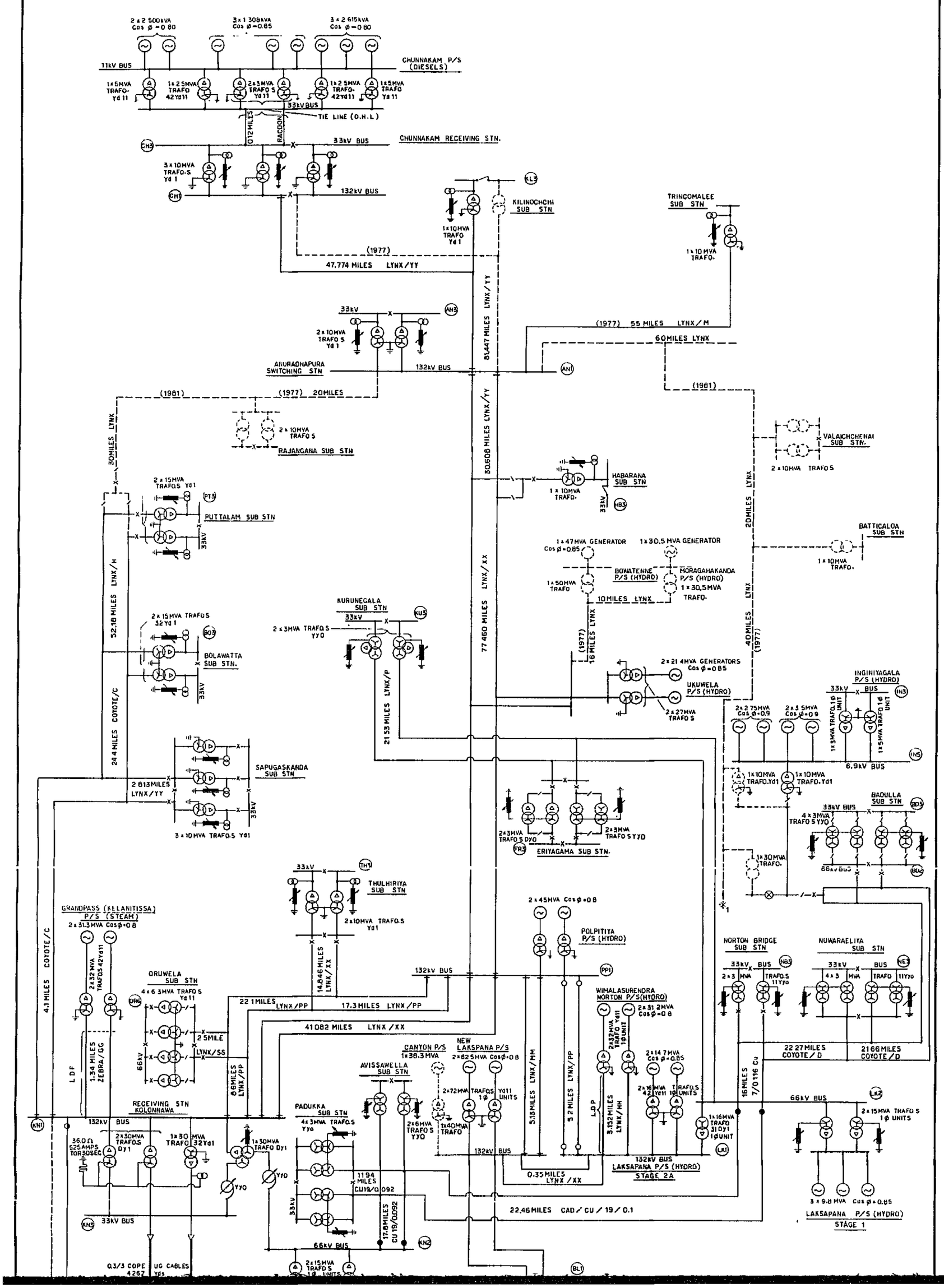
BOWATENNE	40 0MW
CANYON	30 0MW

LIST OF SUBSTATION

CHUNNAKAM	30 MVA
KILINOCHCHI	10 MVA
ANURADHAPURA	20 MVA
PUTTALAM	30 MVA
BOLAWATTA	30 MVA
SAPUGASKANDA	30 MVA
KOLONNAWA	120 MVA
ORUWELA	25 2MVA
THULHIYA	20 MVA
BATMALANA	30 MVA
BALANGODA	10 MVA
DENIYATA	10 MVA
GALLE	30 MVA
KURUNEGALA	12 MVA
BADULLA	12 MVA
NUWARAELIYA	12 MVA
NORTON BRIDGE	6 MVA

LEGEND

- POWER STATION
- POWEP ST.(UNDER CONSTRUCTION)
- GRID SUBSTATION
- 132kV TRNSMISSION LINE
- 66kV — DITTO —
- 33kV — DITTO —
- 132kV — DITTO — (UNDER CONSTRUCTION)


2 x 2 500kVA Cos ø =0 80
3 x 1 308kVA Cos ø =0.85
3 x 2 615kVA Cos ø =0 80
11kV BUS
CHUNNAKAM P/S (DIESELS)
1x5MVA TRAFO Yd 11
1x2 5MVA TRAFO 42Yd11
2x3MVA TRAFO S Yd 11
1x2 5MVA TRAFO 42Yd11
1x5MVA TRAFO Yd 11
33kV BUS
TIE LINE (O.H.L)
0 12 MILES
RACOON
CHUNNAKAM RECEIVING STN.
CH3
33kV BUS
3 x 10MVA TRAFO S Yd 1
CH1
132kV BUS
KL3
KILINOCHCHI SUB STN
1x10MVA TRAFO Yd 1
(1977)
47.774 MILES LYNX/YY
TRINCOMALEE SUB STN
1 x 10 MVA TRAFO.
(1977) 55 MILES LYNX/M
60MILES LYNX
33kV
AN3
2 x 10MVA TRAFO S Yd 1
ANURADHAPURA SWITCHING STN
132kV BUS
AN1
81.447 MILES LYNX/YY
(1981)
(1977) 20MILES
2 x 10MVA TRAFO S
RAJANGANA SUB STN
30MILES LYNX
2 x 15MVA TRAFO S Yd 1
PT3
PUTTALAM SUB STN
33kV
30.608 MILES LYNX/YY
HABARANA SUB STN
1 x 10MVA TRAFO.
33kV
HB3
VALAICHCHENAI SUB STN.
2 x 10MVA TRAFO S
1 x 47MVA GENERATOR Cos ø =0.85
1 x 30.5 MVA GENERATOR
BOWATENNE P/S (HYDRO)
1 x 50MVA TRAFO
MORAGAHAKANDA P/S (HYDRO)
1 x 30.5MVA TRAFO.
10MILES LYNX
20MILES LYNX
BATTICALOA SUB STN
1 x 10MVA TRAFO.
52.18 MILES LYNX/H
2 x 15MVA TRAFO S 32 Yd 1
BO3
BOLAWATTA SUB STN.
33kV
24 4 MILES COYOTE/C
KURUNEGALA SUB STN
33kV
KU3
2 x 3MVA TRAFO S YYO
77 460 MILES LYNX/XX
21 53 MILES LYNX/P
(1977) 16 MILES LYNX
40MILES LYNX (1977)
2 x 21 4MVA GENERATORS Cos ø =0 85
UKUWELA P/S (HYDRO)
2 x 27MVA TRAFO S
INGINIYAGALA P/S (HYDRO)
33kV BUS
IN3
2 x 2 75MVA Cos ø =0.9
2 x 3 5MVA Cos ø =0 9
1 x 3MVA TRAFO 1 Ø UNIT
1 x 5MVA TRAFO 1 Ø UNIT
IN5
6.9kV BUS
1x10MVA TRAFO Yd1
1x10MVA TRAFO Yd1
BADULLA SUB STN
BD3
33kV BUS
4 x 3MVA TRAFO S YYO
66kV BUS
BDK
1 x 30MVA TRAFO.
2 x 3MVA TRAFO S Dyo
2 x 3MVA TRAFO S YYO
FR3
ERIYAGAMA SUB STN.
33kV
TH3
THULHIRIYA SUB STN
2 x 10MVA TRAFO S Yd1
2 x 45MVA Cos ø =0 8
POLPITIYA P/S (HYDRO)
PP1
132kV BUS
NORTON BRIDGE SUB STN
33kV BUS
NB3
2 x 3 MVA TRAFO S 11 Yyo
NUWARAELIYA SUB STN
33kV BUS
NE3
4 x 3 MVA TRAFO 11Yyo
GRANDPASS (KELANITISSA) P/S (STEAM)
2 x 31.3MVA Cos ø =0 8
4.1 MILES COYOTE/C
2 x 32 MVA TRAFOS 42 Yd11
ORUWELA SUB STN
4 x 6 3MVA TRAFOS Yd 11
DN3
66kV
2 5MILE LYNX/SS
14.846 MILES LYNX/XX
22 1MILES LYNX/PP
17.3 MILES LYNX/PP
41 082 MILES LYNX/XX
WIMALASURENDRA NORTON P/S(HYDRO)
2 x 31 2MVA Cos ø =0 8
2 x 32 MVA TRAFO Yd11 1Ø UNIT
2 x 14 7MVA Cos ø =0.85
2 x 16MVA TRAFO S 42 Yd11 1Ø UNITS
22 27MILES COYOTE/D
21 66MILES COYOTE/D
L D F
1.34 MILES ZEBRA/GG
0 6MILES LYNX/PP
CANYON P/S 1x38.3MVA
NEW LAKSPANA P/S 2x62 5MVA Cosø=0 8
AVISSAWELLA SUB STN
2x72MVA TRAFOS 1ø UNITS Yd11
1x40MVA TRAFO
5 13MILES LYNX/MM
5 2 MILES LYNX/PP
3 152 MILES LYNX/HH
L D P
16MILES 7/0 116 Cu
1x16MVA TRAFO 31 Dy1 1ØUNIT
LK1
66kV BUS
LK2
2 x 15MVA TRAFO S 1ø UNITS
3 x 9 8 MVA Cos ø =0 85
LAKSAPANA P/S (HYDRO) STAGE 1
RECEIVING STN KOLONNAWA
132kV BUS
KN1
36 0 Ω 525 AMPS TOR 30SEC
2x30MVA TRAFOS Dy1
1x30 MVA TRAFO 32Yd1
1x30MVA TRAFO Dy1
YYO
33kV BUS
KN2
PADUKKA SUB STN
4x3MVA TRAFOS YYO
11 94 MILES CU19/0 092
17 8MILES CU 19/0.092
66kV BUS
KN6
2x15MVA TRAFO S 1ø UNITS
22.46MILES CAD/CU/19/0.1
0.35MILES LYNX/XX
132kV BUS
LAKSAPANA P/S (HYDRO) STAGE 2A
Q3/3 COPE UG CABLES 4267 Yds
BL1
2 813MILES LYNX/YY
SAPUGASKANDA SUB STN
3 x 10MVA TRAFO S Yd1
33kV

CONNECTION DIAGRAM OF THE TRANSMISSION LINE SYSTEM

Fig 7.4.2

LEGEND

- EARTHING RESISTANCE
- BBC DIST. RELAYS L2 32
- CGE DIST. RELAYS RY 10
- WESTING HOUSE DIST. RELAYS
- ARC SUPPRESSION COIL
- REACTOR
- CIRCUIT BREAKERS
- FUTURE CIRCUIT
- UNDERGROUND CABLE
- EARTHING TRAFO.
- BBC DISTANCE RELAYS L1 201
- ISOLATOR
- BBC DISTANCE RLAYS L3 WY03
- CGE DIST. RELAYS GCW51
- FEED IN FROM OUT SIDE SOURCE

GALLE SUB STN
33kV BUS
3 x 10 MVA TRAFO.
34.53 MILES TIGER / P&L
AGALAWATA SUB STN
2 x 10MVA TRAFO.S
RATMALANA SUB STN
2 x 15MVA TRAFO.S
30 MILES LYNX (1977)
33kV
DENIYAYA SUB STN
1 x 10MVA TRAFO
40 MILES LYNX
27.47 MILES TIGER/P&L
PETTAH P/S
3 x 2 6MVA Cos φ=0.8 (DIESELS)
11kV BUS
0.3/3 CORE UG CABLES 272 Yds
5000 Yds 0.1/3 UG CABLE
ODSS KOLONNAWA
33kV BUS
4 x 5 MVA TRAFO Y d 11
1 x 8MVA Cos φ=0.8 (SYN CON)
0.799Ω/PHASE
2 x 15MVA TRAFOS 16 UNITS
66kV BUS
3 x 12.5MVA TRAFO.S d1 D7 11
0.3/3 CORE UG CABLES 4267 Yds
33kV BUS
12.246 MILES LYNX / XX (1977)
24.8 MILES RACOON/
27.11 MILES LYNX/H
BALANGODA SUB STN
33kV
2 x 5MVA TRAFOS Yd 1
2 x 22MVA TRAFO.S SAMANALAWEWA P/S (HYDRO)
2 x 71MVA Cos φ=0.85
(1977) 10MILES ZEBRA
22.46 MILES CAD / CU / 19 / 0.1
17.6 MILES 0.19/0.092 CU
11.94 MILES CU19/0.092
33kV
66kV BUS
2 x 15MVA TRAFO.S 16 UNITS
16 MILES 7/0.116 Cu
0.35 MILES LYNX / XX
LAKSAPANA P/S (HYDRO) STAGE 2A
132kV BUS
3 x 9 MVA Cos φ=0.85
LAKSAPANA P/S (HYDRO) STAGE 1
1 x 16MVA TRAFO 3 UNIT
3.552 MILES LYNX/HH
5.13 MILES LYNX/HH
5.2 MILES LYNX/PP
2 x 35 MVA TRAFO.S 42 Yd 11 16 UNITS
2 x 14 7MVA Cos φ=0.85
2 x 32 MVA TRAFO 16 UNITS
2 x 31.2MVA Cos φ=0.8
WIMALASURENDRA MORTON P/S (HYDRO)
1 x 10MVA TRAFO
2 x 45MVA Cos φ=0.8
POLPITIYA P/S (HYDRO)
132kV BUS
LD P
1 x 30MVA TRAFO.S YY0
2 x 6MVA TRAFO.S YY0
CANYON P/S
2 x 62.5MVA Cos φ=0.8
NEW LAKSPANA P/S
1 x 38.3MVA
AYISSAWELLA SUB STN
1 x 40MVA TRAFO
2 x 72MVA TRAFO.S 16 UNITS
PADUKKA SUB STN
4 x 3MVA TRAFO.S YY0
1 x 30MVA TRAFO Dy1
2 x 30MVA TRAFO.S 32kV d1
3600 525 4AMPS 10R3066CC
132kV BUS
RECEIVING STN KOLONNAWA
0.86 MILES LYNX/PP
4.1062 MILES LYNX/XX
22.1 MILES LYNX/PP
17.3 MILES LYNX/PP
14.846 MILES LYNX/XX
99kV
LYNX/SS
2.5 MILE
4 x 6.3MVA TRAFO.S Yd 11
ORUWELA SUB STN
2 x 32 MVA TRAFOS 42Yd11
2 x 31.3MVA Cos φ=0.8
GRANDPASS (KELANITISSA) P/S (STEAM)
L.D.F
1.34 MILES ZEBRA/GG
4.1 MILES COYOTE/C
THULHIRIYA SUB STN
33kV
2 x 10MVA TRAFO.S Yd1
5 x 10MVA TRAFO.S Yd1
33kV
2.813 MILES LYNX/YY
SAPUGASKANDA SUB STN
24.4 MILES COYOTE/C
52.18 MILES LYNX/H
33kV
BOLAWATTA SUB STN.
2 x 15MVA TRAFOS 32 Yd 1
PUTTALAM SUB STN
33kV
2 x 15MVA TRAFO.S Yd 1
ERIYAGAMA SUB STN.
2 x 3MVA TRAFO.S DY0
2 x 3MVA TRAFO.S YY0
4 x 3MVA TRAFO.S YY0
33kV BUS
BADULLA SUB STN
1 x 10MVA TRAFO Yd1
1 x 10MVA TRAFO.Yd1
66kV BUS
1 x 30MVA TRAFO.
6.9kV BUS
1 x 5MVA TRAFO.16 UNIT
1 x 3MVA TRAFO.16 UNIT
2 x 2 7.5MVA Cos φ=0.9
2 x 3 5MVA
33kV BUS
INGINIYAGALA P/S (HYDRO)
2 x 21 4MVA GENERATORS Cos φ=0.85
2 x 27MVA TRAFO S
USWELA P/S (HYDRO)
16 MILES LYNX (1977)
40 MILES LYNX (1977)
77.460 MILES LYNX/XX
21.53 MILES LYNX/P
2 x 3MVA TRAFO.S
33kV
KURUNEGALA SUB STN.
1 x 47MVA GENERATOR Cos φ=0.85
1 x 30.5 MVA GENERATOR
BOWATENNE P/S (HYDRO)
1 x 50MVA TRAFO
MORAGAHAKANDA P/S (HYDRO)
1 x 30 5MVA TRAFO.
10MILES LYNX
BATTICALOA SUB STN.
1 x 10MVA TRAFO.
20 MILES LYNX
2 x 10MVA TRAFO.S
HABARANA SUB STN
33kV
1 x 10MVA TRAFO.
50

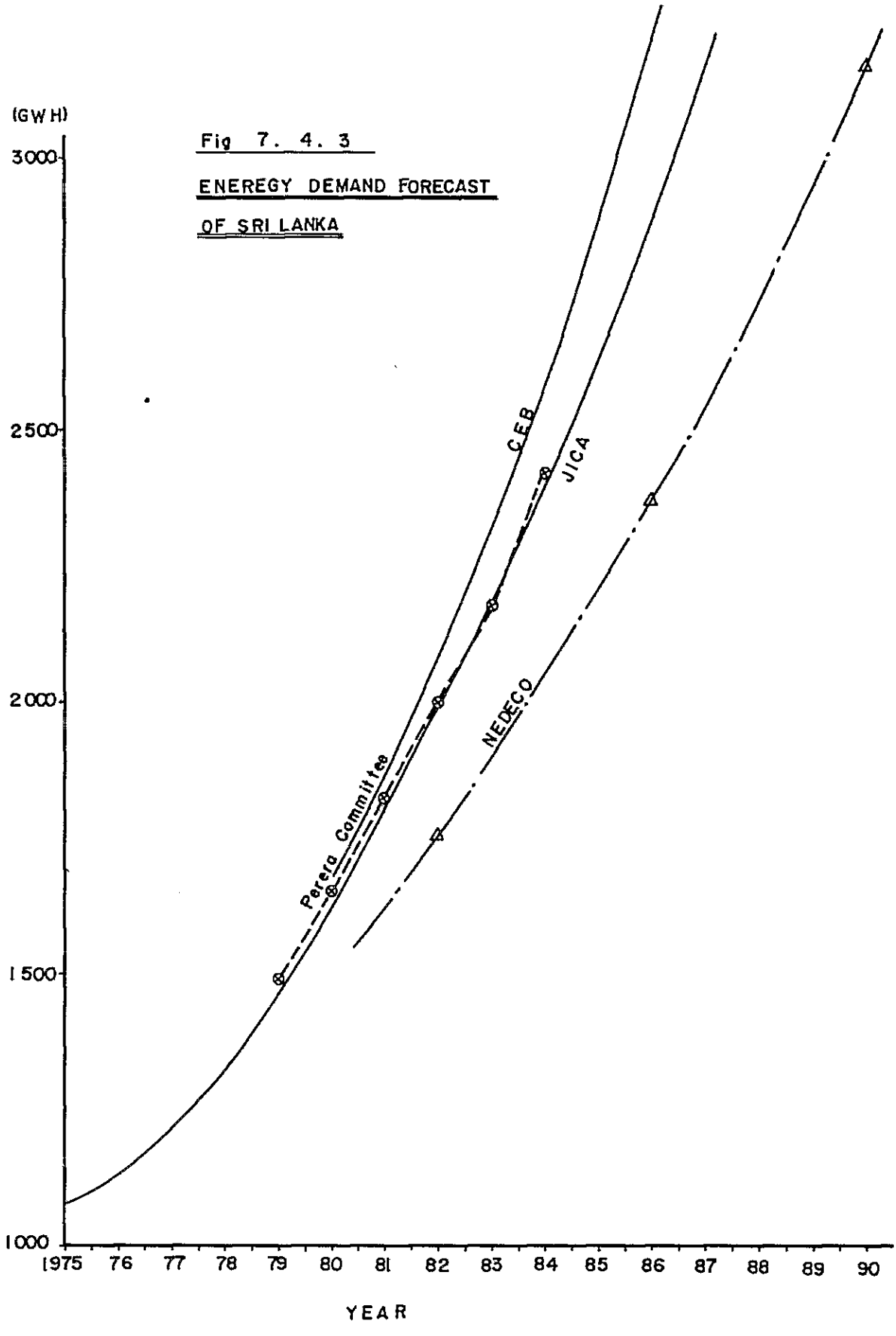


Fig 7. 4. 3

ENEREGY DEMAND FORECAST

OF SRI LANKA

Fig 7.4.4

PEAK POWER DEMAND

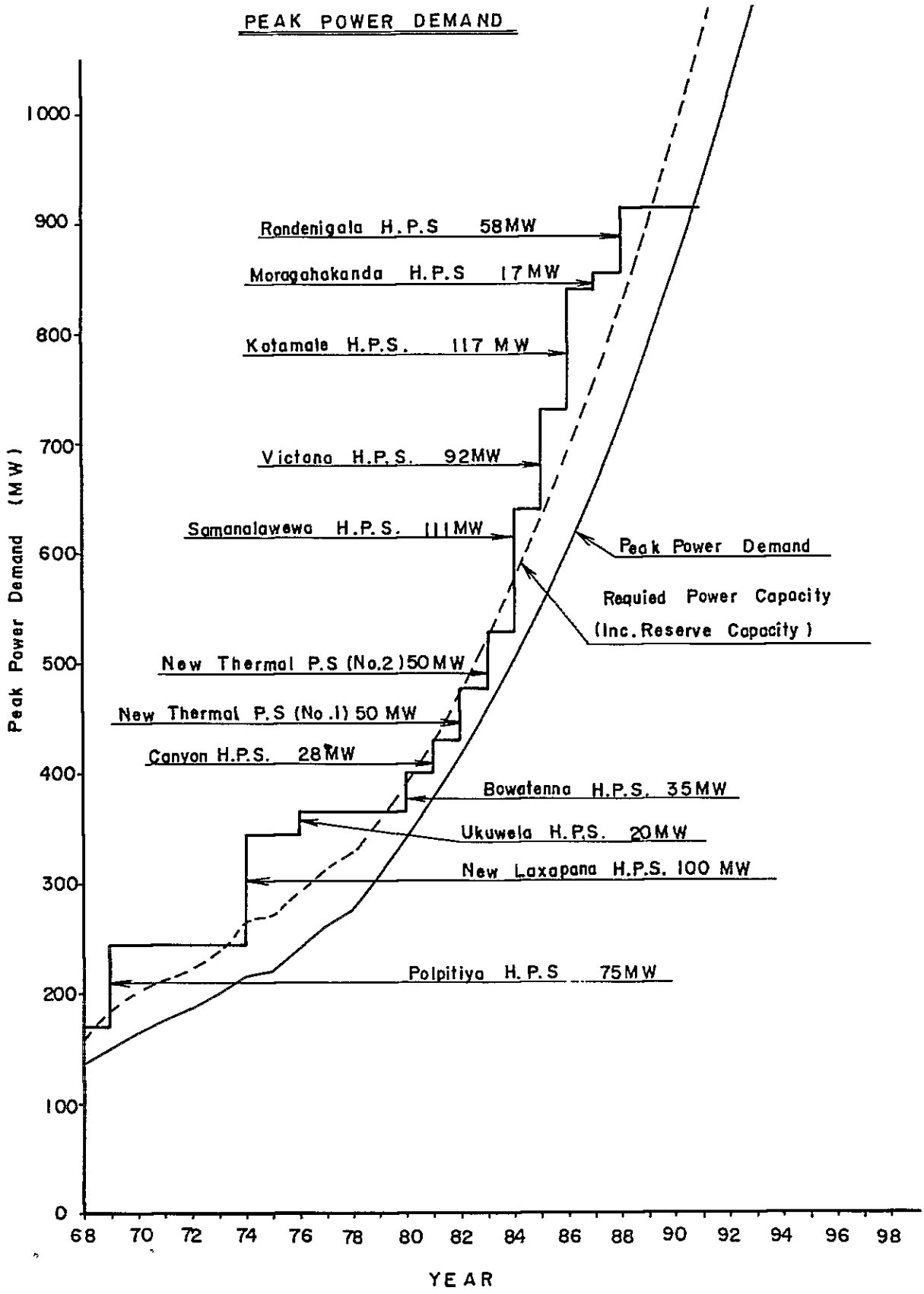
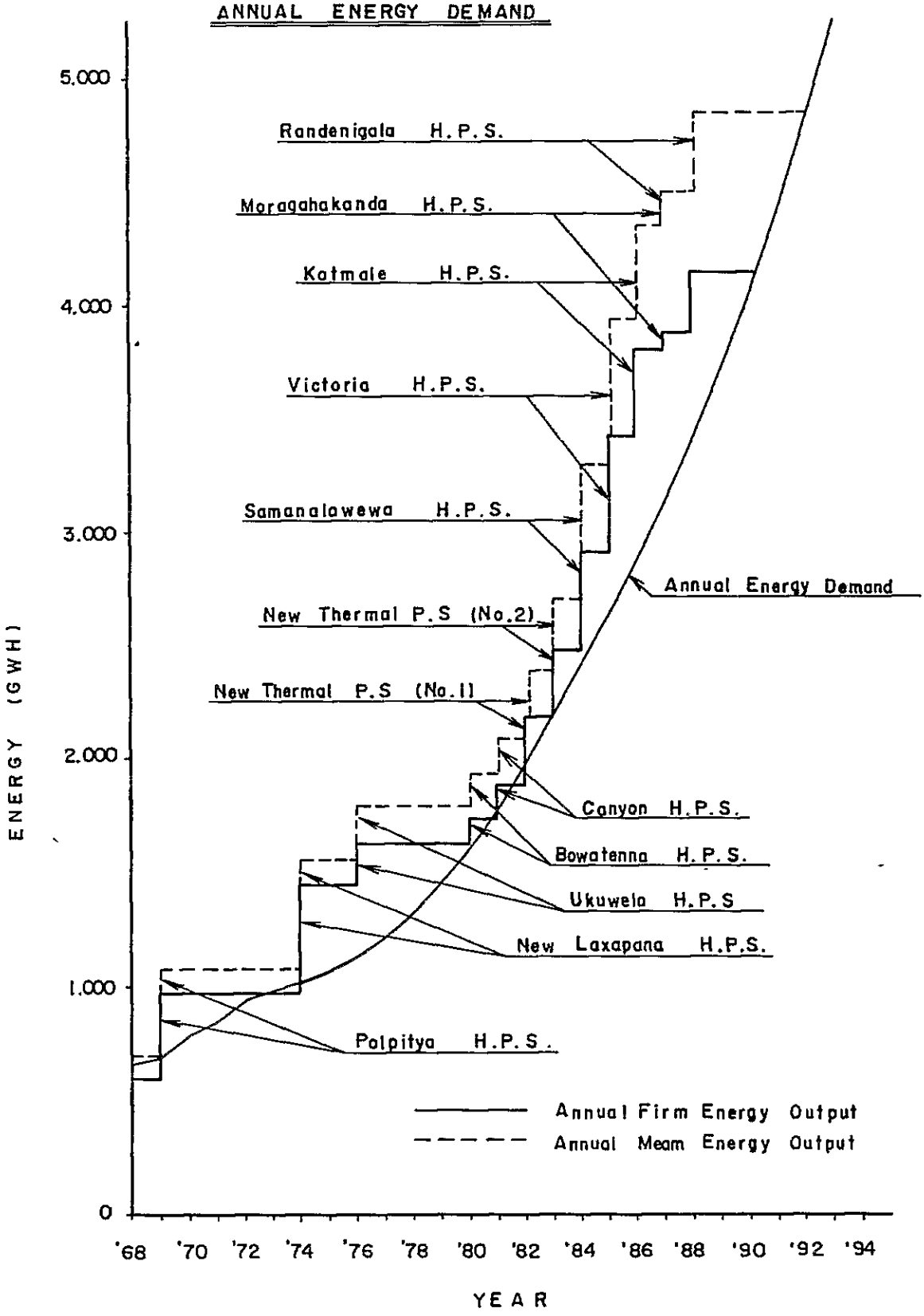


