3.3 RELATED STRUCTURES

3.3.1 Crossings

The main and secondary canals would cross at many places over or under the tributaries, canals, roads and railway. Aqueducts, inverted siphons, culverts and bridges have been designed at these crossings, as required. All the crossings along the main canals are listed in Table 3.3.1 and Table 3.3.2. The hydraulic calculations relating to these crossings are presented in Table 3.3.3.

Design consideration on these crossings are as follows:

a) Aqueducts

The canals would cross a number of tributaries by aqueducts as far as possible (sufficient clearance can be maintained above the maximum flood water level). The design velocity at the aqueduct has been decided twice as much as that for the upper and lower canals from the economic point-of-view. Aqueduct has been designed rectangular in its shape and its top width has been made not less than 4 m so that it would serve as operation and maintenance bridge, too. Wasteway has been added as an accessory structure. The standard designs of aqueducts are shown in Dwg. WI-018 to Dwg. WI-020.

b) Siphons

A siphon is used where an aqueduct will not work. The design velocity at the siphon has been decided twice as much as that for the upper and lower canals from the economic point-of-view as well as non-silt nature of the flow. The shape of the siphon was made rectangular, with 1 barrel if the discharge is less than 10 m^3/s and 2 barrels if over 10 m^3/s. The top of the barrel (barrels) should be at least 2.0 m below river bed where the siphon passes under the tributary. The siphon will have accessory structures such as the gates, trashrack, wasteway, sedimentation basin and scouring sluice. As the siphon will cut the maintenance road into two, a maintenance bridge will be built at such point. (See Dwg. WI-014 to Dwg. WI-017.)

c) Culverts

A culvert will be used for railway crossing (see Dwg. WI-024 and Dwg. WI-025).

d) Bridges

Where the main canal passes under the road or crosses the tributaries by way of siphon, a composite girder bridge (concrete and H-steel beam) has been proposed. The T-20 wheel loading is applicable to highway bridge and T-9 for the maintenance bridge; the width will be 9.0 m for the former and 4.0 m for the latter. (See Dwgs. WI-021 to WI-023.)

e) Cross siphon

A circular concrete pipe was adopted for a small size siphon which serves for the existing canal passing under the main canal. The principal cross-siphon at the crossing point of the main canal and the existing canal will be equipped with an upper-stream gate to divert the main canal flow as required. (See Dwg. WI-031)

3.3.2 Turnouts

The designs of the turnouts for the secondary canals are standardized into 4 types of gate diversion works to facilitate for controlling of discharge and maintenance work. A sluice gate and Parshall flume are used for a large-scale turnout and a Romain gate for an ordinary or small-sized turnout. The standardized designs of these structures are shown in Dwg. WI-026 and Dwg. WI-027.

3.3.3 Checks

Check gates are provided at downstream of the major turnouts to maintain the water surface, to lessen rapid changes in water surface, and to prevent high flow velocity. The check gate is a combination of the fixed overflow and manual operating gate types. They are standardized into 4 types as shown in Dwg. WI-028 and Dwg. WI-029.

3.3.4 Water Measurement Facilities

Installation of the water measuring facilities within the irrigation canal system is imperative for the effective use of the water stored in the Wonogiri Reservoir and for proper water management along the lengthy earthen canals. To meet these requirements, the Colo Weir intake will be equipped with a measuring weir by which to grasp the intake discharge therefrom and all together 4 measuring weirs will be built along the main canals: 3 for the Upper Sala main canal and 1 for the Dengkeng main canal; water measurement is also made possible, though roughly, at many check-gates along the main canals, and the diversion discharge will be known at each turnout. These water measurement facilities are illustrated in Dwg. WI-030.

3.3.5 Others

Apart from the structures mentioned above, it will be desirable to consider planting of shrubs and putting of fences along the canals as well as building of descending stairs into the canals, to prevent any possible loss of human and animal lives, for the amenities of the inhabitants and for the better operation and maintenance of the canals.

Table 3.3.1 Number of proposed Irrigation Facilities

Canal Type	Turnout (T.O)				Check-Gate (C.G)				(W.M.F)		Aqueduce (A)					Siphon (S)				Culvert (C)			Bridge (B)				Cross Siphon	
	1	2	3	4	1	2	3	4	1	2	1	2	3	4	5	1	2	3	4	1	2	3	1	2	3	4	1	2
Upper-solo Main canal	(36)				(9)				(3)		(16)					(19)				(13)			(177)						
I	1		1	2	1											5								3	15	5			
II		1	1	2	1																			2	10			2	13
III			2	4	1				1								5							4	23	5		2	15
IV		1	1	5		2												5		4			1	5	15	5		2	18
V	1		2	4			1		1		5									2				8	10			2	20
VI			2	1			1		1			1	6						3		3			9	13	3		2	6
VII		1	1				1							1					1		1				18	1		1	7
VIII		1		1											3							1		2	13			1	6
IX			1				1															2		2	5			1	7
Sub Total	2	4	11	19	3	2	4		3		5	1	6	1	3	5	5	5	4	6	4	3	1	35	122	19	13	92	
Dengkeng Main canal	(12)				(4)				(1)							(9)				(1)			(93)						
I		1	1	1				1											2		1		1	7	20	2		5	
II			1	2				1		1									1					5	23	1		7	
III			1	2															4					3	4	4		9	
IV				2				1											2					5	8	2	1	6	
V				1				1																1	7		1	5	
Sub Total		1	3	8				4		1									9		1		1	21	62	9	2	32	
Total	2	5	14	27	3	2	4	4	3	1	5	1	6	1	3	5	5	5	13	6	5	3	2	56	184	28	15	124	

Table 3.3.2 Type and Number of Crossings

Canal type	Aqueduct (A)									Siphon (S)										Culvert (C)			Bridge (B)										Cross Siphon	
	1				2	3		4	5		1		2			3		4					1			2			3			4				
	1	2	3	4		1	2		1	2	3	1	2	3	1	2				1	2	3	1	2		1	2	3	1	2	3	1	2	3	1	2
Upper-solo Main Canal	(5)				(1)	(6)		(1)	(3)	(5)		(5)			(5)			(4)		(6)	(4)	(3)	(1)			(35)			(122)			(19)				
I										4	1															3			15			5				
II																										2			10						2	13
III												3	1	1												4			23			5			2	15
IV															2	2	1			4			1			5			15			5			2	18
V	2	1	1	1																2						8			10						2	20
VI					1	4	2											3			3					9			13			3			2	6
VII								1										1			1								18			1			1	7
VIII									1	1	1											1					2			13					1	6
IX																						2					2			5					1	7
Sub total	2	1	1	1	1	4	2	1	1	1	1	4	1	3	1	1	2	2	1	4	6	1	3	3	1	14	17	4	63	41	18	15	4		13	92
Dengkeng Main Canal																		(9)			(1)					(21)			(62)			(9)				
I																		1	1		1					7			20			2				5
II																		1								5			23			1				7
III																		2	2							3			4			4				9
IV																		1	1							5			8			2			1	6
V																										1			7						1	5
Sub total																		4	5		1					1	7	14	20	42		2	7		2	32
Total	2	1	1	1	1	4	2	1	1	1	1	4	1	3	1	1	2	2	1	4	9	6	2	3	3	1	1	14	24	18	63	61	60	15	6	7	15	124

Cross siphon Type 1 = White Waste way
" 2

Bridge Type	Suffix	Width	SAAN(ave)	Profile
1	1	9	19	TT
	2		10	
2	1	6	21	"
	2		11	
	3		6	
3	1	4	21	"
	2		11	
	3		5	
4	1	4	25	"
	2		17.5 x2	TTT
	3		22.5x2	

Legend

Aqueduct

Type	Suffix	C-Section	Profile	Span	Remark
1	1			20	Westeway(W.W.)
	2	⊔⊔ 2.0x2.2x2	TT	30	"
	3			20	Non-W.W.
	4			30	"
2		⊔ 2.8x1.95	TTT	50	W.W.
3	1	"	TT	20	Non-W.W.
	2	"	"	30	"
4		⊔ 2.5x1.8	"	20	W.W.
5	1	⊔ 1.8x1.55	"	20	"
	2	"	"	30	"
	3	"	"	20	Non-W.W.

Siphon

Type	Suffix	C-Section	Length
1	1	⊡ 2.5x2.5x2	35
	2	"	55
2	1	⊡ 2.2x2.2x2	35
	2		45
	3		55
3	1	⊡ 2.0x2.0x2	35
	2		45
	3		55
4	1	⊡ 1.5x1.5	30
	2		35

Culvert

Type	Suffix	C-Section	Length
1		⊡⊡ 2.5x2.5x3	4.7
2	1	⊡ 2.5x1.8x2	8
	2	2.5x1.95x2	4.7
3		⊡ 2.5x1.55	4.7

Dimension m

Table 3.3.3 Hydraulic Calculation of Siphons, Aqueducts and Culverts

Station No.	Discharge (m^3/sec)	Canal Type	Water Depth(m)	V (m/sec)	hv (m)	I ($1x10^{-3}$)	S.A.C	Siphon, Aqueduct & Culvert Transition Length(m)	Section (m)	A (m2)	R (m)	V (m/sec)	hv (m)	I ($1x10^{-3}$)	S.A.C Length(m)	Bend	Loss of Head ht	hec	hf	hb	Σhx1.1	hs	Total
NO.0+600	24.30	I-1	1.92	0.751	0.029	0.1667	S	18	25x25x2	12.340	0.647	1.969	0.198	1.559	35	2	0.031	0.085	0.055	0.040	0.232	0.150	0.38
NO.0+385	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
NO.2+965	23.76	I-2	1.90	0.747	0.028	"	"	"	"	"	"	1.925	0.189	1.490	"	"	0.030	0.081	0.052	0.038	0.221	"	0.37
NO.4+300	23.49	I-3	1.89	0.745	"	"	"	"	"	"	"	1.904	0.185	1.458	"	"	0.029	0.079	0.061	0.037	0.216	"	"
NO.5+715	23.16	I-4	1.87	0.740	"	"	"	"	"	"	"	1.877	0.180	1.417	55	"	"	0.076	0.078	0.036	0.241	"	0.39
NO.10+825	16.88	III-1	1.70	0.689	0.024	"	"	15	22x22x2	9.520	0.571	1.773	0.160	1.493	35	"	0.025	0.068	0.052	0.032	0.195	"	0.35
NO.11+875	16.88	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
NO.13+620	16.69	III-2	1.69	0.687	"	"	"	"	"	"	"	1.753	0.157	1.460	"	"	0.024	0.067	0.051	0.031	0.190	"	0.34
NO.15+110	16.60	III-3	"	"	"	"	"	"	"	"	"	1.744	0.155	1.445	55	"	"	0.066	0.079	"	0.220	"	0.37
NO.19+450	15.09	III-6	1.60	0.666	0.023	"	"	"	"	"	"	1.585	0.128	1.193	45	"	0.020	0.053	0.054	0.026	0.168	"	0.32
NO.22+15	14.44	IV-2	1.58	0.660	0.022	"	"	"	20x20x2	7.910	0.517	1.826	0.170	1.808	35	"	0.030	0.074	0.063	0.034	0.221	"	0.37
NO.23+20	14.34	IV-3	1.57	0.658	"	"	"	"	"	"	"	1.813	0.168	1.782	45	"	0.029	0.073	0.080	"	0.238	"	0.39
NO.23+680	14.22	IV	1.56	0.656	"	"	C	7	25x23x3	11.580	0.717	1.228	0.077	0.5287	4.70	-	0.005	0.028	0.002	-	0.039	-	0.04
NO.24+15	14.22	IV-4	1.56	0.656	"	"	S	15	20x20x2	7.910	0.517	1.798	0.165	1.753	35	2	0.029	0.072	0.061	0.033	0.215	0.150	0.37
NO.26+785	13.77	IV-6	1.54	0.651	0.021	"	"	"	"	"	"	1.741	0.155	1.644	55	"	0.027	0.067	0.090	0.031	0.237	"	0.39
NO.27+740	"	IV	"	"	"	"	C	7	25x23x3	11.430	0.713	1.205	0.074	0.5129	4.70	-	0.005	0.027	0.002	-	0.037	-	0.04
NO.28+60	13.12	"	1.49	0.639	"	"	"	"	"	11.055	0.702	1.187	0.072	0.5081	"	-	"	0.026	"	-	0.036	-	"
NO.28+630	"	IV-7	"	"	"	"	S	15	20x20x2	7.910	0.517	1.659	0.140	1.492	45	2	0.025	0.060	0.067	0.028	0.198	0.150	0.35
NO.29+300	"	IV	"	"	"	"	C	7	25x23x3	11.055	0.702	1.187	0.072	0.5081	4.70	-	0.005	0.026	0.002	-	0.036	-	0.04
NO.30+80	11.55	V	"	0.667	0.023	0.1818	"	5	25x22x3	"	"	1.045	0.056	0.3938	"	-	0.003	0.017	"	-	0.024	-	0.02
NO.30+550	"	V-1	"	"	"	"	A	12	20x22x2	5.880	0.620	1.964	0.197	1.642	40	-	0.022	0.087	0.066	-	0.193	-	0.19
NO.31+425	11.40	V-2	1.48	0.664	"	"	"	"	"	5.840	0.618	1.952	0.194	1.629	50	-	"	0.086	0.081	-	0.208	-	0.21
NO.32+435	"	"	"	"	"	"	"	"	"	"	"	"	"	"	40	-	"	"	0.065	-	0.190	-	0.19
NO.35+30	10.63	V-4	1.42	0.649	0.021	"	"	"	"	5.600	0.608	1.898	0.184	1.574	"	-	0.021	0.082	0.063	-	0.183	-	0.18

Notes: ht = friction loss at transition; hec = loss of head at transition; hf = friction loss; hb = bend loss; hs = loss of head at screen

Table 3.3.3 (continued)

Station No.	Discharge (m3/sec)	Canal					Siphon, Aqueduct & Culvert									Loss of Head						
		Type	Water Depth(m)	V (m/sec)	hv (m)	I ($1x10^{-3}$)	S.A.C	Transition Length (m)	Section (m)	A (m2)	R (m)	V (m/sec)	hv (m)	I ($1x10^{-3}$)	S.A.C Length(m)	Bend	ht	hec	hf	hb	$\sum$hx1.1	hs	Total
NO.36+40	10.63	V-4	1.42	0.649	0.021	0.1818	A	12	20x22x2	5.600	0.608	1.898	0.184	1.574	50	-	0.021	0.082	0.079	-	0.200	-	0.20
NO.39+280	9.56	V	1.34	0.629	0.020	"	C	5	25x22x3	9.930	0.669	0.963	0.047	0.3566	4.70		0.003	0.014	0.002		0.021	-	0.02
NO.40+210	6.08	VI-1	1.29	0.613	0.019	0.2500	A	7	28x1.95	3.572	0.694	1.702	0.148	1.061	70	-	0.009	0.065	0.074	-	0.163	-	0.16
NO.40+810	"	"	"	"	"	"	"	"	"	"	"	"	"	"	50	-	"	"	0.053	-	0.140	-	0.14
NO.42+390	"	"	"	"	"	"	S	9	1.9x1.9	3.565	0.492	1.705	0.146	1.684	35	2	0.017	"	0.059	0.030	0.188	0.150	0.34
NO.42+940	"	"	"	"	"	"	A	7	2.8x1.95	3.572	0.694	1.702	"	1.061	50	-	0.009	"	0.053	-	0.140	-	0.14
NO.43+625	"	"	"	"	"	"	"	"	"	"	"	"	"	"	40	-	"	"	0.042	-	0.128	-	0.13
NO.43+875	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	-	"	"	"	-	"	-	"
NO.44+385	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	-	"	"	"	-	"	-	"
NO.45	"	VI	"	"	"	"	C	5	25x1.95x2	6.370	0.657	0.954	0.046	0.3585	4.70		0.0003	0.014	0.002	-	0.021	-	0.02
NO.45+700	5.85	VI-2	1.26	0.605	"	"	S	9	1.9x1.9	3.565	0.492	1.641	0.137	1.560	35	2	0.016	0.059	0.055	0.027	0.173	0.150	0.32
NO.45+880	"	"	"	"	"	"	A	7	2.8x1.95	3.488	0.686	1.677	0.143	1.046	40	-	0.009	0.062	0.042	-	0.124	-	0.12
NO.47+450	5.30	VI	1.19	0.587	"	"	C	5	25x1.95x2	5.870	0.632	0.903	0.042	0.3383	4.70		0.003	0.012	0.002	-	0.019	-	0.02
NO.48+600	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	"	-	"	-	"
NO.48+760	5.30	VI-3	"	"	"	"	S	9	1.9x1.9	3.565	0.492	1.487	0.113	1.281	35	2	0.014	0.047	0.046	0.023	0.142	0.150	0.29
NO.50+715	4.44	VII-1	"	0.573	0.017	"	A	6	25x1.8	2.935	0.632	1.513	0.117	0.9495	40		0.007	0.050	0.038	-	0.105	-	0.11
NO.51+330	"	VII	"	"	"	"	C	5	2.5x1.8x2	5.870	"	0.756	0.029	0.2371	8.0		0.002	0.006	0.002	-	0.011	-	0.01
NO.52+100	3.13	VII-2	0.980	0.516	0.014	"	S	8	1.5x1.5	2.205	0.390	1.420	0.103	1.592	35	2	0.015	0.045	0.056	0.021	0.151	0.150	0.30
NO.54+30	2.37	VIII-2	"	0.535	0.015	0.2857	A	4.5	1.8x1.55	1.742	0.486	1.361	0.095	1.091	50	-	0.006	0.040	0.055	-	0.111	-	0.11
NO.55+125	"	"	"	"	"	"	"	"	"	"	"	"	"	"	40	-	"	"	0.044	-	0.099	-	0.10
NO.57+450	1.95	VIII-2	0.880	0.506	0.013	"	"	"	"	1.562	0.462	1.248	0.079	0.9812	40	-	0.006	0.033	0.039	-	0.086	-	0.09
NO.58+450	"	VIII	"	"	"	"	C	5	2.5x1.55	2.160	0.537	0.903	0.042	0.4203	4.70		0.004	0.015	0.002	-	0.023	-	0.02
NO.59+150	0.79	IX	0.71	0.440	0.010	0.3333	"	"	2.5x1.2	1.695	0.460	0.466	0.011	0.1376	"		0.002	0001	0.001	-	0.004	-	0.004
NO.60+250	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	"	-	"	-	"

Table 3.3.3 (continued)

Station No.	Discharge (m^3/sec)	Canal					Siphon, Aqueduct & Culvert										Loss of Head						
		Type	Water Depth(m)	V (m/sec)	hv (m)	I ($1x10^{-3}$)	S.A.C	Transition Length(m)	Section (m)	A (m2)	R (m)	V (m/sec)	hv (m)	I ($1x10^{-3}$)	S.A.C Length(m)	Bend	ht	hec	hf	hb	$\sum$hx1.1	hs	Total
NO.0	5.20	I	1.20	0.587	0.018	0.2500	C	5	2.5x1.8x2	5.920	0.634	0.878	0.039	0.3185	8.0	-	0.003	0.011	0.003	-	0.019	-	0.02
NO.2+815	"	I(L)-1	"	"	"	"	S	9	1.9x1.9	3.565	0.492	1.459	0.109	1.233	35	2	0.013	0.046	0.043	0.022	0.136	0.150	0.29
NO.6+25	"	"	"	"	"	"	"	"	"	"	"	"	"	"	30	"	"	"	0.037	"	0.130	"	0.28
NO.11+210	2.96	II(L)-1	1.050	0.550	0.015	0.2702	"	6	1.5x1.5	2.205	0.390	1.342	0.092	1.422	35	"	0.010	0.039	0.050	0.018	0.129	"	"
NO.20+130	1.78	III(L)-2	0.850	0.481	0.012	"	"	"	1.1x1.1	1.165	0.288	1.528	0.119	2.762	30	"	0.018	0.054	0.083	0.024	0.197	"	0.35
NO.21+30	1.55	III(L)-3	0.790	0.463	0.011	"	"	"	"	"	"	1.330	0.090	2.093	30	"	0.014	0.040	0.063	0.018	0.149	"	0.30
NO.21+660	"	"	"	"	"	"	"	"	"	"	"	"	"	"	35	"	"	"	0.073	"	0.160	"	0.31
NO.22+125	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
NO.25+190	0.94	V(L)-1	"	0.437	0.010	0.2857	"	3	0.85x0.85	0.703	0.222	1.337	0.091	2.992	"	"	0.010	0.041	0.105	"	0.191	"	0.34
NO.27	0.81	V(L)-2	0.720	0.417	0.009	"	"	"	"	"	"	1.152	0.068	2.222	30	"	0.008	0.030	0.067	0.014	0.131	"	0.28

4. CONSTRUCTION PLANS

4.1 BASIC CONSIDERATIONS

Basic conditions taken into account for planning the construction method and schedule are presumed as follows.

(1) Workable days: 180 days a year (May - Nov)

(2) Construction period: 5 years

(3) Division of main canal construction work: 4 sections on the Upper Sala main canal and 1 section on the Dengkeng main canal;

The sequence of construction is shown below

Table 4-1 Division of Work and Sequence of Construction of Main Canal

Section	Main Canal No.	Length (m)	Construction (year)	Related Structure					
				Siphon	Aqueduct	Culvert	Turnout	Check gate	Bridge
1	Right No.0-600 - No.15	16,600	1st	9	-	-	10	2	61
2	" No.15 - No.30+500	15,500	2nd	6	-	5	11	4	34
3	" No.30+500 - No.45+500	15,000	3rd	1	11	2	8	-	29
4	" No.45+500 - No.60+800	15,300	5th	3	5	6	7	3	53
5	Left -	31,350	4th	9	-	1	12	4	93

Table 4-2 Division of Work on Secondary Canal

Section	Length (m)			Construction year
	Secondary canal	Rehabilitation canal	Total	
1	5,200	10,000	15,200	1st
2	5,150	7,850	13,000	2nd
3	19,300	7,700	27,000	3rd
4	1,950	7,050	9,000	5th
5	9,600	7,400	17,000	4th

(4) Employment of Manpower throughout the Construction Period

Although good efforts have been made to maximize labor employment for the construction work, a constant labor force which will be daily mobilized would remain at about 8,500, as some part of the work requires an even and exact finish which can be expected only by use of machinery (such as embankment work) and, moreover, the entire construction work must be completed within five years. Hence, most of the earth work called for construction of Colo Weir and the Main Canals would primarily be done by machinery. The total labor force required for the construction work would amount to 15,000/days, if the entire work should be done mainly by man-power.