Fig 7-4-5

ANNUAL ENERGY DEMAND



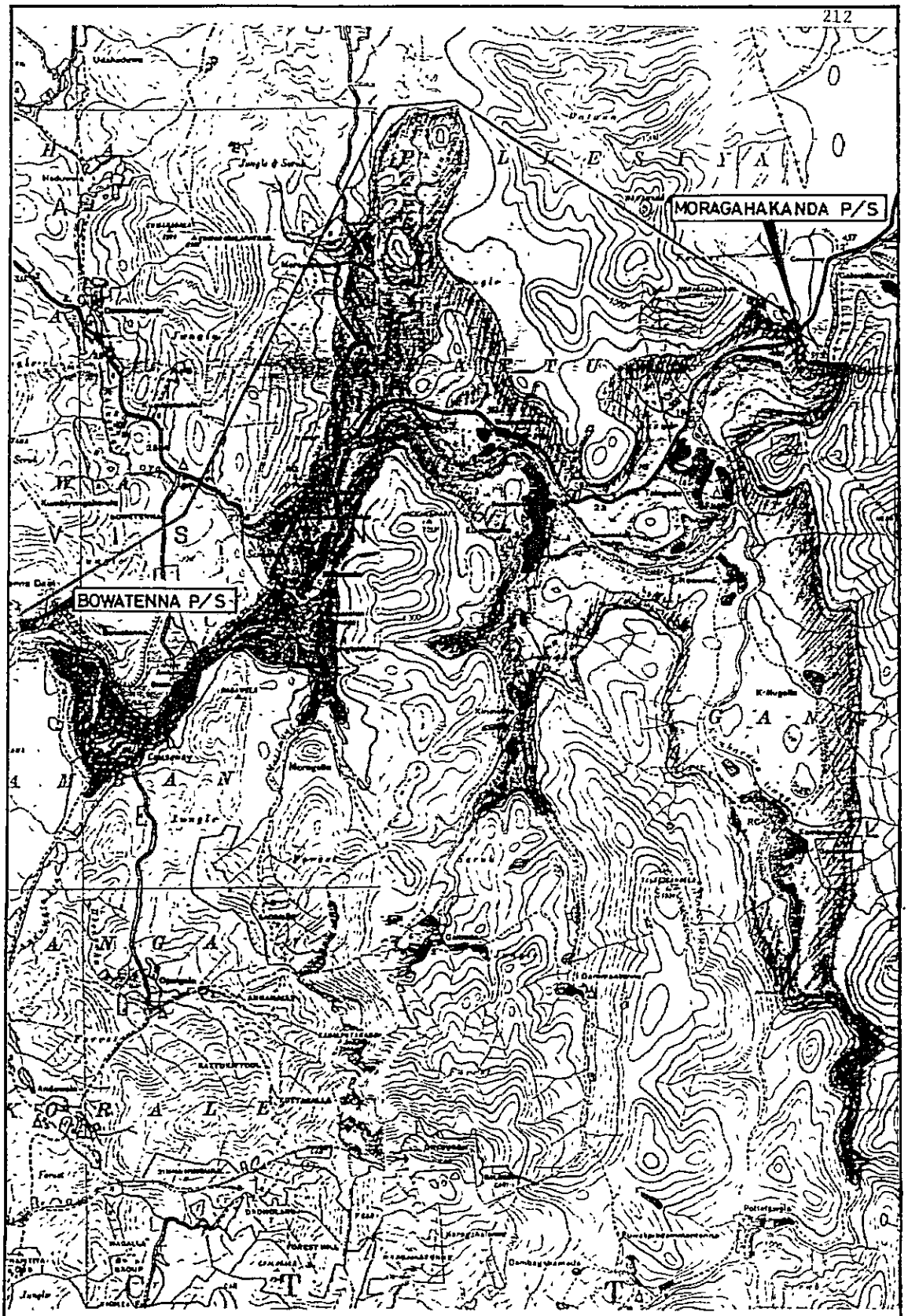


Fig 7.4.6

Fig 7.4.7 CONSTRUCTION TIME SCHEDULE OF G/E

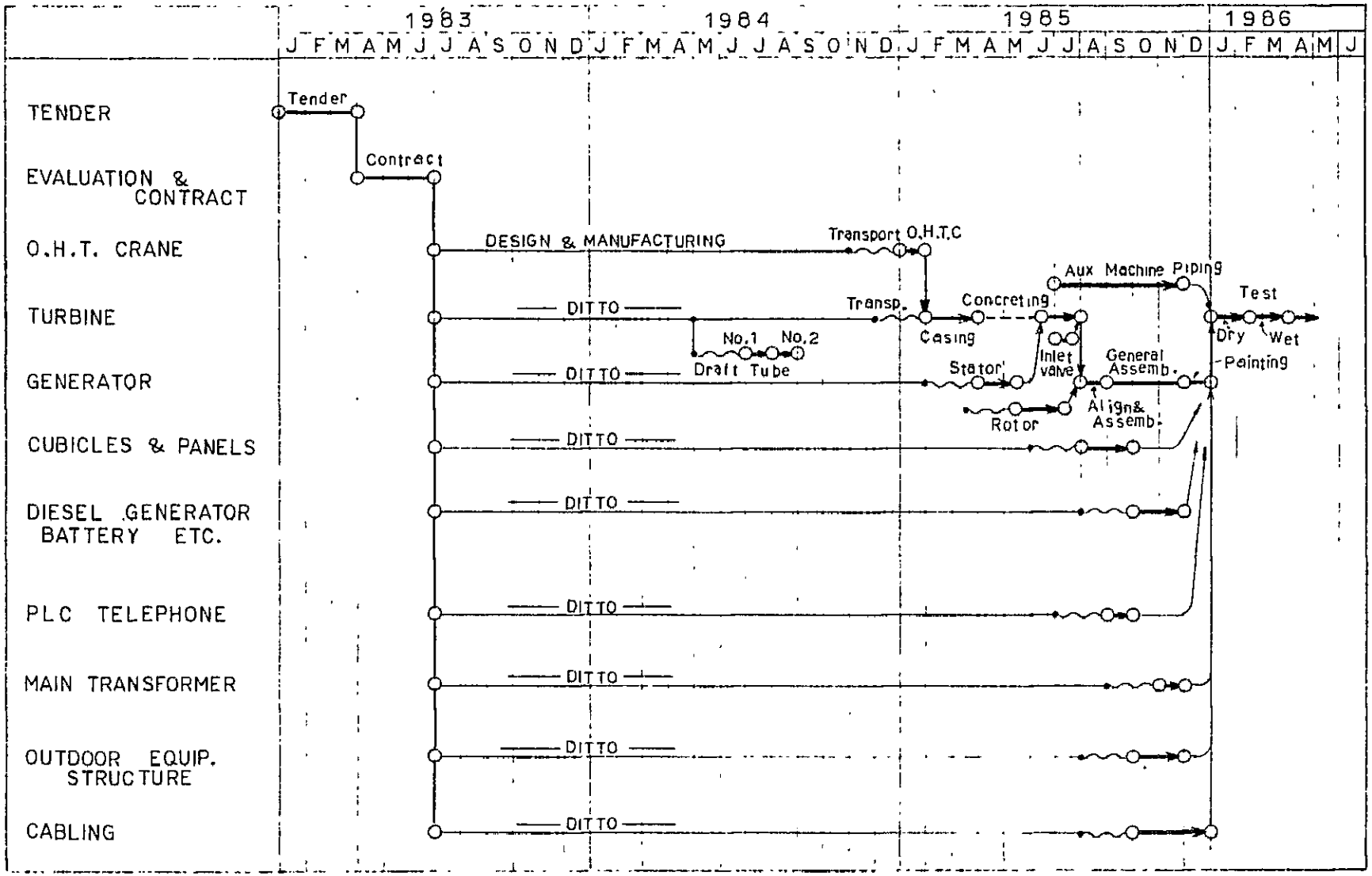
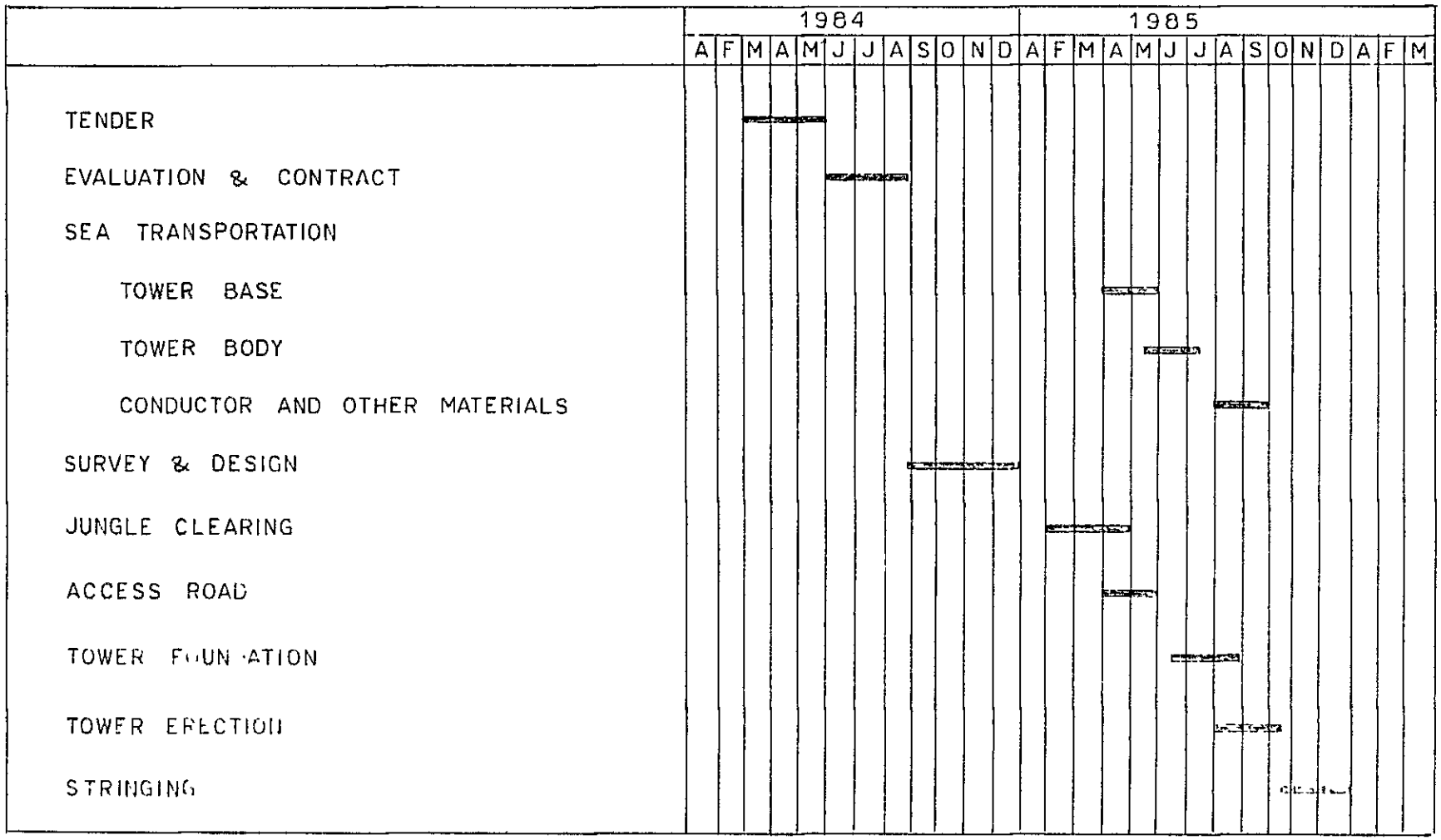


Fig 7.4.8 CONSTRUCTION TIME SCHEDULE OF TRANSMISSION LINE



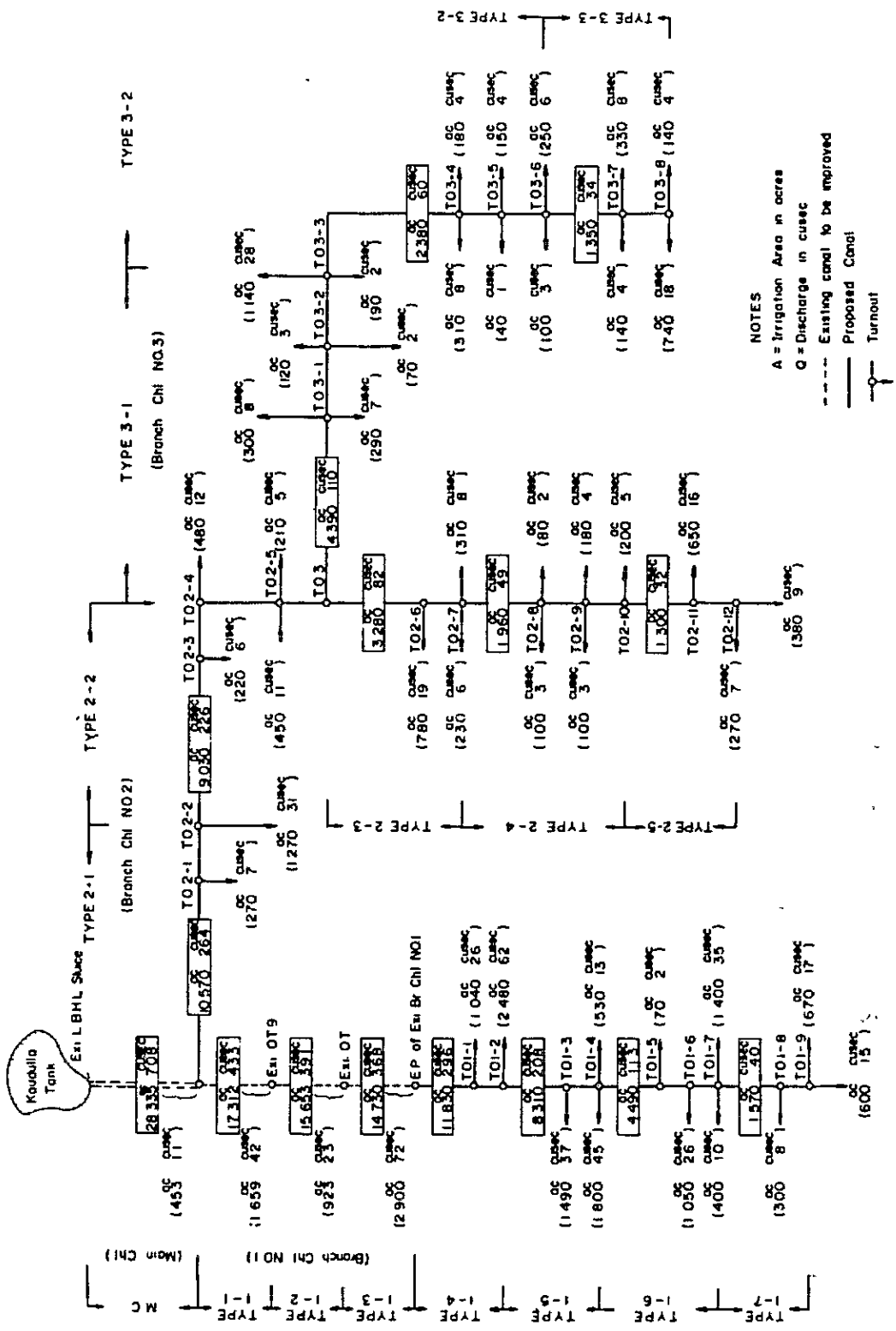
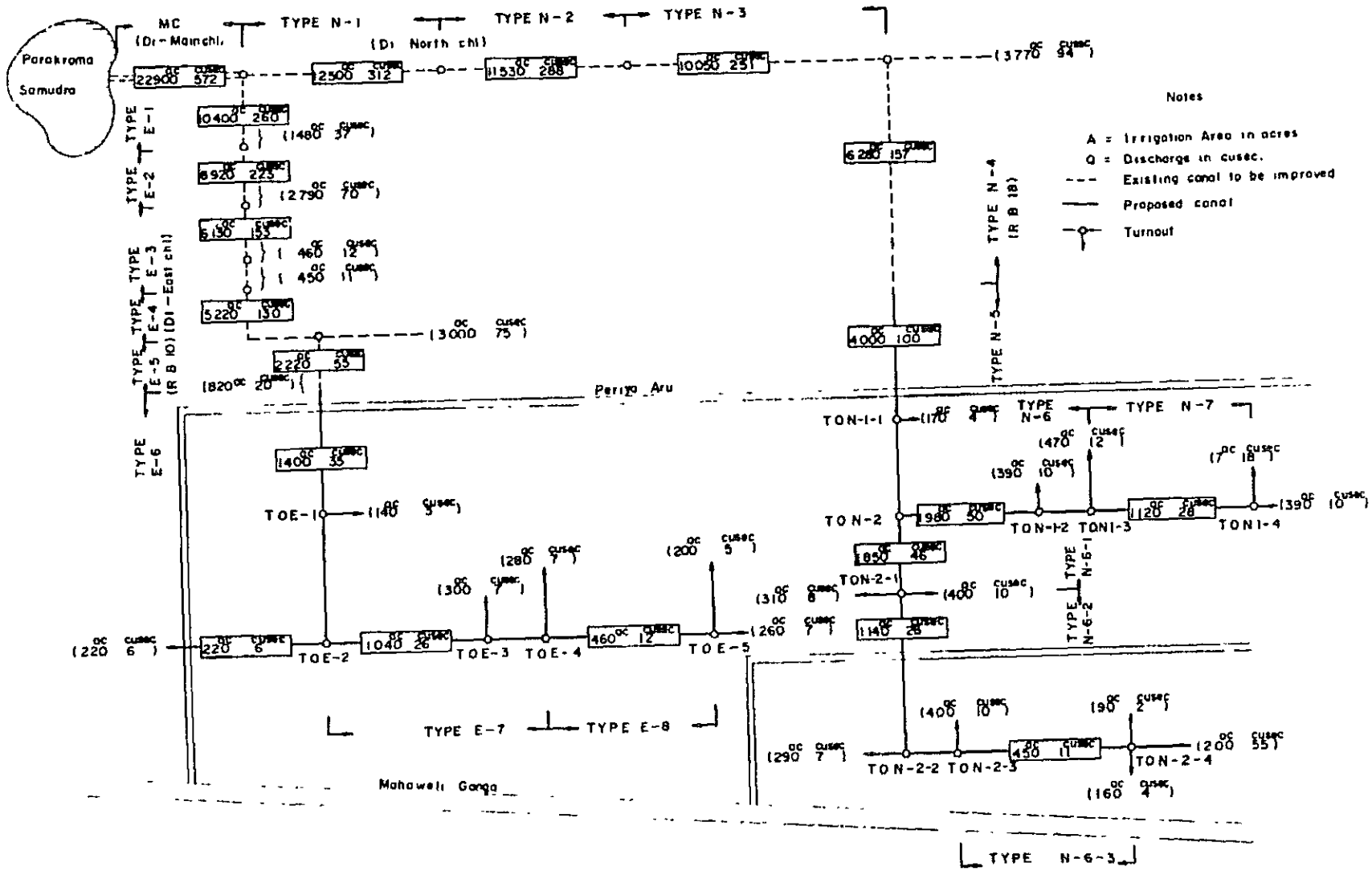


Fig - 7.5.1 System DI Net work and Discharge Assignment

Fig - 7.5.2 System D2 Net Work and Discharge Assignment



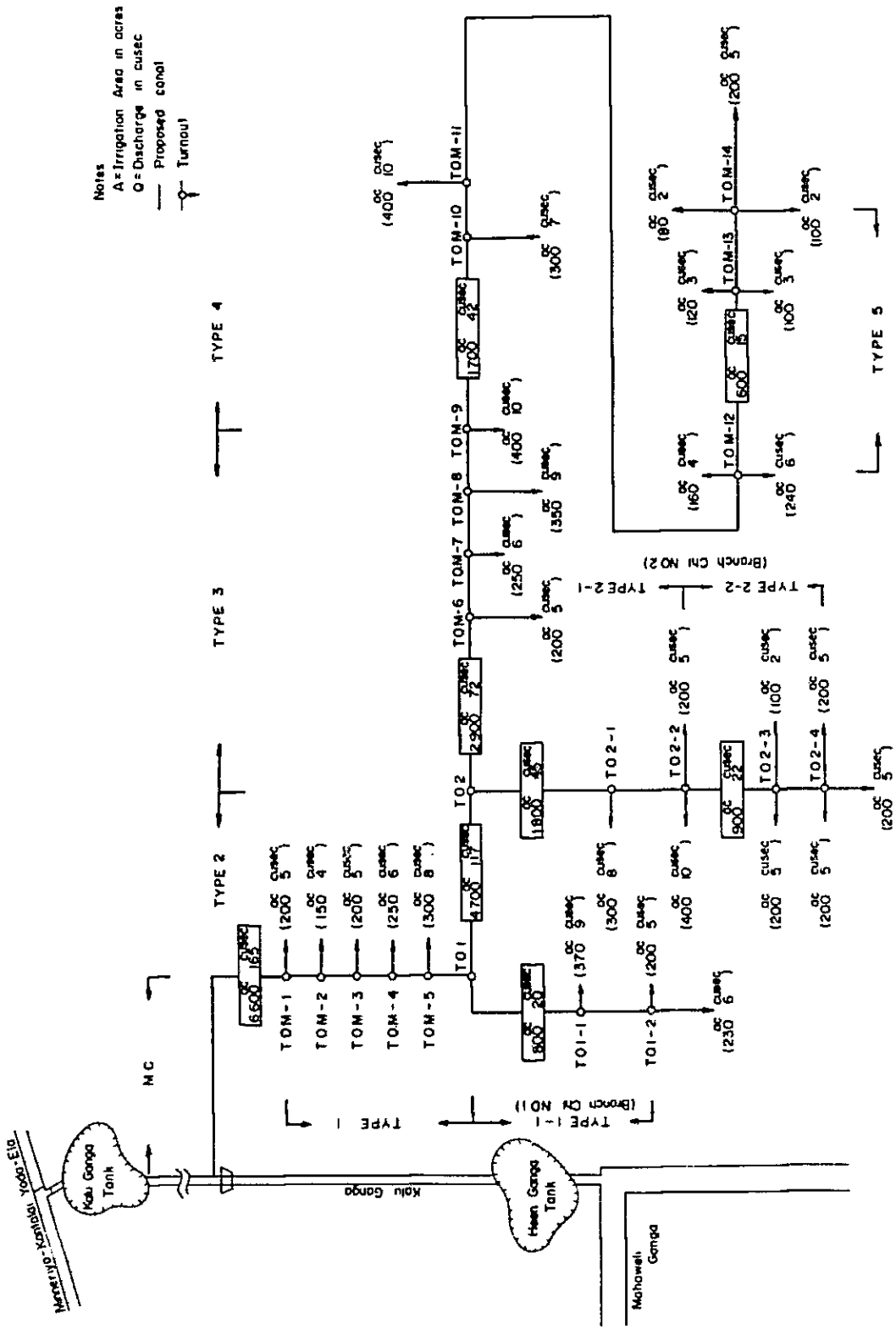


Fig - 7.5.3 System A/D Net Work and Discharge Assignment

Fig . 7.5.4 General Plan of Drainage System

Drainge Channel		Catchment Area (Acres)
Kalu Ganga	①	16 780
	②	14 040
		30 820
Thimbri Ela	③	4 110
	④	2 740
		6 850
Ambagaha Oya	⑤	4 650
	⑥	17 350
		22 000
Periya Aru	⑦	17 800
	⑧	26 500
		44 300
Sinna Ganga	⑨	4 300
Uppu Aru	⑩	12 920
Karappan-Kadawela Aru	⑪	19 030

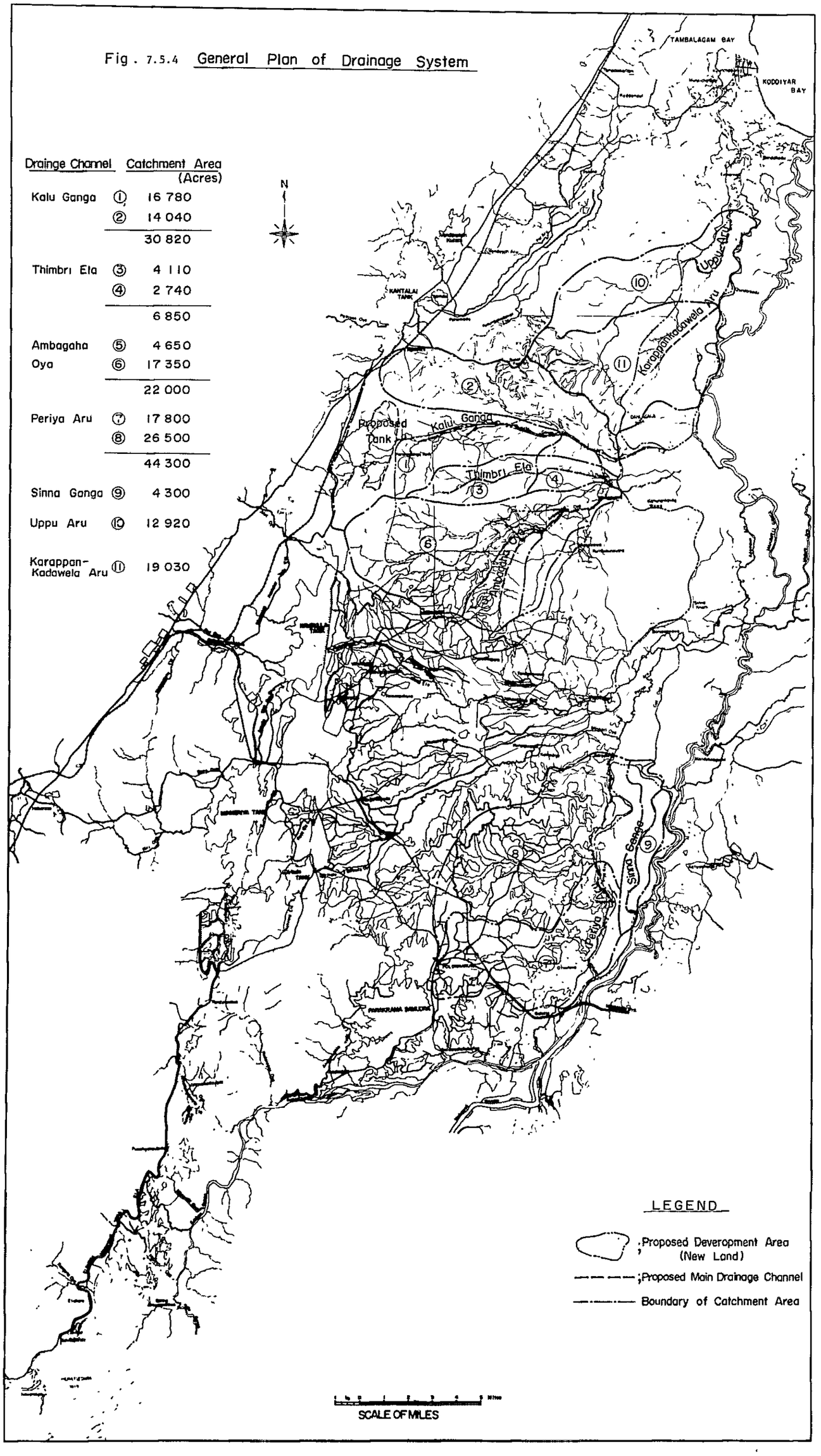


Fig. 7.5.5 Construction Time Schedule

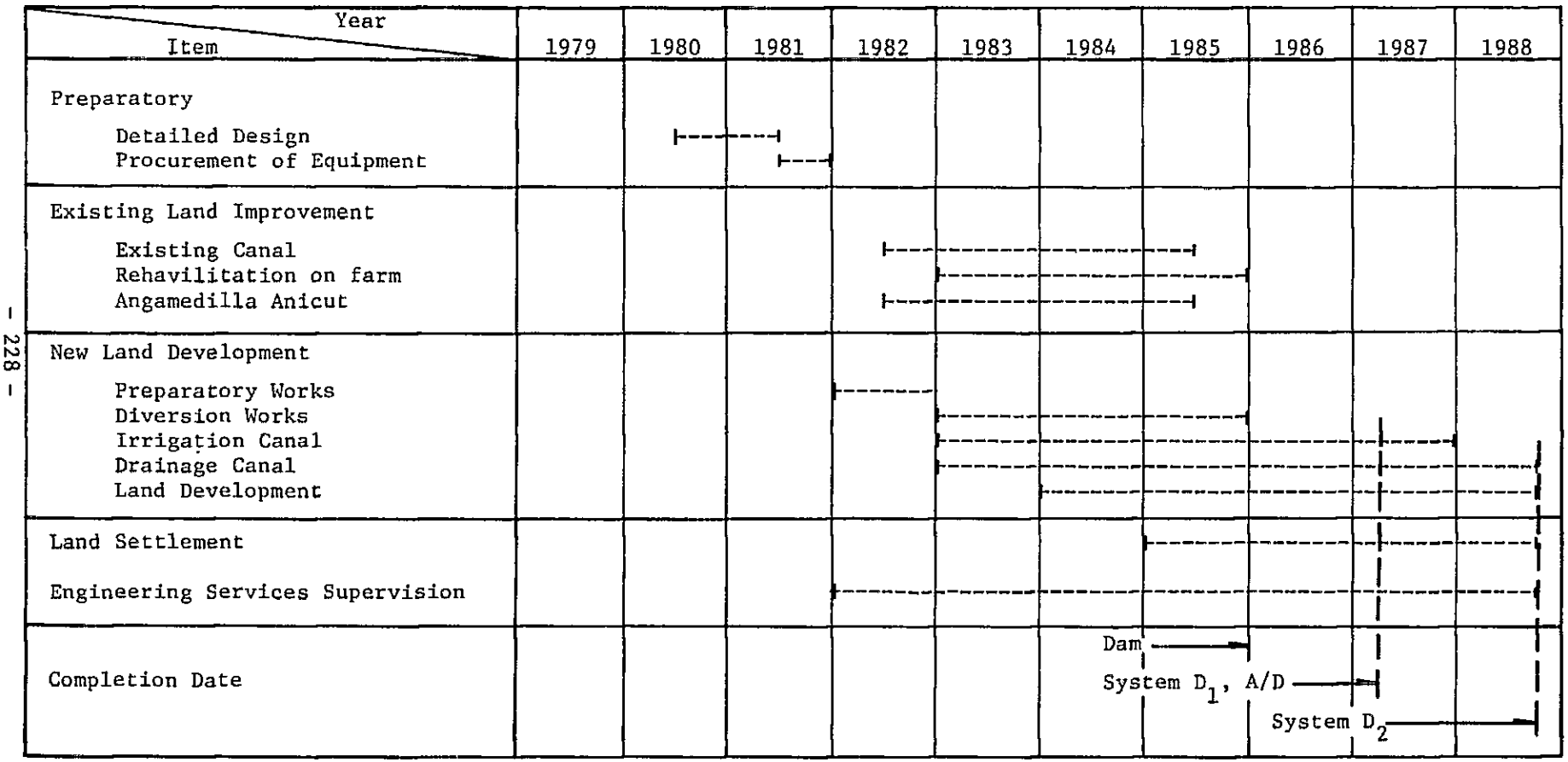
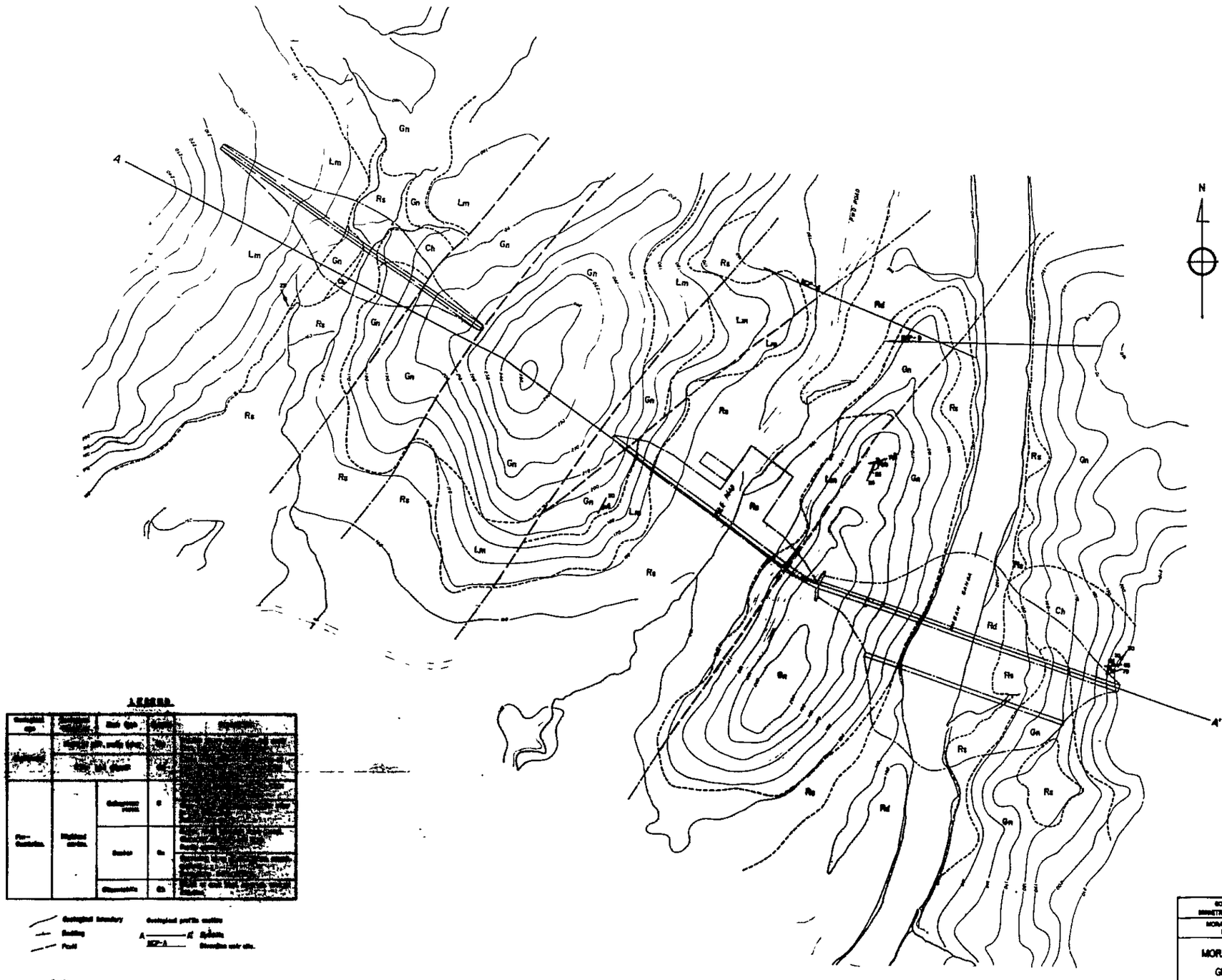
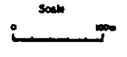


PLATE NO. 9





GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

MORAGAHAKANDA DAM
GEOLOGICAL MAP

DATE | DWG NO. D-001

JAPAN INTERNATIONAL COOPERATION AGENCY

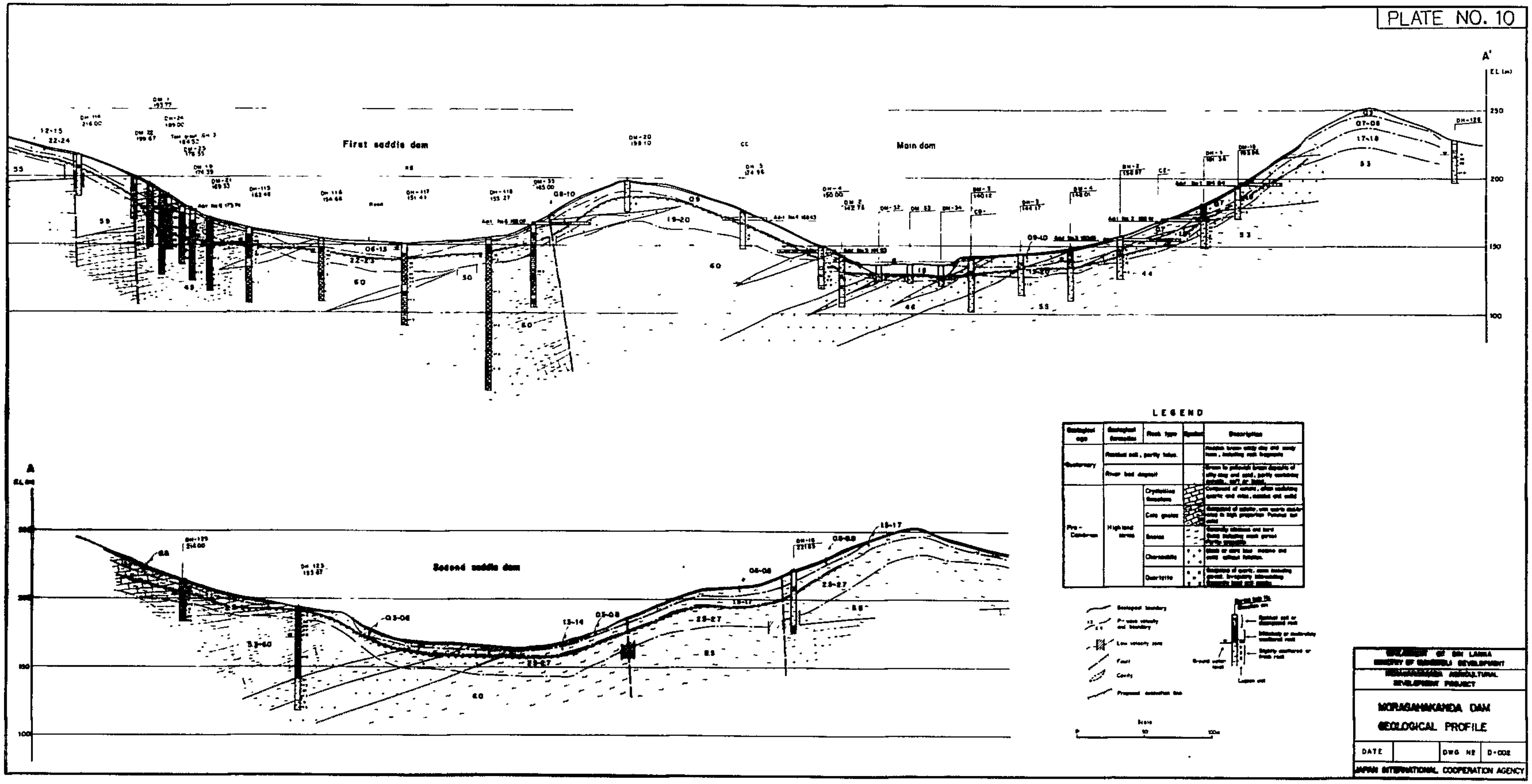
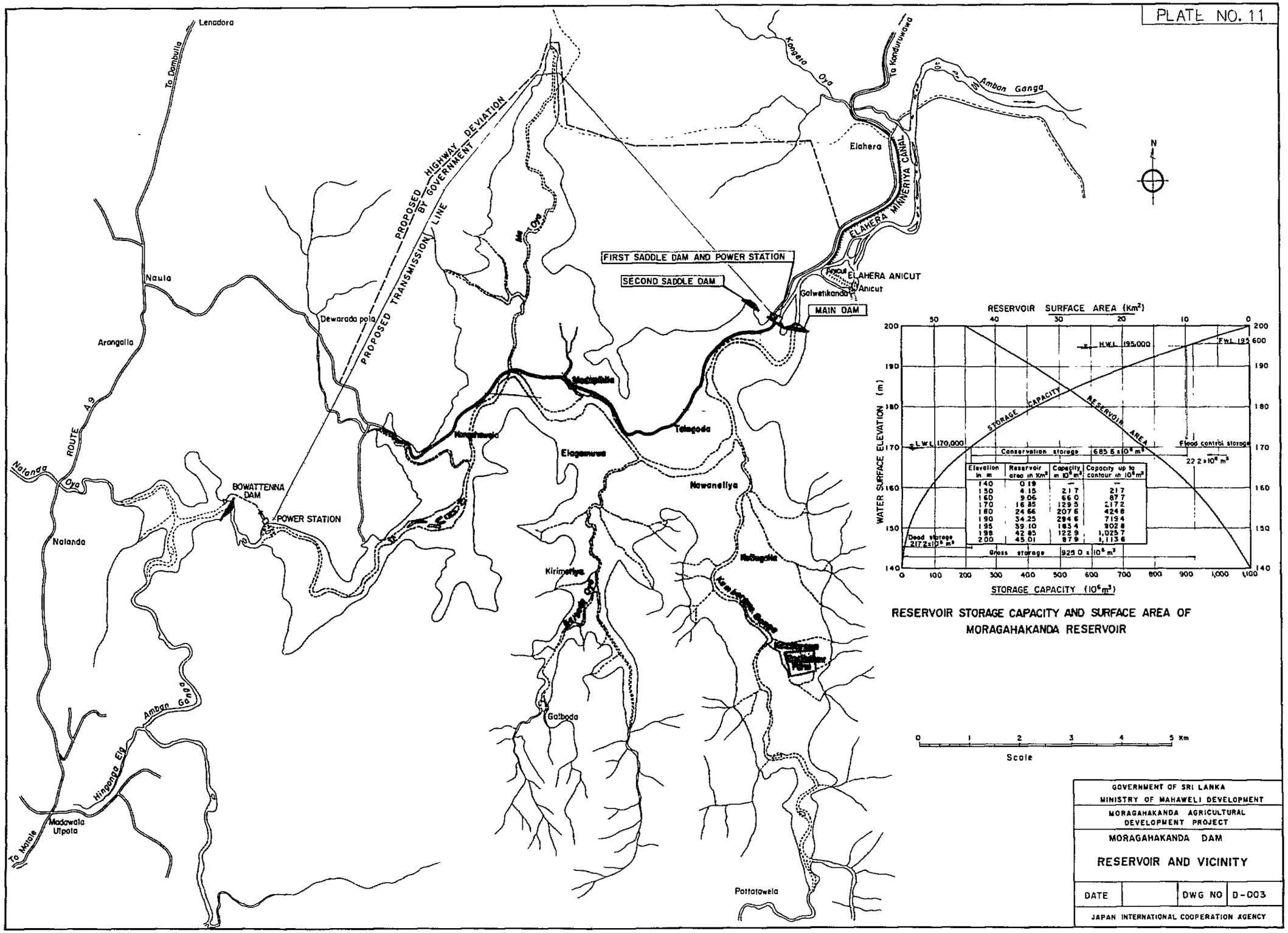


PLATE NO. 10
A'
First saddle dam
Main dam
Second saddle dam
250
200
150
100
LEGEND
MORAGAHAKANDA DAM
GEOLOGICAL PROFILE
DATE
DWG NO
D-002
JAPAN INTERNATIONAL COOPERATION AGENCY

PLATE NO. 11



Elevation in m	Reservoir area in Km²	Capacity in 10^6 m³	Capacity up to contour in 10^6 m³
140	0.19	—	—
150	4.15	21.7	21.7
160	9.06	66.0	87.7
170	16.85	129.5	217.2
180	24.66	207.6	424.8
190	34.25	294.6	719.4
195	39.10	183.4	902.8
198	42.85	122.9	1,025.7
200	45.01	87.9	1,113.6

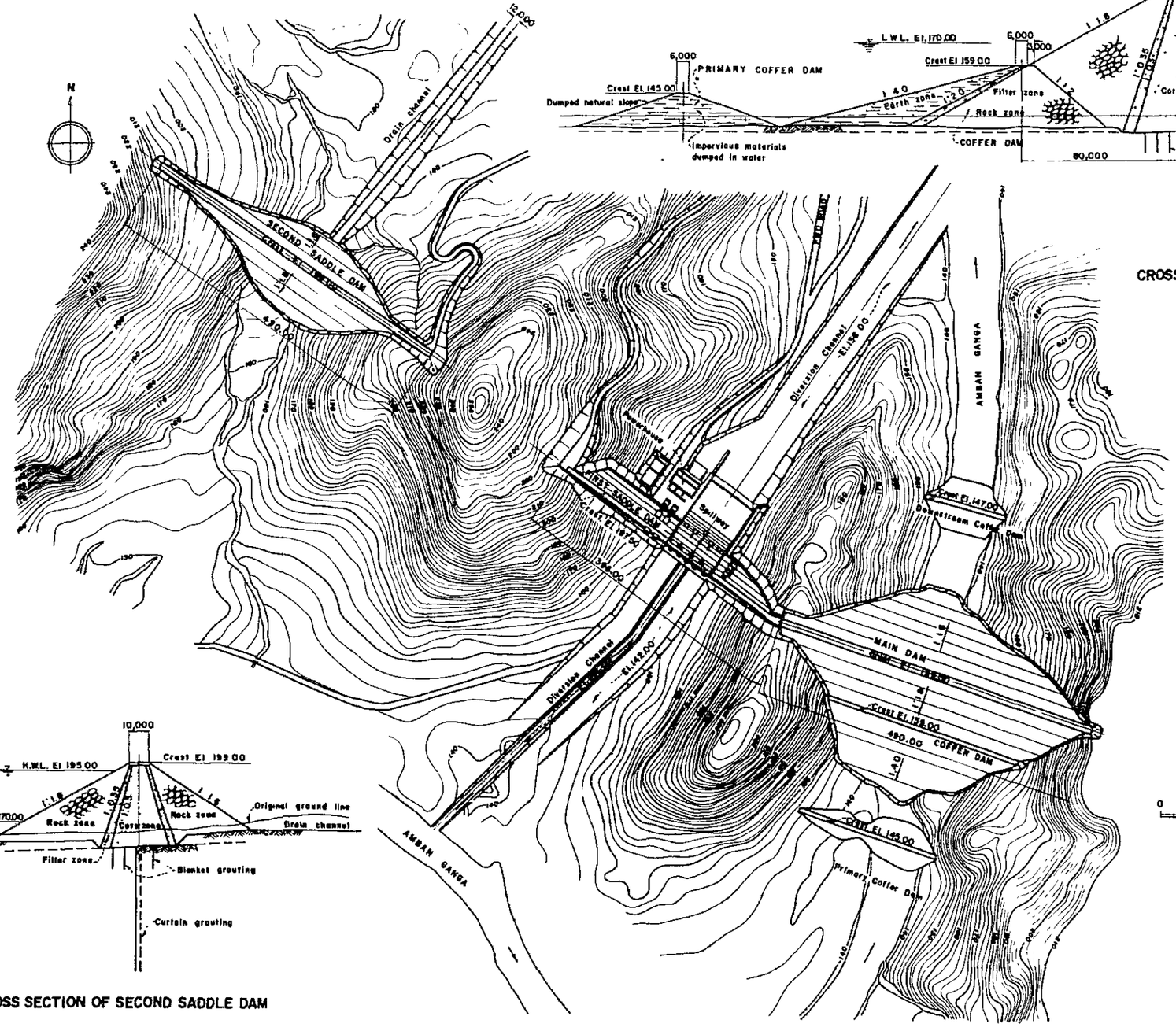
RESERVOIR STORAGE CAPACITY AND SURFACE AREA OF MORAGAHAKANDA RESERVOIR

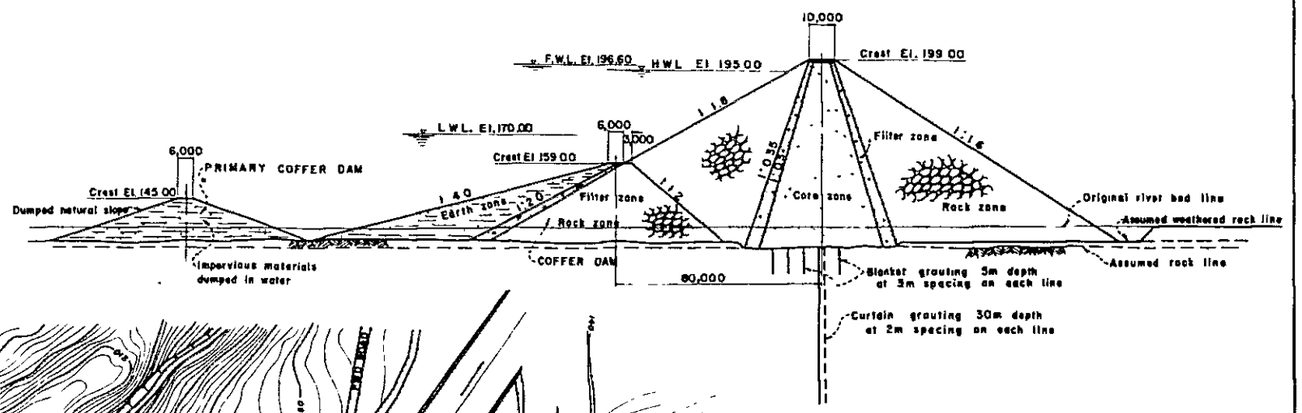
0 1 2 3 4 5 Km

Scale

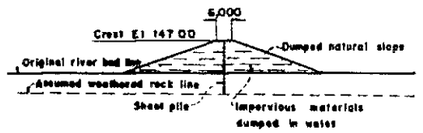
GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT			
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
MORAGAHAKANDA DAM RESERVOIR AND VICINITY			
DATE		DWG NO	D-003
JAPAN INTERNATIONAL COOPERATION AGENCY			

PLATE NO. 12





CROSS SECTION OF MAIN DAM



DOWNSTREAM COFFER DAM

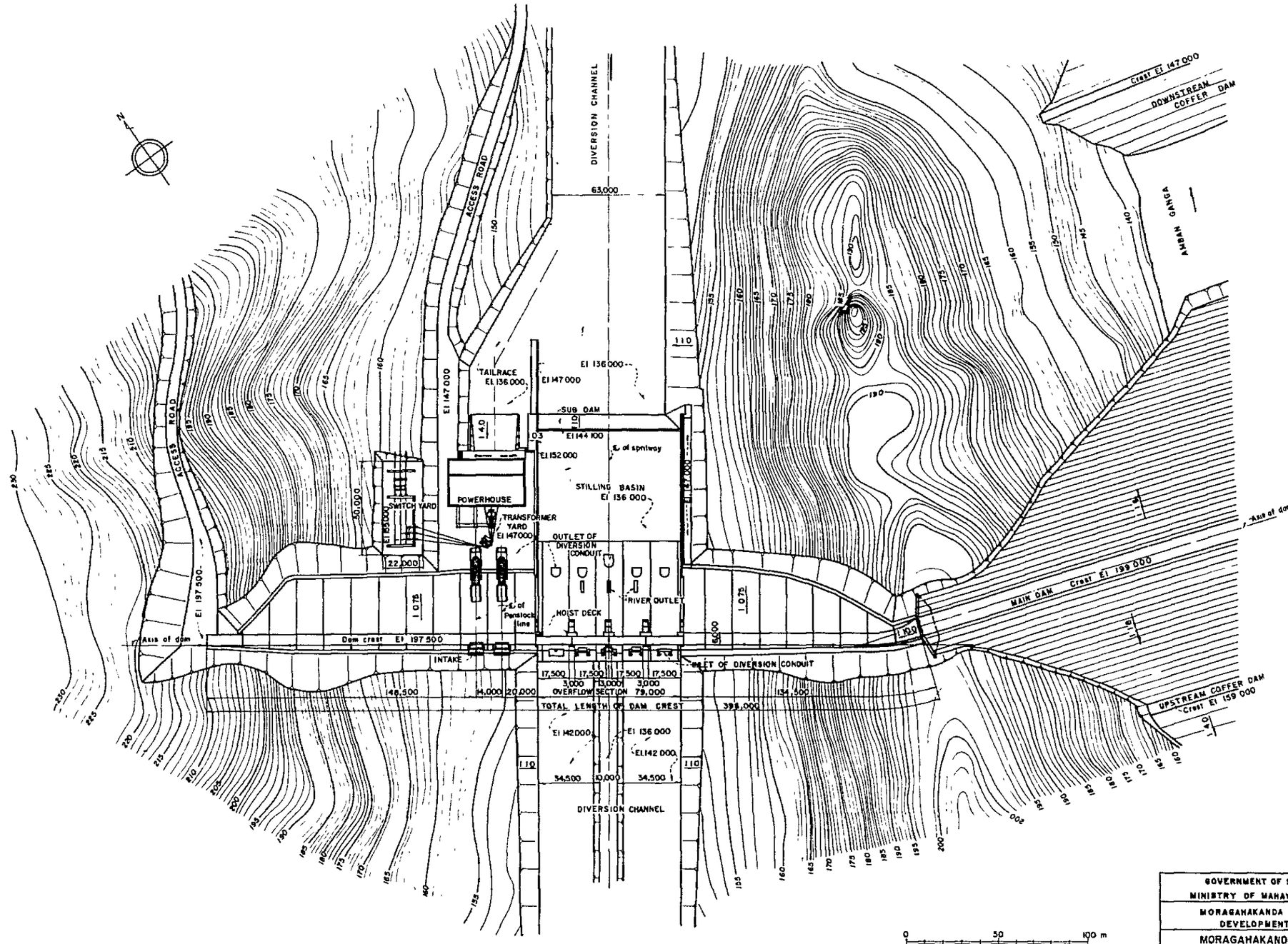
CROSS SECTION OF SECOND SADDLE DAM

0 100 200 300 400 500 m

Scale

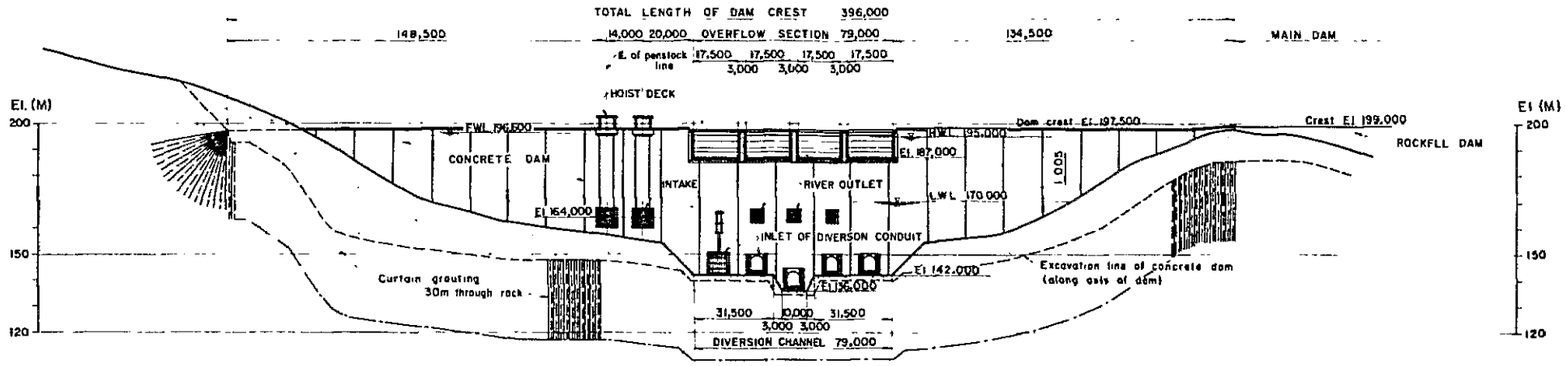
GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT			
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
MORAGHAKANDA DAM GENERAL PLAN			
DATE		D.WG NO.	D-004
JAPAN INTERNATIONAL COOPERATION AGENCY			

PLATE NO. 13

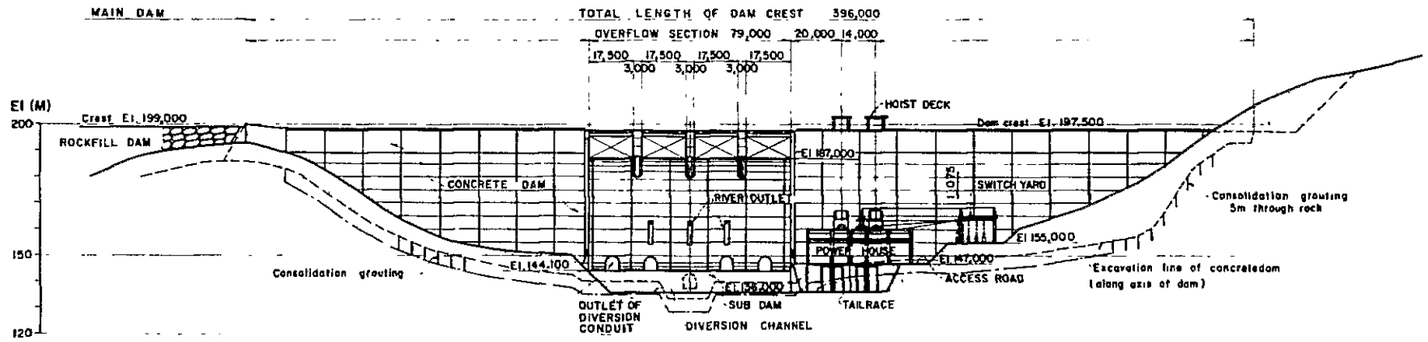


GOVERNMENT OF SRI LANKA			
MINISTRY OF MAHAWELI DEVELOPMENT			
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
MORAGAHAKANDA DAM			
PLAN OF FIRST SADDLE DAM			
DATE		DWG.NO.	D-005
JAPAN INTERNATIONAL COOPERATION AGENCY			

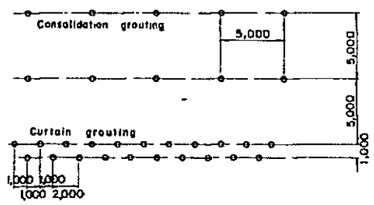
PLATE NO. 14



UPSTREAM ELEVATION



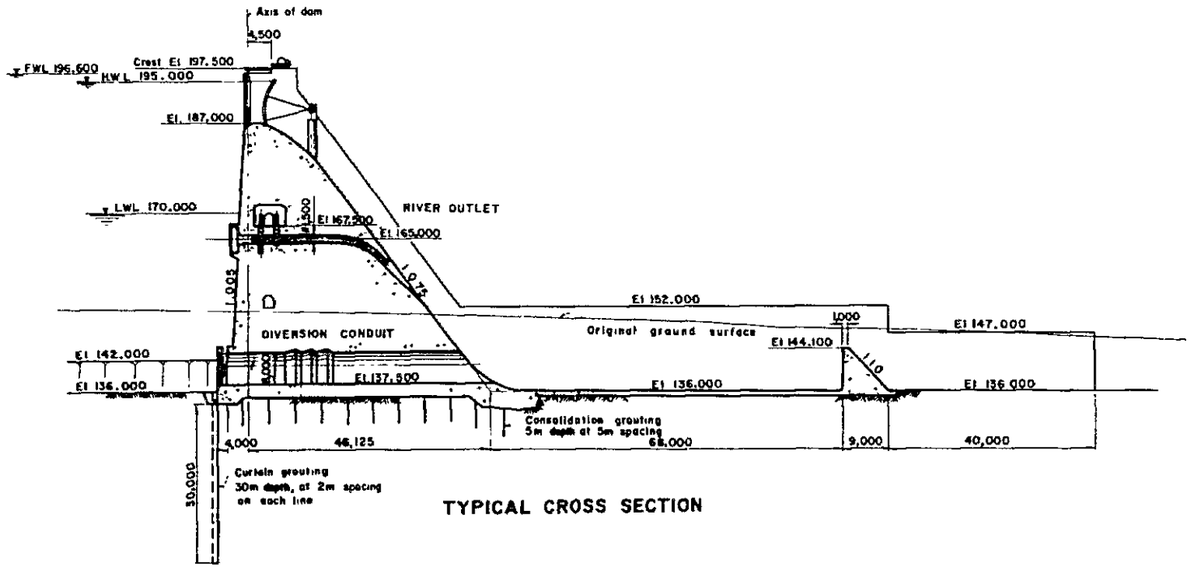
DOWNSTREAM ELEVATION



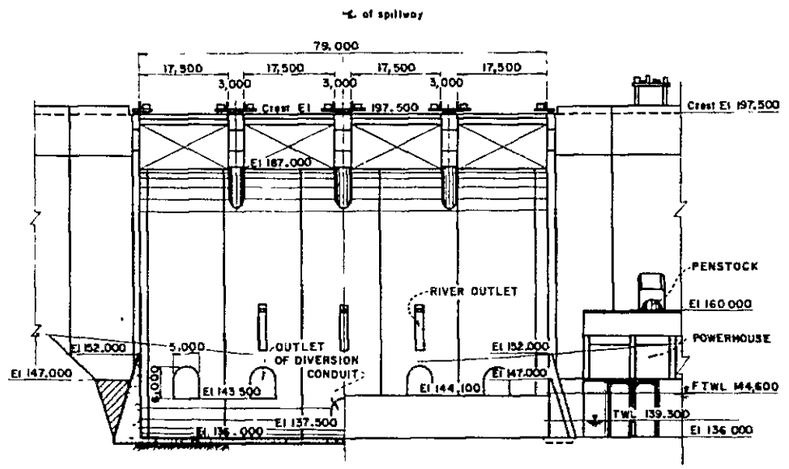
0 50 100 M
Scale

GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT			
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
MORAGAHAKANDA DAM			
ELEVATIONS OF FIRST SADDLE DAM			
DATE		DWG NO	D-006
JAPAN INTERNATIONAL COOPERATION AGENCY			