Allocation of Construction Force:

Colo Weir and Main Canals

Excavation and embankment: 10 % man-power & 90 % mechanical

Secondary canals

Excavation and embankment: 100 % man-power

Farm ditches, Drains & Roads: 100 % man-power

4.2 COLO DIVERSION WEIR

The construction of Colo Weir shall be started in the second year and completed within 2 years, as per Fig.4-1: Construction Schedule. Its start in the second year has been determined from two reasons: the one is the availability of the construction road (from Surakarta-Wonogiri highway to Colo Weir site) through the main canal work (the first construction section) which is scheduled to be completed in the first year, and the other is unavailability of construction machinery through wear and tear during the Wonogiri Dam construction inspite of the assumptions made in the preliminary feasibility study on the latter. The construction period lasting for 2 years will be divided into the first stage (1st year) and the second stage (2nd year) as follows:

First Stage

This stage will be commenced by constructing the temporary structures, provision of power supply facilities, jungle clearing, etc., and followed by excavation of the weir-site. Excavation shall be made by use of bulldozers for the first 1-2 meter depth and, then, by crushing using shovels and back-hoes. The final finishing to the designed section will be carried out by man-power. The spoil (excavated earth) shall be moved out toward both the upper - and the lower - streams as the material for constructing the closing levees, and the remainder shall be deposited at the places shown on the map. After the excavation work will have progressed to the designed ground level, a series of concrete work such as pouring of concrete for levelling - bar arrangement - shuttering - concrete pouring - removal of shuttering, will follow until the weir and the intake will be built in their final shape. Then, gate will be installed. In the meanwhile, riprapping and slope protection work shall be carried on so that such work will be completed simultaneously with that of the weir. Drainage of the groundwater by pumps will become necessary during the excavation work.

Second Stage

Embankment work along the right bank will be started by pushing out the excavated earth toward the river-bed for construction of the closing-levee; wet masonry work will follow along the right bank. After completing the right bank, the closing levees at both the upper - and the lower-streams of the weir and along the right bank shall be removed and a new closing-levee needs to be built across the Sala river to divert the river water into the new channel. Wet masonry work along the left bank built by use of the deposited spoil as well as the material used for the closing-levees will follow. Because of the high-banking required for construction of the embankment work, geological conditions must be confirmed through boring at several points along the bank-alignments to avoid sliding or seepage of the banks.

4.3 CANALS

Canal construction work will be divided into 5 sections: 4 along the Upper Sala Main Canal and 1 for the entire Dengkeng Main Canal. For the perfection of their earth work, the construction period will be limited during dry season, starting in May and finishing in November. Each construction section takes 1 year for completion and their work schedule is as shown in Fig.4-1: Construction Schedule. The initial work for canal construction will be the excavation which is to be started from the point easily accessible to the construction machinery, and all the excavated earth shall be used for embankment. The embankment material shall be layered as

soon as excavated and well compacted; spraying of water by Water Tanker may be required to give the material the optimal moisture content. Embankment work needs uniform compaction; otherwise cracking will cause leakage after the work. When the spoil does not meet full requirement of embankment, the material earth will have to be brought in from elsewhere and if surplus, vice-versa. Crossing structures across the tributaries will be worked out by Copure Method as far as possible to do without closing-levees during their construction period. Their construction will be easier by Copure Method, although it will require more excavation work. Each construction-section shall be linked at its end to the existing tributary and/or drainage canal so that thorough running of irrigation water will be made possible.

Secondary canals are to be built entirely by man-power, but their embankment needs to be compacted as carefully as with the case of main canal; necessary material will have to be brought in by dump-trucks.

4.4 FARM DITCHES, DRAINAGE AND ROADS

3 years' time is allocated for construction of farm ditches and drainage, and 4 years' time for road construction. Construction of farm-ditches and drainage must be very much facilitated if road network will have been completed in advance of 1 year's time. Their work depends entirely on man-power.

Table 4-3 Construction Plants and Equipment for Irrigation Project

No.	Equipment	Capacity	Quantity
1.	Bulldozer	20 ton	15
2.	Crawler loader	2 m^3	5
3.	Back hoe	1.2 m^3	6
4.	Dump truck	8 ton	90
5.	Motor grader	3.7 m	3
6.	Vibration roller	5 ton	3
7.	Fuel tanker	8 ton	2
8.	Water tanker	8 ton	2
9.	Trailer truck	30 ton	1
10.	Cargo truck	6 ton	10
11.	Grease car	6 ton	5
12.	Truck crane	30 ton	1
13.	Portable concrete mixer	0.1 m^3	4
14.	Concrete plant	14 cft x 2	1
15.	Agitator truck	3.2 m^3	3
16.	Pump w/engine	4 inch	8
17.	Road roller	8 ton	2
18.	Screening plant	30 ton/hr	1
19.	Repair shop		1
20.	Saw mill		1
21.	Ripper attachment Bull	20 ton	2
22.	Dragline attachment shovel	1.2 m^3	3
23.	Power shovel attachment	1.2 m^3	3
24.	Miscellaneous		1

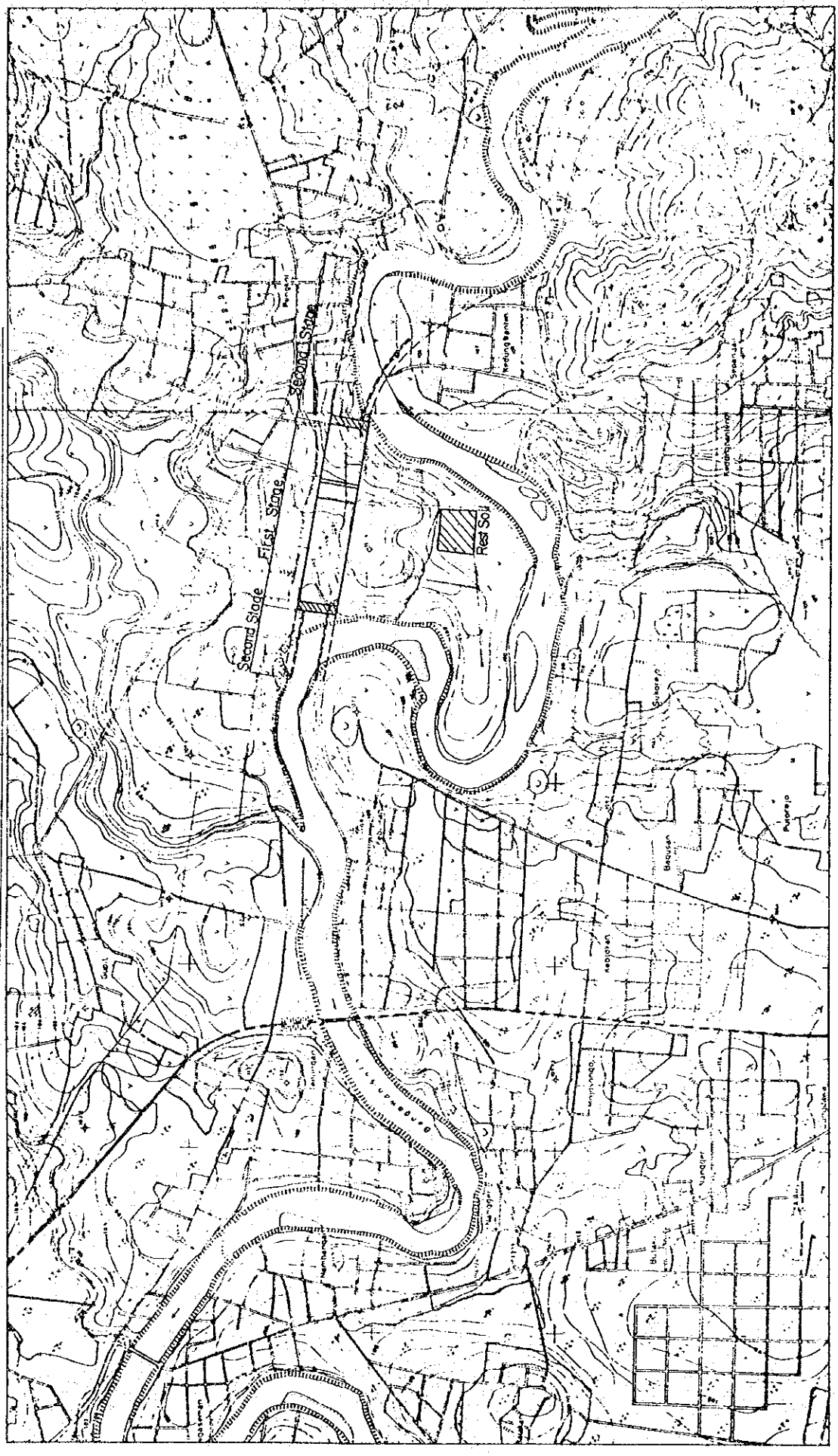
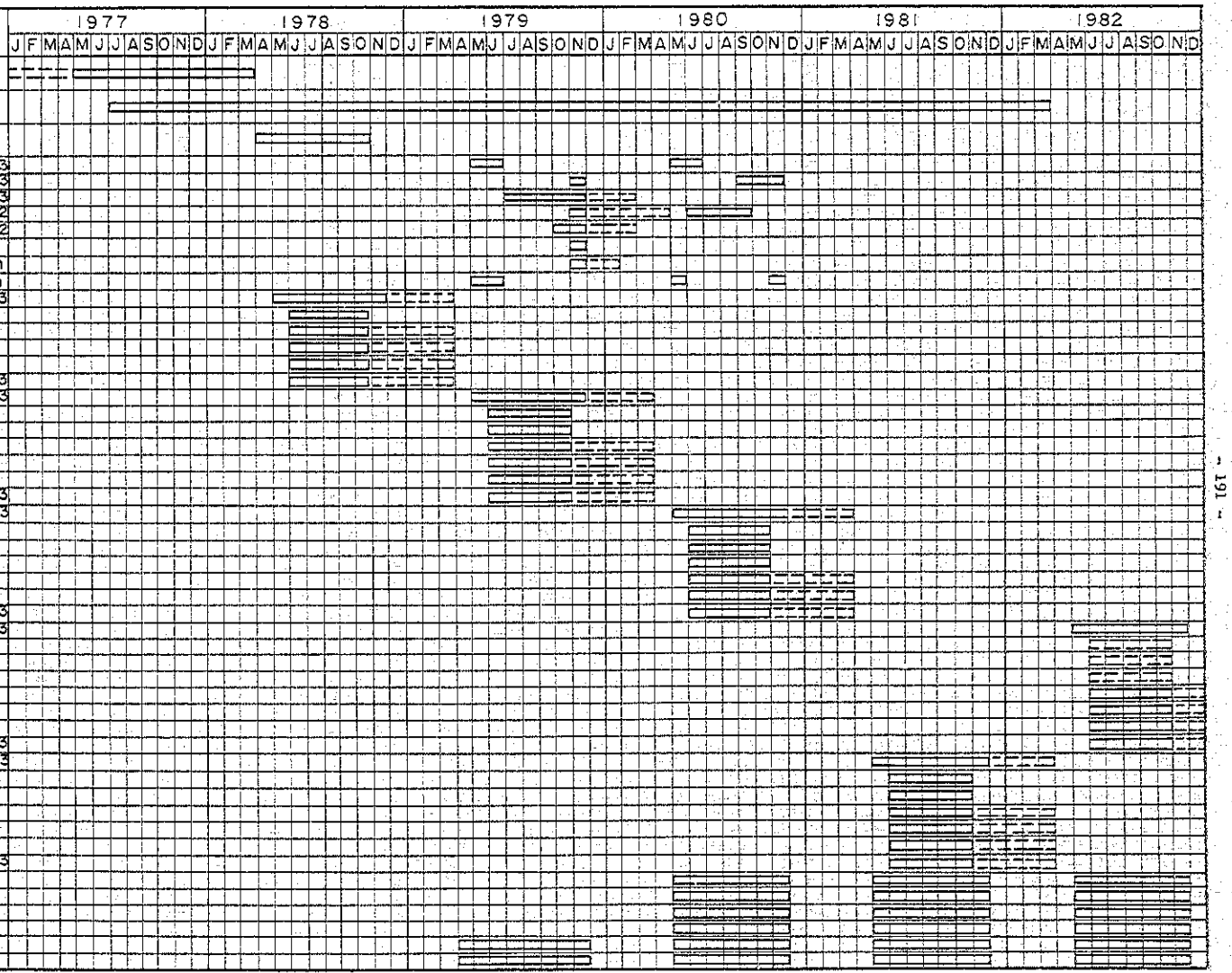


Fig.4.1 Location Map for Construction Schedule of Colo Weir

Fig. 4 - 2 Proposed Construction Schedule

WORK	ITEM	Q'TY
DESIGNS & SPECIFICATIONS		
LAND ACQUISITION & COMPENSATION		
PREPARATORY WORKS		
COLO DIVERSION WEIR	Excavation	429,000 m³
	Embankment	313,000 m³
	Concrete Structue	31,000 m³
	Revetment	23,600 m²
	Riprap	4,100 m²
	Gates	6 nos
	Bridge	1 sum
	Temporay Works	1 sum
SECTION 1 (RIGHT)	Main Canals L=16600m	844,000 m³
	Siphon	9
	Turnout	10
	Check Gate	2
	Bridge	61
	Secondary Canals L=15200	35,000 m³
SECTION 2 (RIGHT)	Main Canals L=15500m	793,000 m³
	Siphon	6
	Culvert	5
	Turnout	11
	Check Gate	4
	Bridge	34
	Secondary Canals L=13000	30,000 m³
SECTION 3 (RIGHT)	Main Canals L=15000m	867,000 m³
	Siphon	1
	Aqueduct	11
	Culvert	2
	Turnout	8
	Bridge	29
	Secondary Canals L=27000	62,000 m³
SECTION 4 (RIGHT)	Main Canals L=15300m	431,000 m³
	Siphon	3
	Aqueduct	5
	Culvert	6
	Turnout	7
	Check Gate	3
	Bridge	53
	Secondary Canals L=9000	21,000 m³
SECTION 5 (LEFT)	Main Canals L=31350	891,000 m³
	Siphon	9
	Culvert	1
	Turnout	12
	Check Gate	4
	Bridge	93
	Secondary Canals L=17000	40,000 m³
FARM DITCH	Rehabilitation Ditch	475,200
	New "	452,800
DRAINAGE	Rehabilitation Drain	316,800
	New "	611,200
FARM ROAD	Rehabilitation Road	548,800
	New "	147,200



5. CONSTRUCTION COST ESTIMATES

IRRIGATION PROJECT

Estimation of the construction cost has been made on the grounds as enumerated below:

i) Unit cost

References have been made to the following projects, especially a) and b):

a) Sempor Dam (comparison of unit prices and lump sum);

b) Brantas (Dec. 1975), and

c) Karangkates Dam.

ii) Machinery cost

Unit price = Domestic price in Japan + Freight + Inland transport Cost (Surabaja - Surakarta)

$$\text{Depreciation cost} = \left(\text{unit price} - (0.1 \times \text{unit price})\right) \times \frac{\text{used year}}{\text{total life year}}$$

Spare parts and consumables = 20% of the depreciation cost.

iii) In such kind of work where excavation is done by use of the machinery, 10% of the total amount of the earth will be handled by man-power in its finish.

iv) Embankment is to be done by using the excavated earth and, only when it is insufficient, the necessary amount of the material earth will be brought in by dump trucks from the borrow pits.

The cost of land acquisition and compensation has been estimated from the sizes of the land deemed appropriately necessary for the Colo Weir, the main and secondary canals, farm-ditches, drains and the roads as is shown in Table 5.1 .

Table 5.1 Cost Estimate for the Irrigation Project
(Economic cost)

(Unit: US$1000)

	Item	Foreign	Local	Total
I.	Civil Works	18,974	19,326	38,300
	Preparatory Works	-	(270)	(270)
	Colo Diversion Weir	(2,490)	(1,680)	(4,170)
	Main Canal	(10,150)	(8,570)	(18,720)
	Secondary Canal	(620)	(1,510)	(2,130)
	Farm Ditch	-	(1,330)	(1,330)
	Drainage Facilities	-	(2,060)	(2,060)
	Farm Road	(1,100)	(3,750)	(4,850)
	Construction Machinery	(4,614)	(156)	(4,770)
II.	Land Acquisition & Compensation	-	200	200
III.	Contingency	2,816	2,884	5,700
IV.	Engineering & Administrative Expenses	2,000	500	2,500
	Total	23,790	22,910	46,700

Table 5.2 Fund Requirement (Contract Base)

(Unit: US$ 1,000)

Item	Foreign	Local	Total
Civil Works	19,230	33,620	52,850
Construction Machinery	6,210	260	6,470
Land Aquisition	-	5,270	5,270
Contingencies	2,880	4,490	7,370
Engineering & Administration Expenses	3,200	790	3,990
Total	31,520	44,430	75,950

Table 5.3 Fund Requirement (Force Account Base)

(Unit: US$ 1,000)

Item	Foreign	Local	Total
Civil Works	19,230	33,620	52,850
Construction Machinery	6,640	2,040	8,680
Land Aquisition	-	5,270	5,270
Contingencies	4,000	4,480	8,480
Engineering & Administration Expenses	4,400	2,470	6,870
Total	34,270	47,880	82,150

Table 5.4 Annual Cost Estimate for Operation & Maintenance

(Unit: US$)

	Item	Quantity & Unit Cost		Cost
I	Irrigation office personnel Expenses	20 x 1200 $/year		24,000
	Others	L.S.		22,000
	Sub total			46,000
II	Colo Weiv office personnel Expenses	4 x 1200 $/year		4,800
	Others	L.S.		1,200
	Sub total			6,000
III	O. & M for turnout personnel Expenses (canal rider)	50 x 960 $/year		48,000
IV	O. & M for Main canals & secondary canals			
	Desilting work & treatment		L.S.	30,000
	Fuel Expenses of Vehicles		L.S.	20,000
	Sub total			50,000
V	O. & M for tertiary canals, farm ditches & drainage ditches.			
	Operation cost for irri. canal		L.S.	50,000
	Desilting work & treatment for irri. canal and drainage.		L.S.	40,000
	Sub total			90,000
VI	Depreciation Cost of O & M facilities (office building, wireless equips & gates)		L.S.	100,000
Total				340,000

Table 5.5 Statement of Items

I. Preparatory Works

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Currency		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
	Office camp house	m2	1,000	130.0	130,000	130.0	130,000	-	-
	Field camp house	"	500	110.0	55,000	110.0	55,000	-	-
	Attendant construction (20%)	sum	1		37,000		37,000	-	-
	Sub total				222,000		222,000	-	-
	General Expenses (20%)				48,000		48,000	-	-
	Total				270,000		270,000	-	-

II. Colo Diversion Weir

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Currency		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
2	Excavation (Man)	m3	12,000	0.6	7,200	0.6	7,200	-	-
1	" (Mechanical)	"	108,000	0.5	54,000	0.4	43,200	0.1	10,800
4	" Breccia-Taff (Man)	"	15,000	1.5	22,500	1.5	22,500	-	-
3	" " (Mechanical)	"	294,000	1.0	294,000	0.8	235,200	0.2	58,800
12	Compacted fill (Man)	"	3,000	0.5	1,500	0.5	1,500	-	-
11	" (Mechanical)	"	25,000	0.4	10,000	0.3	7,500	0.1	2,500
10	Embankment (Man)	"	31,000	0.8	24,800	0.8	24,800	-	-
8	" (Mechanical)	"	282,000	0.9	253,800	0.6	169,200	0.3	84,600
16	Plain concrete	"	23,364	42.0	981,288	10.0	233,640	32.0	747,648
15	Reinforced concrete	"	7,695	46.0	353,970	10.0	76,950	36.0	277,020
19	Reinforcing bar	ton	316	460.0	145,360	70.0	22,120	390.0	123,240
17	Form (A)	m2	15,116	8.0	120,928	6.0	90,696	2.0	30,232
20	Revetment (stone pithing)	"	23,602	13.0	306,826	11.0	259,622	2.0	47,204
14	" (sod facing)	"	56,675	0.3	17,002	0.3	17,002	-	-
	Riprap	"	4,181	17.0	71,077	7.0	29,267	10.0	41,810
	Screen	"	77	10.0	770	6.0	462	4.0	308
	Concrete pipe (ϕ 1800)	m	170	100.0	17,000	80.0	13,600	20.0	3,400
	" (ϕ 1100)	"	96	70.0	6,720	55.0	5,280	15.0	1,440
	Roller type Gate (7.5 x 655m)	sum	2	150,000	300,000	20,000	40,000	130,000	260,000
	" (5.0 x 2.7)	"	3	90,000	270,000	15,000	45,000	75,000	225,000
	" (4.5 x 2.7)	"	1	80,000	80,000	13,000	13,000	67,000	67,000
	Gate valve (ϕ 1100)	"	2	13,000	26,000	2,000	4,000	11,000	22,000
	Operation house	m2	100	100	10,000	100	10,000	-	-
	" Bridge (H-Steel)	t	99	880.0	87,120	220	21,780	660	65,340
16	" " (concrete)	m3	125	42.0	5,250	10	1,250	32	4,000

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Currency		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
	Temporay Works	sum	1		10,000		9,000		1,000
	Other				2,889		1,231		1,658
	Sub total				3,480,000		1,405,000		2,075,000
	General Expenses (20%)				690,000		275,000		415,000
	Total				4,170,000		1,680,000		2,490,000