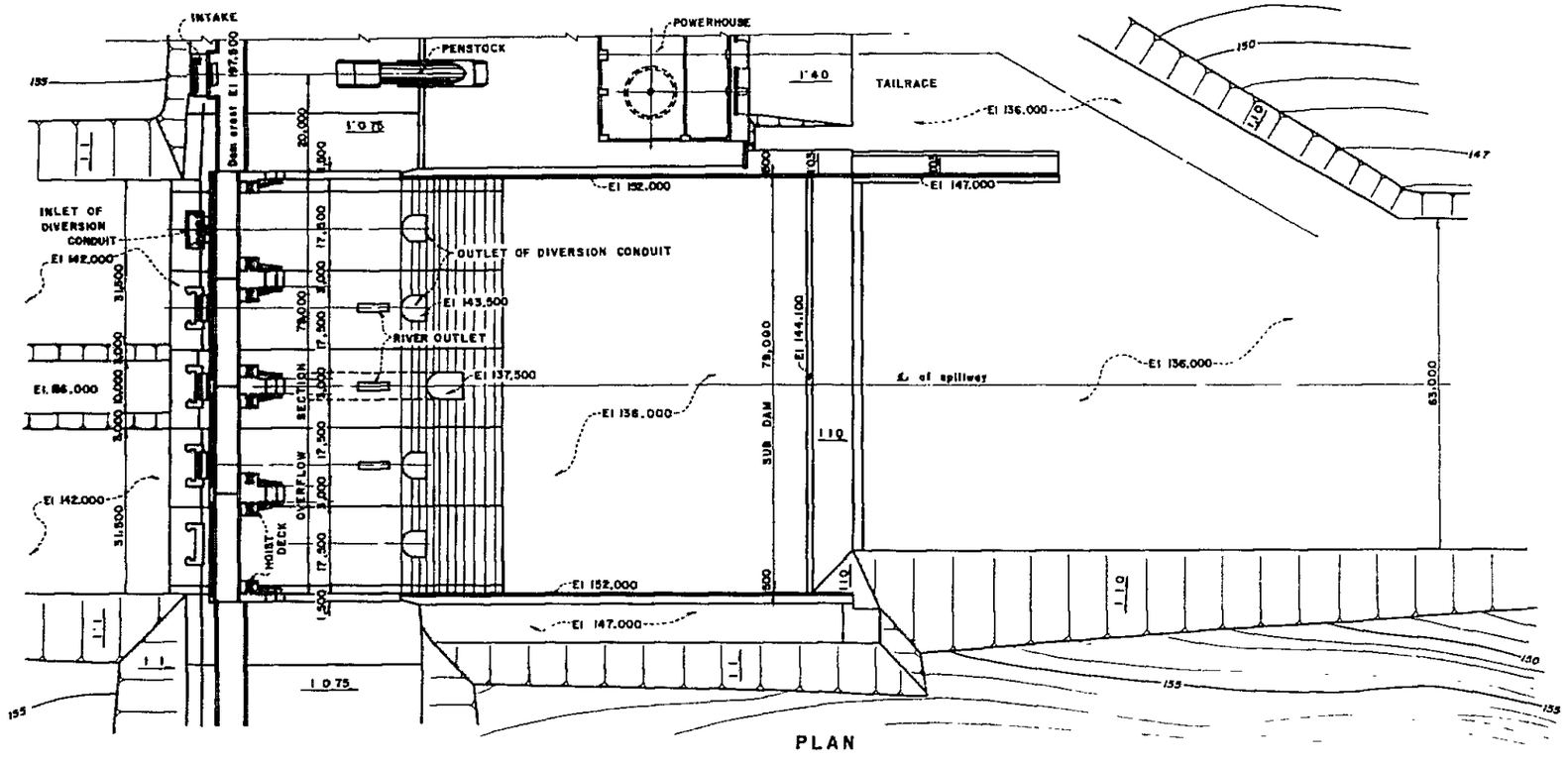
PLATE NO. 15



TYPICAL CROSS SECTION



DOWNSTREAM ELEVATION

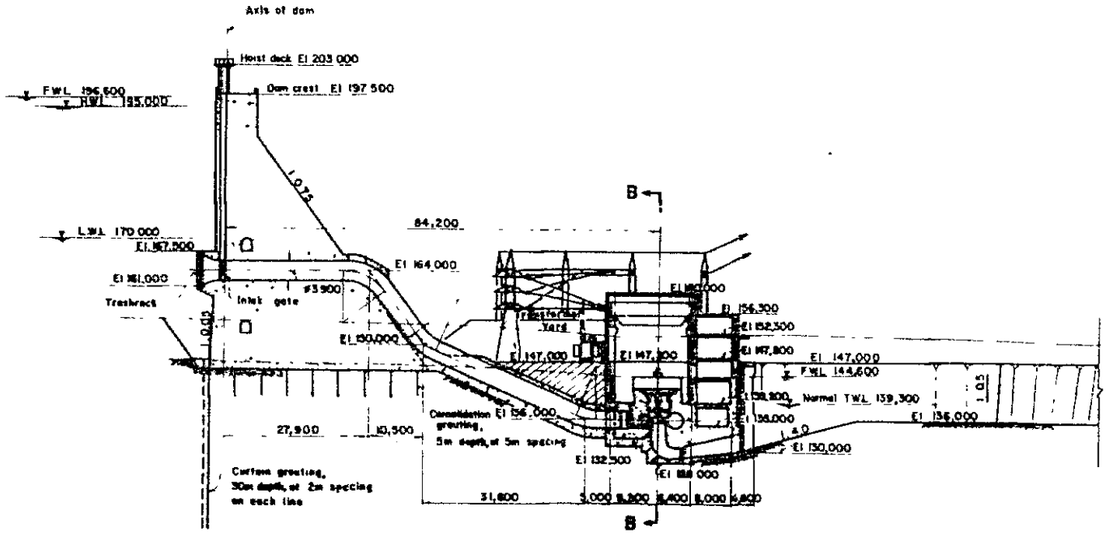


PLAN

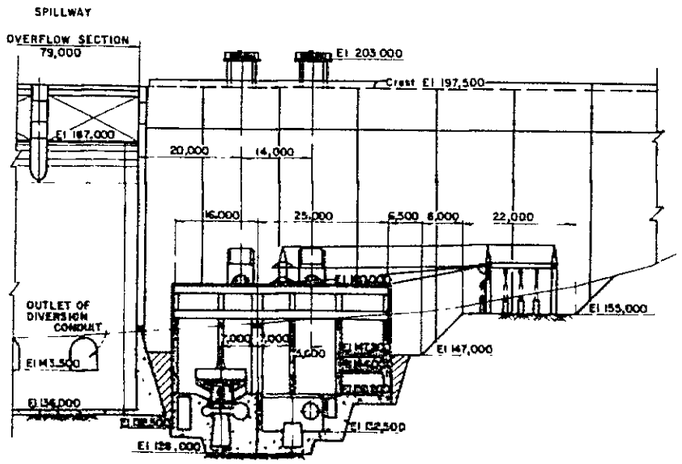
0 50 M
Scale

GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT		
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT		
MORAGAHAKANDA DAM SPILLWAY SECTION OF FIRST SADDLE DAM		
DATE	DWG NO	D-007
JAPAN INTERNATIONAL COOPERATION AGENCY		

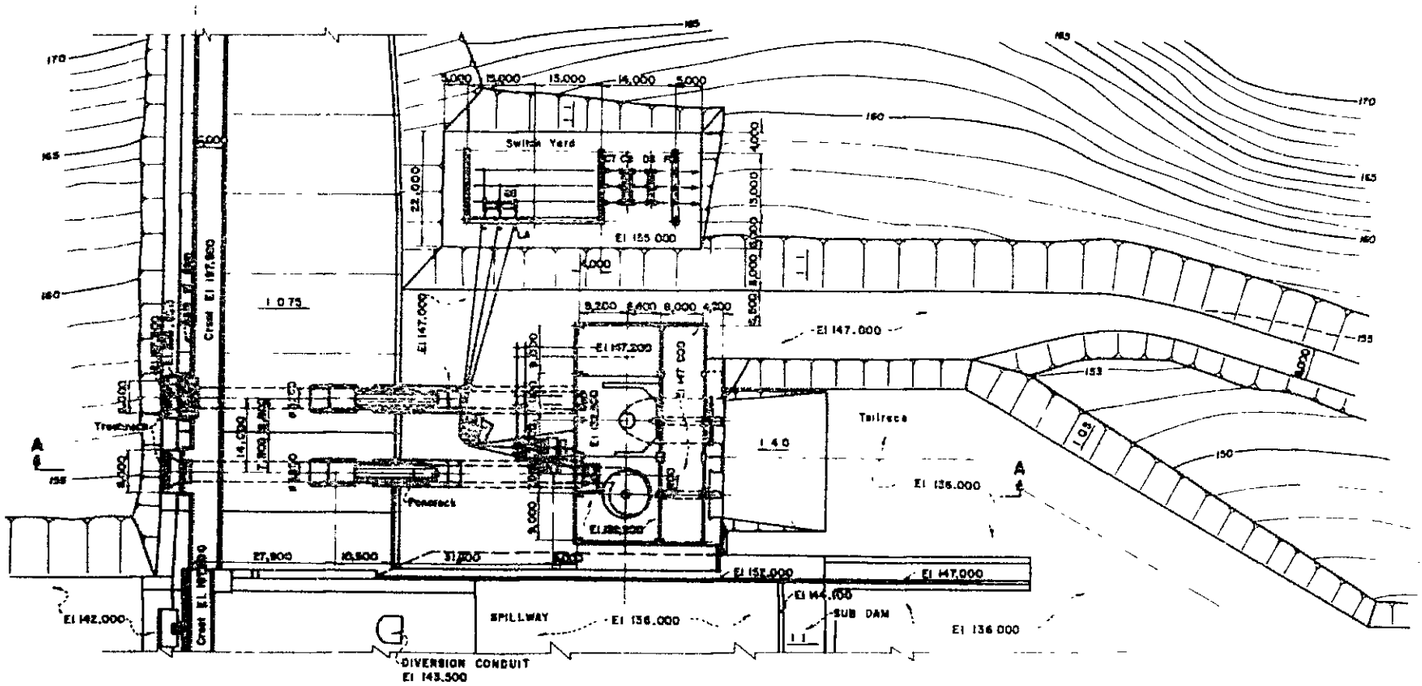
PLATE NO. 16



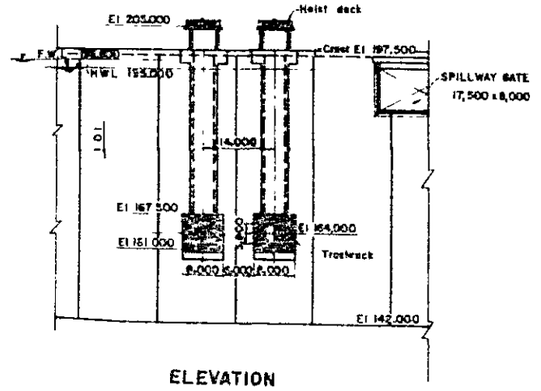
SECTION A–A



SECTION B–B



PLAN



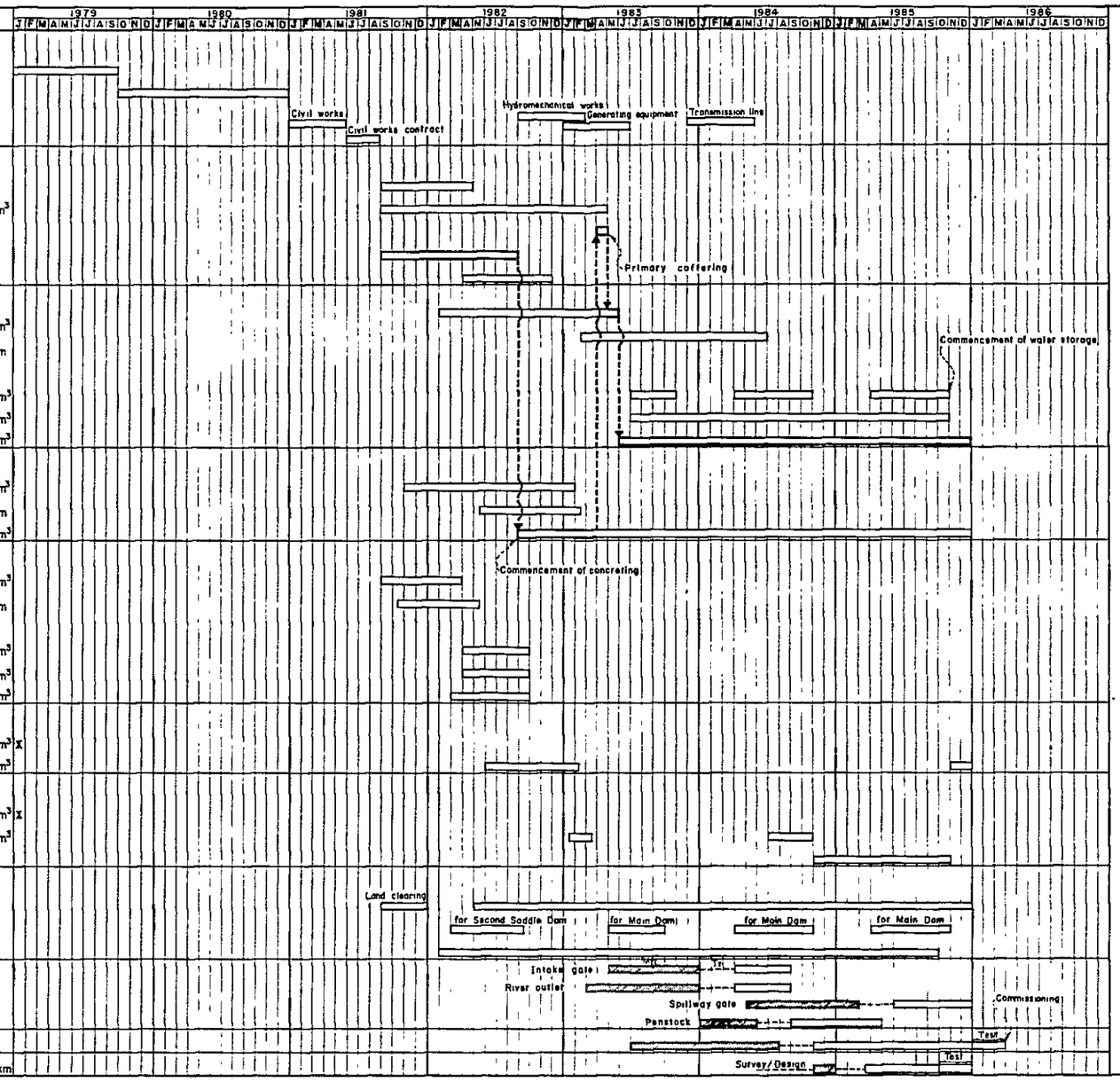
ELEVATION

0 50 M
Scale

GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT		
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT		
MORAGAHAKANDA DAM POWER STATION		
DATE	DWG NO	D - 008
JAPAN INTERNATIONAL COOPERATION AGENCY		

PLATE NO.17

Work Item	Quantity
A Tender & Others	
1. Feasibility study	
2. Tender design	
3 Tender & contract	
4 Mobilization	
B. Preparatory Works	
1 Construction road & bridges	
2. Diversion canal	604,000 m^3
3 Primary cofferdams	
4 Aggregate & concrete plant	
5 Trestle & crane	
C Main Dam	
1. Excavation	578,000 m^3
2. Grouting	20,630 m
3 Embankment	
Core zone	714,000 m^3
Filter zone	182,000 m^3
Rock zone	1,533,000 m^3
D First Saddle Dam	
1. Excavation	248,000 m^3
2. Grouting	16,900 m
3 Concreting	376,000 m^3
E. Second Saddle Dam	
1 Excavation	177,000 m^3
2. Grouting	21,820 m
3 Embankment	
Core zone	139,000 m^3
Filter zone	51,000 m^3
Rock zone	241,000 m^3
F. Stilling Basin	
1 Excavation	58,500 m^3 X
2. Concreting	25,600 m^3
G. Powerhouse	
1. Excavation	119,000 m^3 X
2 Substructure	12,000 m^3
3. Superstructure	L.S
H Quarry Operation	
1. Quarry site	L S
2 Borrow area	
3 River sand	
I. Hydro-mechanical Equipment	L S
J. Electro-mechanical Equipment	L.S
K. Transmission Line	16 km



Remarks

1 Months with hatch are rainy seasons and the rest without hatch are dry seasons

2 Asterisk "x" shows excavation to be made together with diversion canal work.

3 Mfr Manufacturing
Tr Transportation

4. The flow of thick lined is a critical path.

GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

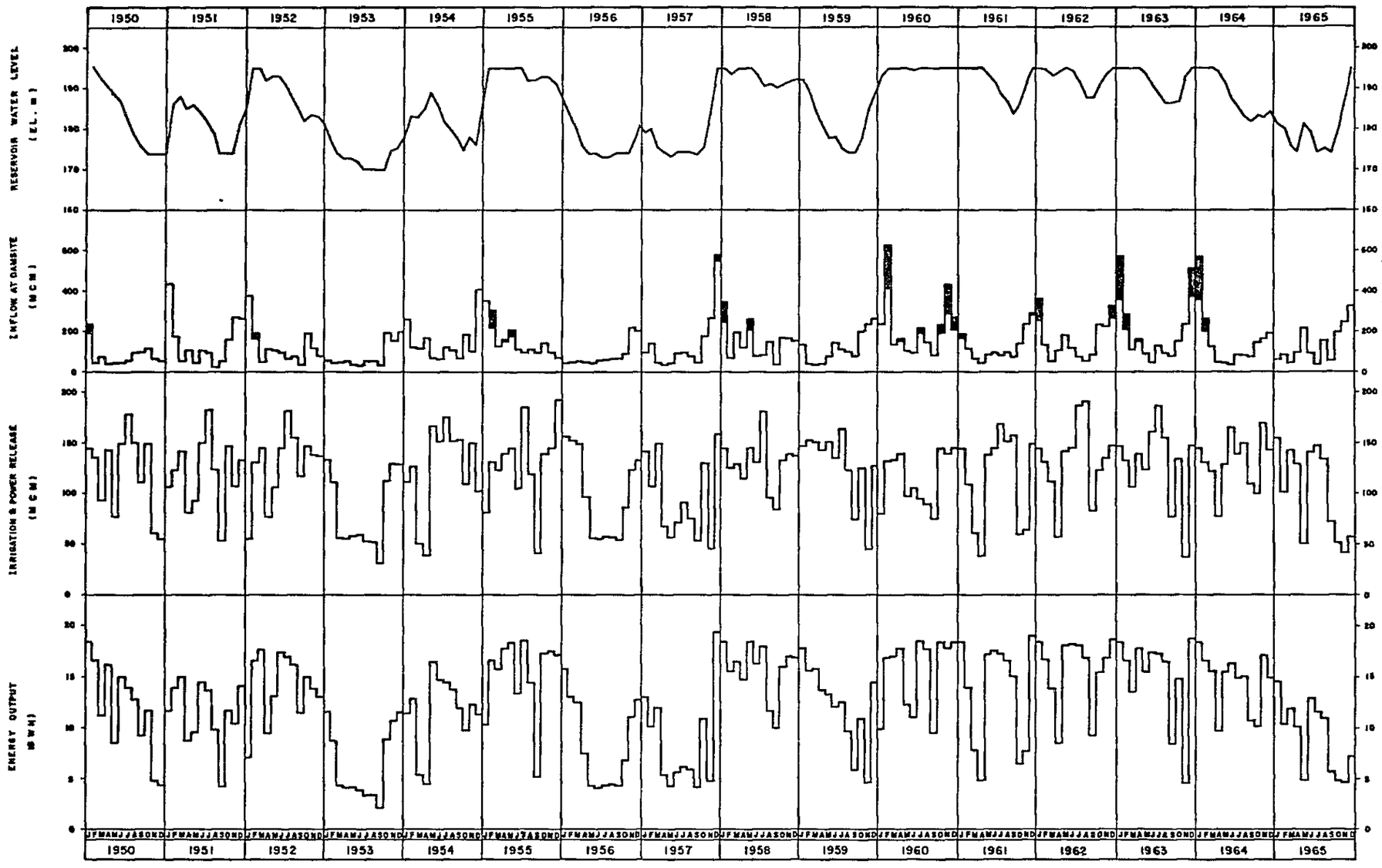
MORAGAHAKANDA DAM

CONSTRUCTION TIME SCHEDULE

DATE		D.W.G. NO	D-009

JAPAN INTERNATIONAL COOPERATION AGENCY

PLATE NO. 18



H.W.L = 195.0 m

L.W.L = 170.0 m

Gross storage capacity
903 MCM

Effective storage capacity
686 MCM

Shaded area indicates spillout from reservoir

Installed capacity
26,000 kw

Average annual energy output, 145.08 GWH

GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT

MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

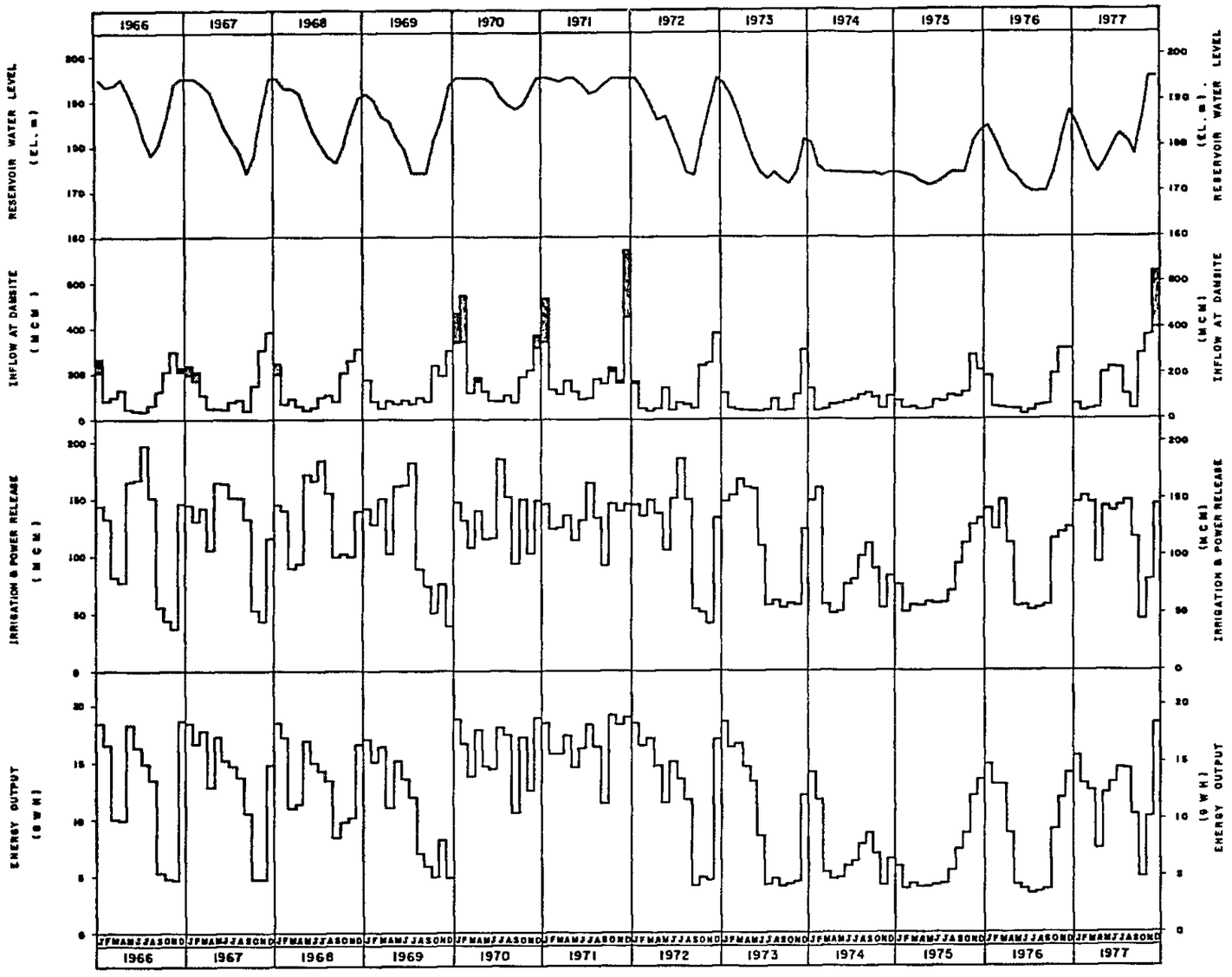
MORAGAHAKANDA DAM

RESERVOIR OPERATION STUDY (1)

DATE		DWG NO	D-010

JAPAN INTERNATIONAL COOPERATION AGENCY

PLATE NO. 19



H.W.L = 195.0 m

L.W.L = 170.0 m

Gross storage capacity, 903 MCM

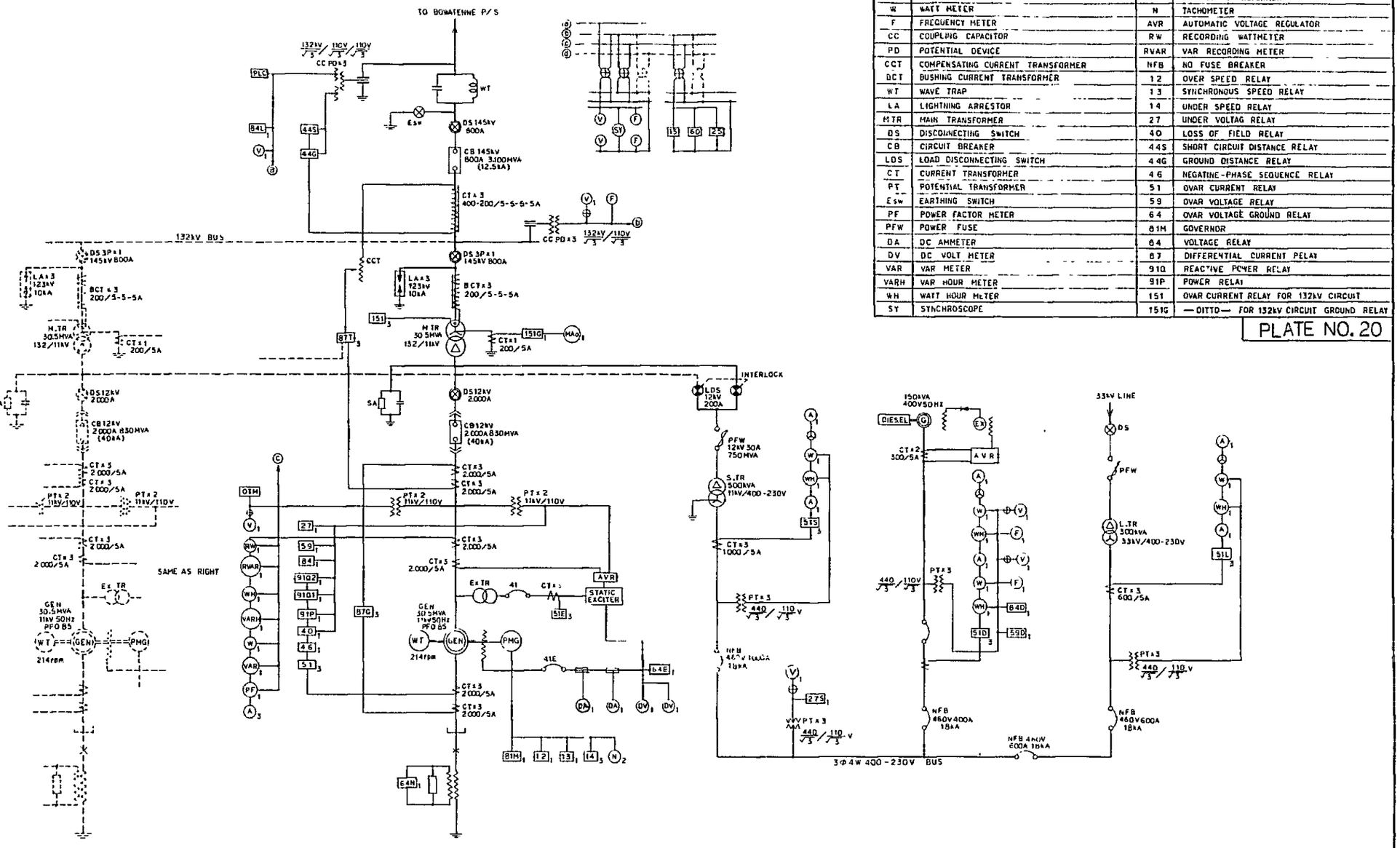
Effective storage capacity, 686 MCM

Shaded area indicates spillout volume from reservoir

Installed capacity, 26,000 kw

Average annual energy output, 145.08 GWH

GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT			
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
MORAGAHAKANDA DAM RESERVOIR OPERATION STUDY (2)			
DATE		DWG NO.	D-011
* JAPAN INTERNATIONAL COOPERATION AGENCY			



MARK	LEGEND	MARK	LEGEND
A	AMMETER	GPT	GROUNDING POTENTIAL TRANSFORMER
V	VOLT METER	EXTR	EXCITER TRANSFORMER
W	WATT METER	N	TACHOMETER
F	FREQUENCY METER	AVR	AUTOMATIC VOLTAGE REGULATOR
CC	COUPLING CAPACITOR	RW	RECORDING WATTMETER
PD	POTENTIAL DEVICE	RVAR	VAR RECORDING METER
CCT	COMPENSATING CURRENT TRANSFORMER	NFB	NO FUSE BREAKER
BCT	BUSHING CURRENT TRANSFORMER	12	OVER SPEED RELAY
WT	WAVE TRAP	13	SYNCHRONOUS SPEED RELAY
LA	LIGHTNING ARRESTOR	14	UNDER SPEED RELAY
MTR	MAIN TRANSFORMER	27	UNDER VOLTAG RELAY
DS	DISCONNECTING SWITCH	40	LOSS OF FIELD RELAY
CB	CIRCUIT BREAKER	44S	SHORT CIRCUIT DISTANCE RELAY
LDS	LOAD DISCONNECTING SWITCH	44G	GROUND DISTANCE RELAY
CT	CURRENT TRANSFORMER	46	NEGATIVE-PHASE SEQUENCE RELAY
PT	POTENTIAL TRANSFORMER	51	OVAR CURRENT RELAY
Esw	EARTHING SWITCH	59	OVAR VOLTAGE RELAY
PF	POWER FACTOR METER	64	OVAR VOLTAGE GROUND RELAY
PFW	POWER FUSE	81M	GOVERNOR
DA	DC AMMETER	84	VOLTAGE RELAY
DV	DC VOLT METER	87	DIFFERENTIAL CURRENT RELAY
VAR	VAR METER	91Q	REACTIVE POWER RELAY
VARH	VAR HOUR METER	91P	POWER RELAY
WH	WATT HOUR METER	151	OVAR CURRENT RELAY FOR 132kV CIRCUIT
SY	SYNCHROSCOPE	151G	—DITTO— FOR 132kV CIRCUIT GROUND RELAY

PLATE NO. 20

GOVERNMENT OF SRILANKA
MINISTRY OF MAHAWELI DEVELOPMENT

MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

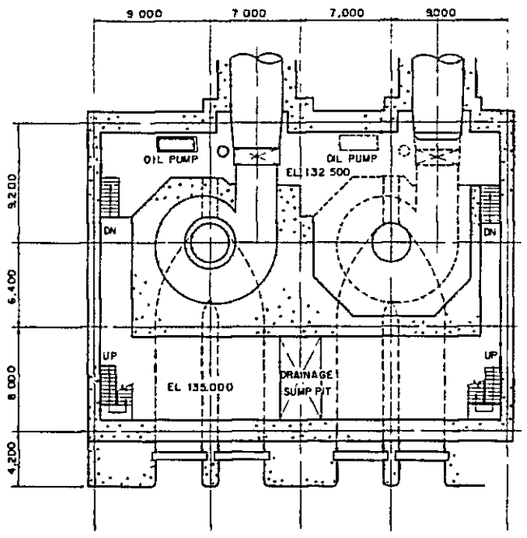
MORAGAHAKANDA POWER STATION

MAIN SINGLE LINE DIAGRAM

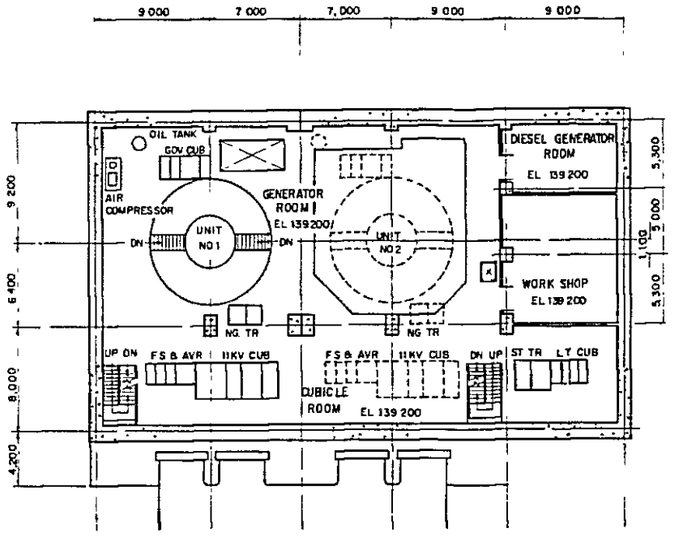
DATE		D.W.G. NO.	F-CO 1

JAPAN INTERNATIONAL CO-OPERATION AGENCY

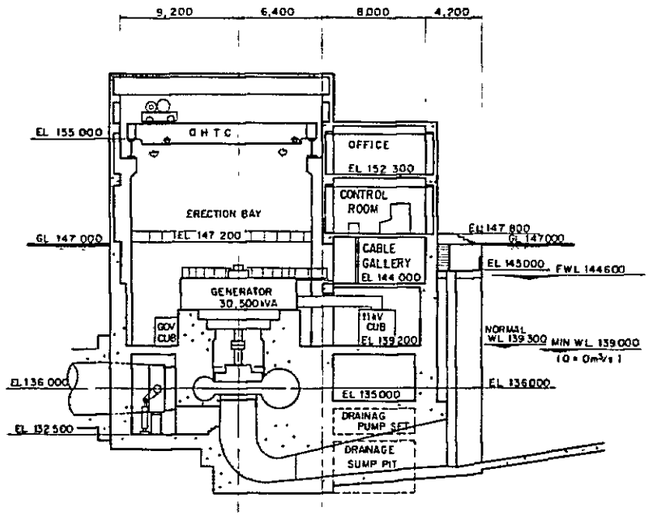
PLATE NO. 21



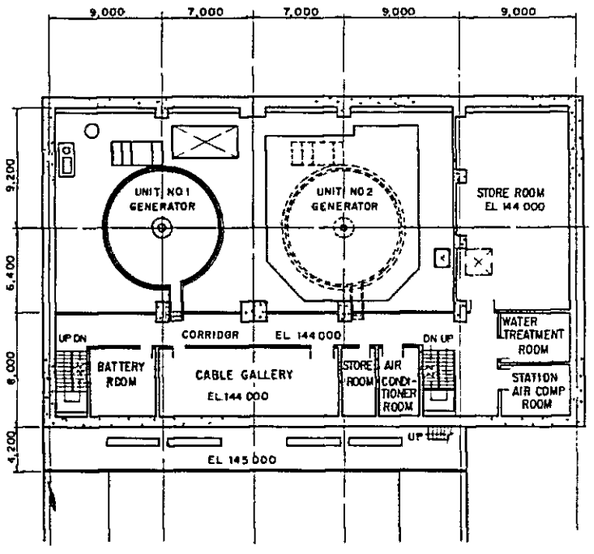
PLAN EL.132.500 AND 135.000



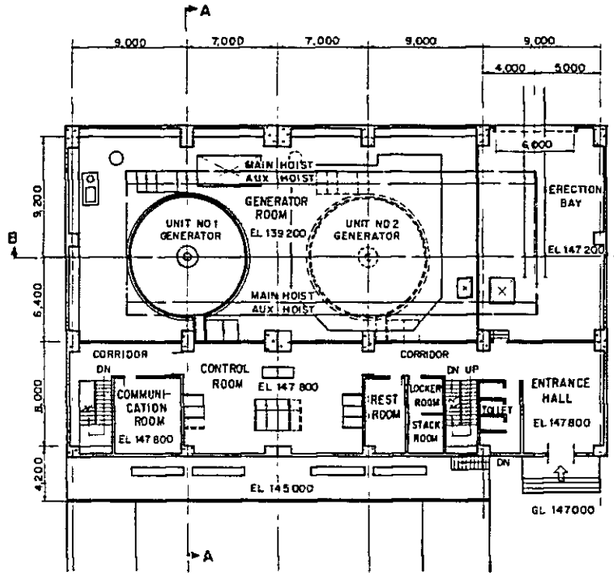
PLAN EL. 139.200



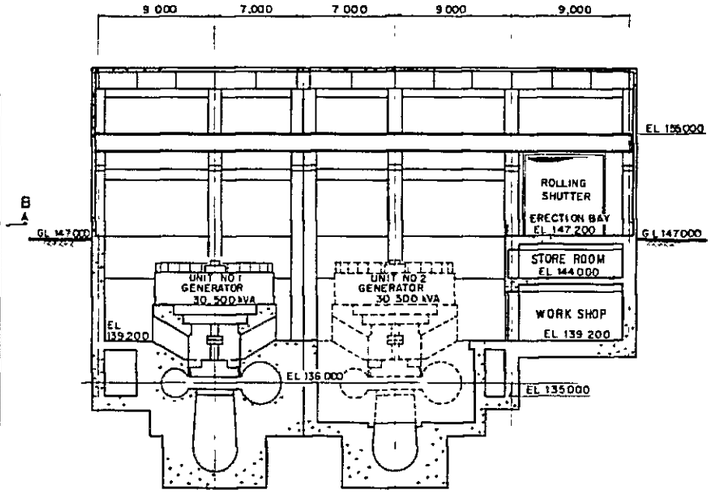
SECTION A — A



PLAN EL. 144.000



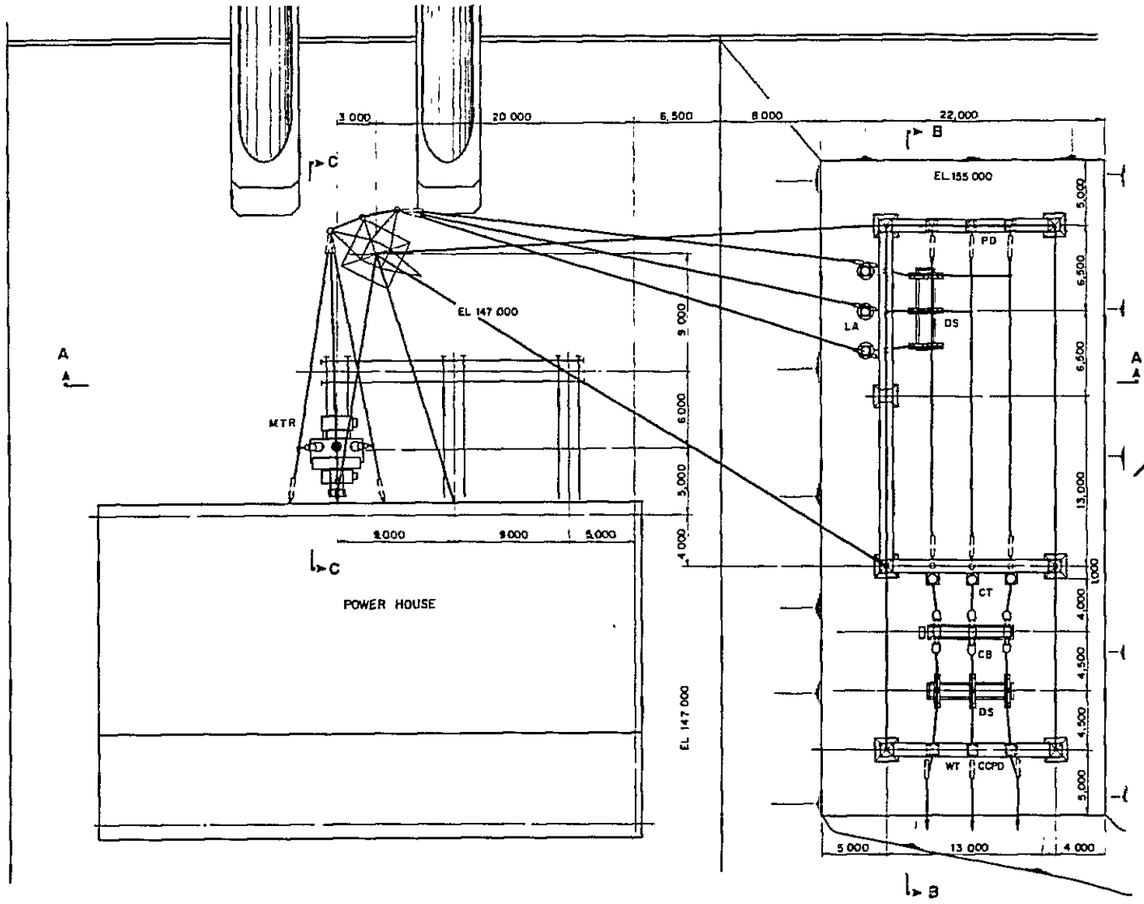
PLAN EL. 147.200 AND 147. 800

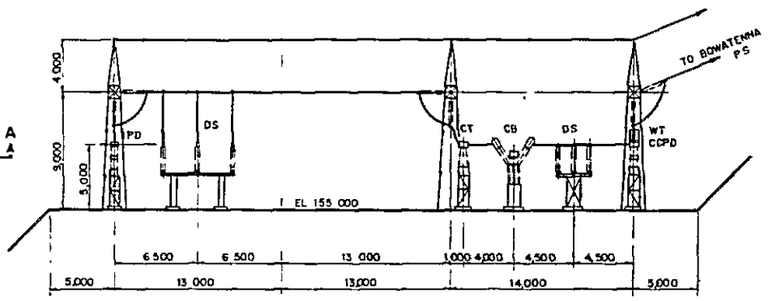


SECTION B — B

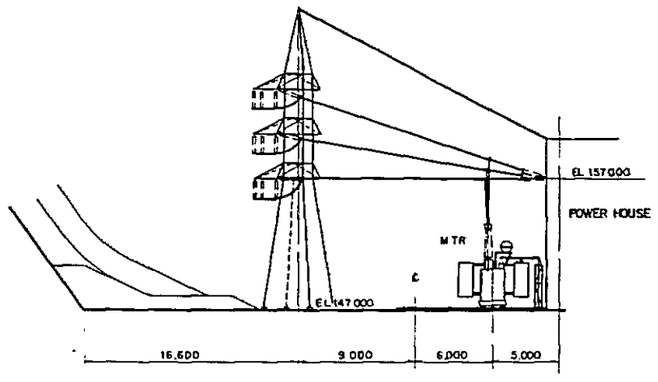
GOVERNMENT OF SRI LANKA	
MINISTRY OF MAHAWELI DEVELOPMENT	
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT	
MORAGAHAKANDA POWER STATION ARRANGEMENT OF INDOOR EQUIPMENT	
DATE	DWG. NO. P-002
JAPAN INTERNATIONAL COOPERATION AGENCY	

PLATE NO. 22

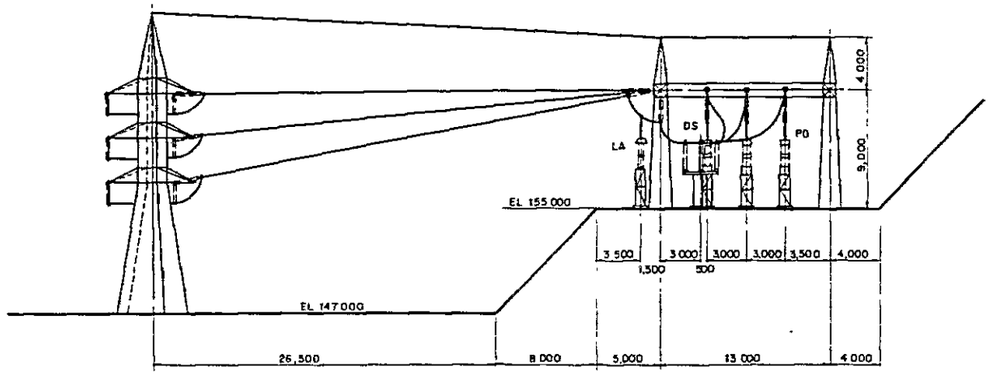




SECTION B—B



SECTION C—C



SECTION A—A

SCALE 1/200

GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT			
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
ARRANGEMENT OF OUTDOOR EQUIPMENT			
DATE		DWG NO.	P-003
JAPAN INTERNATIONAL COOPERATION AGENCY			

GENERAL PLAN

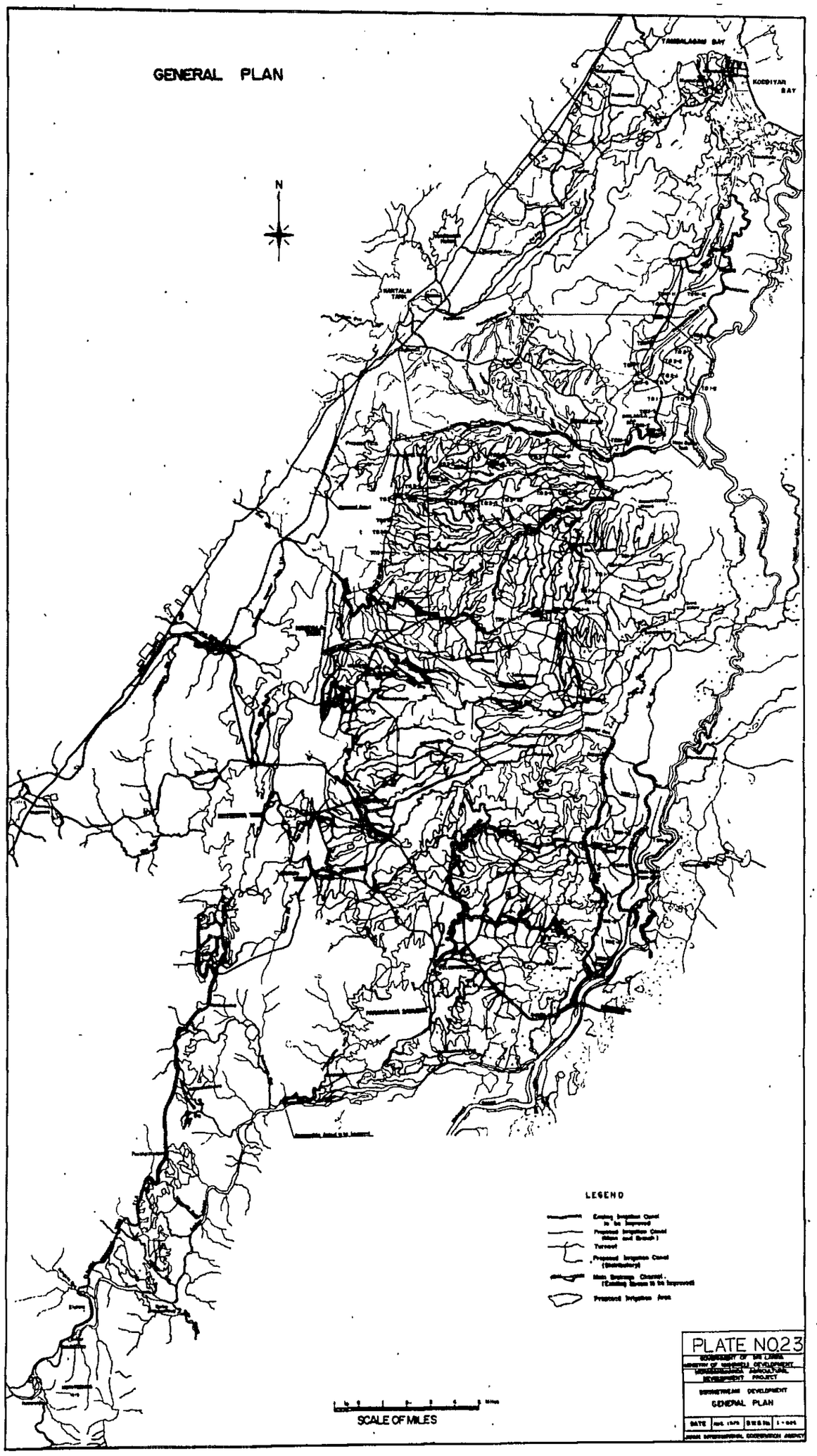


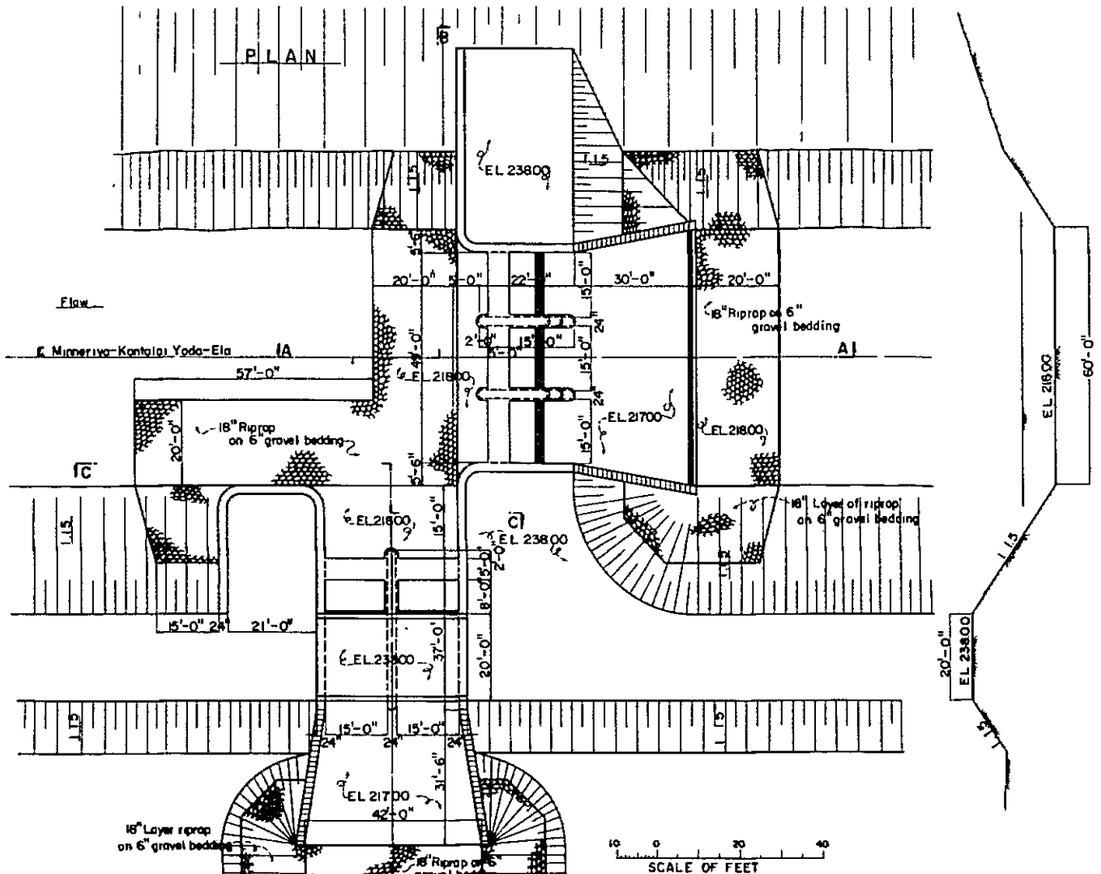
PLATE NO23

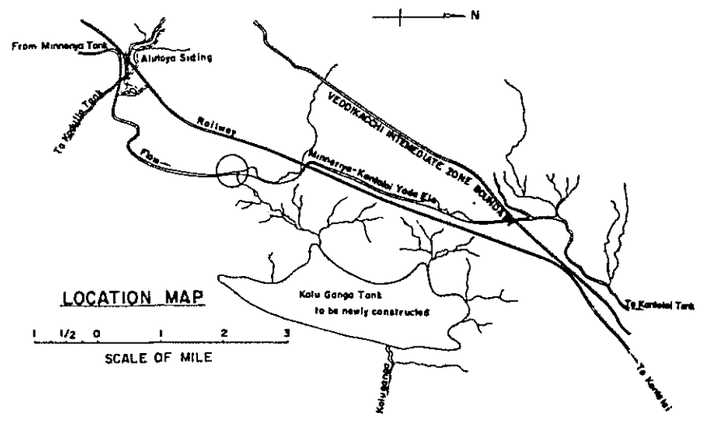
GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MAHAWELI AGRICULTURAL DEVELOPMENT PROJECT

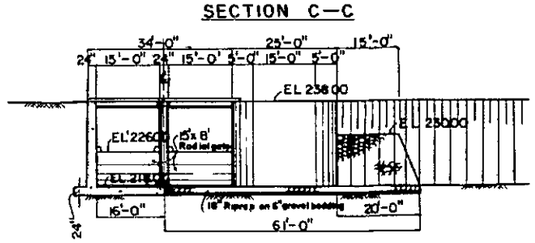
DOWNSTREAM DEVELOPMENT
GENERAL PLAN

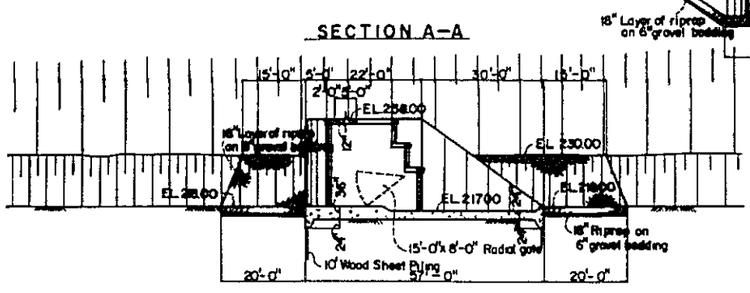
DATE | DWG No. | 1:

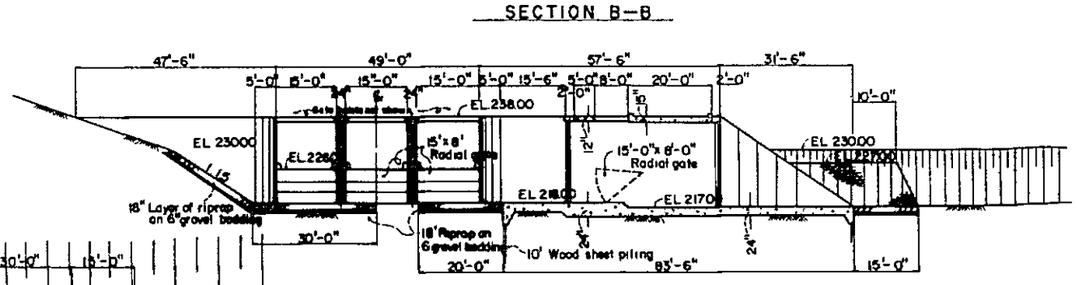
PLATE NO. 24







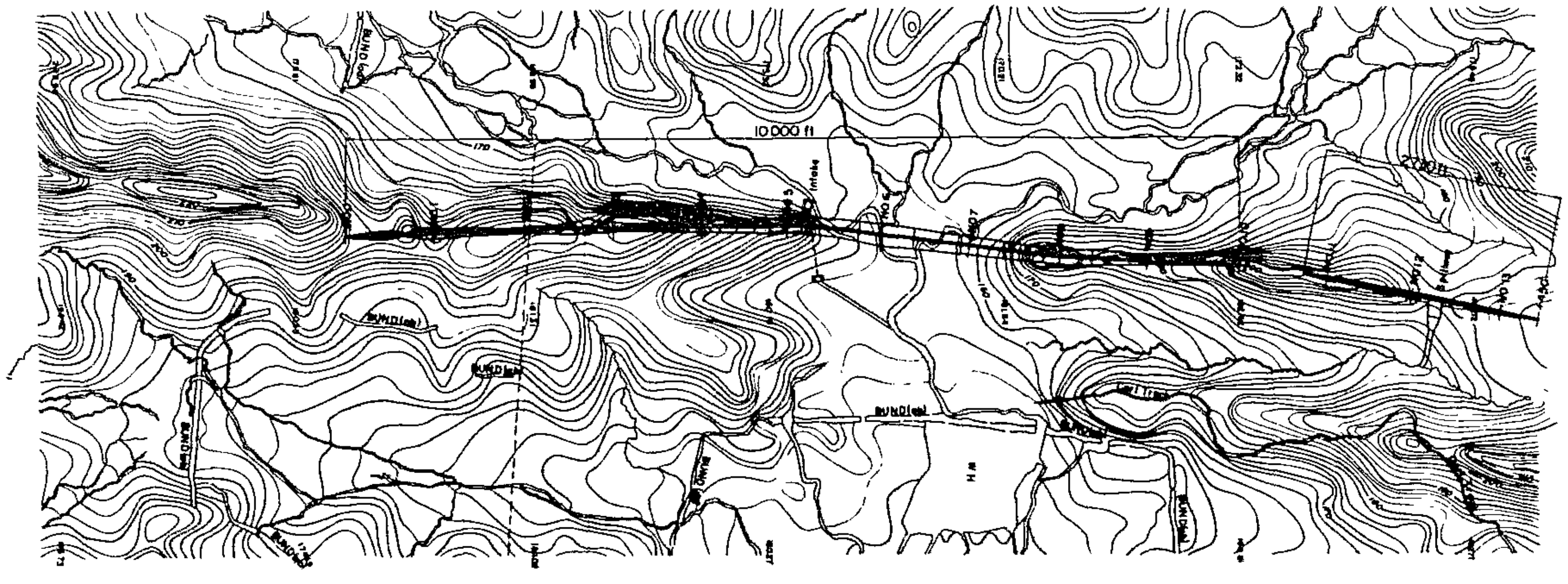




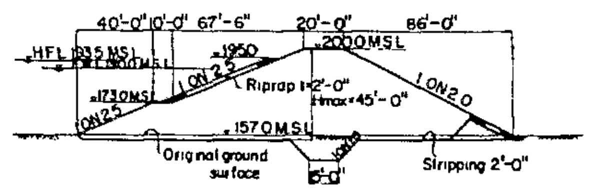
GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
SYSTEM A/D YODA ELA INTAKE			
DATE	AUG 1979	D.W.G. No.	1 - 001
JAPAN INTERNATIONAL COOPERATION AGENCY			

PLATE NO. 25

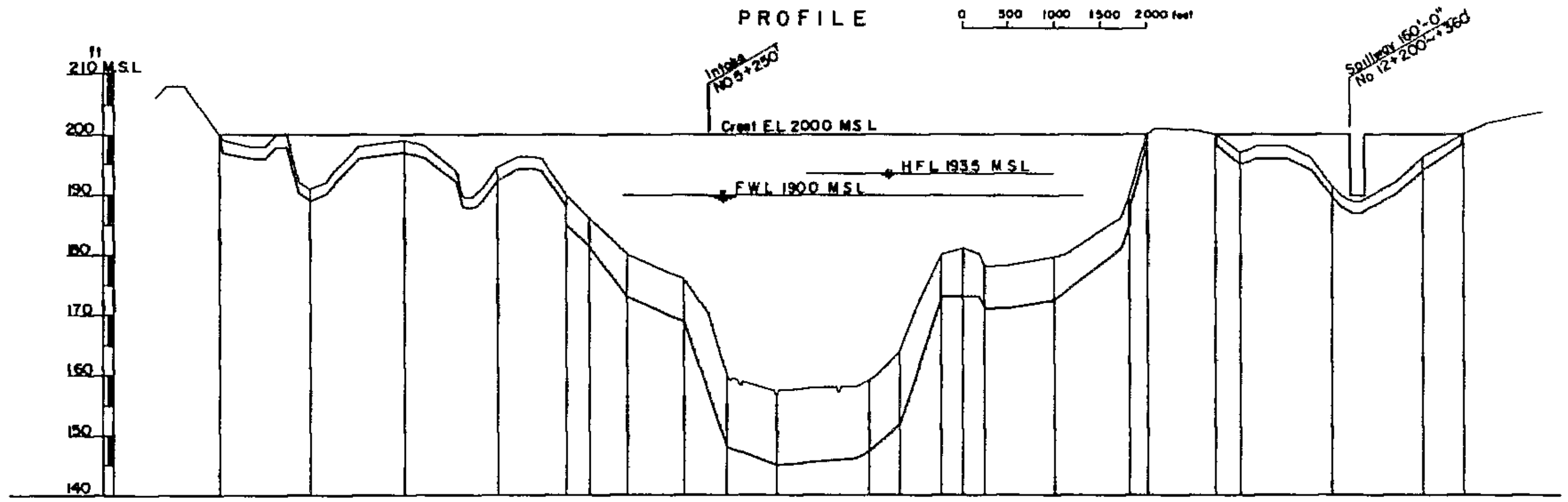
PLAN



TYPICAL DAM SECTION



PROFILE



BOTTOM OF CUTOFF	2000	1890	1970	1928	1880	1850 1812	1730	1690	1480	1450	1470	1520	1730	1730	1710	1725	1810 1640	2000	2000	1950	1895	1942	2000
EXISTING GROUND ELEVATION	2000	1910	1990	1948	1900	1862	1800	1760	1600	1570	1590	1640	1800	1810	1780	1795	1860	2000	2000	1970	1915	1962	2000
DISTANCE in x 100 ft	0 00	10 00	10 00	10 00	7 40	2 60	3 90	6 10	4 40	5 60	10 00	3 40	4 30	2 30	2 20	7 80	8 10	1 90	7 20	2 80	10 00	10 00	4 50
STATION NUMBER	NO 0	NO 1	NO 2	NO 3	+740	NO 4	+390	NO 5	+440	NO 6	NO 7	+340	+770	NO 8	+220	NO 9	+810	NO 10	+720	NO 11	NO 12	NO 13	+450

GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT
SYSTEM A/D
KALU GANGA TANK
PLAN, PROFILE & SECTION

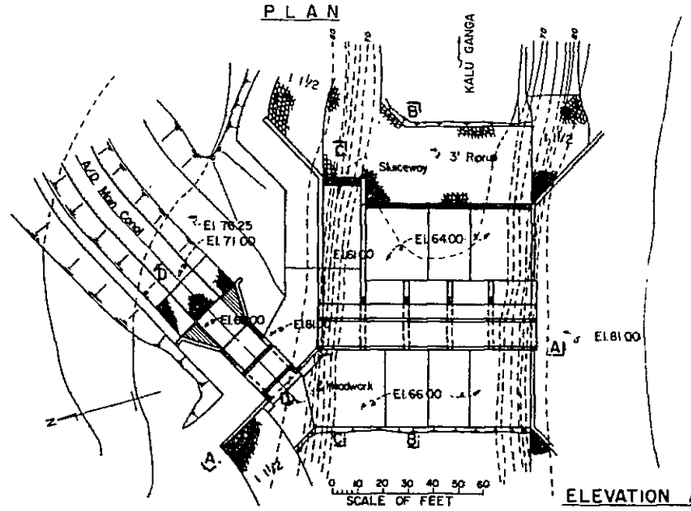
DATE	AUG. 1979	DWG No	I - 002

JAPAN INTERNATIONAL COOPERATION AGENCY

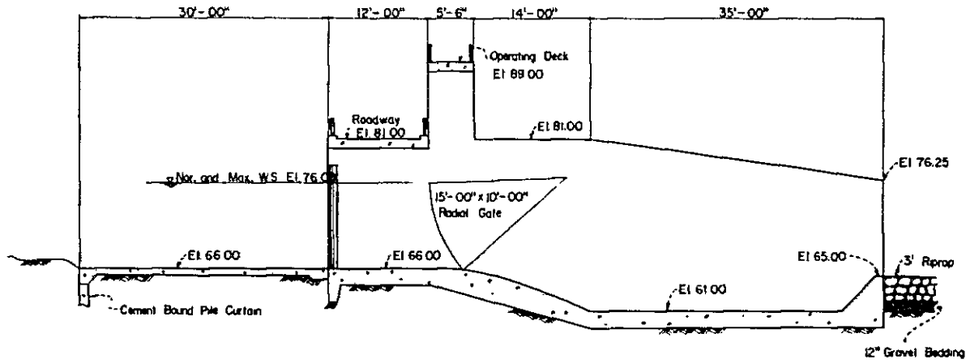
PLATE NO. 26

KALU GANGA ANICUT

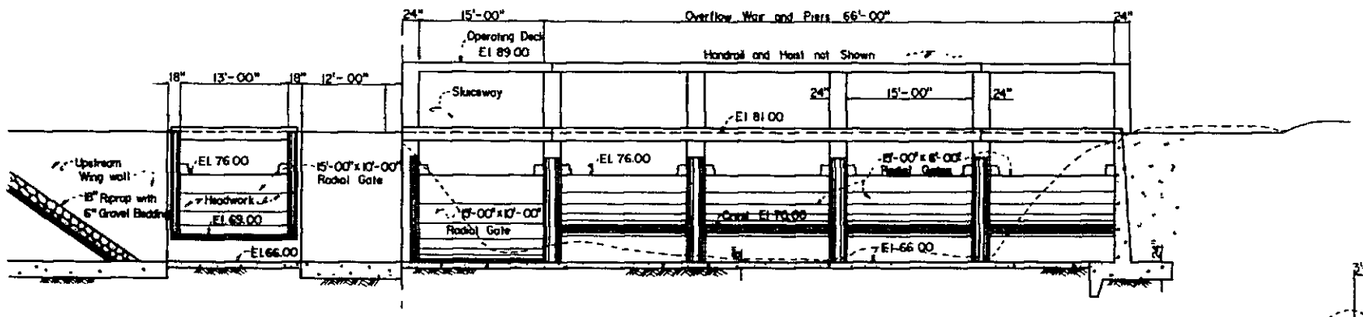
PLAN



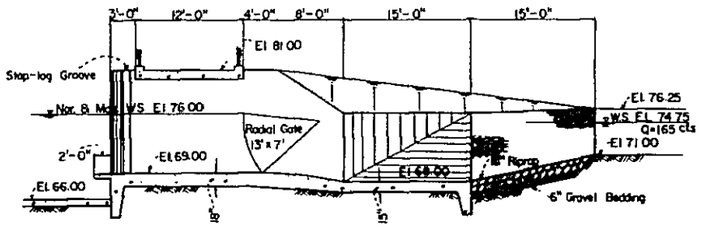
SECTION C—C



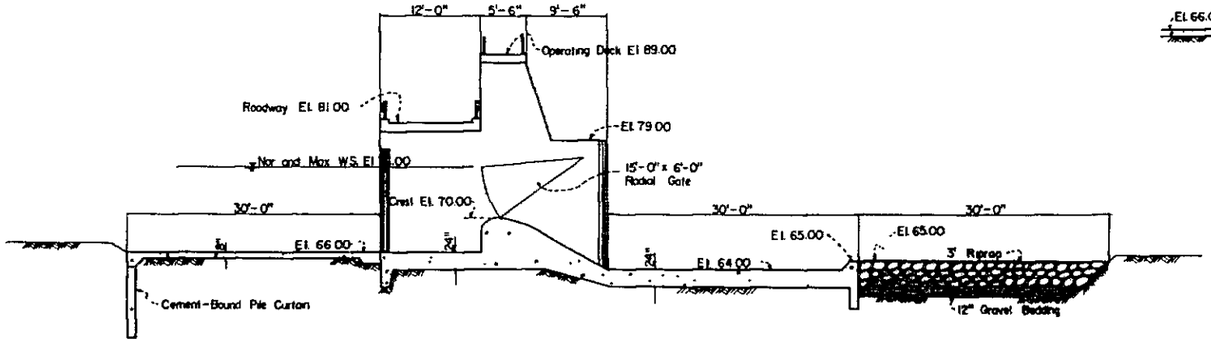
ELEVATION A—A



SECTION D—D



SECTION B—B

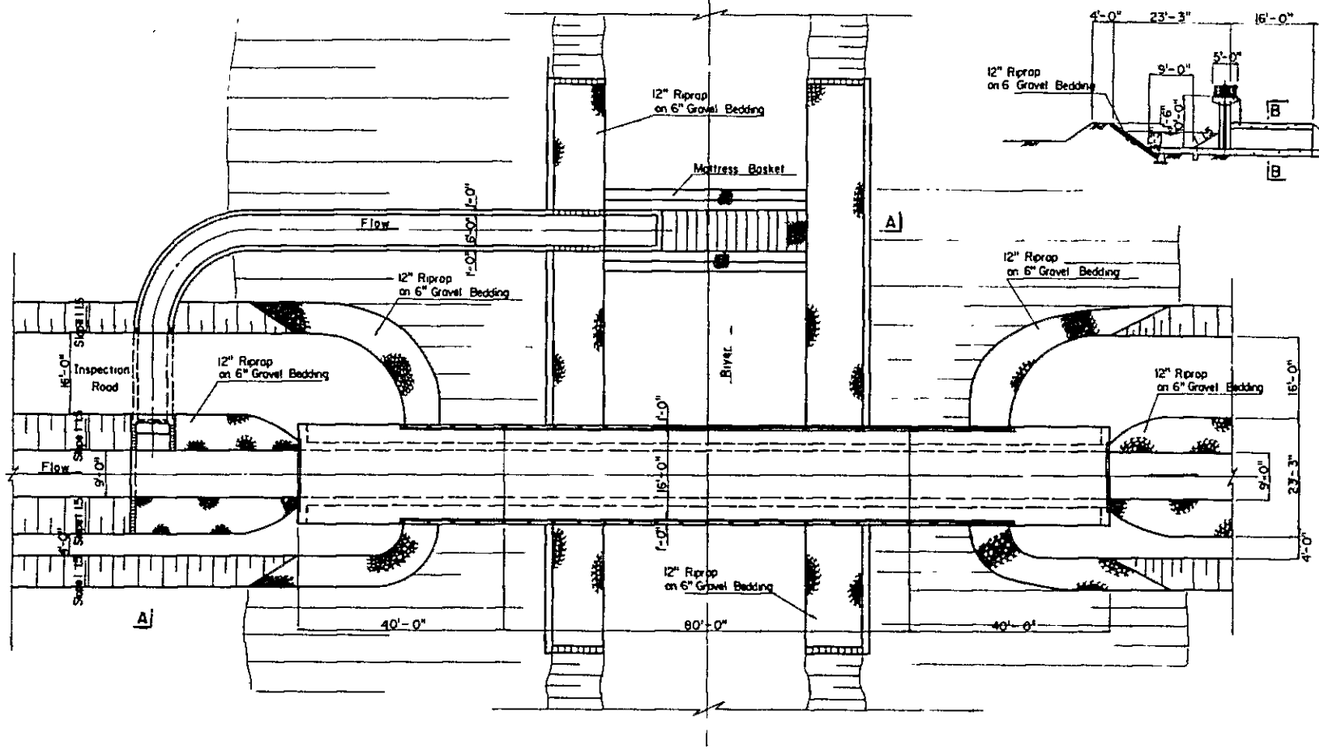


GOVERNMENT OF SRI LANKA			
MINISTRY OF MAHAWELI DEVELOPMENT			
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
SYSTEM A/D			
KALU GANGA ANICUT			
DATE	AUG 1979	D.W.G No.	I - 003
JAPAN INTERNATIONAL COOPERATION AGENCY			

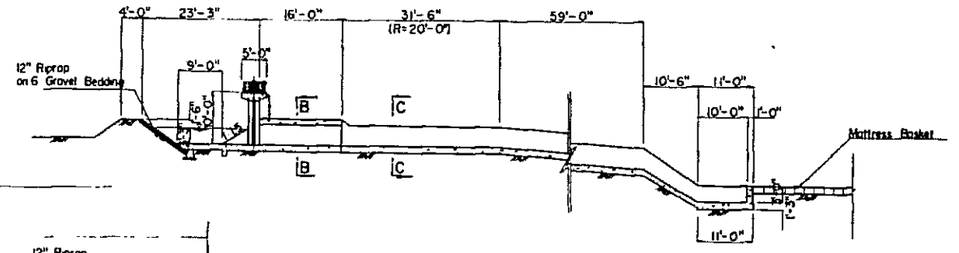
PLATE NO. 27

AQUEDUCTS

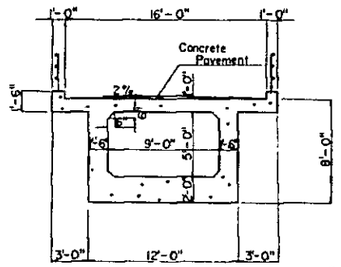
PLAN SCALE A



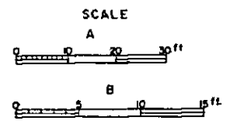
WASTE WAY (SECTION A-A) SCALE A



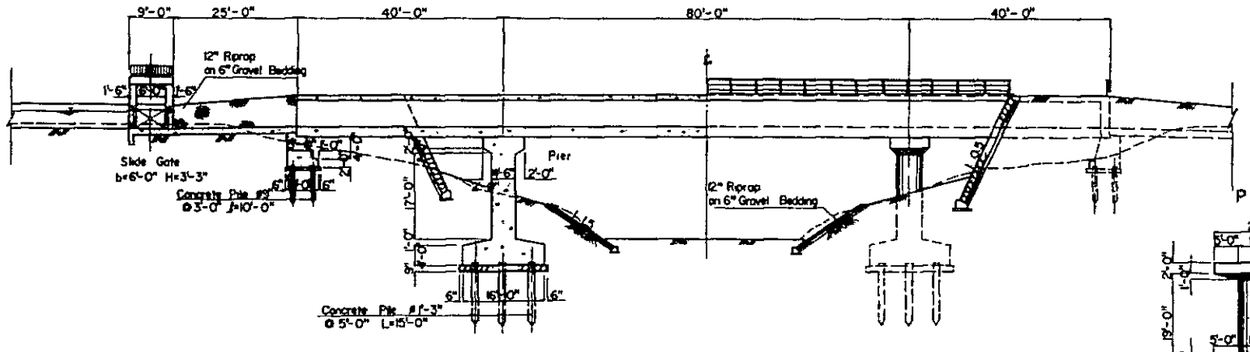
AQUEDUCT SECTION SCALE B



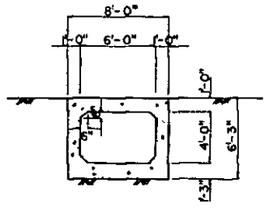
SCALE



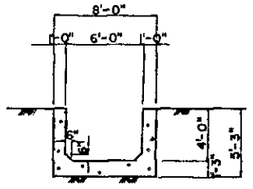
PROFILE SCALE A



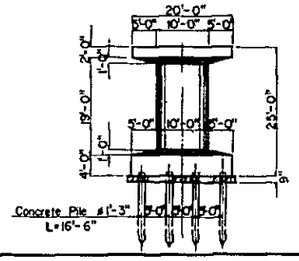
SECTION B-B SCALE B



SECTION C-C SCALE B



PIER SCALE A



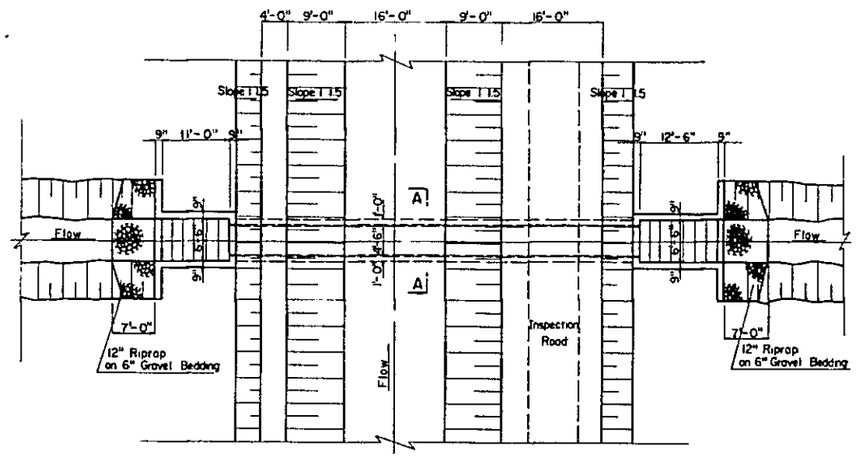
GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
AQUEDUCTS			
DATE	AUG 1979	D.W.G No	1 - 017
JAPAN INTERNATIONAL COOPERATION AGENCY			

PLATE NO. 28

CROSS DRAINS & DRAIN INLETS

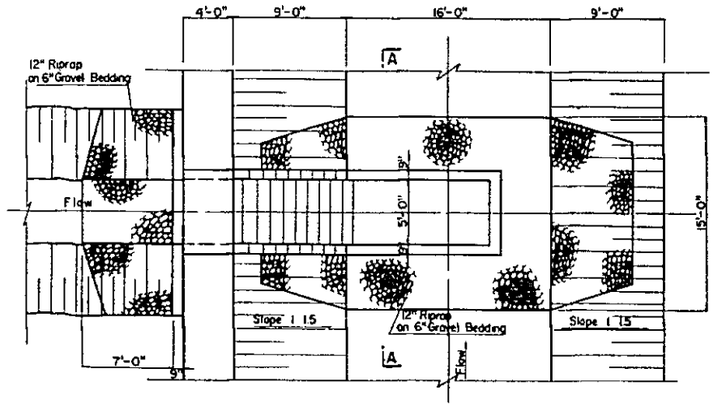
CROSS DRAINS SCALE A

PLAN

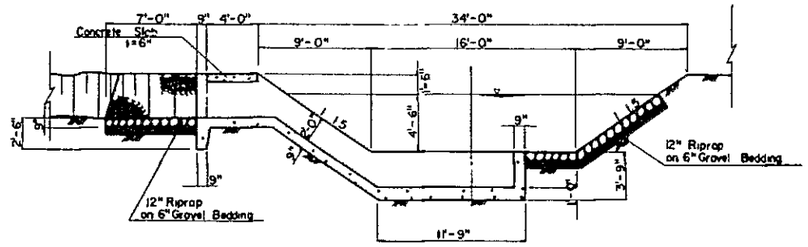


DRAIN INLETS SCALE B

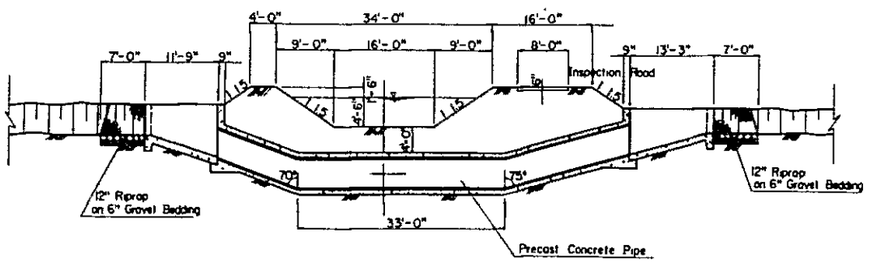
PLAN



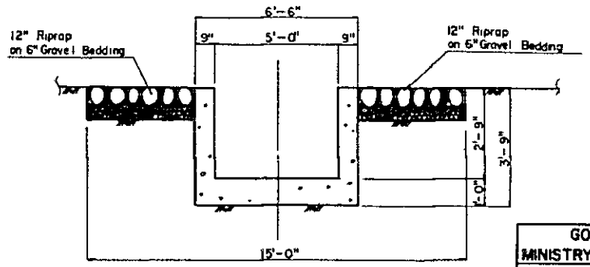
PROFILE SCALE B



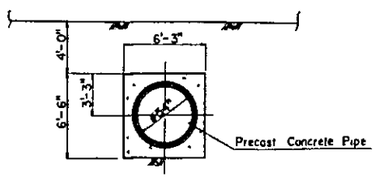
PROFILE SCALE A



SECTION A–A SCALE C

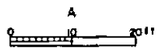


SECTION A–A SCALE B

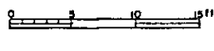


SCALE

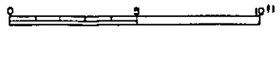
A



B



C



GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

CROSS DRAINS & DRAIN INLETS

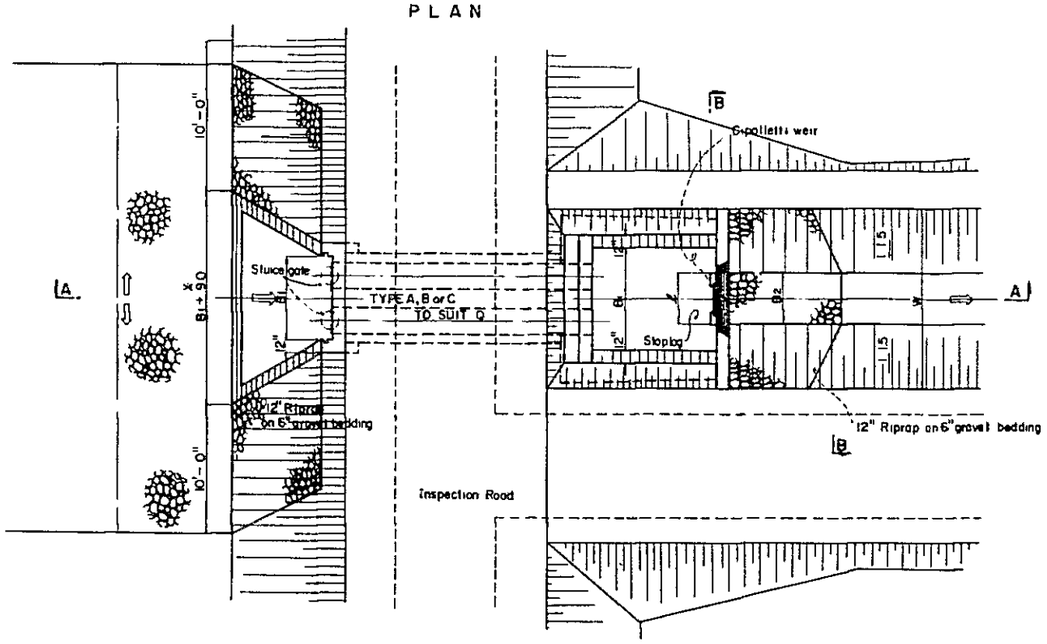
DATE	AUG 1979	D.W.G. No.	I - 018

JAPAN INTERNATIONAL COOPERATION AGENCY

PLATE NO. 29

TURNOUTS

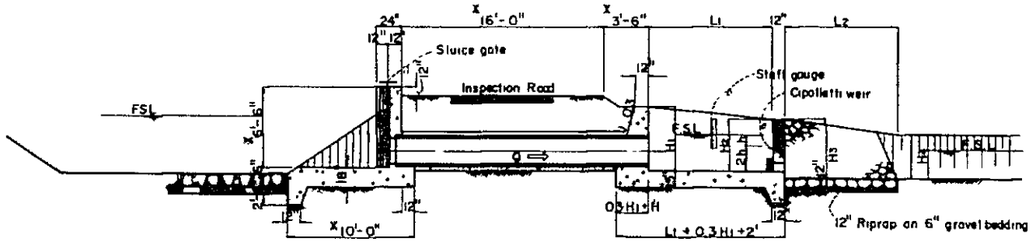
PLAN



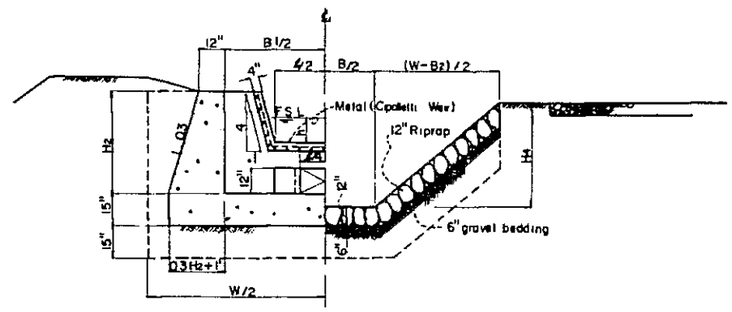
0 5 10 15
SCALE OF FEET

SECTION A—A

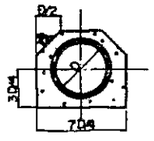
Note X varies with canal type



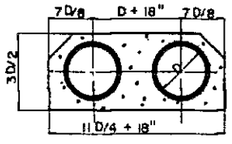
SECTION B—B



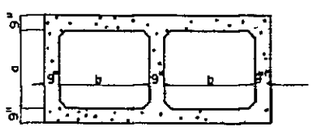
TYPE A



TYPE B



TYPE C



DIMENSIONS (Feet)

TYPE NO		Q (C.F.S)	D	b x a	ℓ	h	H1	H2	H3	H4	B1	B	W	L1	L2
A	1	3	1.00	—	2.0	0.6	2.75	2.75	3.00	2.0	5.0	2.0	8.0	6.0	6.0
	2	5	1.25	—	3.0	0.7	3.00	3.00	3.25	2.0	6.0	3.0	9.0	8.0	8.0
	3	10	1.50	—	3.5	0.9	4.00	4.00	4.25	2.75	6.5	3.5	11.75	8.0	8.0
	4	20	2.50	—	4.0	1.3	5.25	5.25	5.50	3.25	7.0	4.0	13.75	9.0	9.0
B	1	40	2.50	—	5.0	1.8	6.50	6.50	6.75	3.75	9.0	5.0	16.25	11.0	11.0
	2	60	3.00	—	7.0	1.8	6.75	6.75	7.00	4.00	11.0	7.0	19.0	14.0	14.0
	3	80	3.50	—	8.0	2.0	7.25	7.25	7.50	4.25	12.0	8.0	20.75	15.0	15.0
	4	100	4.00	—	9.0	2.3	8.25	8.25	8.50	4.75	13.0	9.0	23.25	16.0	16.0
	5	130	4.50	—	10.0	2.5	9.00	9.00	9.50	5.00	14.0	10.0	25.0	17.0	17.0
C	1	160	—	5.0×4.0	12.0	2.5	9.00	9.00	9.50	5.25	16.0	12.0	27.75	20.0	20.0
	2	200	—	5.0 4.0	14.0	2.7	9.50	9.50	10.00	5.50	18.0	14.0	30.5	22.0	22.0

GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

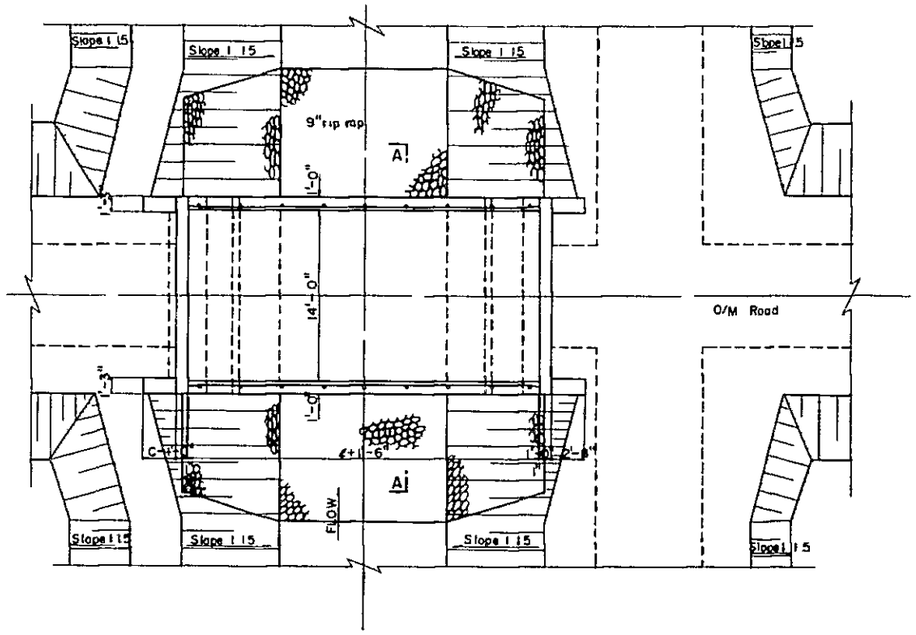
TURNOUTS

DATE	AUG 1979	D.W.G. No.	I - 020

JAPAN INTERNATIONAL COOPERATION AGENCY

BRIDGES

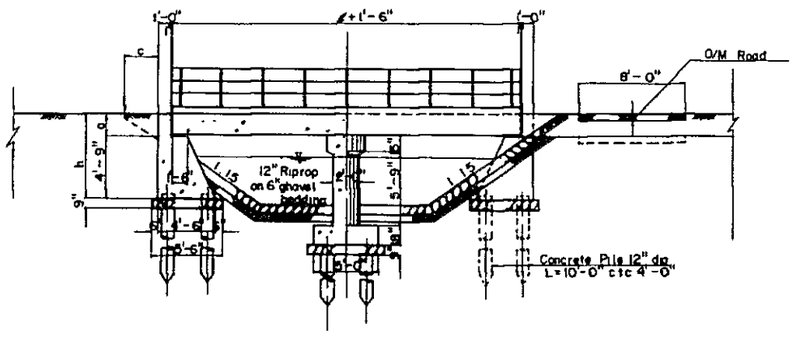
PLAN



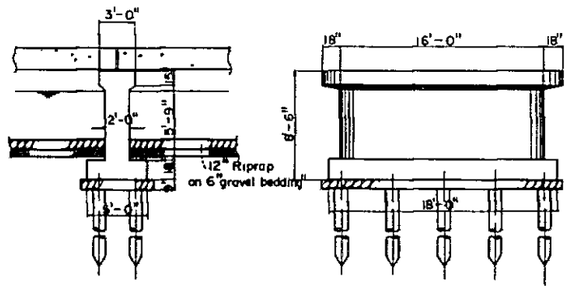
DATA TABLE

TYPE	ℓ	t	a	h	c
A	25'-0"	1'-9"	1'-9"	6'-6"	3'-0"
B	20'-0"	1'-6"	1'-6"	6'-3"	2'-9"
C	15'-0"	1'-3"	1'-3"	6'-0"	2'-3"
D	10'-0"	1'-3"	1'-3"	6'-0"	2'-3"

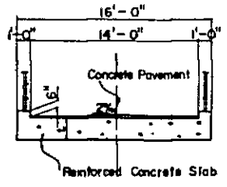
PROFILE



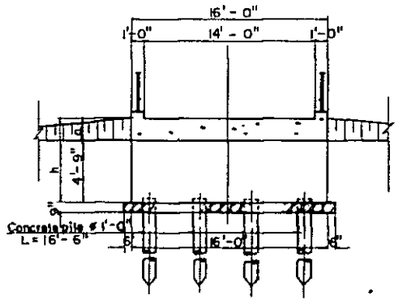
PIER



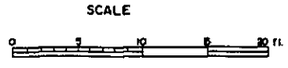
SECTION A-A



ABUTMENT



SCALE

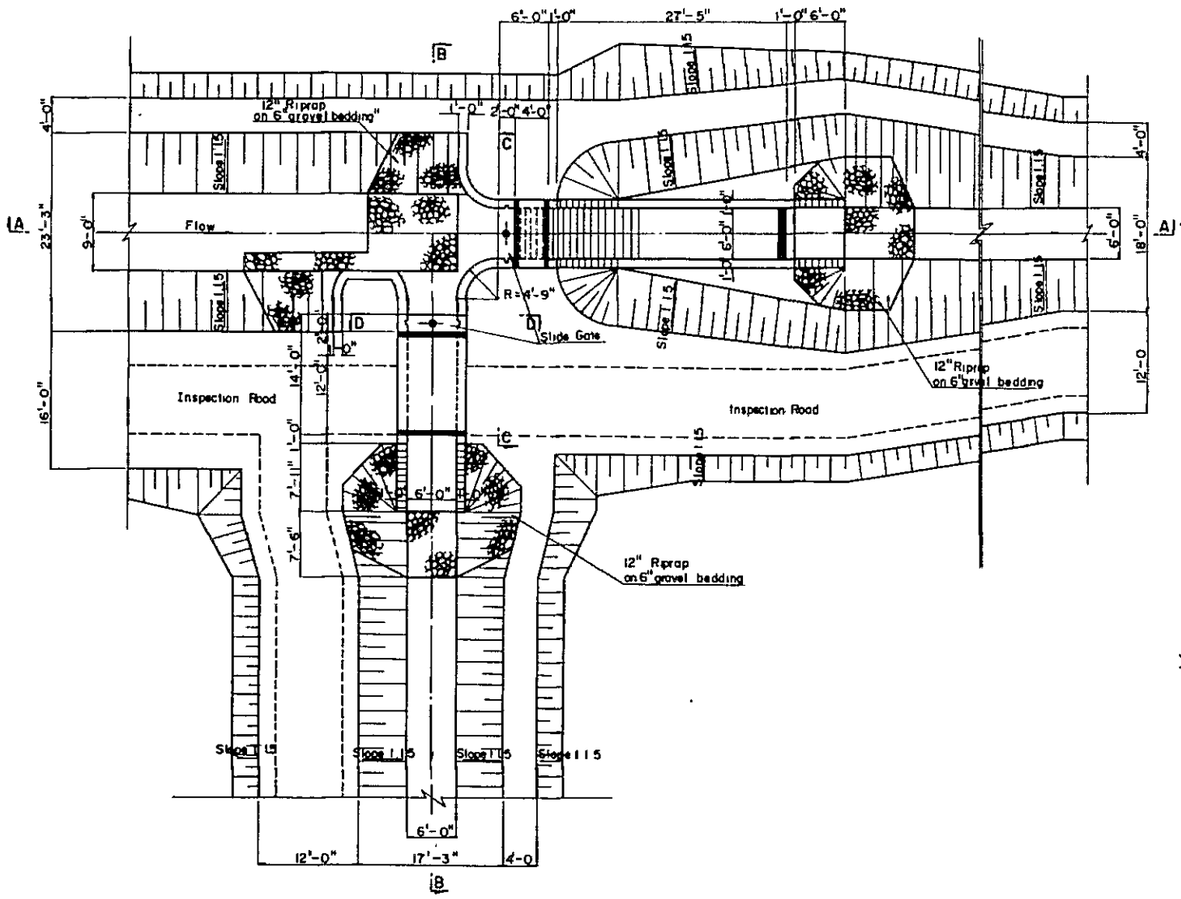


GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
BRIDGES			
DATE	AUG 1979	DWG.No.	I - 019
JAPAN INTERNATIONAL COOPERATION AGENCY			