III. Main Canals

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Currency		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
2	Excavation (Man)	m3	163,000	0.6	97,800	0.6	97,800	-	-
1	" (Mechanical)	"	1,465,000	0.5	732,500	0.4	586,000	0.1	146,500
8	Embankment (")	"	1,628,000	0.9	1,465,200	0.6	976,800	0.3	488,400
5	" (Truck-Mecha)	"	570,000	1.5	855,000	1.0	570,000	0.5	285,000
14	Sod facing	m2	817,000	0.3	245,100	0.3	245,100	-	-
	Related Structure								
3-1	Turnout	sum	48		625,800		476,900		148,900
3-2	Check gate	"	13		489,500		147,900		341,600
3-3	Aqueduct	"	16		1,343,400		510,400		833,000
3-4	Siphon	"	28		3,093,500		1,321,100		1,772,400
3-5	Culvert	"	14		115,000		58,200		56,800
3-6	Bridge	"	270		3,837,000		1,099,400		2,737,600
3-7	Water Measurement Facility	"	4		32,900		21,600		11,300
3-8	Inverted Siphon	"	139		2,677,700		1,034,800		1,642,900
	Sub total				15,610,400		7,146,000		8,464,400
	General Expenses (20%)				3,109,600		1,424,000		1,685,600
	Total				18,720,000		8,570,000		10,150,000

IV. Secondary Canal

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Curren		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
2	Excavation (Man)	m^3	53,100	0.6	31,860	0.6	31,860	-	-
10	Embankment (")	"	53.100	0.8	42,480	0.8	42,480	-	-
6	" (Truck-Man)	"	68,500	2.0	137,000	1.8	123,300	0.2	13,700
14	Sod facing	m^2	192,000	0.3	57,600	0.3	57,600	-	-
3-1-4	Turnout (Type 4)	Sum	103	9,100	937,300	7,100	731,300	2,000	206,000
3-6-8	Bridge (" 3-3)	"	103	3,500	360,500	1,100	113,300	2,400	247,200
4-1	Rehabilitation of canal	"	1		50,000		50,000	-	-
	Attendant construction (10%)		1		161,260		114,160		47,100
	Sub total				1,778,000		1,264,000		514,000
	General Expenses (20%)				352,000		246,000		106,000
	Total				2,130,000		1,510,000		620,000

V. Farm Ditch (L = 928,000 m)

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Currency		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
V-1	Rehavilitation Ditch	m	475,200	1.04	494,208	1.04	494,208	-	-
V-2	New "	"	452,800	1.14	516,192	1.14	516,192	-	-
	Attendant Construction (10%)	Sum	1		101,000		101,000		
	Sub total				1,111,400		1,111,400	-	-
	General Expenses (20%)				218,600		218,600	-	-
	Total				1,330,000		1,330,000		

VI. Drainage (L = 928,000 m)

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Currency		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
VI-1	Rehabilitation Drain	m	316,800	1.38	437,184	1.38	437,184	-	-
VI-2	New "	"	611,200	1.84	1,124,608	1.84	1,124,608	-	-
	Attendant Construction (10%)	Sum	1		156,208		156,208	-	-
	Sub total				1,718,000		1,718,000	-	-
	General Expenses (20%)				342,000		342,000	-	-
	Total				2,060,000		2,060,000	-	-

VII. Farm Road (L = 708,000 m)

(Unit: US$)

Item No.	Work	Unit	Quantity	Total		Local Currency		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
VII-1	Rehabilitation Road	m	548,800	4.86	2,667,168	3.66	2,008,608	1.20	658,560
VII-2	New "	"	147,200	6.88	1,012,736	5.68	836,096	1.20	176,640
	Attendant Construction (10%)				367,096		284,296		82,800
	Sub total				4,047,000		3,129,000		918,000
	General Expenses (20%)				803,000		621,000		182,000
	Total				4,850,000		3,750,000		1,100,000

VIII. Depreciation cost of construction plant & Equipment

(Unit: US$)

Item No.	Work		Unit	Quantity	Total Price		Total	Depreciation	
					Unit Price	Amount	Life year	year	cost
	Bulldozer	20^{t}	No	15	60,000	900,000	90	75	675,000
	Crawler loader	20^{m3}	"	5	55,000	275,000	30	25	206,200
	Back hoe	1.2^{m3}	"	6	130,000	780,000	42	30	501,400
	Dump truck	8^{ton}	"	90 +22	14,000	+ 308,000 1,260,000	360	450	1,417,500
	Motor grader	3.7^{m}	"	3	35,000	105,000	18	15	78,700
	Vibration roller	5^{t}	"	2	12,000	24,000	12	10	18,000
	Fuel tanker	8^{t}	"	2 +1	20,000	+ 20,000 40,000	8	10	45,000
	Water tanker	8^{t}	"	2 +1	20,000	+ 20,000 40,000	8	10	45,000
	Trailer truck	30^{t}	"	1		70,000	6	5	52,500
	Cargo truck	6^{t}	"	10 +1	9,000	+ 27,000 90,000	40	50	101,200
	Grease car	6^{t}	"	2 +1	25,000	+ 25,000 50,000	8	10	62,500
	Truck crane	30^{t}	"	1		110,000	6	5	82,500
	Portable concrete mixer	0.1^{m}	"	4 +1	5,000	+ 5,000 20,000	12	20	30,000
	Concrete plant	14^{cft} x2	"	1		100,000	8	5	56,300
	Agitator truck	3.2^{m3}	"	3	22,000	66,000	15	15	59,400
	Pump w/engine	4 inch	"	8 +5	1,000	+ 5,000 8,000	24	40	12,000
	Road roller	8^{t}	"	2	20,000	40,000	14	10	25,700
	Screening plant	30/hr	"	1		150,000	7	5	96,400
	Repair shop		L.S	1		10,000	-	-	9,000
	Saw mill		L.S	1		5,000	-	-	4,500

(to be continued)

(Unit: US$)

Item No.	Work	Unit	Quantity	Total Price		Total	Depreciation	
				Unit Price	Amount	Life year	year	cost
	Ripper attachment 20^{t} Bull	No	2	8,000	16,000	12	10	12,000
	Dragline attachment 1.2^{m3} Shovel	"	3	10,000	30,000	21	15	19,300
	Power Shovel attachment	"	3	10,000	30,000	21	15	19,300
	Miscellaneous	L.S		240,000	240,000			216,000
					+ 410,000			
	Sub total				4,459,000			3,845,400
	(Force account)				(4,869,000)			3,845,000
	Spare parts & Consumables				821,000			769,000
	Labour				1,200,000	(1,200x200x5)		156,000
	Sub total				2,021,000			925,000
	Total				6,890,000			4,770,000

IX. Land Acquisition & Compensation

(Unit: US$)

Item No.	Work	Unit	Quantity	Economic Price		Financial Price			
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
	Land Acquisition								
	Sawa - Irrigated	ha	619	-	-	3,614	2,237,066		
	" - Rainfed	"	379	-	-	2,169	822,051		
	Tegal	"	20	-	-	964	19,280		
	Yard	"	34	819	27,846	2,650	90,100		
	Sub total		1,052		27,846		3,168,497		
	Compensation								
	Bamboo	No	200	434	86,800	723	144,600		
	Wooden	"	50	867	43,350	1,446	72,300		
	Brick	"	20	1,880	37,600	3,132	62,640		
	Sub total		270		167,750		279,540		
	Total				195,596		3,448,037 /1		
					200,000		3,450,000		

Note: /1 This amount does not include price escalation.

Table 5.6 Unit Cost

(Unit: US$)

Item No.	Work	Unit	Quantity	Total Unit Price	Local Currency Portion	Foreign Currency Portion
	Excavation					
1	Soil (Mechanical)	m^3	1	0.5	0.4	0.1
2	" (Man)	"	1	0.6	0.6	-
3	Breccia-Taff (Mechanical)	"	1	1.0	0.8	0.2
4	" (Man)	"	1	1.5	1.5	-
	Embankment					
5	Dring Soil (Truck)(Mechanical)	m^3	1	1.5	1.0	0.5
6	" (")(Man)	"	1	2.0	1.8	0.2
7	" (Cart)(Man)	"	1	1.3	1.3	-
8	Excavation Divert D=300m (Mechanical)	"	1	0.9	0.6	0.3
9	" " D=100m (Mechanical)	"	1	0.7	0.5	0.2
10	" D=30m (Man)	"	1	0.8	0.8	-
	Compacted fill					
11	Soil (Mechanical)	m^3	1	0.4	0.3	0.1
12	" (Man)	"	1	0.5	0.5	-
13	Breccia-Taff (Mechanical)	"	1	0.5	0.4	0.1
14	Sod facing	m^2	1	0.3	0.3	-
15	Rainforced Concrete	m^3	1	46.0	10.0	36.0
16	Plain concrete	"	1	42.0	10.0	32.0

(to be continued)

(Unit: US$)

Item No.	Work	Unit	Quantity	Total Unit Price	Local Currency Portion	Foreign Currency Portion
	Form					
17	Structure (A)	m^2	1	8.0	6.0	2.0
18	Simple (B)	"	1	7.0	5.0	2.0
19	Rainfocing bar	ton	1	460.0	70.0	390.0
20	Stone Pitching	m^2	1	13.0	11.0	2.0
21	Gravel bedding	m^3	1	6.0	4.0	2.0

Table 5.7 Land Acquisition & Compensation

Land Acquisition

(unit: ha)

Work \ Land	Sawa		Tegal	Yard	Total
	irrigated	Rainfed			
Main Canal	140	82	-	23	245
Secondary Canal	28	19	-	-	47
Ditch, Drain, Road	451	274	-	-	725
Colo Weir	-	4	20	11	35
Total	619	379	20	34	1,052

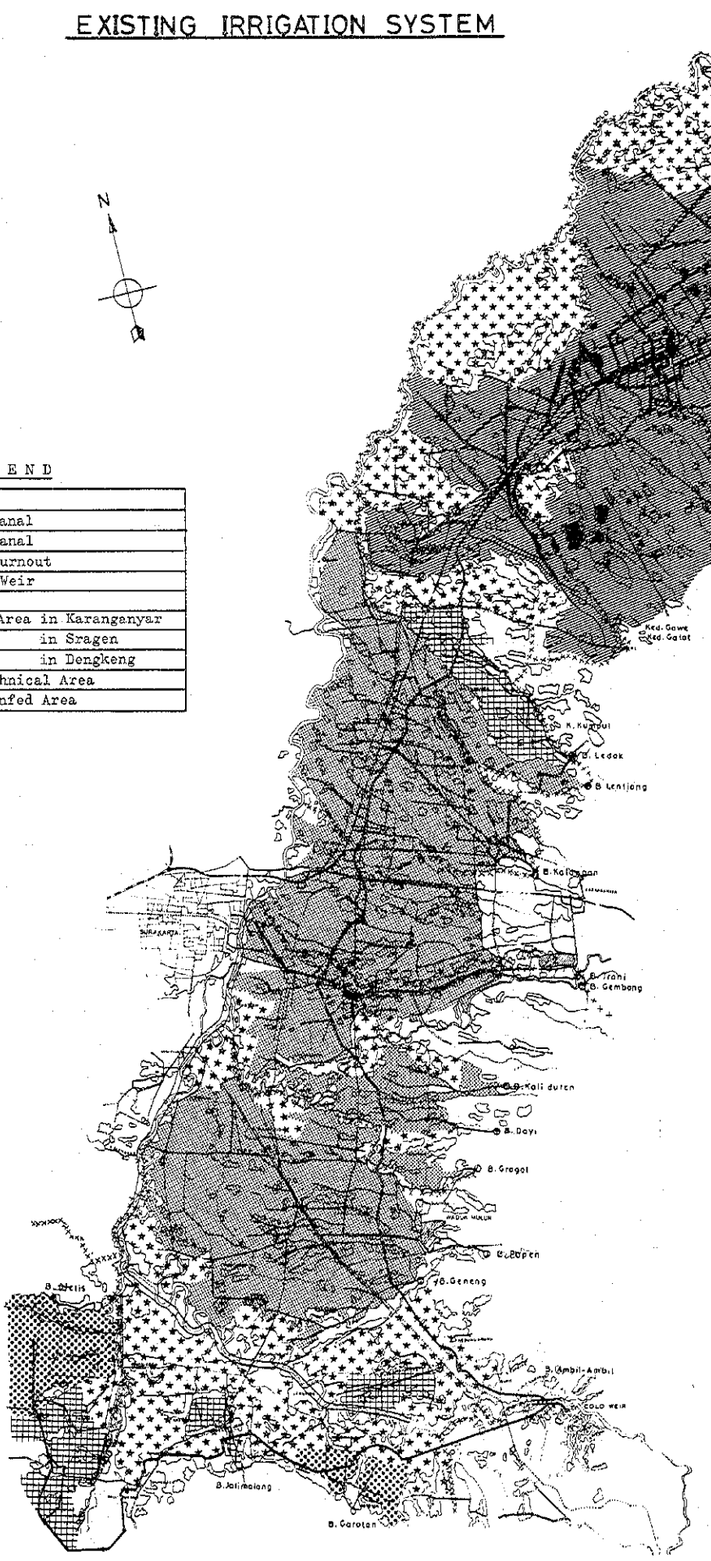
Compensation

(unit: a house)

Work \ Item	Banboo house	Wooden house	Brick house	Total
Main Canal	150	40	20	210
Colo Weir	50	10	-	60
Total	200	50	20	270

6. DRAWINGS

EXISTING IRRIGATION SYSTEM



LEGEND

———	Main Canal
———	Existing Canal
- - - - -	Proposed Canal
●	" Turnout
○	Diversion Weir
⬭	Reservoir
⁘⁘⁘	Technical Area in Karanganyar
⁘⁘⁘	" in Sragen
⁘⁘⁘	" in Dengkeng
⁘⁘⁘	Semi - Technical Area
★★★★	Non or Rainfed Area

Existing Diversion Weir

No	Name	Name of Tributary	Irrigation Area Wet S. ha	Irrigation Area Dry S. ha
Right				
1	B. Ambil ambil	K. Ambil ambil	223	0
2	B. Geneng	K. Jlantah	760	219
3	B. Tapen	"	Reservier	
4	B. Langsur	K. Nglangsur	Mulur	
5	B. Dari	K. Kumet	331	30
6	B. Kaliduren	K. Bening	570	170
7	B. Gembong	K. Gembong	} 2137	990
8	B. Trani	K. Samin		
9	B. Pancuran	K. Cabak	} 34	0
10	B. Karang	K. "		
11	B. Palur	K. Bibis	45	45
12	B. Jumak	K. Gandu	225	144
13.	B. Dukuh	K. "	283	184
14	B. Kalangan	K. Wulur	1,427	1,316
15	B. Jonkang	K. Gabahan	583	284
16	B. Kebak	Atvur Siwaluh	210	129
17	B. Lungge	"	177	145
18	B. Pengin	K. Tempuran	891	482
19	B. Ledok	K. Grompol	204	64
20	B. Banjaransari	"	460	187
21	B. Craken	K. Craken	208	67
22	B. Kedunggatot	K. Karang	} 2033	599
23	B. Kedung Gawe	K. Jambangan		
24	B. Krikilan	Atvur Prampalan		
25	B. Gebang	K. Mungkung	459	162
26	B. Banggo	K. Tempuran	488	113
27	B. Sepreh	K. Sragen	253	80
28	B. Karas	K. "	124	31
29	B. Krapyak	K. "	314	103
30	B. Randu	K. Ngrandu	256	121
31	B. Maron	K. Ngrandu	74	27
32	B. Ngarum	K. Ngarum	603	218
33	B. Klenteng	K. Ngampunan	938	311
34	B. Kedung Song	K. Bayat	212	53
35	B. Nangsri	K. Karang	1,344	361
36	B. Kedungduren	K. Sawur	} 758	145
37	B. Winong	K. Sawur		
38	B. Piji			
Left				
1	B. Garotan	K. Pijinan	319	0
2	B. Jatimalang	K. Dawung	235	0
3	B. Pencit	K. Dengkeng	250	0

Existing Reservoir

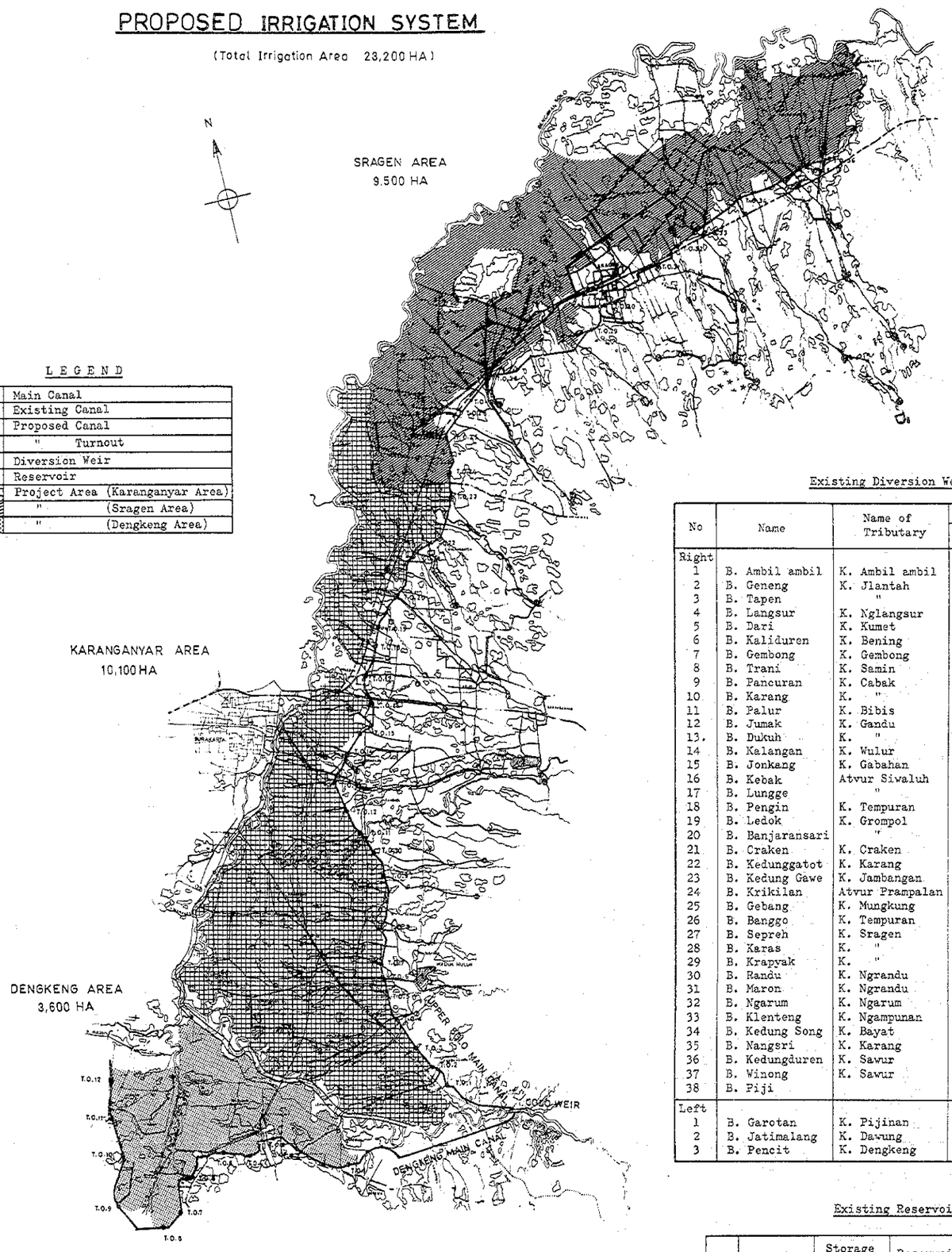
No	Name	Storage Capacity 10^3 m3	Reservoir Area ha	Irrigation Area Wet S ha	Irrigation Area Dry S ha
1	Mulur	4,935	100	4,028	1,530
2	Lalung	3,000	65	2,183	1,643
3	Tewel	79.5	3.4	275	71
4	Kebangan	500	13	1,947	1,235
5	Gebyar	701	100	1,727	420
6	Brambang	104	4	709	185

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION
EXISTING IRRIGATION SYSTEM

Date : July. 31. 1976 D.W.G. NO. WI-001

PROPOSED IRRIGATION SYSTEM

(Total Irrigation Area 23,200 HA)



LEGEND

———	Main Canal
———	Existing Canal
- - - - -	Proposed Canal
●	" Turnout
○	Diversion Weir
	Reservoir
	Project Area (Karanganyar Area)
	" (Sragen Area)
	" (Dengkeng Area)

Existing Diversion Weir

No	Name	Name of Tributary	Irrigation Area Wet S. ha	Irrigation Area Dry S. ha
Right				
1	B. Ambil ambil	K. Ambil ambil	223	0
2	B. Geneng	K. Jlantah	760	219
3	B. Tapen	"	Reservier	
4	B. Langsur	K. Nglangsur	Mulur	
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7	B. Gembong	K. Gembong	} 2137	990
8	B. Trani	K. Samin		
9	B. Pancuran	K. Cabak	} 34	0
10	B. Karang	K. "		
11	B. Palur	K. Bibis	45	45
12	B. Jumak	K. Gandu	225	144
13.	B. Dukuh	K. "	283	184
14	B. Kalangan	K. Wulur	1,427	1,316
15	B. Jonkang	K. Gabahan	583	284
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26	B. Banggo	K. Tempuran	488	113
27	B. Sepreh	K. Sragen	253	80
28	B. Karas	K. "	124	31
29	B. Krapyak	K. "	314	103
30	B. Randu	K. Ngrandu	256	121
31	B. Maron	K. Ngrandu	74	27
32	B. Ngarum	K. Ngarum	603	218
33	B. Klenteng	K. Ngampunan	938	311
34	B. Kedung Song	K. Bayat	212	53
35	B. Nangsri	K. Karang	1,344	361
36	B. Kedungduren	K. Sawur	} 758	145
37	B. Winong	K. Sawur		
38	B. Piji			
Left				
1	B. Garotan	K. Pijinan	319	0
2	B. Jatimalang	K. Dawung	235	0
3	B. Pencit	K. Dengkeng	250	0