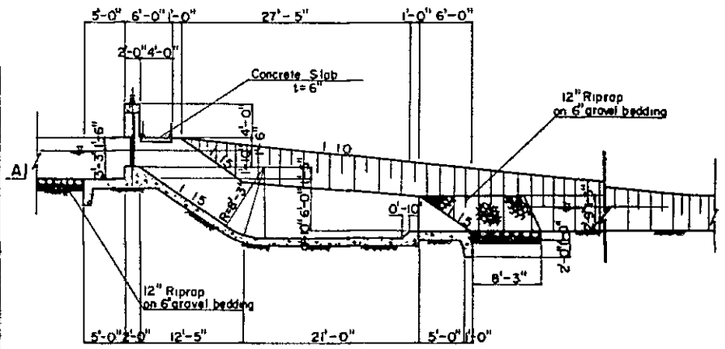
PLATE NO. 31

DIVISION STRUCTURES TYPE A

P L A N SCALE A



SECTION A—A SCALE A



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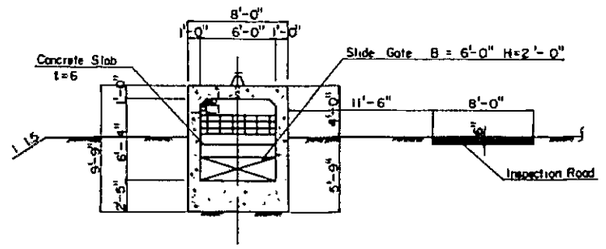

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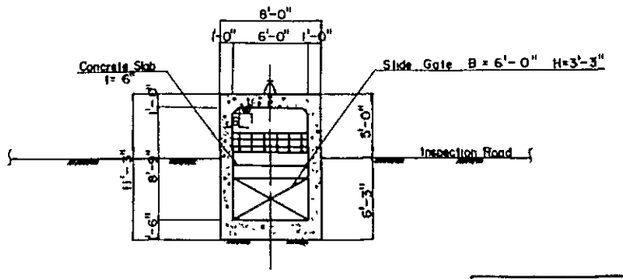

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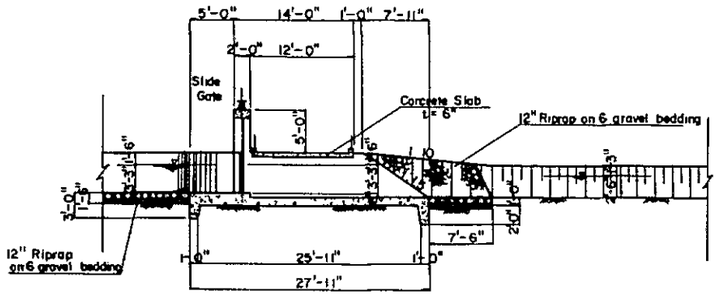

SCALE

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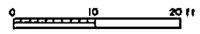

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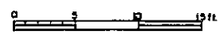
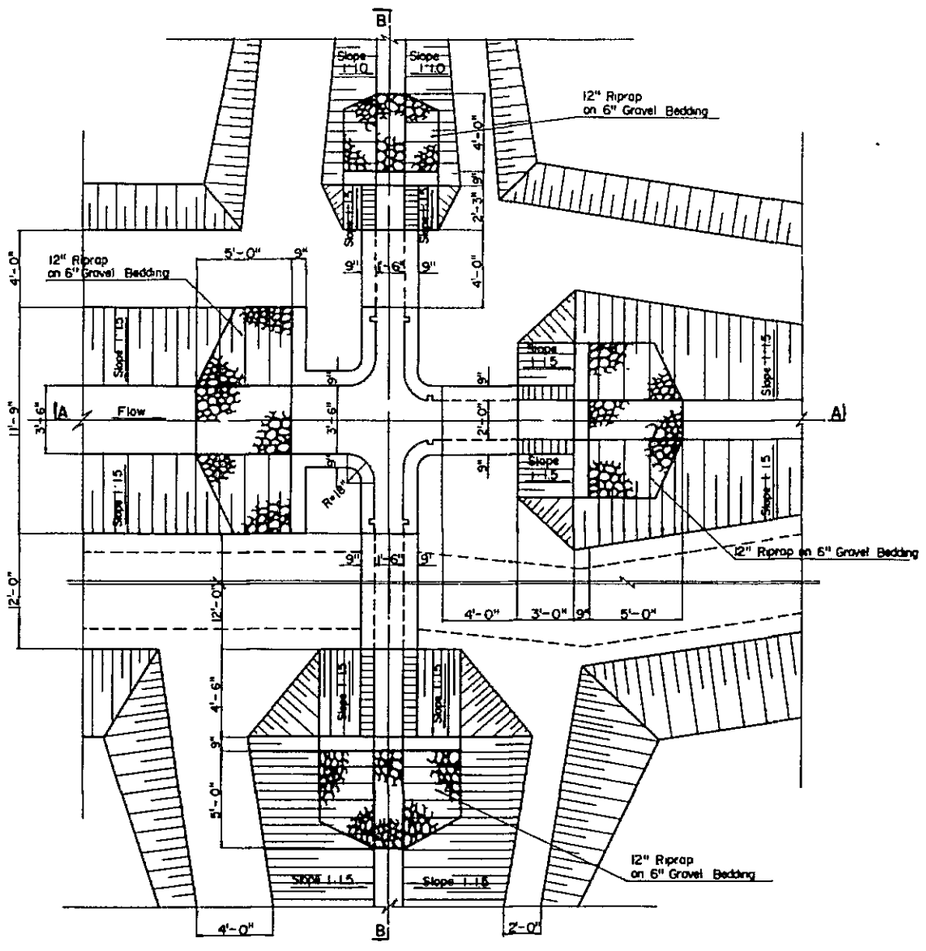


GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT	
DIVISION STRUCTURES TYPE A	
DATE: AUG 1979	D.W.G.No.: 1-021
JAPAN INTERNATIONAL COOPERATION AGENCY	

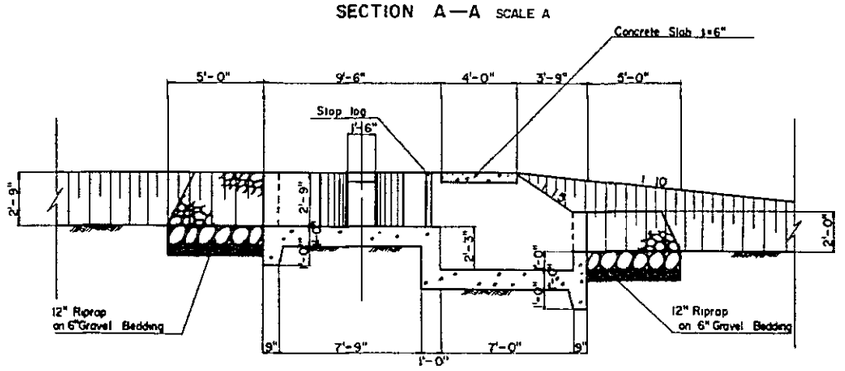
PLATE NO. 32

DIVISION STRUCTURES TYPE B

PLAN SCALE A



SECTION A—A SCALE A



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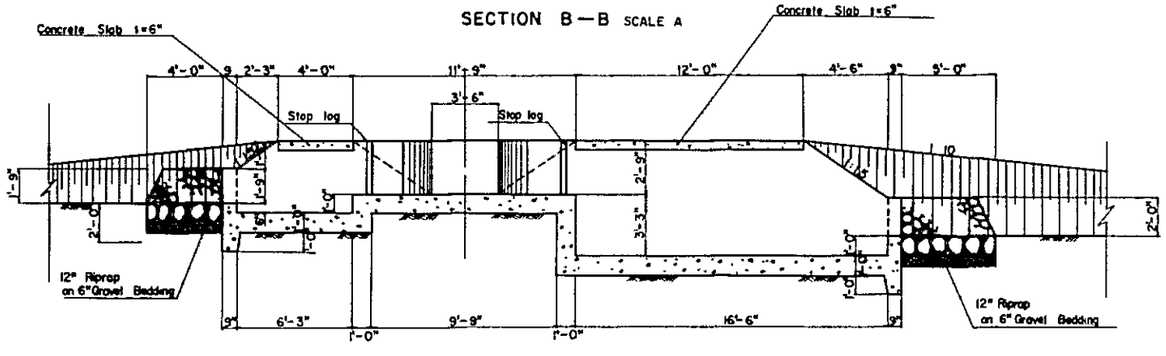


SCALE
A
0 1 2 3 4 5 6m

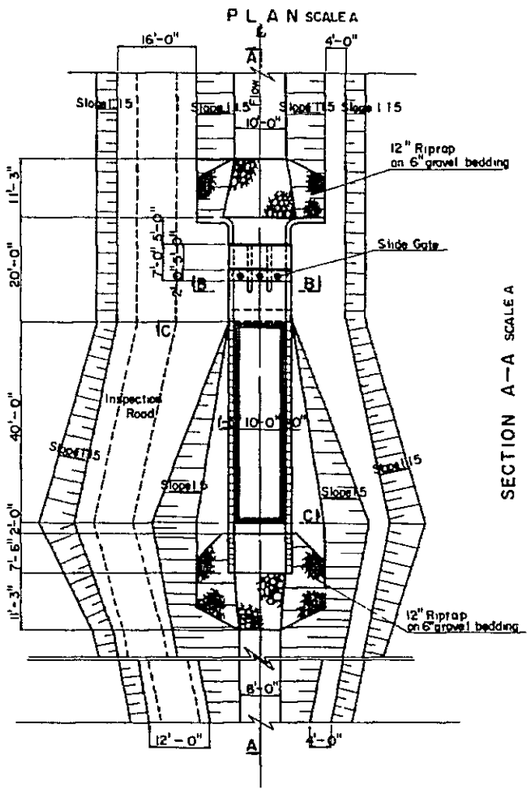
GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
DIVISION STRUCTURES TYPE B			
DATE	AUG 1979	D.W.G.No.	I - 022
JAPAN INTERNATIONAL COOPERATION AGENCY			

PLATE NO. 33

CHECK STRUCTURES

TYPE 1

PLAN SCALE A



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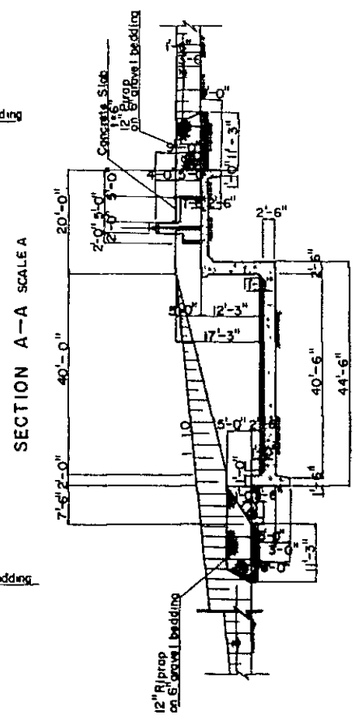
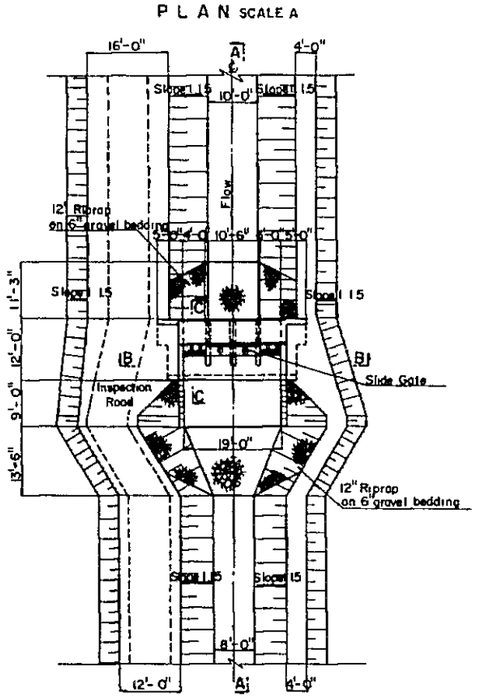
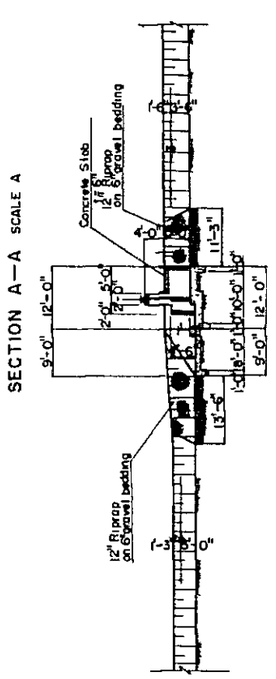


TYPE 2

PLAN SCALE A



SECTION A–A SCALE A



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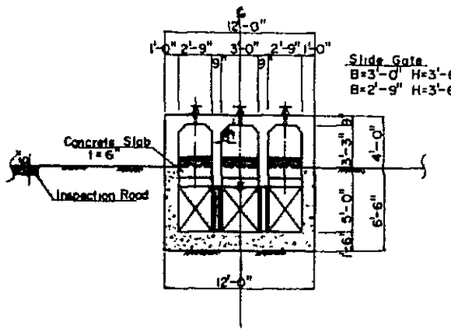
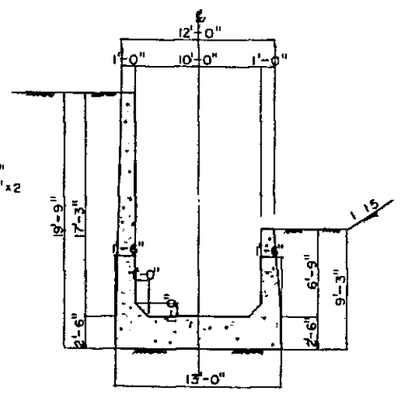
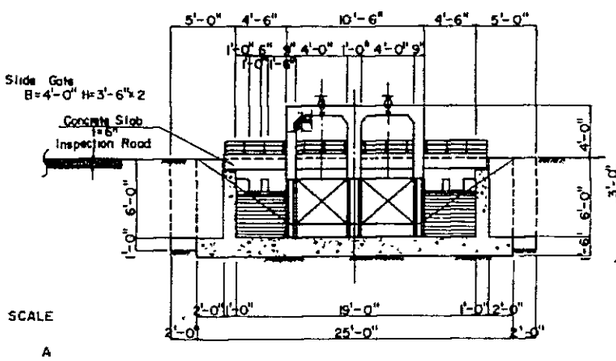


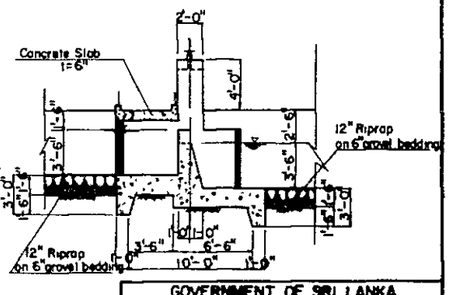
SECTION C–C SCALE B



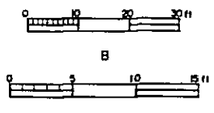
SECTION B–B SCALE B



SECTION C–C SCALE B



SCALE

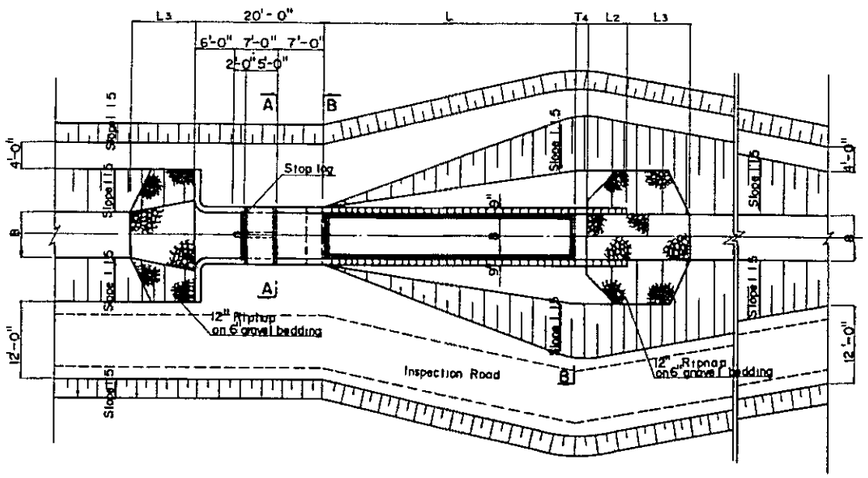


GOVERNMENT OF SRI LANKA	
MINISTRY OF MAHAWELI DEVELOPMENT	
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT	
CHECK STRUCTURES	
DATE	AUG 1979
D.W.G No.	1-023
JAPAN INTERNATIONAL COOPERATION AGENCY	

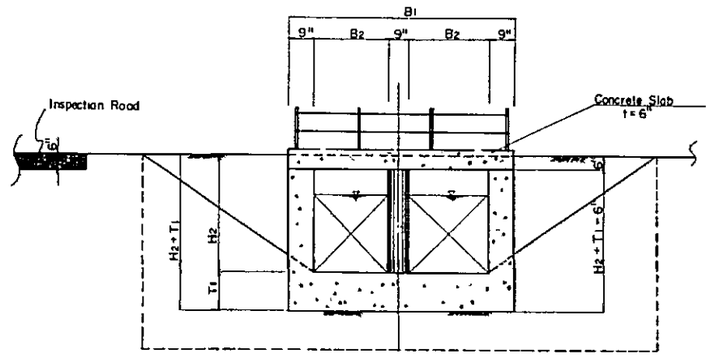
PLATE NO. 34

DROP STRUCTURES

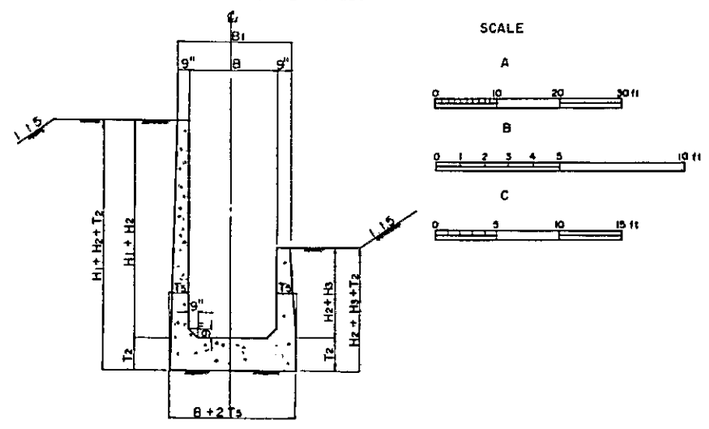
PLAN SCALE A



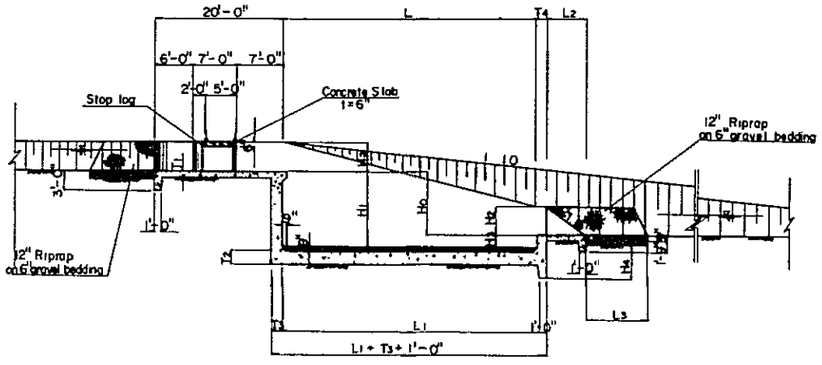
SECTION A—A SCALE B



SECTION B—B SCALEC



PROFILE SCALE A



DIMENSION (Feet)

TYPE NO.	Ho	B	B1	B2x2	H1	H2	H3	H4	L	L1	L2	L3	T1	T2	T3	T4	T5
I	5'-0"	5'-0"	6'-6"	4'-3"	6'-3"	3'-6"	1'-3"	5'-0"	20'-0"	20'-3"	5'-3"	7'-11"	9"	1'-3"	1'-0"	9"	1'-3"
II	8'-0"	7'-0"	8'-6"	6'-3"	10'-0"	4'-0"	1'-9"	6'-0"	30'-0"	30'-3"	6-0"	9'-0"	1'-0"	1'-9"	1'-6"	1'-3"	1'-9"
III	10'-0"	7'-0"	8'-6"	6'-3"	11'-6"	4'-6"	1'-9"	6'-3"	40'-0"	40'-3"	6'-9"	10" 2"	1'-0"	2'-0"	1'-9"	1'-6"	1'-9"

GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

DROP STRUCTURES

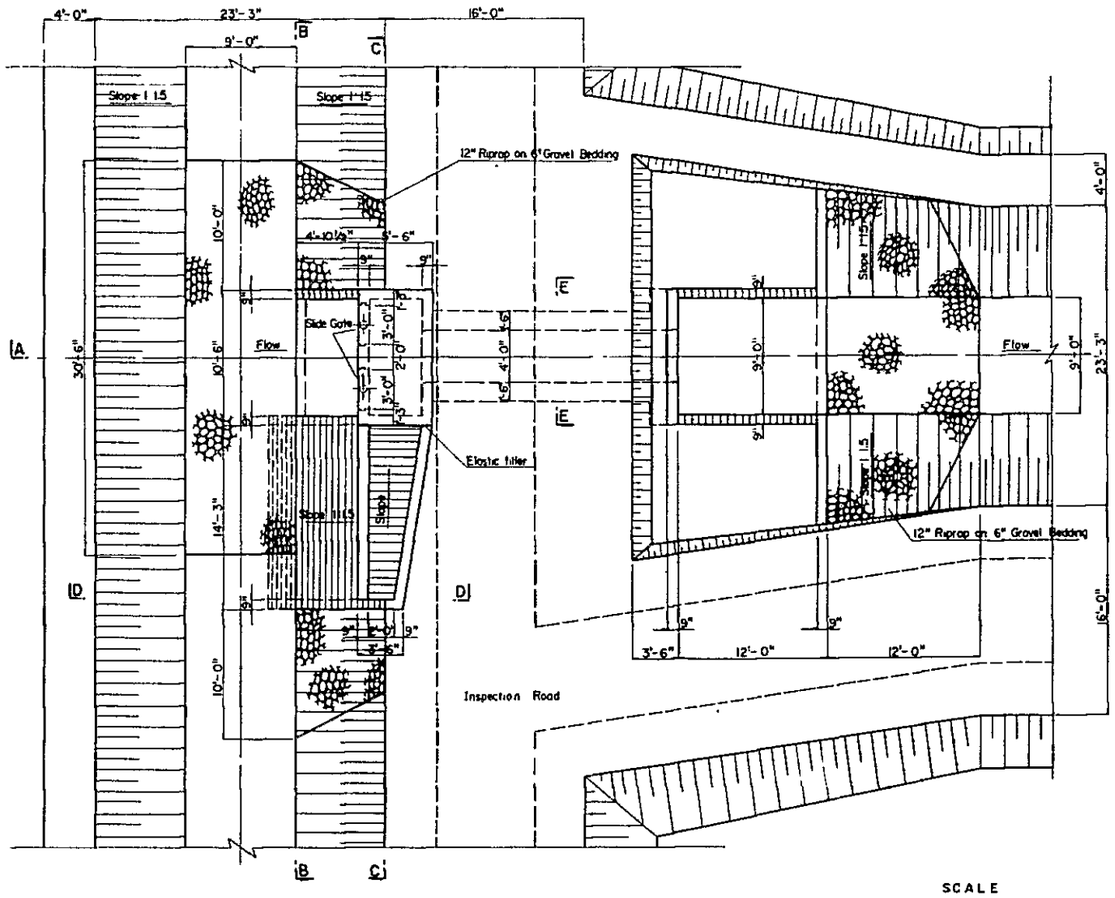
DATE	AUG 1979	D.W.G No.	1 - 024

JAPAN INTERNATIONAL COOPERATION AGENCY

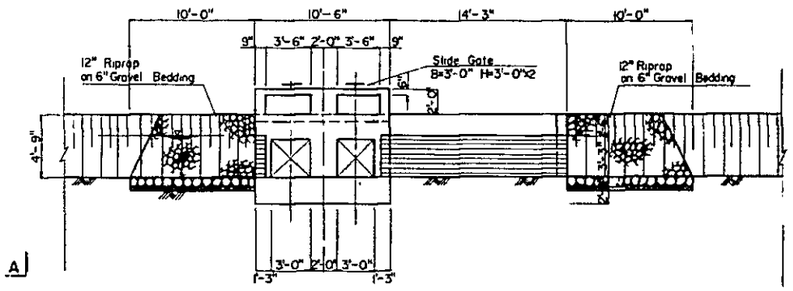
PLATE NO. 35

SPILLWAYS & WASTEWAYS

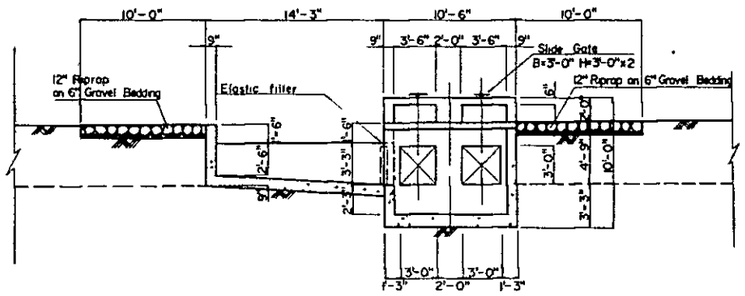
PLAN SCALE A



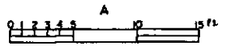
SECTION B—B SCALE A



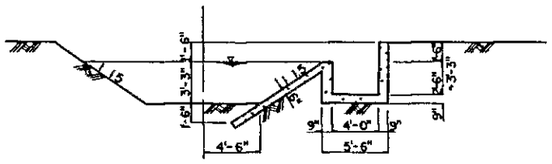
SECTION C—C SCALE A



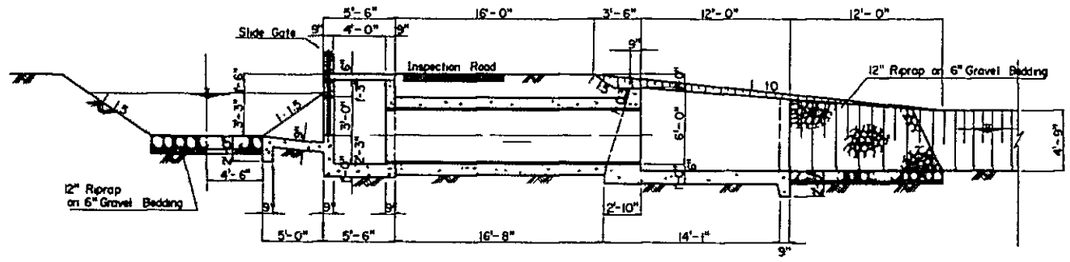
SCALE A



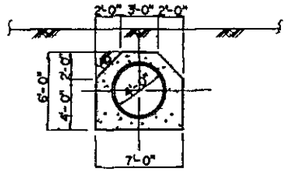
SECTION D—D SCALE A



SECTION A—A SCALE A



SECTION E—E SCALE A

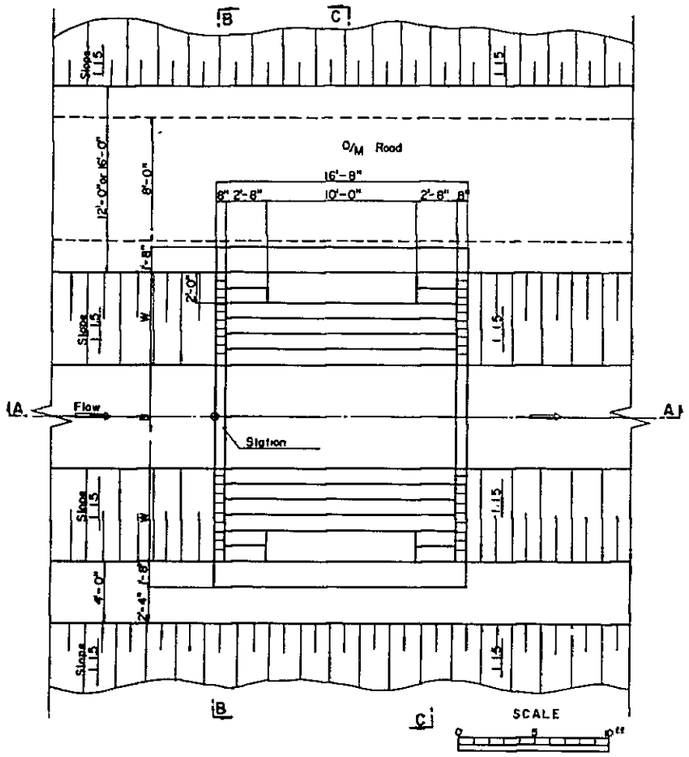


GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT			
SPILLWAYS & WASTEWAYS			
DATE	AUG 1979	D.W.G.No	1-025
JAPAN INTERNATIONAL COOPERATION AGENCY			

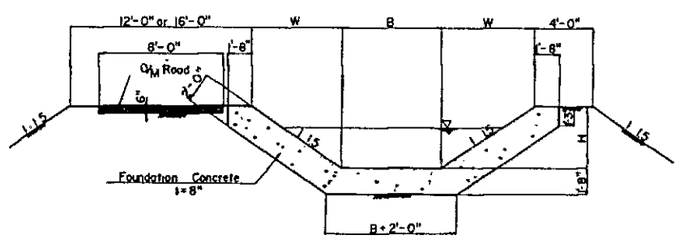
PLATE NO. 36

BATHING & WASHING PLACES

PLAN

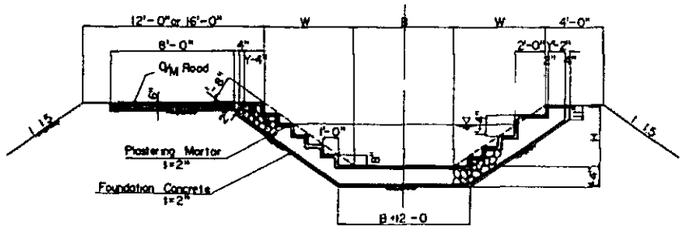


SECTION B—B



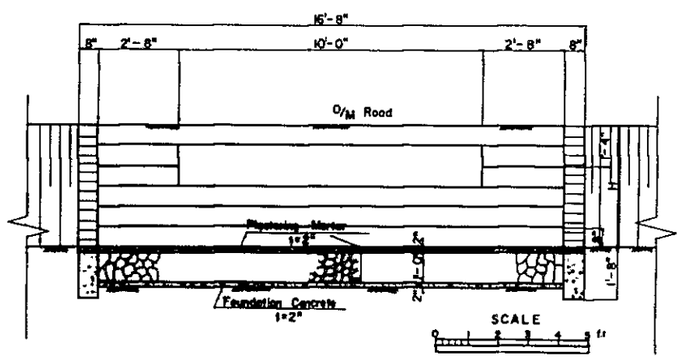
SCALE 0 5 10 ft.

SECTION C—C



SCALE 0 5 10 ft.