Existing Reservoir

No	Name	Storage Capacity 10^3m3	Reservoir Area ha	Irrigation Area Wet S ha	Irrigation Area Dry S ha
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2	Lalung	3,000	65	2,183	1,643
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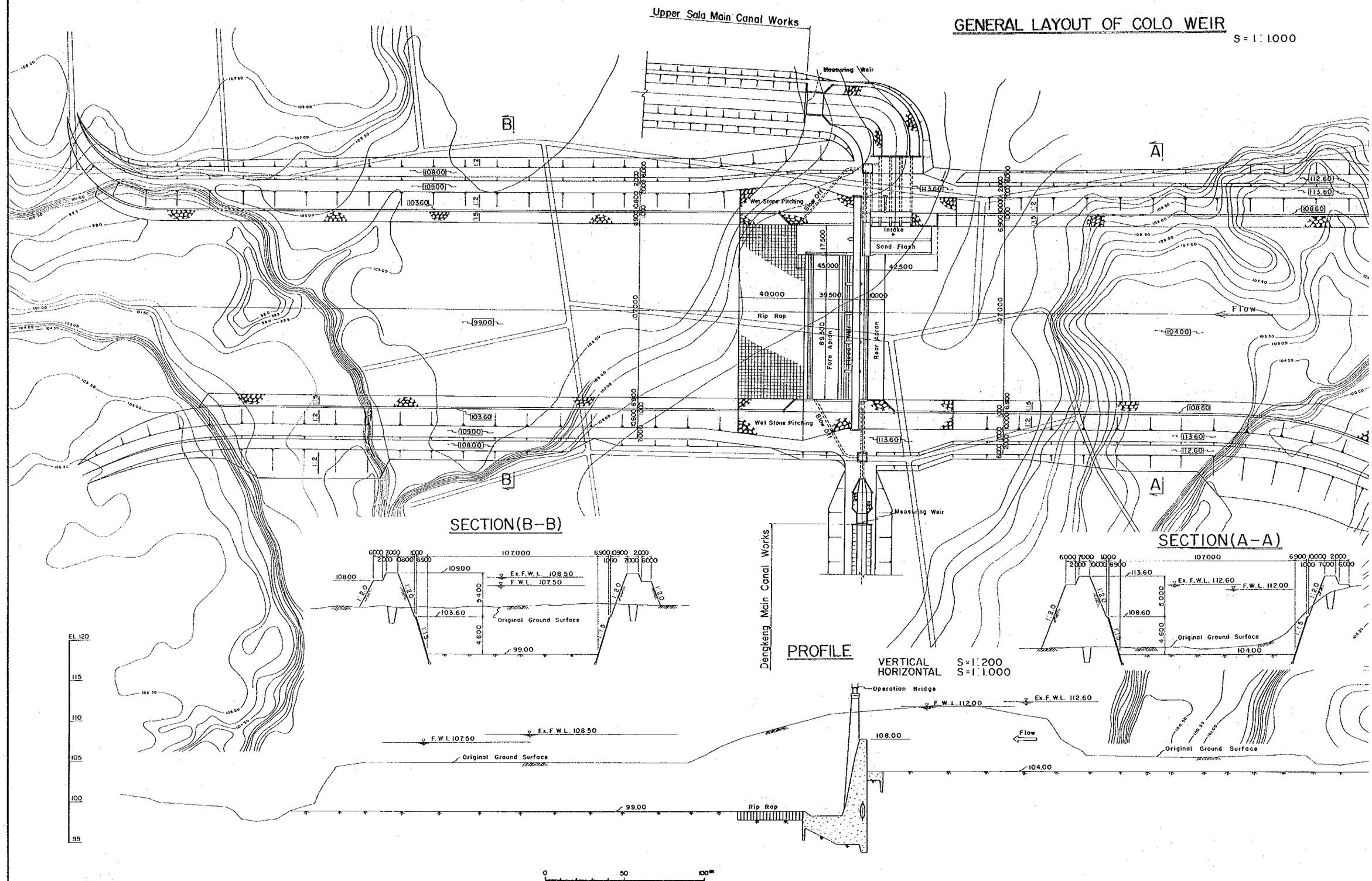
4	Kebangan	500	13	1,947	1,235
5	Gebyar	701	100	1,727	420
6	Brambang	104	4	709	185

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION
PROPOSED IRRIGATION SYSTEM

Date : July. 31. 1976 | D.W.G NO WI-002

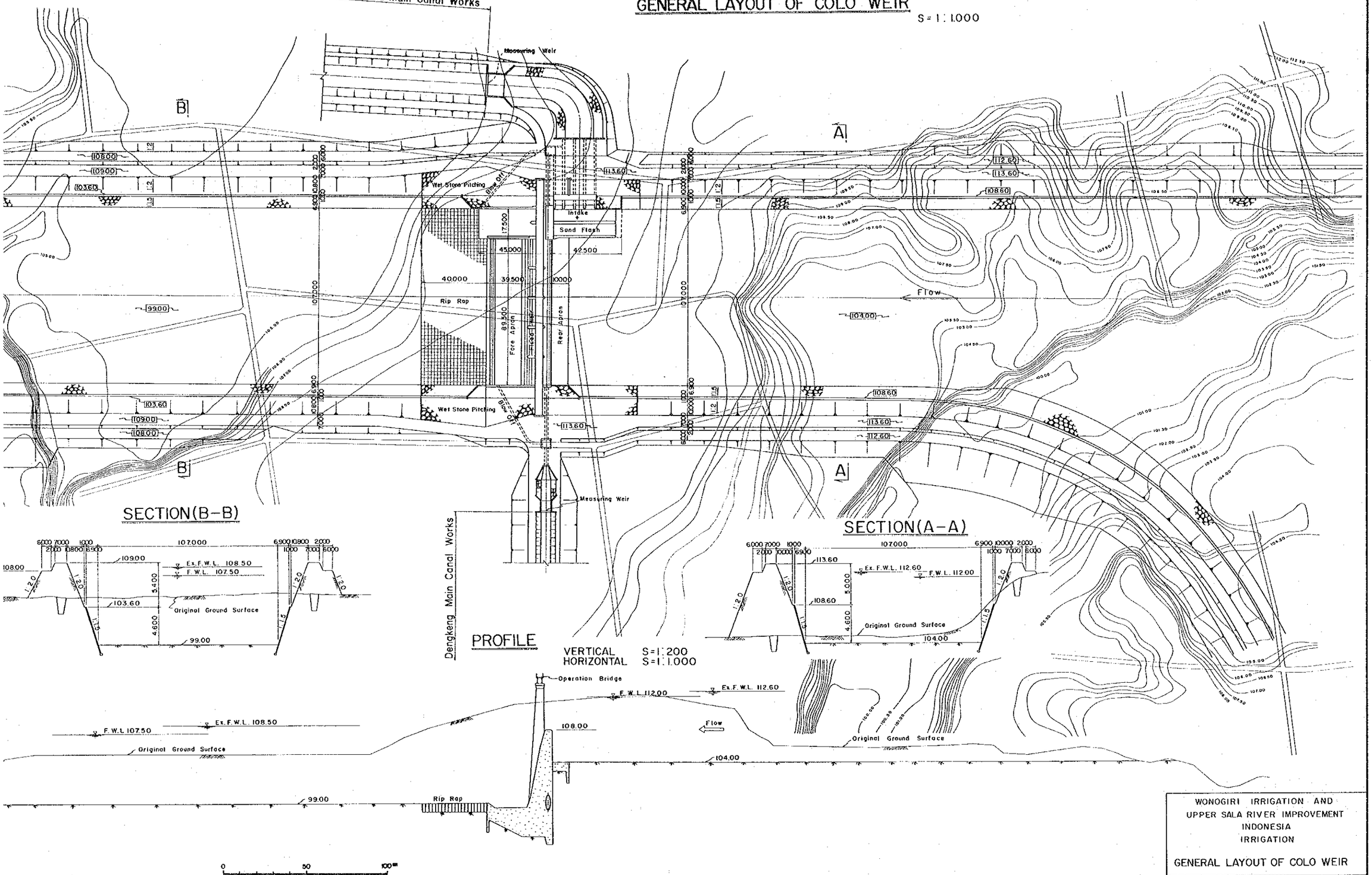
GENERAL LAYOUT OF COLO WEIR

S = 1 : 1.000



GENERAL LAYOUT OF COLO WEIR

S = 1 : 1.000



SECTION(B-B)

SECTION(A-A)

PROFILE

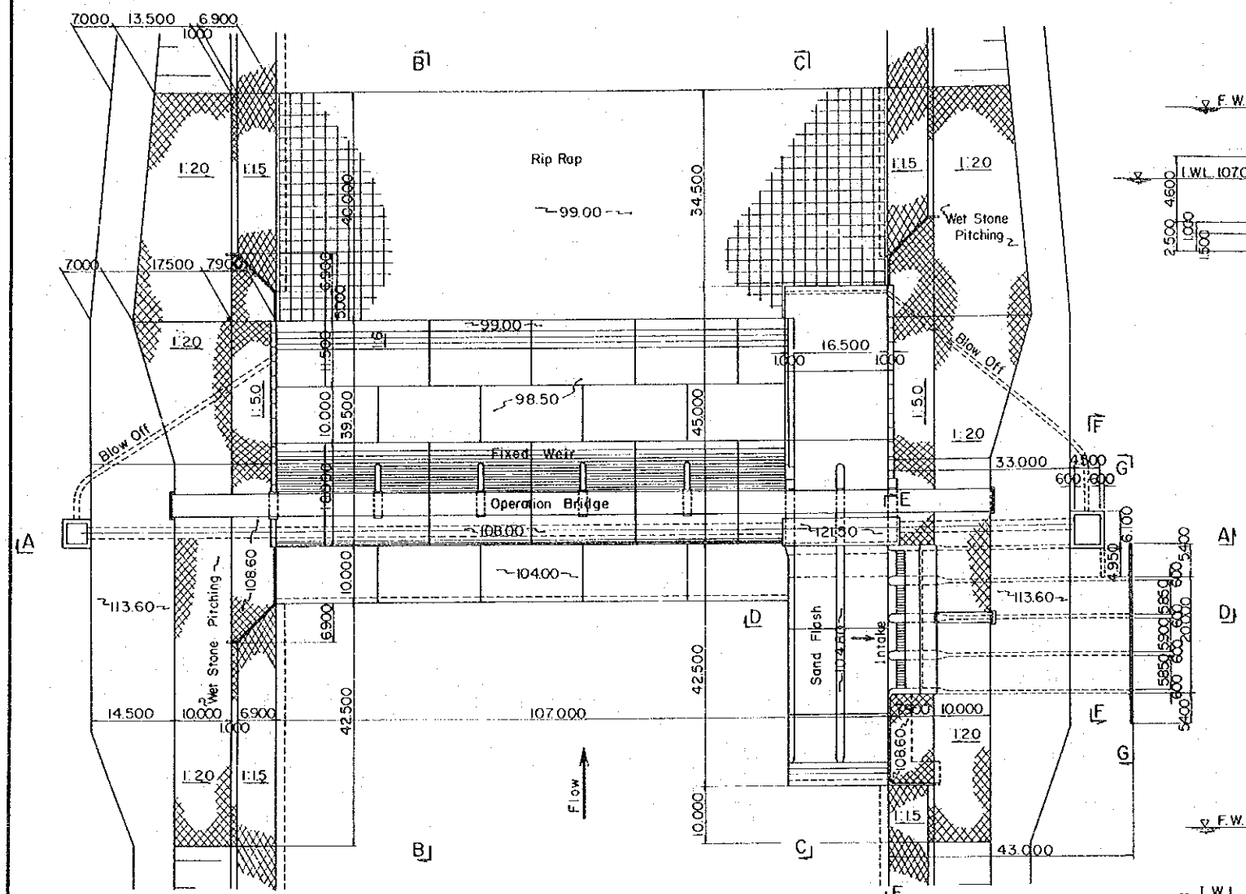
VERTICAL S=1:200
HORIZONTAL S=1:1.000

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

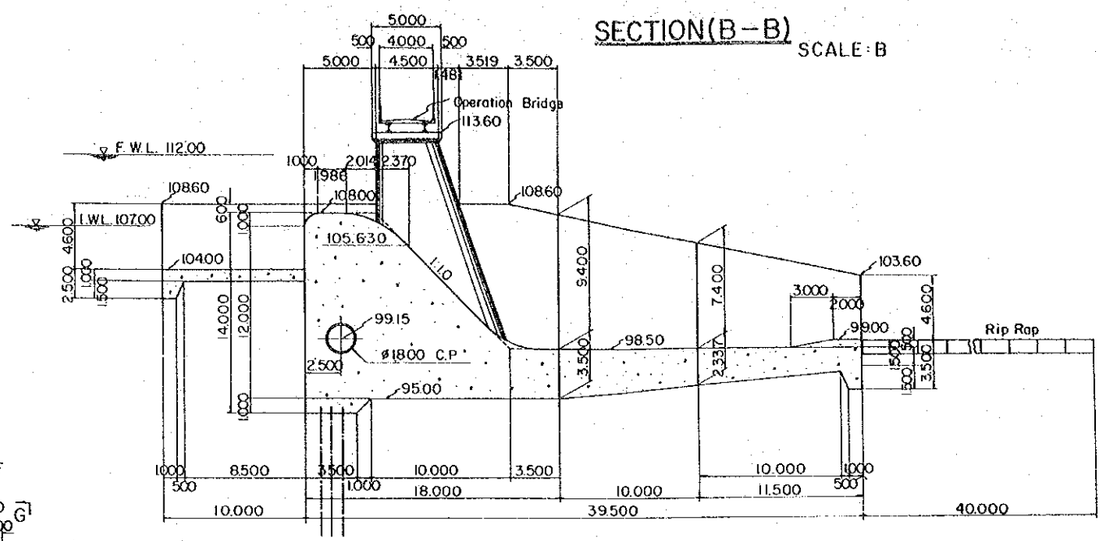
GENERAL LAYOUT OF COLO WEIR

Date : July. 31. 1976 | D.W.G. NO. WI-003

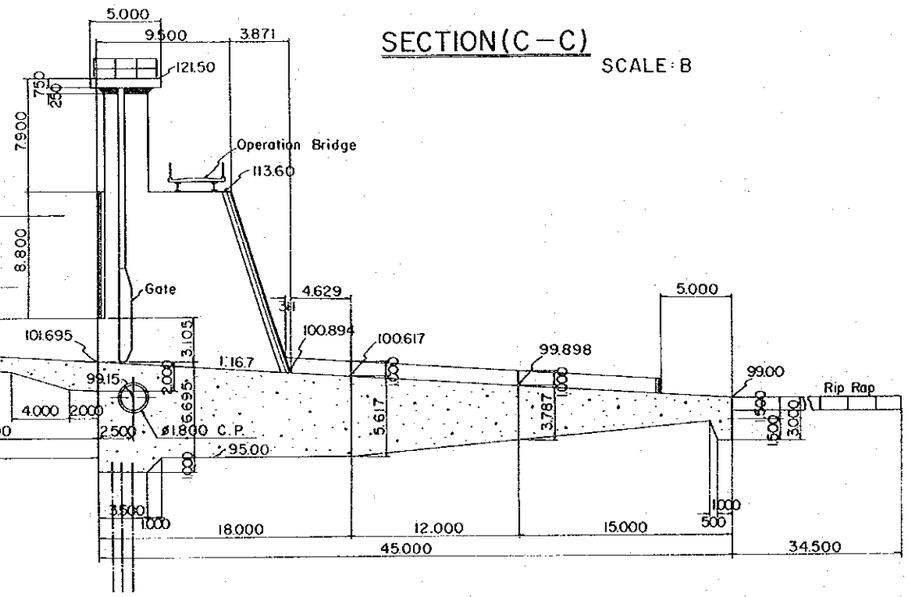
PLAN
SCALE : A



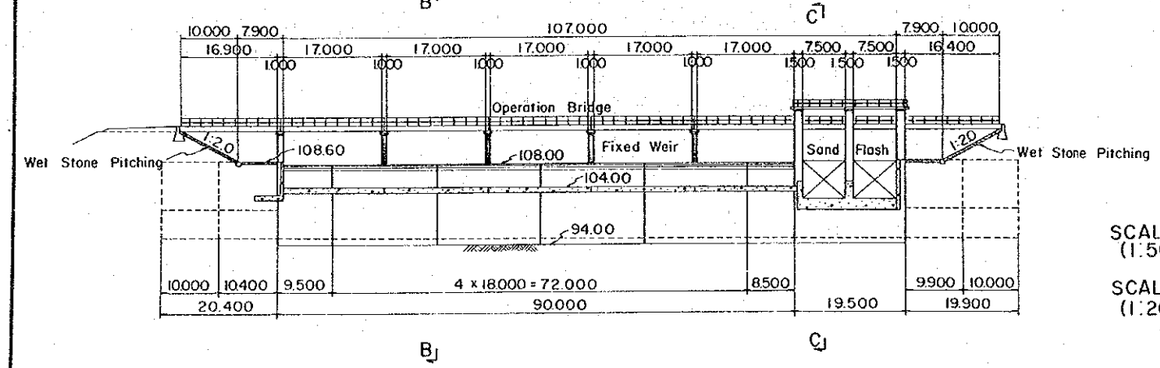
SECTION(B-B)
SCALE : B



SECTION(C-C)
SCALE : B



SECTION(A-A)
SCALE : A



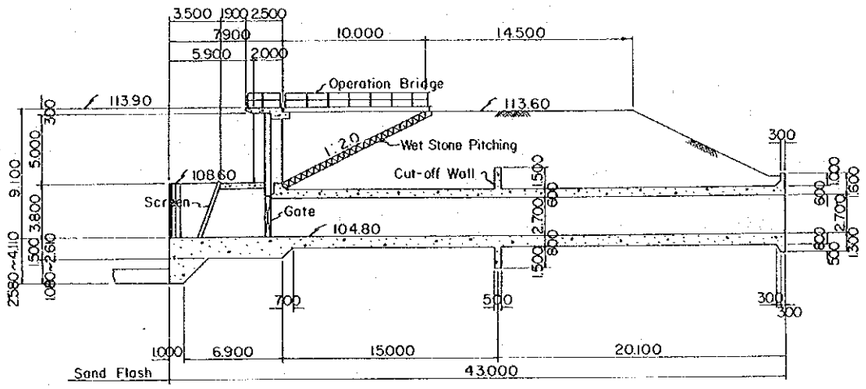
SCALE : A (1:500)

SCALE : B (1:200)

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA IRRIGATION
COLO WEIR
Date : July. 31. 1976 | D.W.G NO. WI - 004

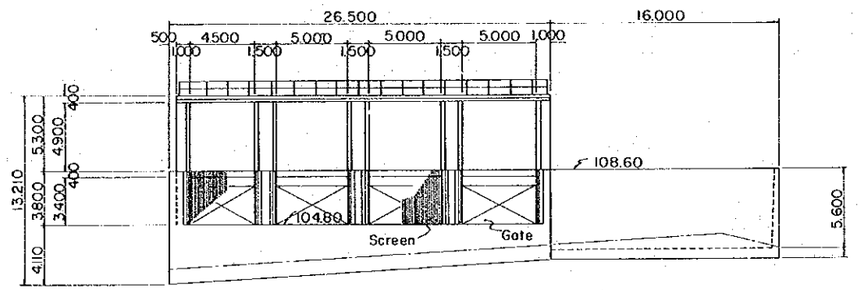
SECTION(D-D)

SCALE : B



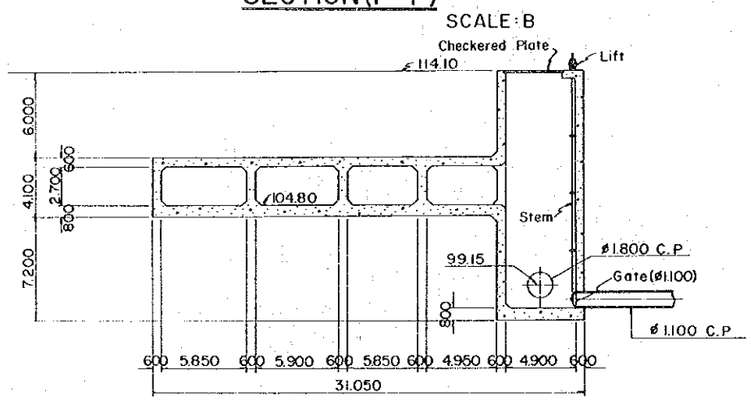
SECTION(E-E)

SCALE : B



SECTION(F-F)

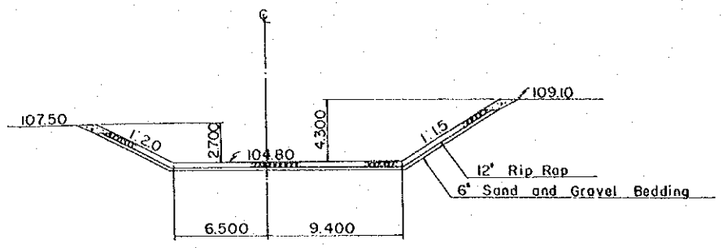
SCALE : B



RIGHT SIDE TRANSITION

SCALE : B

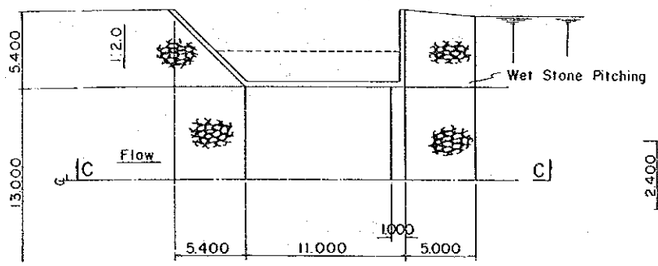
TALE FLONT



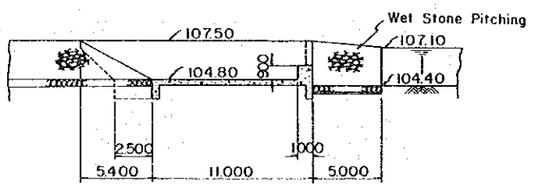
RIGHT SIDE MEASURING WEIR

PLAN

SCALE : B



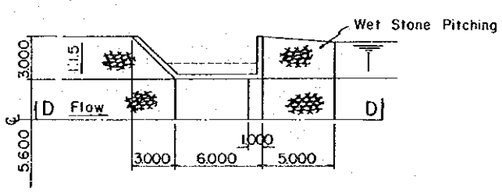
C – C



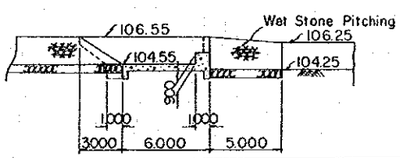
LEFT SIDE MEASURING WEIR

PLAN

SCALE : B



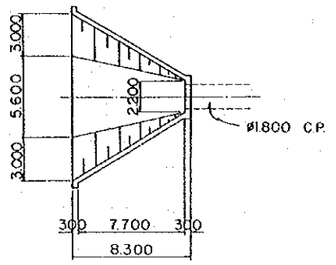
D – D



LEFT SIDE TRANSITION

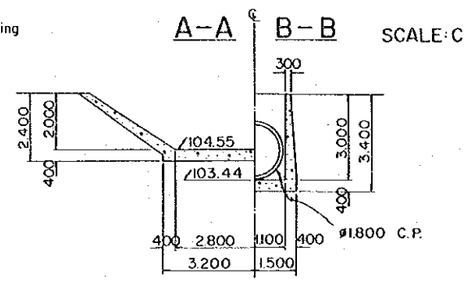
PLAN

SCALE : B



A-A B-B

SCALE : C



SCALE : B (1 : 200) 0 5 10 m

SCALE : C (1 : 100) 0 5 m

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

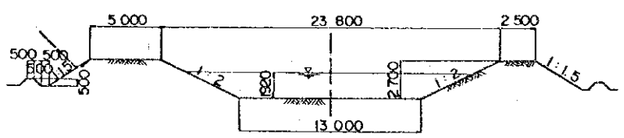
COLO WEIR

Date : July. 31. 1976 | D.W.G. NO WI-005

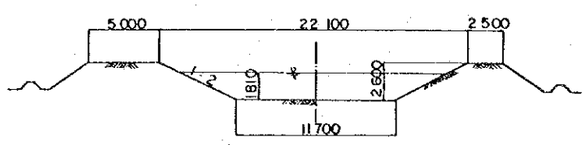
PROFILE OF UPPER SALA MAIN CANAL (I)

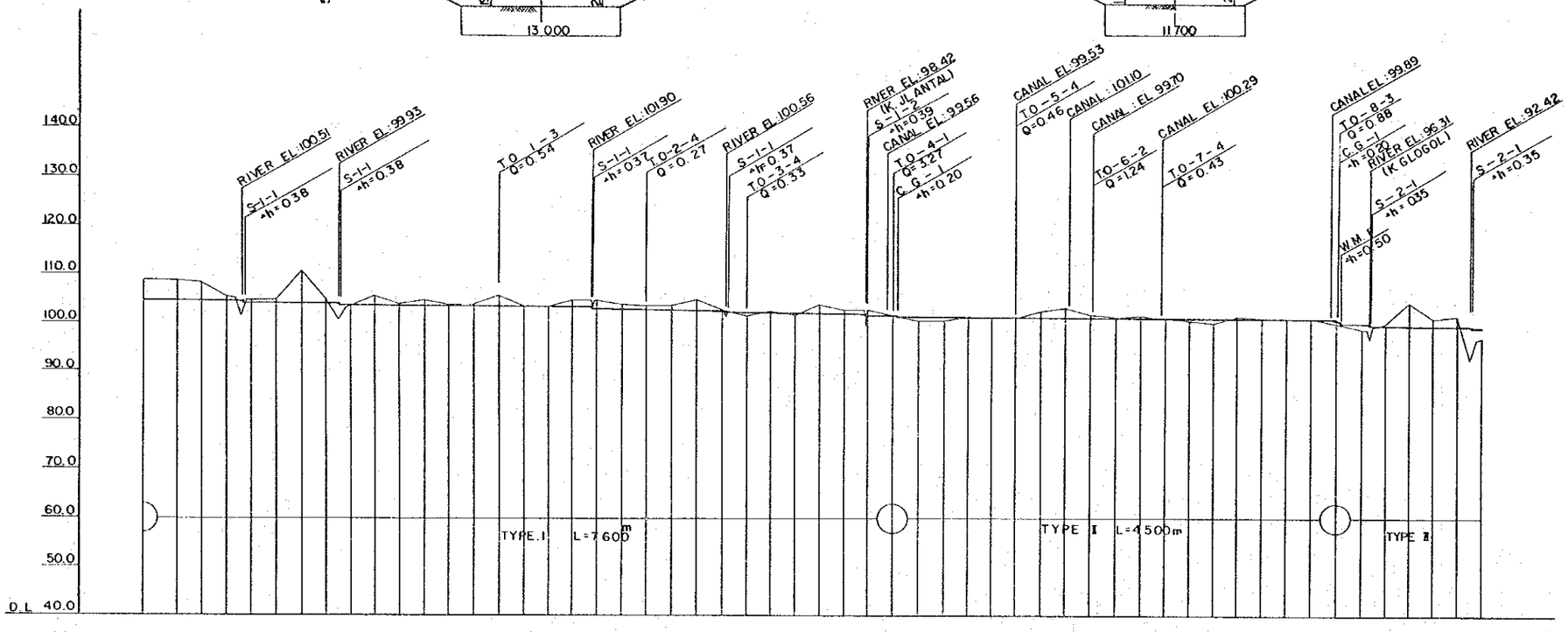
SCALE A

TYPE I SCALE B



TYPE II SCALE B





LEGEND

- T.O Turnout
- A Aqueduct
- S Siphon
- C.G Check Gate
- C Culvert
- W.M.F Water Measurement Facility

SCALE A

HORIZONTAL 0m 500 1000 1500

VERTICAL 0m 10 20

SCALE B

0m 5 10

Station No	Dist	Accum Dist	Ground Elev	Bottom of Canal	Water Surf	Top Bank	Hight of Embar	Depth of Exca	Grade
-600	0	0	+0834	+0440	+0632	+107.10		3.94	0.40
-250	350	350	+0836	+0434				4.02	
NO.1	250	600	+0780	+0430				3.50	
-750	"	850	+0500	+0426				0.74	
-500	"	1100	+0418	+0385				0.33	
-250	"	1350	+0412	+0381				0.31	
NO.0	"	1600	+0333	+0377				6.56	
+250	"	1850	+0408	+0372				0.36	
+500	"	2100	+0330	+0331			0.01		
+750	"	2350	+0507	+0327				1.80	
NO.1	"	2600	+0330	+0323				0.07	
+250	"	2850	+0435	+0319				1.16	
+500	"	3100	+0333	+0315				0.18	
+750	"	3350	+0330	+0311				0.19	
NO.2	"	3600	+0527	+0306	+0496			2.21	
+250	"	3850	+0350	+0302				0.48	
+500	"	4100	+0270	+0298			0.28		
+750	"	4350	+0416	+0294				1.22	
NO.3	"	4600	+0422	+0254				1.68	
+250	"	4850	+0324	+0250				0.74	
+500	"	5100	+0293	+0246	+0435			0.47	
+750	"	5350	+0339	+0241				0.98	
NO.4	"	5600	+0446	+0237				2.09	
+250	"	5850	+0219	+0233			0.14		
+500	"	6100	+0104	+0193	+0380		0.89		
+750	"	6350	+0184	+0189			0.05		
NO.5	"	6600	+0139	+0185			0.46		
+250	"	6850	+0360	+0181				1.79	
+500	"	7100	+0231	+0176				0.55	
+750	"	7350	+0230	+0135				0.95	
NO.6	"	7600	+0104	+0131	+0318	+104.01	0.27		
+250	"	7850	+0228	+0111	+0292	+103.71	0.85		
+500	"	8100	+0228	+0103			0.75		
+750	"	8350	+0080	+0099			0.19		
NO.7	"	8600	+0074	+0095			0.21		
+250	"	8850	+0080	+0090	+0269		0.10		
+500	"	9100	+0209	+0086				1.22	
+750	"	9350	+0280	+0082				1.98	
NO.8	"	9600	+0138	+0078	+0250			0.60	
+250	"	9850	+0085	+0074				0.11	
+500	"	10100	+0096	+0070				0.26	
+750	"	10350	+0044	+0065	+0135		0.21		
NO.9	"	10600	+0120	+0061			0.41		
+250	"	10850	+0080	+0057			0.77		
+500	"	11100	+0061	+0053				0.08	
+750	"	11350	+0072	+0049				0.23	
NO.10	"	11600	+0051	+0045				0.06	
+250	"	11850	+0037	+0040			0.03		
+500	"	12100	+0016	+0036	+0206	+102.96	0.74		
+750	"	12350	98.48	99.62	+0186	+102.61	1.14		
NO.11	"	12600	99.50	99.24				0.26	
+250	"	12850	+0400	99.20				4.80	
+500	"	13100	+0093	99.16				1.77	
+750	"	13350	+0145	99.12				2.33	
NO.12	"	13600	+0167	98.73	+0043	+101.18	1.95		

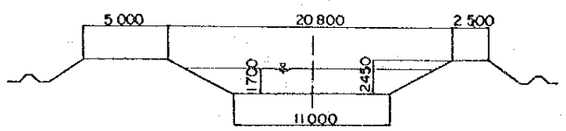
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION
PROFILE & CROSS-SECTION OF UPPER SALA MAIN CANAL (I)

Date :July. 31. 1976 | D.W.G. NO. WI-006

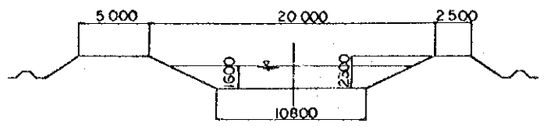
PROFILE OF UPPER SALA MAIN CANAL (2)

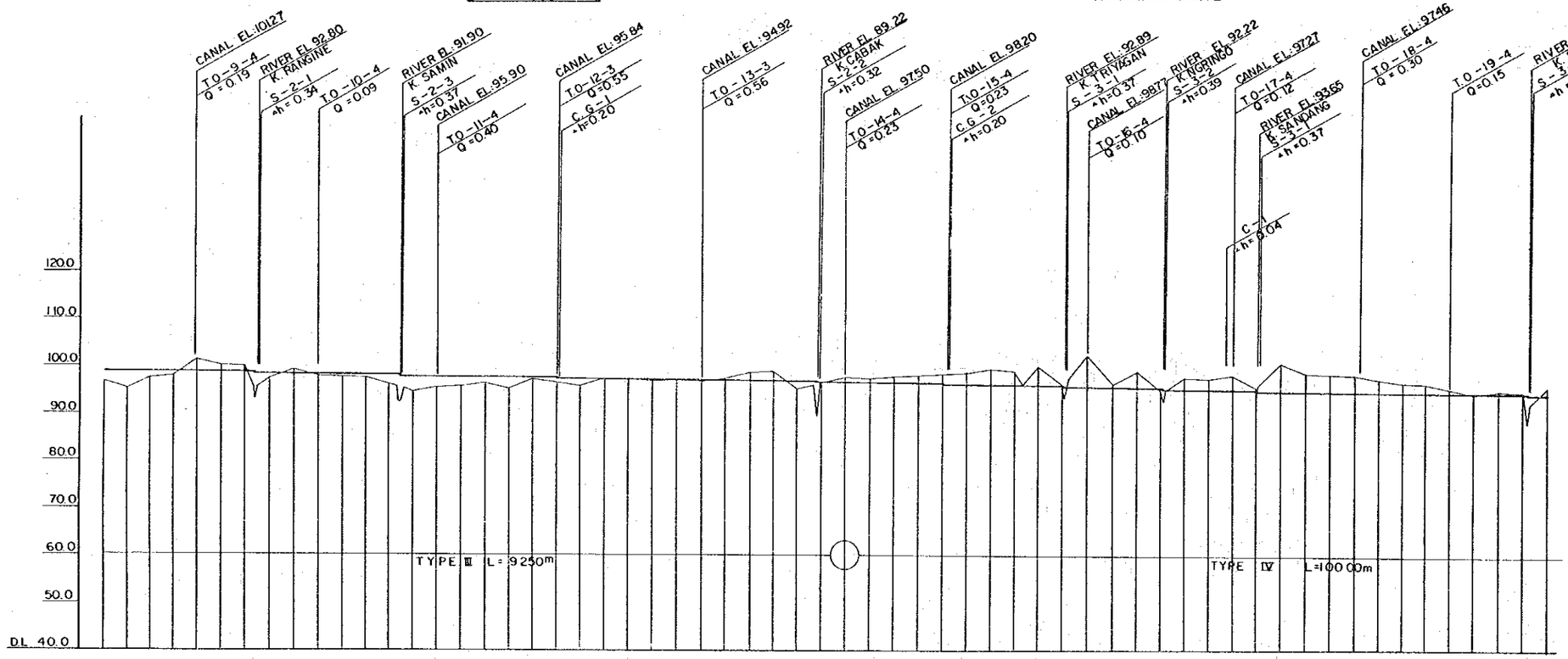
SCALE A

TYPE III SCALE B



TYPE IV SCALE B





Station No	Dist	Accum Dist	Ground Elev	Bottom of Canal	Water Surf	Top Bank	Hight of Embank	Depth of Exca	Grade
NO12	0	13600	96.78	98.73	HQ43	101.18	1.95		1/6000
+250	250	13950	95.18	98.69			3.51	2.66	
+500	"	14100	97.50	98.65			1.15		
+750	"	14350	97.80	98.61			0.81		
NO13	"	14600	101.23	98.57	100.26			1.45	
+250	"	14850	99.98	98.53					
+500	"	15100	99.86	98.48				1.38	
+750	"	15350	97.27	98.11			0.84		
NO14	"	15600	99.16	98.07				1.09	
+250	"	15850	97.84	98.03	99.72		0.19		
+500	"	16100	97.61	97.99			0.38		
+750	"	16350	97.48	97.95			0.47		
NO15	"	16600	96.13	97.91			1.78		
+250	"	16850	94.50	97.51			3.01		
+500	"	17100	95.50	97.47	99.14		1.97		
+750	"	17350	95.60	97.42			1.82		
NO16	"	17600	96.32	97.38			1.06		
+250	"	17850	96.07	97.34			1.27		
+500	"	18100	97.07	97.30			0.23		
+750	"	18350	96.43	97.26	98.93		0.83		
NO17	"	18600	95.72	97.02	98.69		1.30		
+250	"	18850	97.07	96.98			0.09		
+500	"	19100	97.15	96.94			0.21		
+750	"	19350	96.60	96.89			0.29		
NO18	"	19600	96.78	96.85			0.07		
+250	"	19850	96.50	96.81	98.41		0.31		
+500	"	20100	97.09	96.77			0.32		
+750	"	20350	98.52	96.73			1.79		
NO19	"	20600	98.61	96.69			1.92		
+250	"	20850	94.92	96.64			1.72		
+500	"	21100	96.23	96.29			0.06		
+750	"	21350	97.42	96.25	97.85	98.70 98.55	1.17	96.25	
NO20	"	21600	97.12	96.21			0.91		
+250	"	21850	97.55	96.17			1.38		
+500	"	22100	97.73	96.13			1.60		
+750	"	22350	98.04	96.08	97.68		1.96		
NO21	"	22600	98.29	95.84	97.46		2.45		
+250	"	22850	99.07	95.80			3.27		
+500	"	23100	98.63	95.76			2.87		
+750	"	23350	99.78	95.72			4.06		
NO22	"	23600	95.91	95.68			0.23		
+250	"	23850	101.90	95.26	96.85		6.62		
+500	"	24100	95.91	96.24			0.67		
+750	"	24350	98.74	95.19			3.55		
NO23	"	24600	94.60	95.15			0.55	2.46	
+250	"	24850	97.19	94.73			2.46		
+500	"	25100	97.13	94.69			2.44		
+750	"	25350	97.81	94.61	96.17		3.20		1/6000
NO24	"	25600	95.00	94.57			0.43		
+250	"	25850	100.16	94.17			5.99		
+500	"	26100	98.23	94.13			4.10		
+750	"	26350	98.00	94.09			3.91		
NO25	"	26600	97.75	94.04	95.59		3.71		
+250	"	26850	96.77	94.00			2.77		
+500	"	27100	96.08	93.96			2.12		
+750	"	27350	95.85	93.92			1.93		
NO26	"	27600	94.81	93.88	95.42		0.93		
+250	"	27850	93.75	93.84			0.09		
+500	"	28100	94.40	93.79			0.61		
+750	"	28350	94.10	93.74			0.36		
NO27	"	28600	95.10	93.34	94.62	95.64	1.76		

LEGEND

- T.O — Turnout
- A — Aqueduct
- S — Siphon
- C G — Check Gate
- C — Culvert
- W.M.F — Water Measurement Facility

SCALE A

HORIZONTAL: 0m 500 1000 1500

VERTICAL: 0m 10 20

SCALE B

0m 5 10

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

IRRIGATION

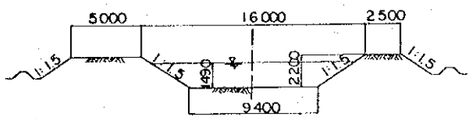
PROFILE & CROSS-SECTION OF UPPER SALA MAIN CANAL (2)

Date : July. 31 1976 | D.W.G NO WI. 007

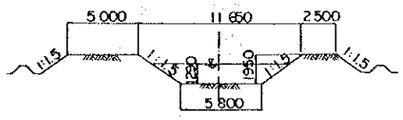
PROFILE OF UPPER SALA MAIN CANAL (3)

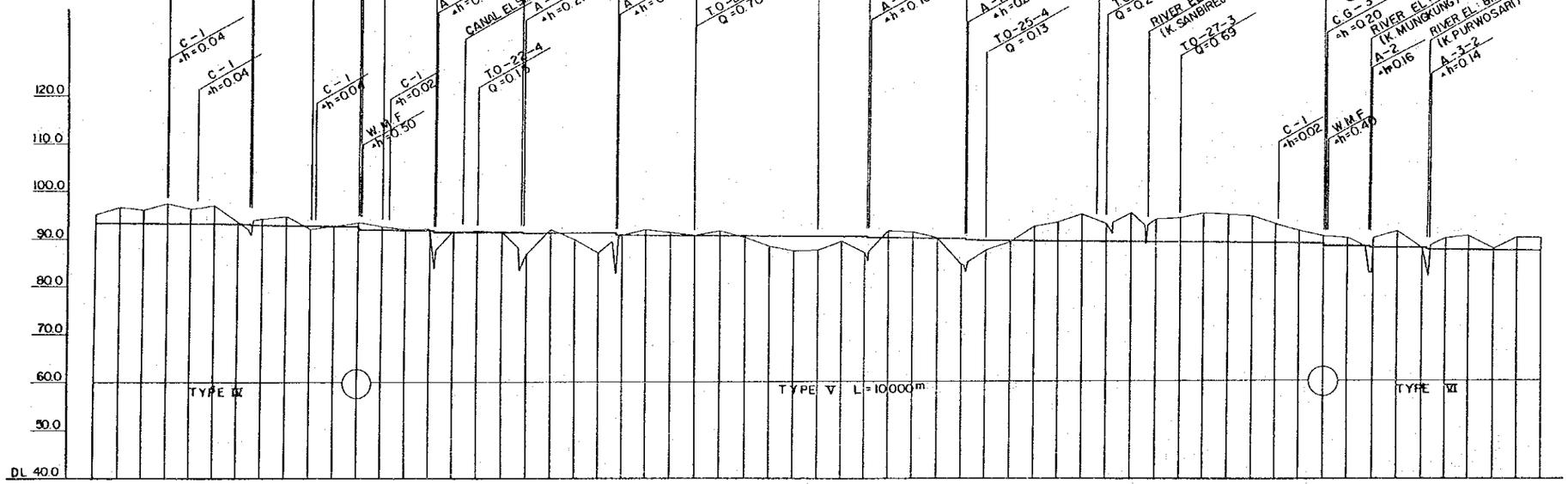
SCALE A

TYPE V SCALE B



TYPE VI SCALE B





LEGEND

- T.O — Turnout
- A — Aqueduct
- S — Siphon
- C.G — Check Gate
- C — Culvert
- W.M.F — Water Measurement Facility

SCALE A

HORIZONTAL 0m 500 1000 1500

VERTICAL 0m 10 20

SCALE B

0m 5 10

Station No.	Dist.	Accum. Dist.	Ground Elev.	Bottom of Canal	Water Surf.	Top Bank	Hight of Embank.	Depth of Exca.	Grade
NO.27	0	28600	95.10	93.34	94.62	95.64		1.76	93.36
+250	250	28850	96.60	93.29				3.31	
+500	"	29100	96.00	93.25				2.75	
+750	"	29350	97.40	93.17				4.23	
NO.28	"	29600	96.19	93.13	94.62			3.06	
+250	"	29850	96.85	93.05				3.80	
+500	"	30100	93.37	93.01				0.36	
+750	"	30350	94.14	92.63				1.51	
NO.29	"	30600	94.63	92.59				2.04	
+250	"	30850	91.90	92.55			0.65	0.03	
+500	"	31100	92.50	92.47				0.97	92.43
+750	"	31350	93.40	92.43	93.32	94.73		0.68	92.23
NO.30	"	31600	93.37	92.25	93.72	94.43		0.30	
+250	"	31850	91.92	91.62				0.45	
+500	"	32100	92.03	91.58				0.45	
+750	"	32350	91.26	91.35			0.09	0.19	
NO.31	"	32600	91.50	91.31	92.79		0.02	0.19	
+250	"	32850	91.24	91.26			4.31	0.81	
+500	"	33100	86.71	91.02			1.15	0.81	
+750	"	33350	91.79	90.98			4.00		
NO.32	"	33600	89.78	90.93			0.10		
+250	"	33850	86.89	90.89				1.12	
+500	"	34100	90.56	90.66				0.45	
+750	"	34350	91.74	90.62				0.07	
NO.33	"	34600	91.02	90.57				1.05	
+250	"	34850	90.60	90.53	91.96		0.33		
+500	"	35100	91.53	90.48			2.24		
+750	"	35350	90.10	90.43			3.04		
NO.34	"	35600	88.15	90.39			2.75		
+250	"	35850	87.30	90.34			0.85		
+500	"	36100	87.55	90.30	91.72		3.29		
+750	"	36350	89.40	90.25				1.51	
NO.35	"	36600	86.92	90.21				1.45	
+250	"	36850	91.50	89.99				0.30	
+500	"	37100	91.40	89.95			5.26		
+750	"	37350	90.20	89.90			1.93		
NO.36	"	37600	84.60	89.86			0.28		
+250	"	37850	87.70	89.63	91.04				
+500	"	38100	89.30	89.58				3.17	
+750	"	38350	92.70	89.53				4.07	
NO.37	"	38600	93.56	89.49				5.69	
+250	"	38850	95.13	89.44				3.60	
+500	"	39100	93.00	89.40	90.80			5.93	
+750	"	39350	95.28	89.35				4.75	
NO.38	"	39600	94.06	89.31				5.02	
+250	"	39850	94.28	89.26	90.60			5.96	
+500	"	40100	95.18	89.22				5.83	
+750	"	40350	95.00	89.17				5.36	
NO.39	"	40600	94.49	89.13				3.76	
+250	"	40850	92.84	89.08				2.48	
+500	"	41100	91.50	89.02				1.53	88.97
+750	"	41350	90.50	88.97	90.31	91.17		1.69	88.77
NO.40	"	41600	90.00	88.91	90.06	90.72		1.95	
+250	"	41850	90.06	88.11				3.55	
+500	"	42100	91.60	88.05					
+750	"	42350	87.90	87.98			0.08	2.24	
NO.41	"	42600	90.04	87.80				2.76	
+250	"	42850	90.50	87.74				0.22	
+500	"	43100	87.89	87.67				2.60	
+750	"	43350	90.21	87.61				2.64	
NO.42	"	43600	90.19	87.55					