SECTION A—A



DIMENSIONS

CANAL TYPE	B	H	W
SYSTEM-D1 TYPE 1-5	15'—0"	5'—6"	8'—3"
SYSTEM-D2 TYPE E-3	22'—0"	4'—6"	6'—9"
SYSTEM-A/D TYPE 3	7'—6"	4'—3"	6'—4½"

GOVERNMENT OF SRI LANKA
MINISTRY OF MAHAWELI DEVELOPMENT
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT

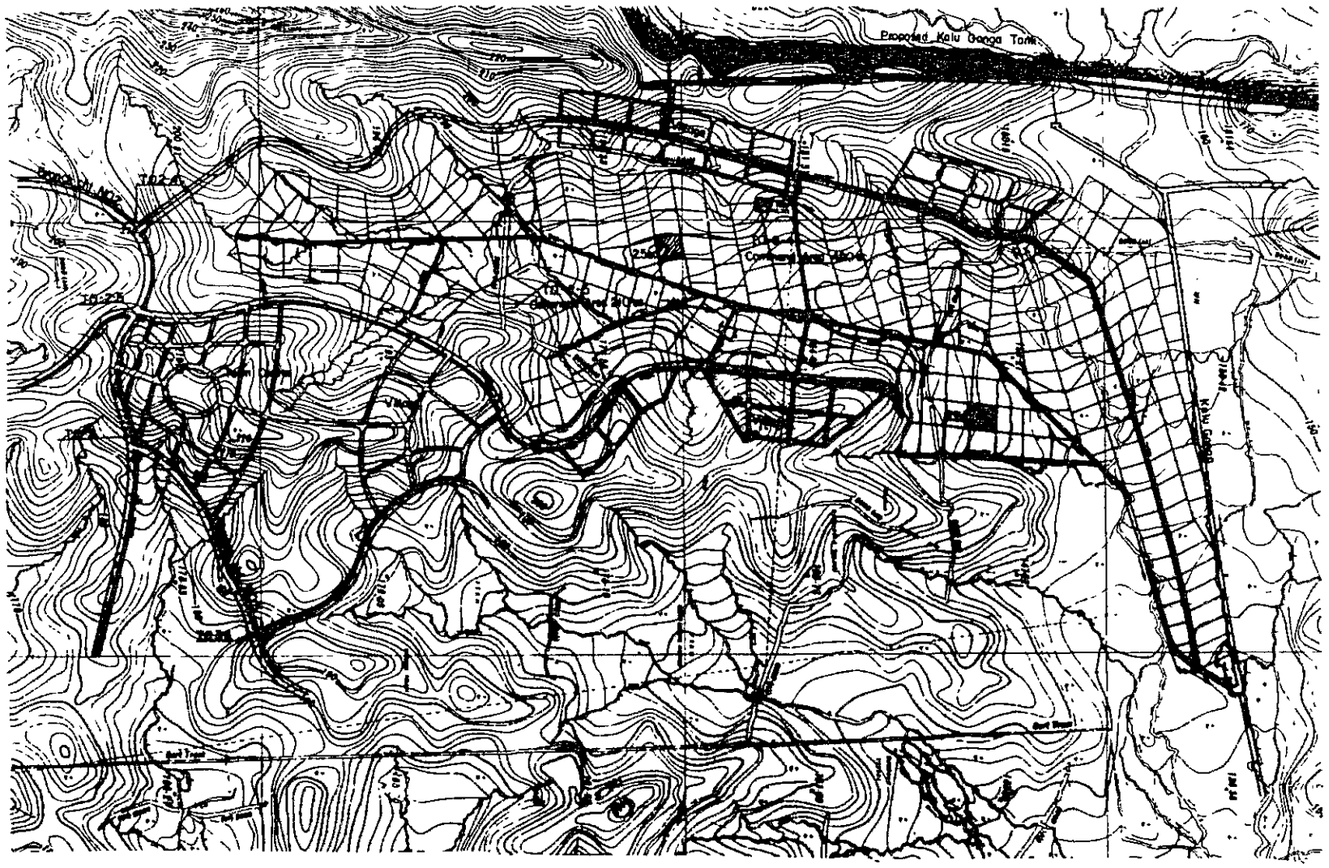
BATHING & WASHING PLACES

DATE	AUG 1979	D.W.G.No.	1 - 026

JAPAN INTERNATIONAL COOPERATION AGENCY

PLATE NO 37

LAYOUT IN SAMPLE AREA SYSTEM D1



SCALE
FEET
0 200 400 600 800 1000 1200
METRES
0 100 200 300 400 500

LEGEND

- Distributary
- Field Channel
- Check Gate
- Turnouts
- Roads
- Secondary Drainage
- Field Drains

GOVERNMENT OF SRI LANKA MINISTRY OF MAHAWELI DEVELOPMENT	
MORAGAHAKANDA AGRICULTURAL DEVELOPMENT PROJECT	
LAYOUT IN SAMPLE AREA SYSTEM D1	
DATE	AUG 1979
D.W.G.No	1 - 027
JAPAN INTERNATIONAL COOPERATION AGENCY	

Chapter VIII: ECONOMIC EVALUATION

8.1 Introduction

Development of the Moragahakanda project would generate a considerable amount of benefits to Sri Lanka due to increases in agricultural production, hydro power output, employment oppotunities as well as other multiplied economic effects. The objective of the economic analysis is to assess benefits and costs of the project in economic terms and to indicate its economic viability.

The major costs include construction, operation and maintenance of the dam, hydroelectric plant and reservoir area and development of irrigation and drainage system associated with other infrastructures and services which support the Socio-economic activites in the area, whilst the major benefits comprise hydro-power output, increases in agricultural production and social welfare which, when brought about, are anticipated to spill over into other neighbouring areas.

8.2 Methodology and Approach

8.2.1 Evaluation Criteria

The criteria used in evaluating the project are the present value, internal rate of return and benefit cost analysis. Costs and benefits are priced in terms of economic price which are of true value to the national economy. All these costs and benefits are valued in terms of 1978 constant prices therefore excluding the effects of inflation. An analysis period of 50 years is used.

Since all the factors relevant to the economic analysis are not necessarily determined assured, sensitivity tests are applied by changing certain variable factors when and where necessitation deems.

8.2.2 Discount Rate and Shadow Pricing

The following describes the assumptions made for the pricing of inputs and outputs of the project.

1) Discount Rate:

A discount rate of 10 per cent is normally used by Government Agencies and by international lending agencies for Sri Lanka. In the economic evaluation, therefore, the 10 percent discount rate is used for the standard analysis case, whilst the discount rate of 12 per cent applied only in the sensitivity analysis case.

2) Shadow Price of Foreign Exchange:

At present, the Sri Lanka rupee is probably over-valued in terms of its official exchange rate of about Rs 15 for US$ 1.0. A shadow rate of Rs 18 for US$ 1.0 is therefore used in the analysis.

3) Oppotunity Cost of Labour:

As it is considered, presently as well as in the future, that the abundance of farm labour as well as that of unskilled labour is likely to be available for irrigated agriculture and various construction works, a figure of only 50 per cent of the market wage rate for unskilled labour is taken into account in the economic analysis. For all other types of labour the economic and financial prices are the same.

4) Pricing of Other Project Inputs and Outputs:

Necessary adjustment was made for other major inputs and outputs of the project such as petroleum, cement, reinforcing steel bar and other imported construction materials as well as for crops and fertilizer. The prices of these items are by and large distorted by subsides, import duties and other transfers, thus significant differences between the economic and financial prices are noticed for certain items.

8.3 Economic Analysis

8.3.1. Summary of Benefits and Costs

1) Hydropower Benefits:

Hydropower benefits are assessed based on the costs of the alternative thermal project. Benefits from a hydropower project producing a given amount of dipendable power and secondary energy can be calculated by estimating the capital and recurrent costs of generating the same power output in the best alternative thermal project.

The benefits comprise two distinct types of components. Firstly, the costs of providing the same generation capacity which hydropower would give can be termed "capacity benefits" or 'KW benefits". Secondly, fuel and other operating costs required in generating each kilowatt (KWH) of electricity which would otherwise be produced by hydropower can be termed "energy benefits" or "kwh benefits".

Methodology and process of calculating the benefits are discussed in 7.4.5. Power Benefit in Chapter VII but in terms of financial prices which therefore have been converted into economic prices.

The Moragahakanda power station with 16.10 MW of dipendable peak output producing 6616 GWH of yearly energy product will generate the benefits from 1986 and thenafter. The brnefit stream is shown in the Table 8.2.

2) Irrigation Benefits:

The methodology adopted for the estimation of irrigation benefits for the project is described in 5.2.9. Net Agricultural Benefits in Chapter V. The benefits in terms of economic prices are summarized in Table 8.2.

3) Summary of Project Costs:

All the project cost including dam, power station, irrigation facilities and social infrastructures is converted into economic prices which are broken down into capital and shown in Table 8.1.

Project cost totals Rs. 3,187 million of which Dam and Powerstation require two third or Rs. 2,112 million, while Down Stream Development Rs. 1,075 million. In the latter the cost of social infrastructure development is included because agricultural activities in the new lands would not be able to be satisfactorily performed unless various community facilitis are provided to the farmers and their families. However, since these facilities can benefit other people in the neighbouring areas and all of them are not always directly related to production activities, it is assumed only one third of the total development cost be allocated to the project.

Table 8.1. Summary of Project Cost in 1978 Economic Prices

Particular	Rs. million	Disbursement
Head work:		
Dam, capital:	1,966.3	1981 - 1985
reccurent:	9.8/year	1986 -
Generating Equipment and Transmission,		
Capital :	146.1	1985 - 1986
reccurent:	2.2/year	1986 -
Sub-total	2,112.4 plus	12.0 /year
Down Stream Development		
Irrigation Facilities,		
Capital :	899.2	1980 - 1988
reccurent:	21.3 /year	1986 -
Social Infrastructures /1		
Capital :	175.4	1985 - 1987
reccurent:	36.5 /year	1987 -
Sub-total	1,074.6 plus	57.8 /year
TOTAL	3,187.0 plus	69.8 /year

/1: only 1/3 of the total development cost of social infrastructures required in the area.

Table 8.2. Cash Flow of Benefits and Costs of the Project

		COST (Rs Million)									BENEFIT (Rs. million)						
		HEAD WORK				DOWN STREAM DEVELOPMENT				TOTAL	Irrigation Benefits			Hydropower Benefits			TOTAL
		Dam		Generating Equip. & Transmission		Irrigation Facilities		Social Infrastructure									
	Year	Capital	O & M	Capital	O & M	Capital	O & M	Capital	O & M		Existing Lands	New Lands	Sub-Total	KW Benefits	KWH Benefits	Sub-Total	
1.	1980	-	-	-	-	15.4	-	-	-	15.4	-	-	-	-	-	-	-
2.	1981	207.0	-	-	-	21.9	-	-	-	228.9	-	-	-	-	-	-	-
3.	1982	394.5	-	-	-	126.6	-	-	-	521.1	-	-	-	-	-	-	-
4.	1983	380.0	-	-	-	196.2	-	-	-	577.0	-	-	-	41.3	-	41.3	41.3
5.	1984	535.4	-	93.8	-	140.5	-	-	-	769.7	-	-	-	227.8	-	227.8	227.8
6.	1985	448.6	-	52.3	-	171.8	-	32.1	-	704.8	-	-	-	65.8	-	65.8	65.8
7.	1986	-	9.8	-	2.2	93.1	21.3	125.8	-	252.2	56.9	-	56.9	-	67.2	67.2	124.1
8.	1987	-	9.8	-	2.2	87.1	21.3	17.5	36.5	174.4	126.7	51.9	178.6	-	67.2	67.2	245.8
9.	1988	-	9.8	-	2.2	46 6	21.3	-	36.5	116.4	169.9	66.1	236.0	-	67.2	67.2	303.2
10.	1989	-	9.8	-	2.2	-	21.3	-	36.5	69.8	229.8	78.9	308.7	-	67.2	67.2	375.9
11.	1990	-	9.8	-	2.2	-	21.3	-	36.5	69.8	284.4	105.7	390.1	-	67.2	67.2	457.3
12.	1991	-	9.8	-	2.2	-	21.3	-	36.5	69.8	337.6	132.6	470.4	-	67.2	67.2	537.6
13.	1992	-	9.8	-	2.2	-	21.3	-	36.5	69.8	337.6	159.4	497.0	-	67.2	67.2	564.2
14.	1993	-	9.8	-	2.2	-	21 3	-	36.5	69.8	337.6	183.1	520.7	-	67.2	67.2	587.9
15.	1994	-	9.8	-	2.2	-	21.3	-	36 5	69.8	337.6	216.9	554.5	-	67.2	67.2	621.7
16.	1995	-	9.8	-	2.2	-	21.3	-	36.5	69.8	337.6	220.9	558.5	-	67.2	67.2	625.7
:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
30.	2009	-	9.8	-	2.2	-	21.3	-	36.5	69.8	337.6	220.9	558.5	-	67.2	67.2	625.7
31.	2010	-	9.8	-	2.2	-	21.3	-	36.5	69.8	337.6	220.9	558.5	334.9	67.2	402.1	960.6
32.	2011	-	9.8	-	2.2	-	21.3	-	36.5	69.8	337.6	220.9	558.5	-	67.2	67.2	625.7
:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
41.	2020	-	9.8	-	2.2	-	21.3	-	36.5	69.8	337.6	220.9	558.5	-	67.2	67.2	625.7
42.	2021	-	9.8	146 1	2.2	-	21.3	-	36.5	215.9	337.6	220.9	558.5	-	67.2	67.2	625.7
43.	2022	-	9.8	-	2.2	-	21.3	-	36 5	69.8	337.6	220.9	558.5	-	67.2	67.2	625.7
:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
55.	2034	-	9.8	-	2.2	-	21 3	-	36 5	69.8	337.6	220.9	558.5	-	67 2	67.2	625.7
56.	2035	-	9 8	487 7	2.2	-	21 3		36 5	417.9	337.6	220.9	558.5	-	67.2	67.2	625.7

8.3.2. Economic Analysis

1) Analysis Results for Standard Analysis Case:

Based on the cashflow of the costs and benefits summarized in the Table 8.2., an economic analysis was carried out for the standard analysis case: 10 % of discount rate shadowpricing of foreign exchange rate of Rs. 18.0 at US$ 1.0, shadowpricing of major construction materials and oppotunity cost of unskilled labour being considered.

As is shown in the Table 8.3. herebelow economic returns from the project implementation amount Rs.578.8 million in terms of net present value. Internal rate of return (IRR) is 12.0 precent, while the Benefit Cost ratio at the discount rate of 10 per cent is 1.22, thus the implementation of this project can be economically justified.

Table 8.3. Rusults of the Economic Analysis for Standard Analysis Case

	IRR (%)	Net Present Value (Rs million)	B/C Ratio (r=10%)
Value	12.0	575.8	1.22

2) Sensitivity Tests

In order to determine the economic viability of the project, a sensitivity test was done by changing the following factors.

(1) Discount Rate: 12 %
(2) Capital Costs: 15 % higher
(3) Capital Costs: 15 % lower
(4) Foreign Exchange Rate: Rs 15.0 at US$ 1.0

The rusults of the sinsitivity analysis can be summarized as shown in the Table 8.4. Details of the discounted benefits and costs are presented in the Table 8.5 through 8.9.
cate the project will be economically feasible in any analysis case.

Table 8.4 Results of Sensitivity Analysis

Particular	Sensitivity Case				
	A	B	C	D	E
Discount Rate	10	12	10	10	12
Capital Costs	-	-	15% higher	15% lower	-
Foreign Exchange Rate (to US$ 1.0)	Rs. 15	Rs. 15	Rs. 18	Rs. 18	Rs. 18
IRR (%)	- 13.0 -		10.8	13.0	12.0
NPV (Rs million)	872.4	270.5	275.8	875.8	Δ 3.7
B/C Ratio	1.37	1.13	1.09	1.39	1.00

3) Conclusion

In the economic analysis only two types of major benefits were discussed and analysed quantitatively. The analysis indicate the level of these benefits is large enough so that the project will be economically feasible. The implementation of the project, moreover, bring about other direct or indirect intangible benefits into the areas as well as to Sri Lnaka. Major benefits which can be expected additionally include increase of employment oppotunities, increase of fish production from the reservoir to be constructed, generation of secondary and tertiary industries in association with the large-scale agricultural development as well as community development, increase of social welfare standard and so on. Implementation of the project, therefore, can be recommended from the national economic view point.

Table 8.5

Benefits and Costs for Alternative Analysis Cases

CASE A

Analysis Condition:	Discount Rate: 10%
	Construction Costs: ± 0%
	Conversion Rate for Foreign Exchange: US$ 1.0 = Rs. 15.0
	Shadow Pricing for Major Materials: considered
	Oppotunity Cost of Unskilled Labour: considered

Type of Benefit/Cost	Discounted Amount at Year 1980 (Rs. million)	(%)
BENEFIT TOTAL	3,204.5	(100.0)
Irrigation Benefits		
-Existing Lands	1,667.3	(52.0)
-New Lands	909.1	(28.4)
Hydro Power Benefits		
-KW Benefits	214.4	(6.7)
-KWH Benefits	413.7	(12.9)
COST TOTAL	2,332.1	(100.0)
Head work		
-Dam (Capital plus O & M)	1,295.7	(55.6)
-Generating Equipment and Transmission (Capital plus O & M)	95.7	(4.1)
Down Stream Development		
-Irrigation Facilities (Capital plus O & M)	644.0	(27.6)
-Social Infrastructures (Capital plus O & M)	296.7	(12.7)

B-C Ratio: 1.37

Net Present Value: Rs. 872.4 million

Table 8.6

Benefits and Costs for Alternative Analysis Cases

CASES B

Analysis Condition:	Discount Rate: 12% Construction Costs: ± 0% Conversion Rate for Foreign Exchange: US$ 1.0 = Rs. 15.0 Shadow Pricing for Major Materials: considered Oppotunity Cost of Unskilled Labour: considered

Type of Benefit/Cost	Discounted Amount at Year 1980 (Rs. million)	(%)
BENEFIT TOTAL	2,390.8	(100.0)
Irrigation Benefits		
-Existing Lands	1,229.4	(51.4)
-New Lands	651.2	(27.2)
Hydro Power Benefits		
-KW Benefits	193.5	(8.1)
-KWH Benefits	316.7	(13.3)
COST TOTAL	2,120.3	(100.0)
Head work		
-Dam (Capital plus O & M)	1,215.1	(57.3)
-Generating Equipment and Transmission (Capital plus O & M)	85.9	(4.0)
Down Stream Development		
-Irrigation Facilities (Capital plus O & M)	581.3	(27.4)
-Social Infrastructures (Capital plus O & M)	238.0	(11.3)

B-C Ratio: 1.13

Net Present Value: Rs. 270.5 million

Table 8.7

Benefits and Costs for Alternative Analysis Cases

CASES C

Analysis Condition:	Discount Rate: 10%
	Construction Costs: 15% higher
	Conversion Rate for Foreign Exchange: US$ 1.0 = Rs. 18.0
	Shadow Pricing for Major Materials: considered
	Oppotunity Cost of Unskilled Labour: considered

Type of Benefit/Cost	Discounted Amount at Year 1980 (Rs. million)	(%)
BENEFIT TOTAL	3,335.9	(100.0)
Irrigation Benefits		
-Existing Lands	1,667.3	(50.0)
-New Lands	909.1	(27.2)
Hydro Power Benefits		
-KW Benefits	283.7	(8.5)
-KWH Benefits	475.8	(14.3)
COST TOTAL	3,060.1	(100.0)
Head work		
-Dam (Capital plus O & M)	1,730.6	(56.6)
-Generating Equipment and Transmission (Capital O & M)	129.4	(4.2)
Down Stream Development		
-Irrigation Facilities (Capital plus O & M)	851.2	(27.8)
-Social Infrastructures (Capital plus O & M)	348.9	(11.4)

B-C Ratio: 1.09

Net Present Value: Rs. 275.8 million

Table 8.8

Benefits and Costs for Alternative Analysis Cases

CASES D

Analysis Condition:	Discount Rate: 10%
	Construction Costs: 15 % lower
	Conversion Rate for Foreign Exchange: US$ 1.0 = Rs. 18.0
	Shadow Pricing for Major Materials: considered
	Oppotunity Cost of Unskilled Labout: considered

Type of Benefit/Cost	Discounted Amount at Year 1980 (Rs. million)	(%)
BENEFIT TOTAL	3,137.7	(100.0)
Irrigation Benefits		
-Existing Lands	1,667.3	(53.1)
-New Lands	909.1	(29.0)
Hydro Power Benefits		
-KW Benefits	209.7	(6.7)
-KWH Benefits	351.6	(11.2)
COST TOTAL	2,261.9	(100.0)
Head work		
-Dam (Capital plus O & M)	1,279.2	(56.6)
-Generating Equipment and Transmission (Capital plus O & M)	95.6	(4.2)
Down Stream Development		
-Irrigation Facilities (Capital plus O & M)	629.2	(27.8)
-Social Infrastructures (Capital plus O & M)	257.9	(11.4)

B-C Ratio: 1.39

Net Present Value: Rs. 875.8 million

Table 8.9

Benefits and Costs for Alternative Analysis Cases

CASE E

Analysis Condition:	Discount Rate: 12% Construction Costs: ± 0% Conversion Rate for Foreign Exchange: US$ 1.0 = Rs. 18.0 Shadow Pricing for Major Materials: considered Oppotunity Cost of Unskilled Labour: considered

Type of Benefit/Cost	Discounted Amount at Year 1980 (Rs. million)	(%)
BENEFIT TOTAL	2,420.0	(100.0)
Irrigation Benefits		
-Existing Lands	1,229.4	(50.8)
-New Lands	651.2	(26.9)
Hydro Power Benefits		
-KW Benefits	222.7	(9.2)
-KWH Benefits	316.7	(13.1)
COST TOTAL	2,423.7	(100.0)
Head work		
-Dam (Capital plus O & M)	1,411.2	(58.2)
-Generating Equipment and Transmission (Capital plus O & M)	100.9	(4.1)
Down Stream Development		
-Irrigation Facilities (Capital plus O & M)	668.2	(27.6)
-Social Infrastructures (Capital plus O & M)	243.4	(10.1)

B-C Ratio: 1.00

Net Present Value: ΔRs. 3.7 million

Table 8-10 Cash Flow of Project Investment at Estimated Current Prices 1/

(Rs million)

		HEAD WORK								DOWN STREAM DEVELOPMENT												
		Dam				Generating Equipt. & Transmission				Irrigation Facilities				Social Infrastructure				Total				
		Capital			O&M	Capital			O&M	Capital			O&M	Capital			O&M	Capital			O&M	Total
	Year	F/C	L/C	Total		F/C	L/C	Total		F/C	L/C	Total		F/C	L/C	Total		F/C	L/C	Total		
1	1980	-	-	-	-	-	-	-	-	12.8	5.3	18.1	-	-	-	-	-	12.8	5.3	18.1	-	18.1
2	1981	148.8	88.0	236.8	-	-	-	-	-	20.8	7.2	28.0	-	-	-	-	-	169.6	95.2	264.8	-	264.8
3	1982	380.3	88.3	468.6	-	-	-	-	-	143.0	30.2	173.2	-	-	-	-	-	523.3	118.5	641.8	-	641.8
4	1983	387.1	70.7	477.8	-	-	-	-	-	189.3	95.6	284.9	-	-	-	-	-	576.4	186.3	762.7	-	762.7
5	1984	574.5	135.3	709.8	-	116.0	7.1	123.1	-	73.9	144.2	218.1	-	-	-	-	-	764.4	286.6	1,051.0	-	1,051.0
6	1985	507.9	120.4	628.3	-	51.4	22.0	73.4	-	100.2	182.4	282.6	-	21.2	31.6	52.8	-	680.7	356.4	1,037.1	-	1,037.1
7	1986	-	-	-	15.1	-	-	-	3.4	51.2	111.3	162.5	36.7	7.1	251.6	258.7	-	58.3	362.9	421.2	55.2	476.4
8	1987	-	-	-	16.0	-	-	-	3.5	52.8	108.4	161.2	38.9	3.3	33.9	37.2	73.8	56.1	142.3	198.4	132.2	330.6
9	1988	-	-	-	17.0	-	-	-	3.8	32.6	58.4	91.0	41.3	-	-	-	78.3	32.6	58.4	91.0	140.4	231.4
10	1989	-	-	-	18.1	-	-	-	4.0	-	-	-	43.8	-	-	-	83.1	-	-	-	149.0	149.0
11	1990	-	-	-	19.1	-	-	-	4.2	-	-	-	46.5	-	-	-	88.2	-	-	-	158.0	158.0
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Total		1,998.6	522.7	2,521.3		167.4	29.1	196.5		676.6	743.0	1,419.6		31.6	317.1	348.7		2,874.2	1,611.9	4,486.1		

1/: Escalation factors are assumed as follows:

	1978	1979	1980	1981	1982	1983 onwards	
Local Component :	-	12.2	7.9	7.9	6.3	6.25	(%/year)
Foreign Component :	-	———	8.0	———		5.50	

: Escalation factors for O&M are determined based on the assumption that the cost comprises 20% of F/C and 80% of L/C.

Table 8-11 Cash Flow of Project Investment at Current Prices[1/]

(million yen)

Year	HEAD WORK: Dam Capital F/C	Dam Capital L/C	Dam Capital Total	Dam O&M	Generating Equipt. & Transmission Capital F/C	Generating Equipt. & Transmission Capital L/C	Generating Equipt. & Transmission Capital Total	Generating Equipt. & Transmission O&M	DOWN STREAM DEVELOPMENT: Irrigation Facilities Capital F/C	Irrigation Facilities Capital L/C	Irrigation Facilities Capital Total	Irrigation Facilities O&M	Social Infrastructure Capital F/C	Social Infrastructure Capital L/C	Social Infrastructure Capital Total	Social Infrastructure O&M	Total Capital F/C	Total Capital L/C	Total Capital Total	Total O&M	Total
1 1980	-	-	-	-	-	-	-	-	166.4	68.9	235.3	-	-	-	-	-	166.4	68.9	235.3	-	235.3
2 1981	1,934.4	1,144.0	3,078.4	-	-	-	-	-	270.4	93.6	364.0	-	-	-	-	-	2,204.8	1,237.6	3,442.4	-	3,442.4
3 1982	4,943.9	1,147.9	6,091.8	-	-	-	-	-	1,859.0	392.6	2,251.6	-	-	-	-	-	6,802.9	1,540.5	8,343.4	-	8,343.4
4 1983	5,032.3	1,179.1	6,211.4	-	-	-	-	-	2,460.9	1,242.8	3,703.7	-	-	-	-	-	7,493.2	2,421.9	9,915.1	-	9,915.1
5 1984	7,468.5	1,758.9	9,227.4	-	1,508.9	92.3	1,600.3	-	960.7	1,874.6	2,835.3	-	-	-	-	-	9,937.2	3,725.8	13,663.0	-	13,663.0
6 1985	6,602.7	1,565.2	8,167.9	-	668.2	286.0	954.2	-	1,302.6	2,371.2	3,673.8	-	275.6	410.8	686.4	-	8,849.1	4,633.2	13,482.3	-	13,482.3
7 1986	-	-	-	196.3	-	-	-	44.2	665.6	446.9	2,112.5	477.1	92.3	3,270.8	3,363.1	-	757.9	4,717.7	5,475.6	717.6	6,193.2
8 1987	-	-	-	208.0	-	-	-	45.5	686.4	409.2	2,095.6	505.7	42.9	440.7	483.6	959.4	729.3	1,849.9	2,579.2	1,718.6	4,297.8
9 1988	-	-	-	221.0	-	-	-	49.4	423.8	759.2	1,183.0	536.9	-	-	-	1,017.9	423.8	759.2	1,183.0	1,825.2	3,008.2
10 1989	-	-	-	235.3	-	-	-	52.0	-	-	-	569.4	-	-	-	1,080.3	-	-	-	1,937.0	1,937.0
11 1990	-	-	-	248.3	-	-	-	54.6	-	-	-	604.5	-	-	-	1,146.6	-	-	-	2,054.0	2,054.0
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Total	25,981.8	6,795.1	32,776.9		2,176.2	378.3	2,554.5		8,795.8	9,659.0	18,454.8		410.8	4,122.3	4,533.1		37,364.6	20,954.7	58,319.3		

1/: Escalation factors are assumed as follows:

	1978	1979	1980	1981	1982	1983 onwards	
Local Component :	-	12.2	7.9	7.9	6.3	6.25	(%/year)
Foreign Component :	-	———	8.0	———		5.50	

: Escalation factors for O&M are determined based on the assumption that the cost comprises 20% of F/C and 80% of L/C.

Chapter IX: RECOMMENDATIONS AND OUTSTANDING ISSUES

Feasibility study having been concluded, the Moragahakanda Agricultural Development Project awaits the detailed survey at the earliest possible point of time. To facilitate such survey, the F/S team would like to point out some actions to be taken by the Government of Sri Lanka, under two headings:

A: MORAGAHAKANDA DAM AND POWER STATION

In order to step up an early implementation of the Project, the financial arrangement shall be expedited side by side with the preparation of definite plan of the Project and tender documents for the construction.

The definite plan investigation will be needed to consolidate the economic and technical viability of the stage development of power station as recommended in this Report. Some supplementary investigations will be required for preparation of the tender design.

The definite plan investigation will mainly include the topographic survey around Kongetta Oya Afterbay site and possible NCP canal route to the Kongetta Oya, the geological investigation at the Afterbay weir site as well as around the Elahera Anicut as an alternative site, and material survey for the construction.

The supplemantary investigation for the tender design will include the following:

(i) Topographic survey on such areas not covered by the existing maps as inlet of diversion channel, quarry site, contractor's quarters etc.;

(ii) Topographic survey along the proposed transmission-line to Bowatenna Power Station;

(iii) Additional core drilling, permeability test, grouting test and aditing at the damsite and core drilling at the quarry;

(iv) Trial mix test of concrete and shearing test of rock material;

(v) Collection of additional meteo-hydrologic data for estimation of probable maximum flood;

(vi) Reconnaissance and assessment of present conditions of transportation facilities such as roads, railways and port, and

(vii) Collection of cost data.

It is recommended that the investigations mentioned above and the tender design had better be made in collaboration with the competent, international consulting engineers in view of the earliest implementation of the Project. The period required for the investigation and the preparation of tender design will take 12 to 15 months at the shortest.

B: DOWNSTREAM DEVELOPMENT

Prior to the commencement of the detailed design survey on the irrigation/drainage facilities (rehabilitation and new provision), it is desirable to have the following data and materials collected, prepared and compiled for ready reference:

(i) Topographic Maps (1/2,500 - 1/5,000 with 2' contour) for System D_1, D_2 and A/D;

(ii) Survey to identify the area under unauthorized cultivation which is being distributed widely in the Project Area and totalling 7,600 ha (18,700 ac);

(iii) Profiles and crossings of the existing canals which would be utilized for new land irrigation will need to be identified along the undermentioned courses and distances:

(1) Parakrama Samudra: D_1-Main Canal and D_1-North Canal (incl. RB 18) and D_1-East Canal (Incl. RB 10);

(2) Elahera-Minneriya Yoda Ela: Downstream of the rehabilitated portion; and

(3) Minneriya-Kantalai Yoda Ela: Portion or portions badly requiring repair and rehabilitation.