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

IRRIGATION

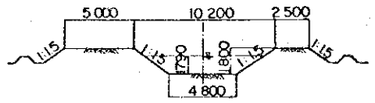
PROFILE & CROSS-SECTION OF UPPER SALA MAIN CANAL (3)

Date : July. 31 1976 | D.W.G. NO WI-008

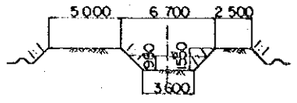
PROFILE OF UPPER SALA MAIN CANAL (4)

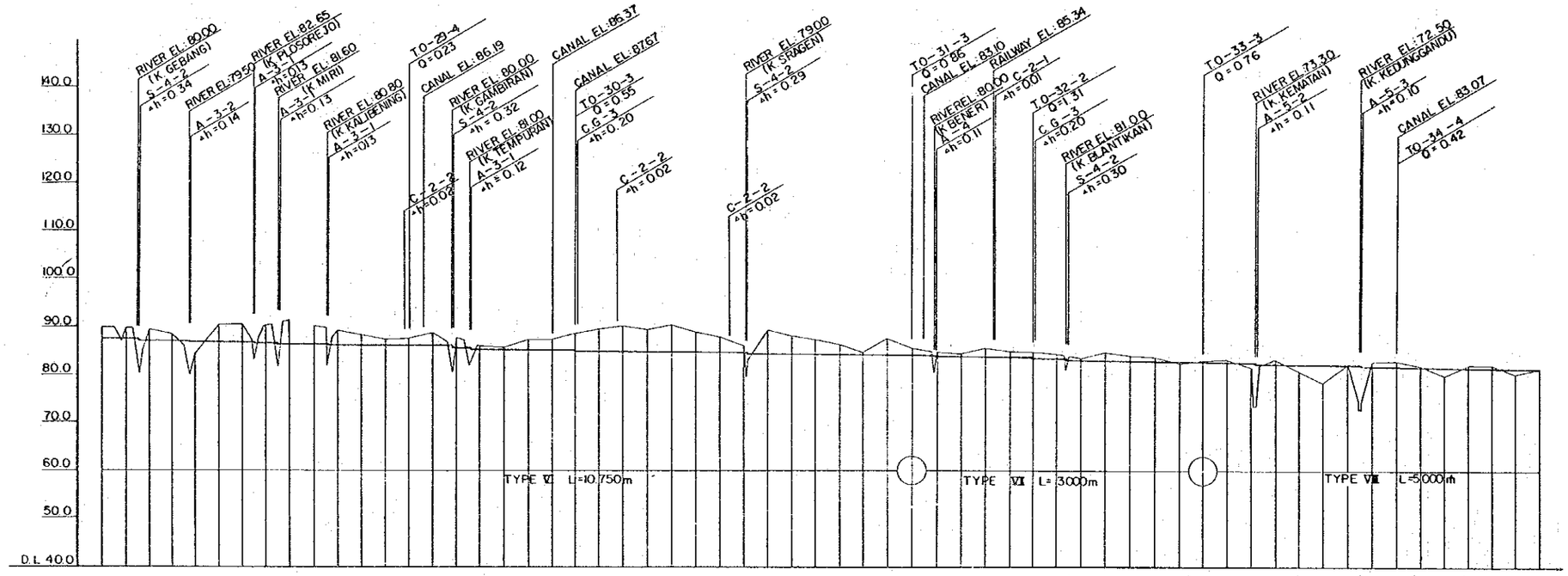
SCALE A

TYPE VI SCALE B



TYPE VII SCALE B





Station No.	Dist	Accum. Dist	Ground Elev	Bottom of Canal	Water Surf.	Top Bank	Hight of Embn	Depth of Exca.	Grade
NO42	0	43600	90.19	87.55	86.84	89.50		2.64	
+250	250	43850	90.00	87.49				2.51	
+500	"	44100	89.50	87.10				2.40	
+750	"	44350	88.35	87.03				1.32	
NO43	"	44600	84.50	86.85			2.35		
+250	"	44850	90.43	86.79				3.64	
+500	"	45100	90.50	86.72				3.78	
+750	"	45350	90.00	86.54				3.46	
NO44	"	45600	91.44	86.36	87.65			5.08	
+250	"	45850	90.10	86.30				3.80	
+500	"	46100	89.20	86.15				3.05	
+750	"	46350	88.41	86.06				2.35	
NO45	"	46600	87.34	86.00				1.34	
+250	"	46850	87.55	85.92	87.18			1.63	
+500	"	47100	87.74	85.86				2.88	
+750	"	47350	88.08	85.49				2.59	
NO46	"	47600	85.96	85.32				0.64	
+250	"	47850	85.65	85.26				0.39	
+500	"	48100	87.34	85.19				2.15	
+750	"	48350	87.27	85.13	86.33			2.14	
NO47	"	48600	88.64	84.87	86.06			3.57	
+250	"	48850	89.53	84.81				4.72	
+500	"	49100	90.00	84.73				5.27	
+750	"	49350	89.39	84.67				4.72	
NO48	"	49600	90.25	84.61				5.64	
+250	"	49850	88.92	84.54				4.38	
+500	"	50100	87.85	84.48				3.31	
+750	"	50350	85.89	84.40				1.49	
NO49	"	50600	89.30	84.06				5.24	
+250	"	50850	88.00	84.00				4.00	
+500	"	51100	87.12	83.94				3.18	
+750	"	51350	86.08	83.88				2.20	
NO50	"	51600	84.66	83.81				0.85	
+250	"	51850	87.29	83.75				3.54	
+500	"	52100	85.39	83.69	84.88	85.64		1.70	8360
+750	"	52350	84.60	83.44		85.49		1.10	
NO51	"	52600	84.30	83.47				0.83	
+250	"	52850	85.43	83.40				2.03	
+500	"	53100	84.82	83.34	83.28			1.48	
+750	"	53350	84.70	83.08	84.47			1.42	
NO52	"	53600	84.27	83.02	84.06			1.25	
+250	"	53850	83.37	82.67				0.70	
+500	"	54100	84.55	82.60				1.95	
+750	"	54350	83.86	82.54				1.34	
NO53	"	54600	83.54	82.48				1.06	
+250	"	54850	82.30	82.42			0.12		
+500	"	55100	82.83	82.35	83.33	84.15		0.48	8235
+750	"	55350	83.15	82.28		83.90		0.87	
NO54	"	55600	81.40	82.21			0.81		
+250	"	55850	83.00	82.04				0.96	
+500	"	56100	80.59	81.97			1.38		
+750	"	56350	78.30	81.90			3.60		
NO55	"	56600	82.15	81.83				0.32	
+250	"	56850	82.72	81.67				1.05	
+500	"	57100	82.76	81.60	82.48			1.16	
+750	"	57350	81.76	81.53				0.23	
NO56	"	57600	79.84	81.46			1.62		
+250	"	57850	82.00	81.39				0.61	
+500	"	58100	81.78	81.31				0.47	
+750	"	58350	80.10	81.24			1.14		
NO57	"	58600	81.37	81.17	82.05	82.72		0.20	

Grade: 1/4000 | 1/4000 | 1/3500

LEGEND

- T.O Turnout
- A Aqueduct
- S Siphon
- C.G Check Gate
- C Culvert
- W.M.F Water Measurement Facility

SCALE A

HORIZONTAL 0m 500 1000 1500

VERTICAL 0m 10 20

SCALE B

0m 5 10

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

IRRIGATION

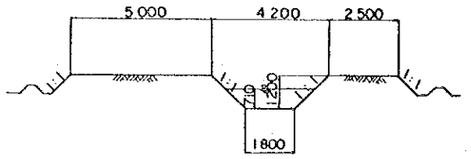
PROFILE & CROSS-SECTION OF UPPER SALA MAIN CANAL (4)

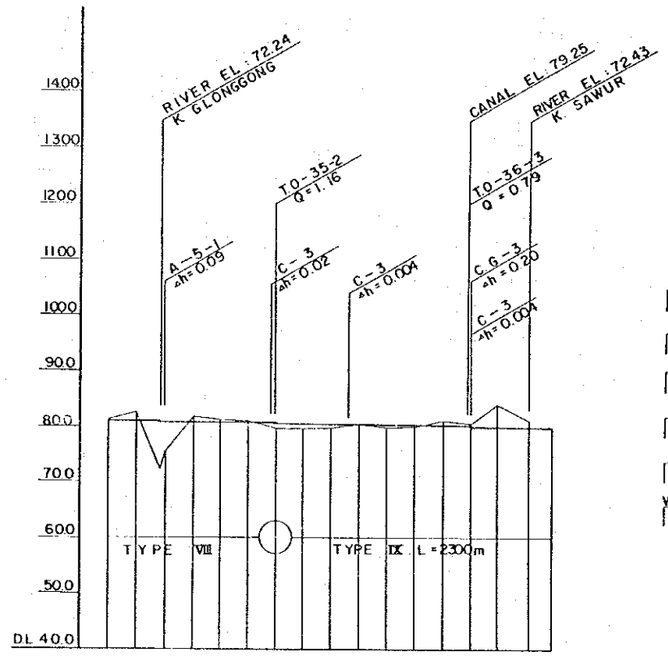
Date : July. 31 1976 | D.W.G. NO WI - 009

PROFILE OF UPPER SALA MAIN CANAL (5)

SCALE A

TYPE IX SCALE B





LEGEND

- T.O — Turnout
- A — Aqueduct
- S — Siphon
- C.G — Check Gate
- C — Culvert
- W.M.F — Water Measurement Facility

Station No.	Dist	Accum Dist	Ground Elev	Bottom of Canal	Water Surf	Top Bank	Hight of Embank	Depth of Excn
Grow								
NO.57	0	58600	81.37	81.17	82.05	82.72		0.20
+250	250	58700	82.56	81.10				1.46
+500	"	59100	79.61	80.95			5.34	
+750	"	59350	81.87	80.88				0.99
NO.58	"	59600	81.27	80.81				0.46
+250	"	59850	81.17	80.74	81.53	82.20		0.43
+500	"	60100	79.67	80.65	81.36	81.85	0.98	
+750	"	60350	79.68	80.57			0.89	
NO.59	"	60600	79.82	80.48			0.66	
+250	"	60850	80.40	80.40			0	
+500	"	61100	79.81	80.32			0.51	
+750	"	61350	80.08	80.23			0.15	
NO.60	"	61600	81.07	80.15				0.92
+250	"	61850	80.31	80.07	80.78			0.24
+500	"	62100	83.87	79.87	80.58			4.08
+800	300	62400	81.00	79.69	80.40	80.89		1.31
Grow						82.05		

3.000

SCALE A

HORIZONTAL: 0m 500 1000 1500

VERTICAL: 0m 10 20

SCALE B

0m 5

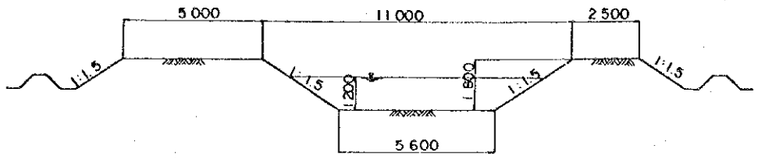
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION
PROFILE & CROSS-SECTION OF
UPPER SALA MAIN CANAL (5)

Date : July. 31. 1976 | D.W.G NO WI-010

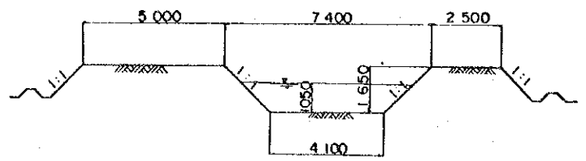
PROFILE OF DENGKENG MAIN CANAL (I)

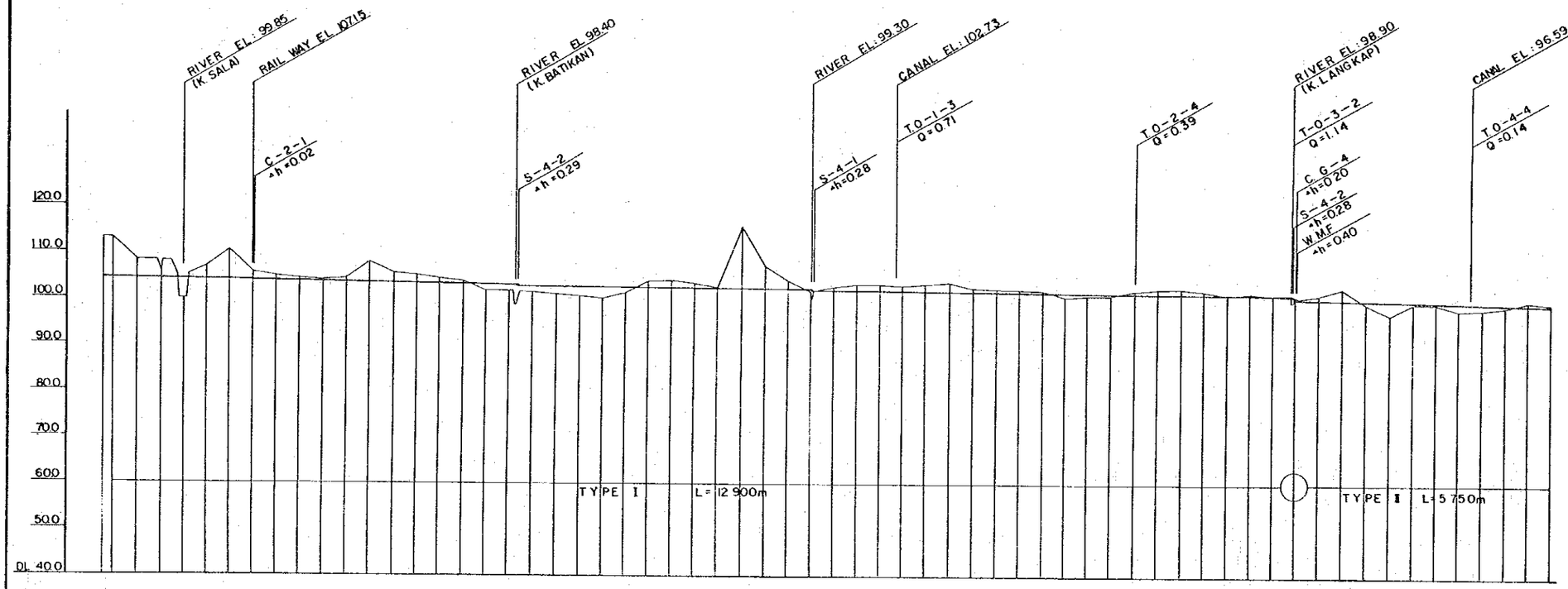
SCALE A

TYPE I SCALE B



TYPE II SCALE B





LEGEND

T.O	Turnout
A	Aqueduct
S	Siphon
C G	Check Gate
C	Culvert
W.M.F	Water Measurement Facility

Station No	Dist	Accum Dist	Ground Elev	Bottom of Canal	Water Surf	Top Bank	Hight of Embar	Depth of Exca	Grade
-600	0	0	113.00	104.25	105.45	106.05		8.75	1/4000
-500	100	100	113.00	104.23				8.77	
-250	250	350	108.00	104.16				3.84	
NO.1	"	600	105.30	104.10	105.30		4.19	1.20	
-750	"	850	99.85	104.04				2.72	
-500	"	1100	106.70	103.98				6.29	
-250	"	1350	110.20	103.91				1.63	
NO.0	"	1600	105.48	103.85				0.93	
+250	"	1850	104.70	103.77				0.57	
+500	"	2100	104.28	103.71				0.21	
+750	"	2350	103.86	103.65				0.62	
NO.1	"	2600	104.20	103.58				4.18	
+250	"	2850	107.70	103.52				2.04	
+500	"	3100	105.50	103.46				1.50	
+750	"	3350	104.90	103.40				0.87	
NO.2	"	3600	104.20	103.33				0.23	
+250	"	3850	103.50	103.27			1.71		
+500	"	4100	101.50	103.21			1.56		
+750	"	4350	101.59	103.15	104.35				
NO.3	"	4600	101.20	102.81			1.61		
+250	"	4850	100.80	102.75			1.95		
+500	"	5100	100.10	102.68			2.58		
+750	"	5350	99.80	102.62			2.82		
NO.4	"	5600	101.00	102.56			1.56		
+250	"	5850	103.50	102.50			1.02		
+500	"	6100	103.80	102.43			1.37		
+750	"	6350	103.25	102.37			0.88		
NO.5	"	6600	102.30	102.31			0.01		
+250	"	6850	115.20	102.25			12.95		
+500	"	7100	106.90	102.18			4.72		
+750	"	7350	103.77	102.12			1.65		
NO.6	"	7600	101.32	102.06			0.74		
+250	"	7850	102.20	101.73			0.47		
+500	"	8100	102.70	101.66			1.04		
+750	"	8350	102.83	101.60			1.23		
NO.7	"	8600	102.40	101.54	102.65		0.86		
+250	"	8850	102.88	101.48			1.40		
+500	"	9100	103.20	101.41			1.79		
+750	"	9350	102.01	101.35			0.66		
NO.8	"	9600	101.85	101.29			0.56		
+250	"	9850	101.80	101.23			0.57		
+500	"	10100	101.50	101.16			0.34		
+750	"	10350	103.00	101.10			0.80		
NO.9	"	10600	102.50	101.04			0.54		
+250	"	10850	100.50	100.98			0.48		
+500	"	11100	101.20	100.91	101.91		0.59		
+750	"	11350	101.95	100.85			1.10		
NO.10	"	11600	102.03	100.79			1.24		
+250	"	11850	101.50	100.73			0.77		
+500	"	12100	100.80	100.66			0.14		
+750	"	12350	101.00	100.60			0.40		
NO.11	"	12600	100.84	100.54			0.30		
+250	"	12850	100.00	100.21	101.26	102.01	0.21		1/3700
+500	"	13100	100.80	100.01	101.06	101.66	0.01	1.25	
+750	"	13350	102.30	99.55	100.60			2.82	
NO.12	"	13600	98.70	99.48					
+250	"	13850	96.50	99.41			0.71		
+500	"	14100	99.00	99.34			2.84		
+750	"	14350	98.95	99.28			0.28		
NO.13	"	14600	97.60	99.21			0.26		
+250	"	14850	97.90	99.14			1.54		
+500	"	15100	98.50	99.07	100.09		1.17		
+750	"	15350	99.55	99.01			0.51		
NO.14	"	15600	99.15	98.94		100.52		0.61	
				98.87				0.28	

SCALE A

HORIZONTAL 0m 500 1000 1500

VERTICAL 0m 10 20

SCALE B

0m 5

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

IRRIGATION

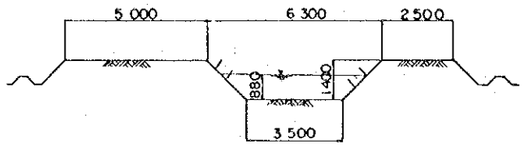
PROFILE & CROSS-SECTION OF DENGKENG MAIN CANAL (I)

Date July. 31. 1976 | D.W.G NO WI-011

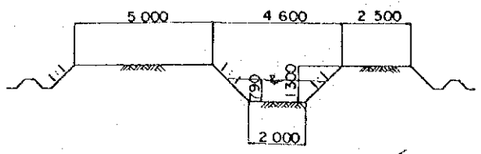
PROFILE OF DENGKENG MAIN CANAL (2)

SCALE A

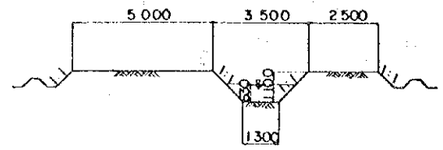
TYPE III SCALE B

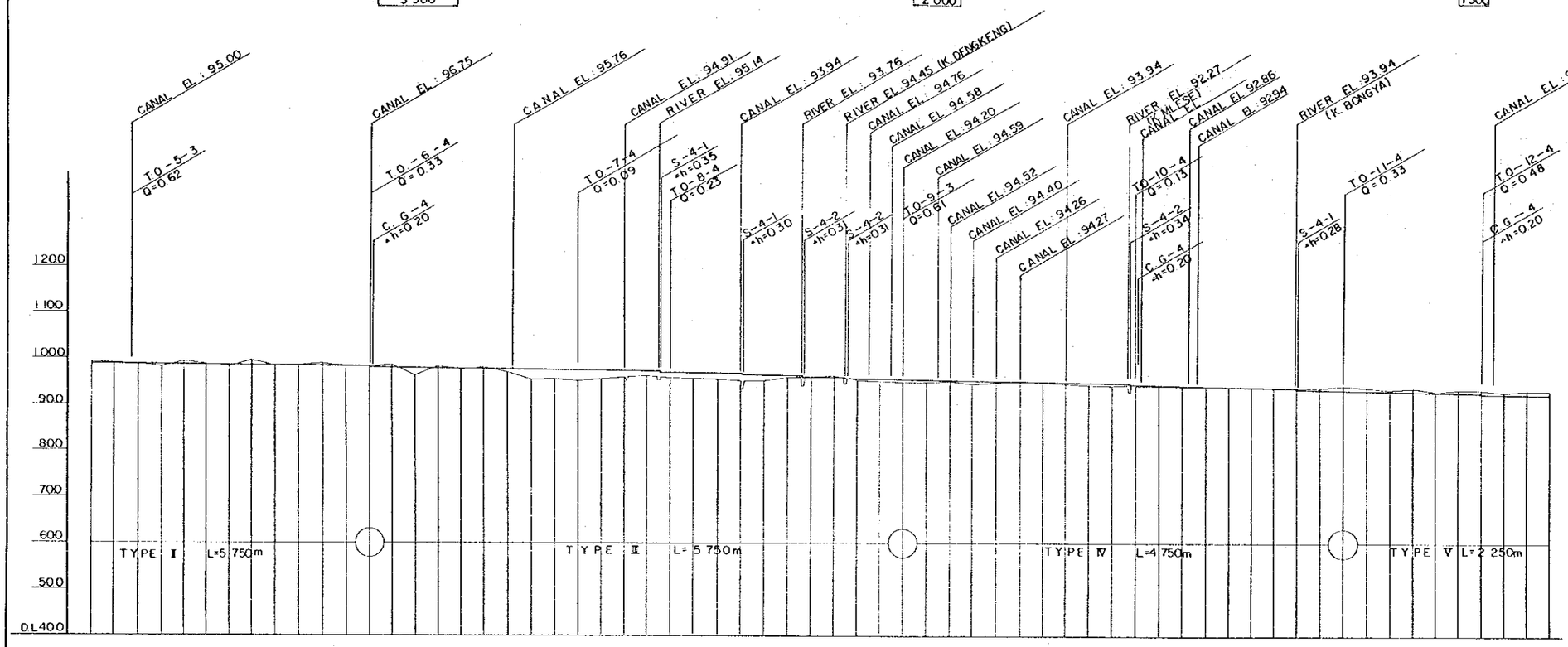


TYPE IV SCALE B



TYPE V SCALE B





LEGEND

- TO — Turnout
- A — Aqueduct
- S — Siphon
- CG — Check Gate
- C — Culvert
- WMF — Water Measurement Facility

Station No	Dist	Accum Dist	Ground Elev	Bottom of Canal	Water Surf	Top Bank	Height of Embankment	Depth of Excavation	Grade
NO.14	0	15600	99.15	98.87	99.89	100.52		0.28	
+250	250	15850	99.06	98.80			0.52	0.26	
+500	"	16100	98.75	98.74	99.62			0.01	
+750	"	16350	98.15	98.67				0.70	
NO.15	"	16600	99.30	98.60				0.17	
+250	"	16850	98.70	98.53			0.32	1.10	
+500	"	17100	98.15	98.47				0.24	
+750	"	17350	99.50	98.40			0.13	0.50	
NO.16	"	17600	98.20	98.33	99.21			0.17	
+250	"	17850	98.50	98.26				0.65	
+500	"	18100	98.70	98.20			0.08	0.44	
+750	"	18350	98.30	98.13		99.71		0.32	
NO.17	"	18600	97.98	98.06	98.94	99.26	1.57		
+250	"	18850	98.45	97.80	98.74				
+500	"	19100	96.16	97.73			0.09		
+750	"	19350	98.10	97.66					
NO.18	"	19600	97.50	97.59			0.67		
+250	"	19850	97.85	97.53			2.09		
+500	"	20100	96.79	97.46					
+750	"	20350	95.30	97.39			2.02		
NO.19	"	20600	95.30	97.32					
+250	"	20850	96.00	97.26	98.11		2.26		
+500	"	21100	95.40	97.19					
+750	"	21350	95.70	97.12			1.79		
NO.20	"	21600	96.00	97.05					
+250	"	21850	95.60	96.65	97.44		1.42		
+500	"	22100	95.40	96.58					
+750	"	22350	95.20	96.51			1.05		
NO.21	"	22600	94.98	96.44					
+250	"	22850	94.96	96.09			1.05		
+500	"	23100	95.54	95.99					
+750	"	23350	95.60	95.66			1.18		
NO.22	"	23600	96.00	95.59					
+250	"	23850	95.00	95.22			1.31		
+500	"	24100	94.85	95.16					
+750	"	24350	94.60	95.09	95.88	96.49	1.46	0.41	96.09
NO.23	"	24600	94.62	95.02		96.39			
+250	"	24850	94.69	94.95			1.13		
+500	"	25100	94.34	94.88					
+750	"	25350	94.57	94.80			0.45		
NO.24	"	25600	94.60	94.73					
+250	"	25850	94.40	94.66			0.06		
+500	"	26100	94.25	94.59					
+750	"	26350	93.97	94.52			0.22		
NO.25	"	26600	93.89	94.45					
+250	"	26850	94.00	94.05	94.84		0.31	0.22	
+500	"	27100	93.82	93.85	94.57				
+750	"	27350	93.65	93.71			0.49	0.04	
NO.26	"	27600	93.60	93.64					
+250	"	27850	93.50	93.57			0.40		
+500	"	28100	93.41	93.49					
+750	"	28350	93.20	93.42			0.26		
NO.27	"	28600	93.50	93.35					
+250	"	28850	93.20	93.01			0.54	0.15	
+500	"	29100	92.94	92.94	93.66	94.24	0.23	0.19	94.09
+750	"	29350	93.44	92.86	93.57	94.04		0.84	92.94
NO.28	"	29600	93.04	91.77			0.13	0.58	
+250	"	29850	93.23	92.69				0.27	
+500	"	30100	92.64	92.61			0.26	0.54	
+750	"	30350	93.09	92.52				0.03	
NO.29	"	30600	93.04	92.44	93.07		0.34	0.57	
+250	"	30850	92.58	92.16	92.87			0.60	
+500	"	31100	92.70	92.08			0.55	0.40	
+750	"	31350	92.65	92.00	92.63	93.10		0.62	93.00
		31500		91.935			0.56	0.65	
							0.05		

3700 | 3700 | 3500 | 3000

SCALE A

HORIZONTAL 0m 500 1000 1500

VERTICAL 0m 10 20

SCALE B

0m 5

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

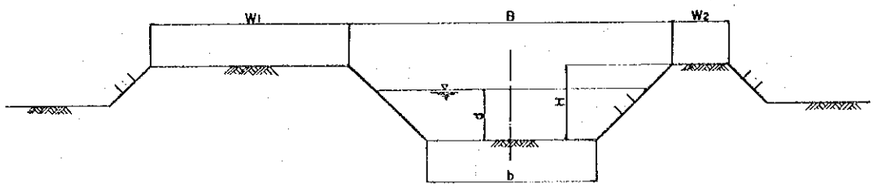
IRRIGATION

PROFILE & CROSS-SECTION OF DENGKENG MAIN CANAL (2)

Date July 31. 1976 | D.W.G. NO WI - 012

STANDARD CROSS SECTION

SECONDARY CANAL

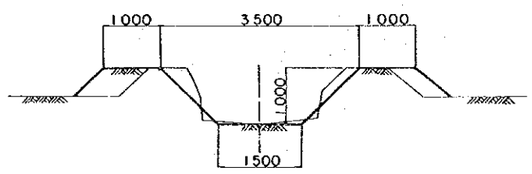


Data Table

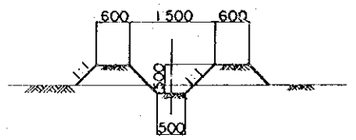
(Dimension m)

TYPE	Q	b	B	d	H	W1	W2	CANAL LENGTH
1	1.62 1.40	3.0	5.70	0.90	1.35	3.50	1.00	4 600
2	0.92 0.70	2.1	4.40	0.75	1.15	"	"	9 900
3	0.68 0.50	1.8	4.00	0.70	1.10	"	"	11 100
4	0.42 0.30	1.3	3.20	0.60	0.95	"	"	2 650
5	0.29 0.20	0.9	2.70	0.55	0.90	"	"	5 350
6	0.19 0.10	0.7	2.40	0.50	0.85	"	"	6 600
7	0.07	0.5	1.90	0.40	0.70	"	"	1 000

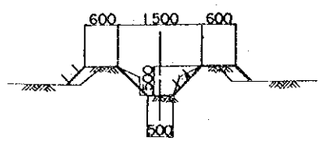
REHAVILITATION
Existing Canal



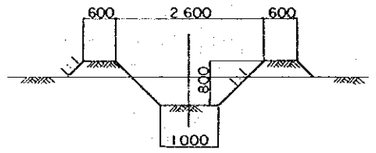
FARM DITCH



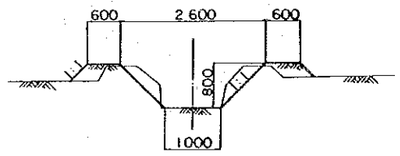
REHAVILITATION
Existing Ditch



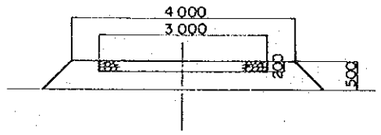
FARM DRAIN



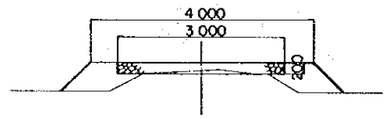
REHAVILITATION
Existing Drain



FARM ROAD



REHAVILITATION
Existing Road



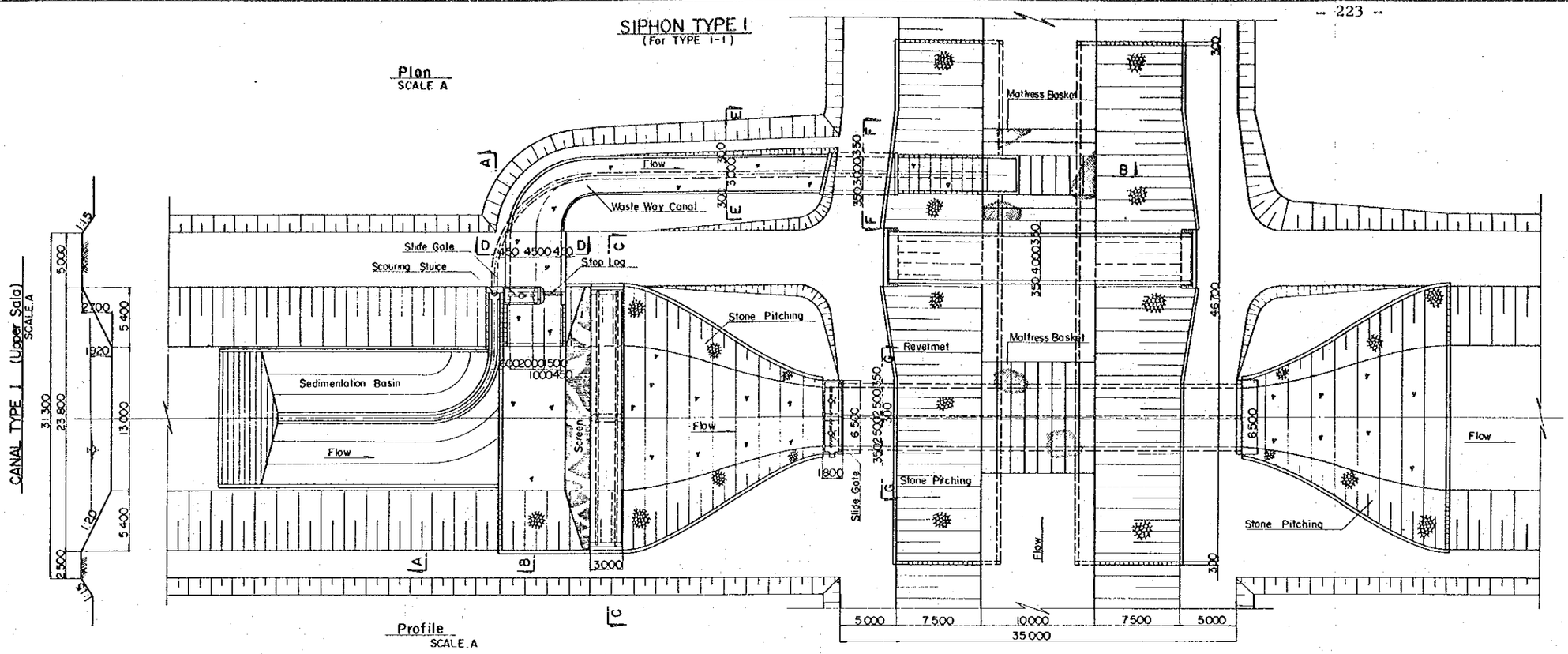
SCALE 0 1 2 3 4 5M

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION
STANDARD CROSS-SECTION OF
SECONDARY CANAL & OTHERS

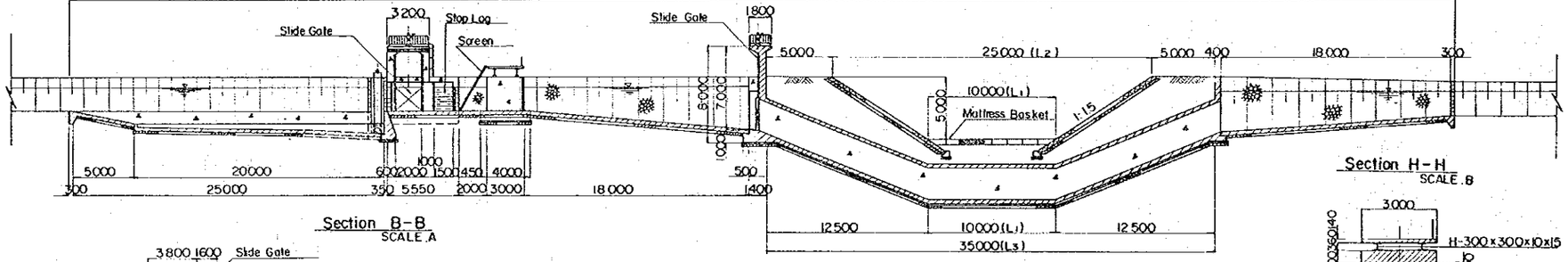
Date : July. 31. 1976 | D.W.G. NO. WI - 013

SIPHON TYPE I
(For TYPE I-1)

Plan
SCALE A



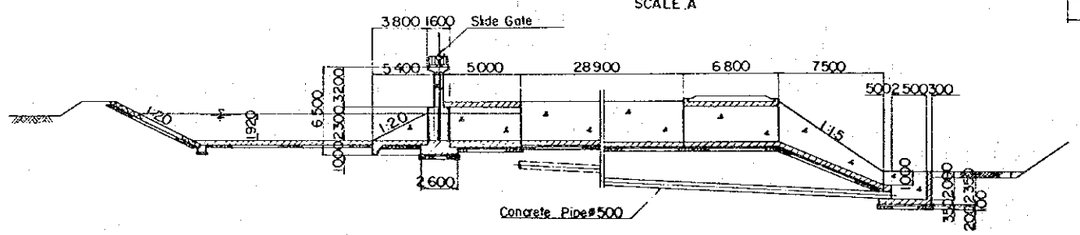
Profile
SCALE A



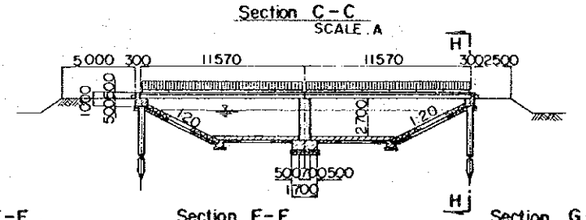
Data Table

TYPE	I-1	I-2
Nos	4	1
L1	10m	30m
L2	25"	45"
L3	35"	55"

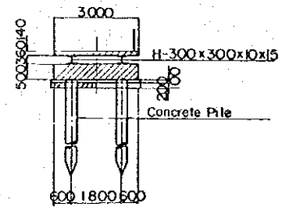
Section B-B
SCALE A



Section C-C
SCALE A

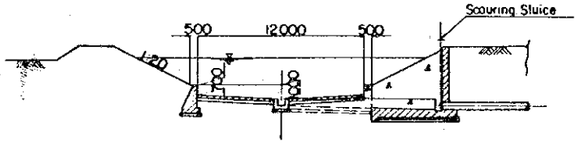


Section H-H
SCALE B

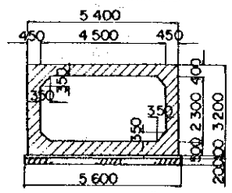


SCALE A
SCALE B

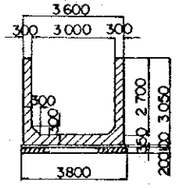
Section A-A
SCALE A



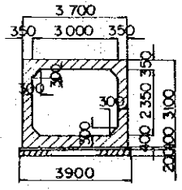
Section D-D
SCALE B



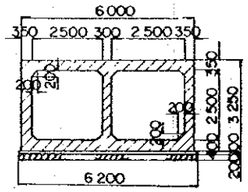
Section E-E
SCALE B



Section F-F
SCALE B



Section G-G
SCALE B



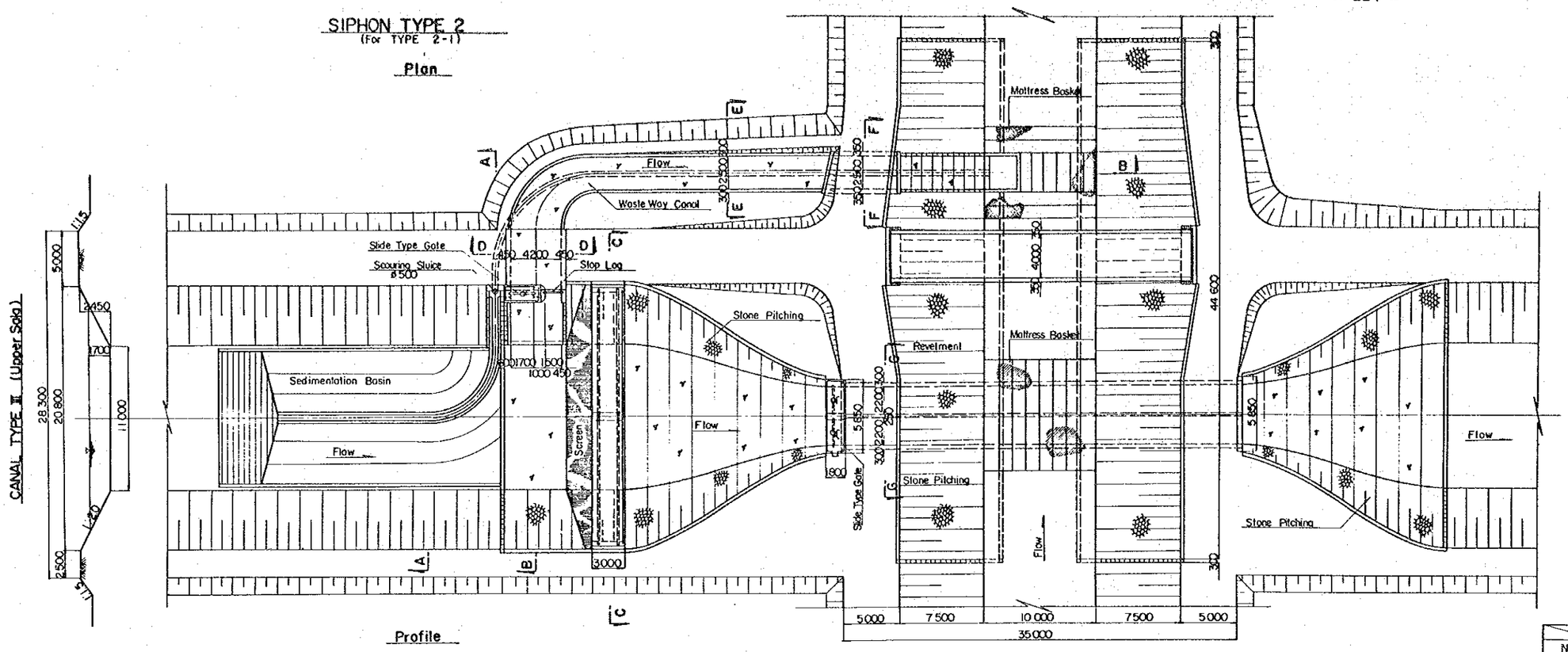
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

SIPHON (TYPE.I)

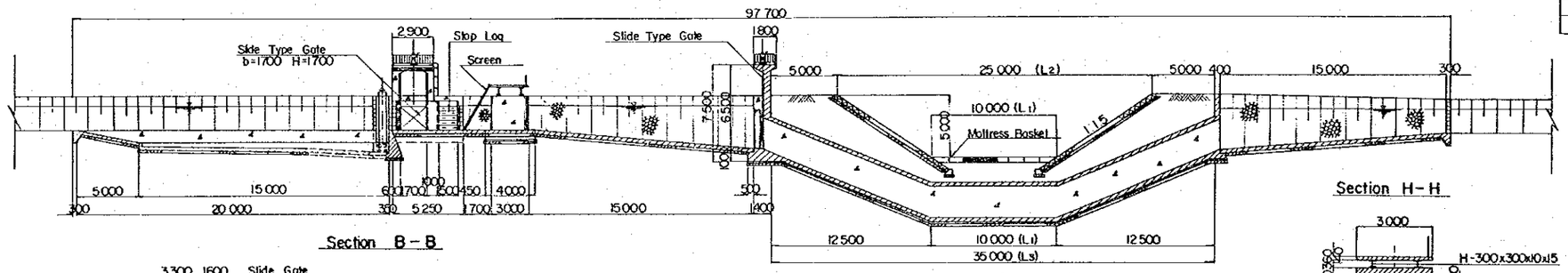
Date : July. 31. 1976 | D.W.G. NO WI - 014

SIPHON TYPE 2
(For TYPE 2-1)

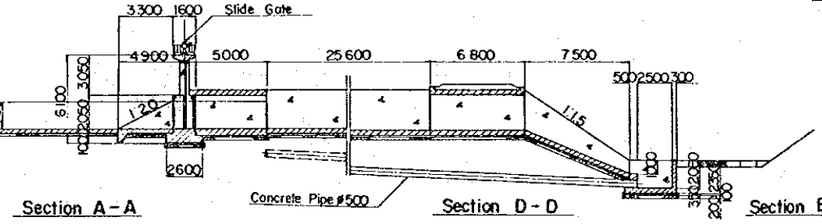
Plan



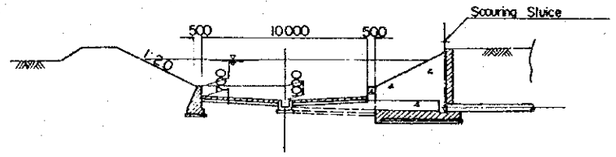
Profile



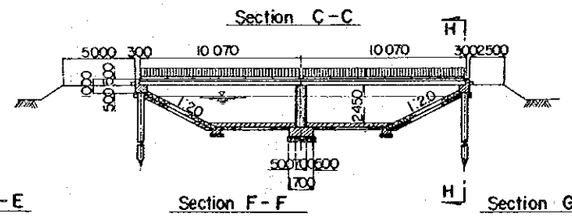
Section B - B



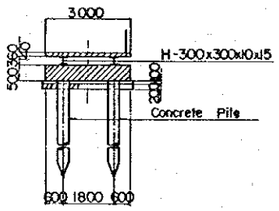
Section A - A



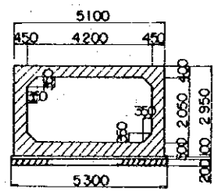
Section C - C



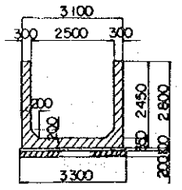
Section H - H



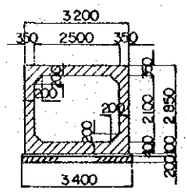
Section D - D



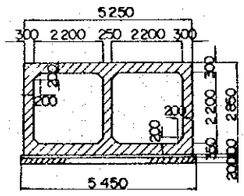
Section E - E



Section F - F



Section G - G



Data Table

TYPE	2 - 1	2 - 2	2 - 3
Nos	3	1	1
L 1	10 m	20 m	30 m
L 2	25 "	35 "	45 "
L 3	35 "	45 "	55 "

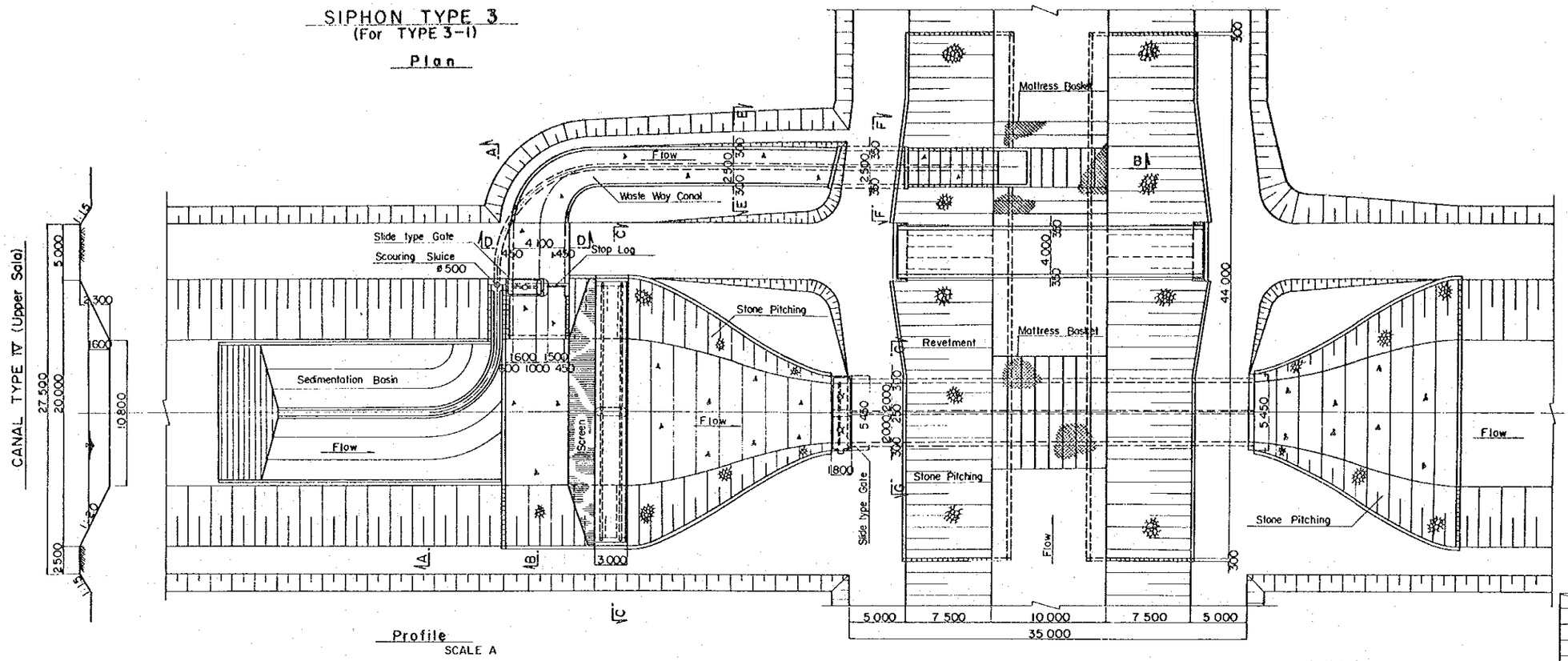
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

SIPHON (TYPE.2)

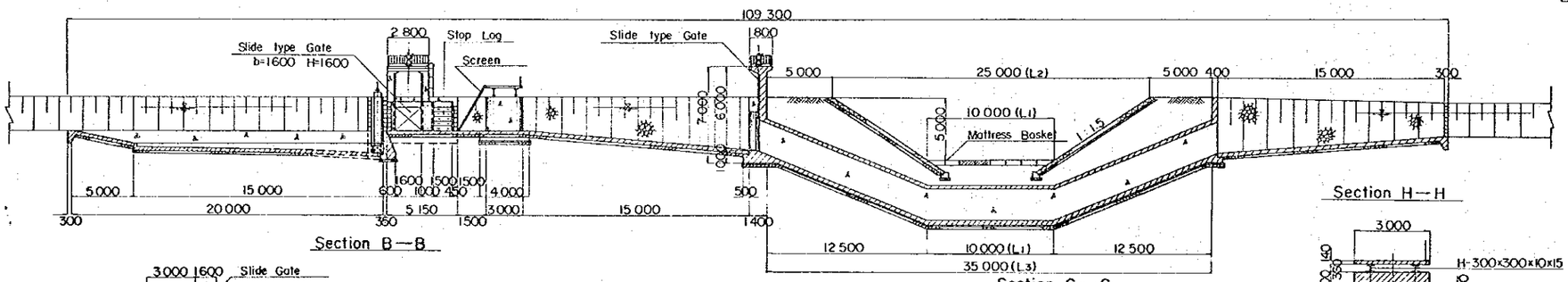
Date . July. 31. 1976 | D.W.G. NO WI - 015

SIPHON TYPE 3
(For TYPE 3-1)

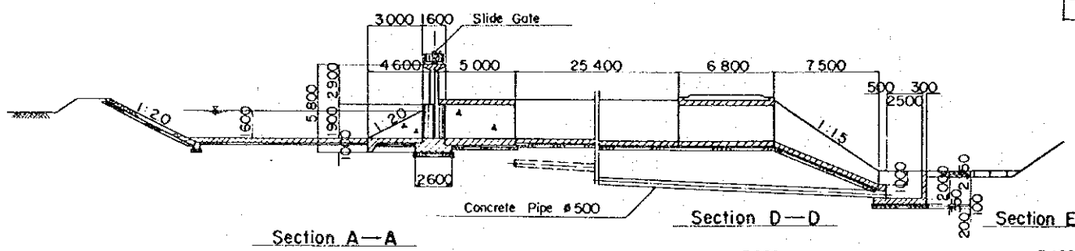
Plan



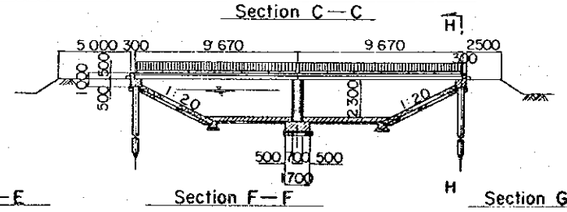
Profile
SCALE A



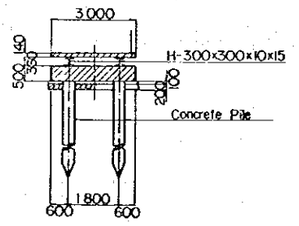
Section B—B



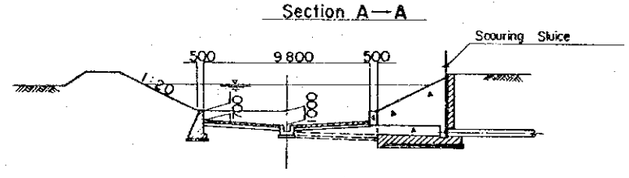
Section C—C



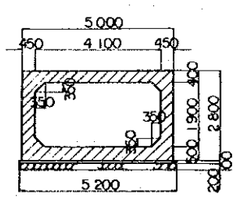
Section H—H



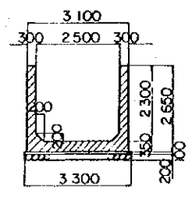
Section A—A



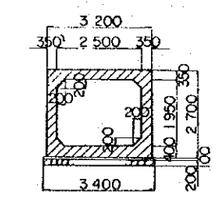
Section D—D



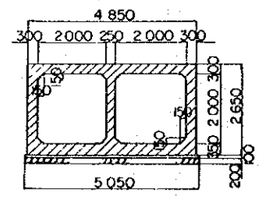
Section E—E



Section F—F



Section G—G



Data Table

Type	3-1	3-2	3-3
Nos.	2	2	1
L1	10 m	20 m	30 m
L2	25 "	35 "	45 "
L3	35 "	45 "	55 "

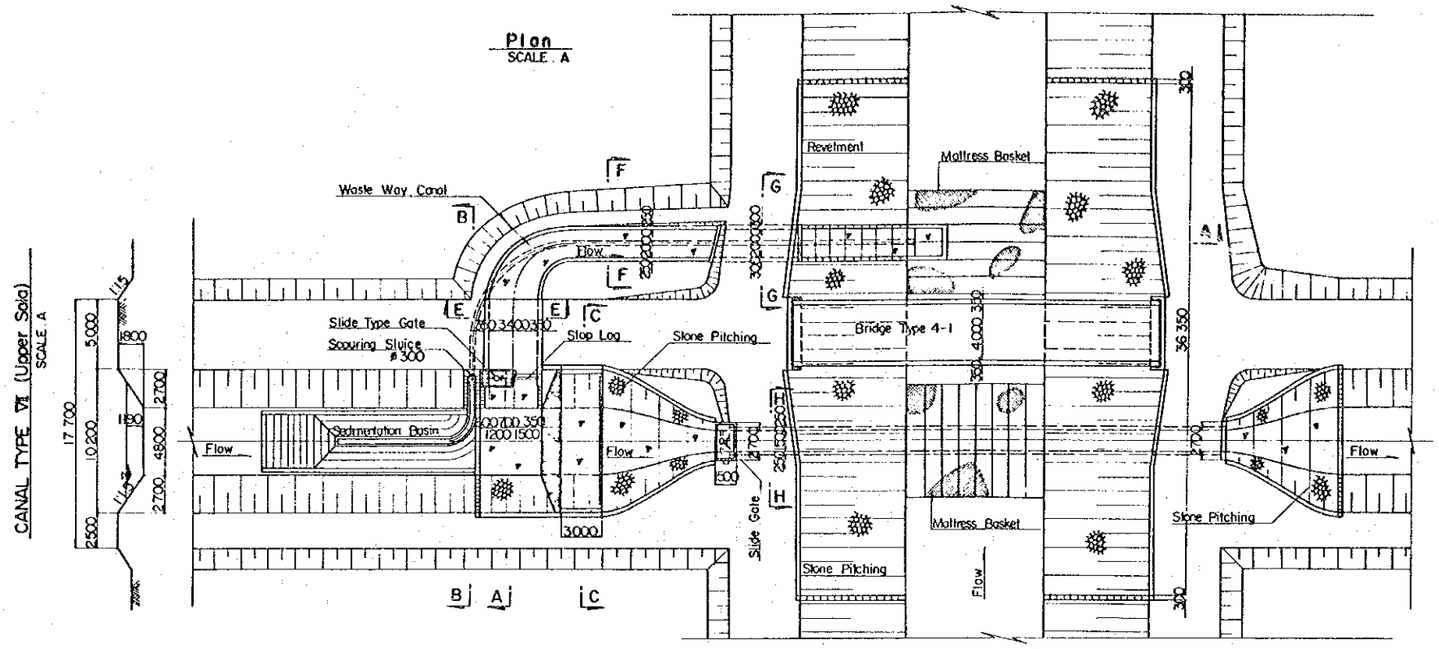
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

SIPHON (TYPE 3)

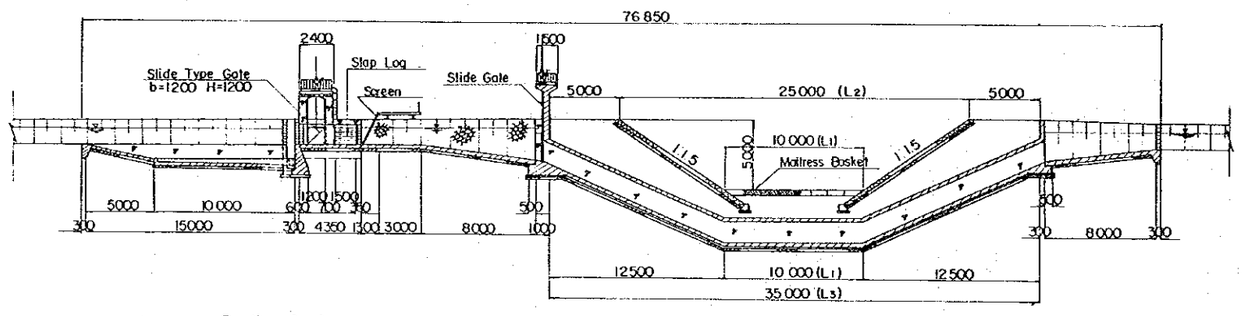
Date : July. 31. 1976 | D.W.G. NO. WI-016

SIPHON TYPE - 4
(For TYPE 4-2)

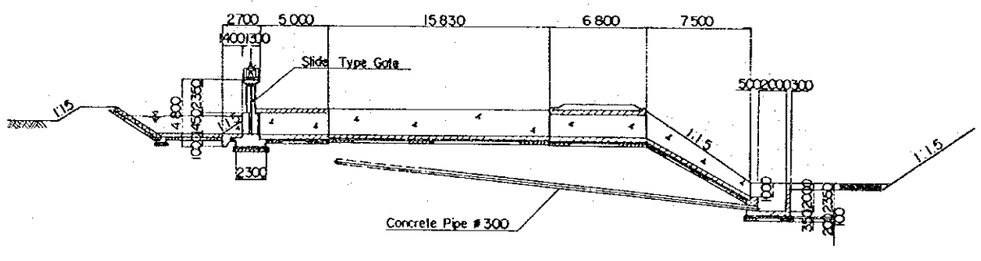
Plan
SCALE . A



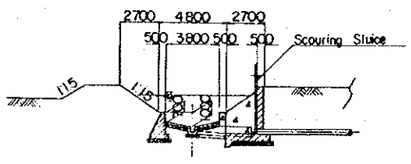
Profile
SCALE. A



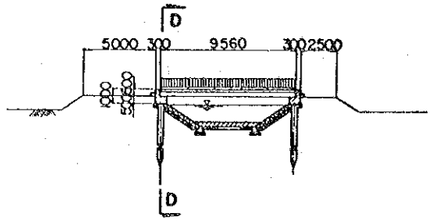
Section A-A
SCALE. A



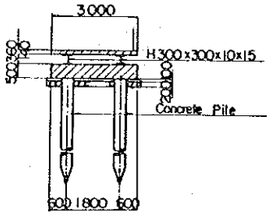
Section B-B
SCALE. A



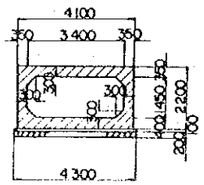
Section C-C
SCALE. A



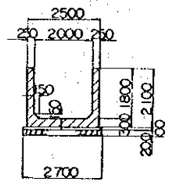
Section D-D
SCALE. B



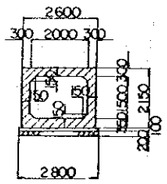
Section E-E
SCALE B



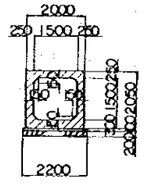
Section F-F
SCALE. B



Section G-G
SCALE. B



Section H-H
SCALE. B



Data Table

MARK \ TYPE	4-1	4-2
Nos	4	9
L1	5 m	10 m
L2	20 "	25 "
L3	30 "	35 "

SCALE. A 0 5 10 15 20M

SCALE. B 0 5 10M

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

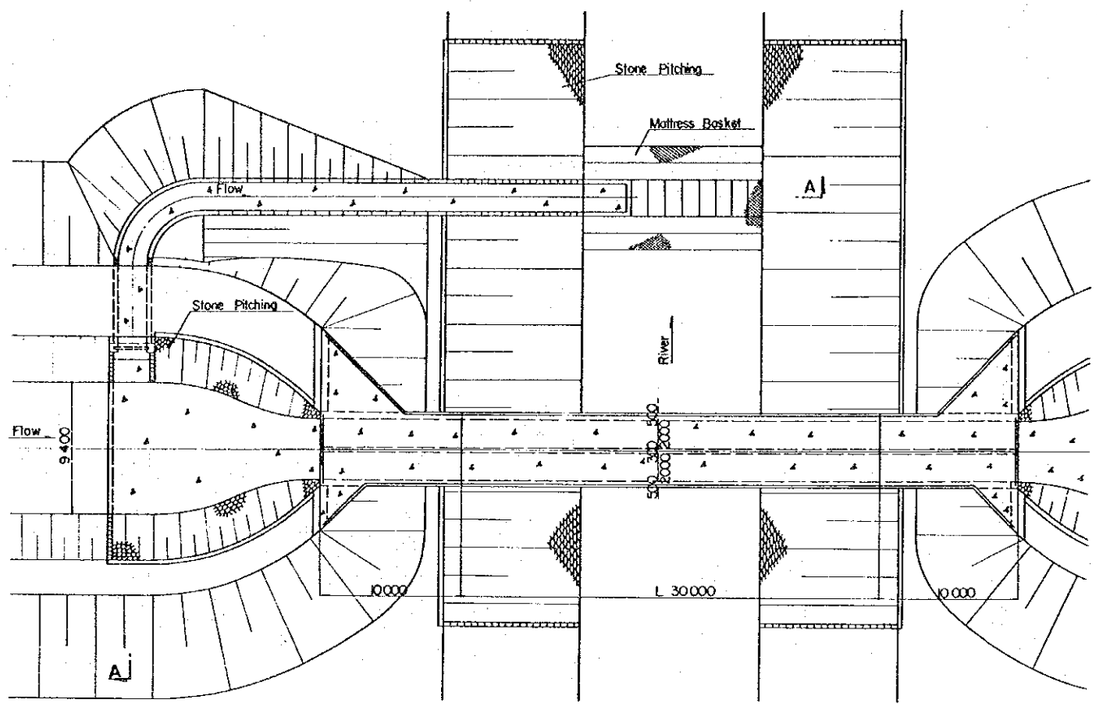
SIPHON (TYPE 4)

Date : July 31. 1976 | D.W.G NO WI - 017

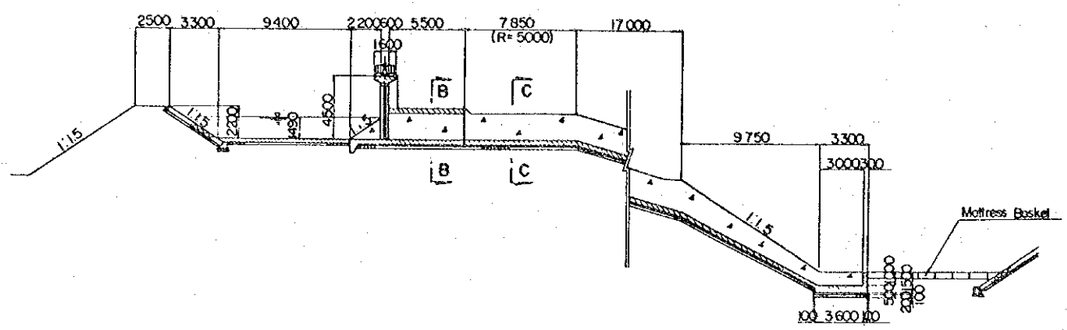
AQUEDUCT TYPE I

(For TYPE I-2)

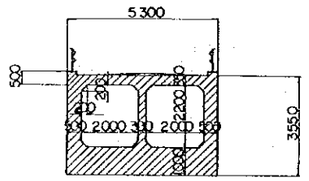
Plan
SCALE . A



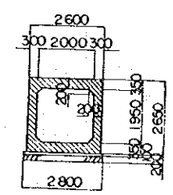
Waste Way (Section A - A)
SCALE .A



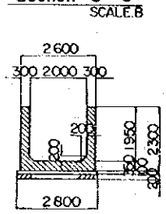
Aqueduct Section
SCALE . B



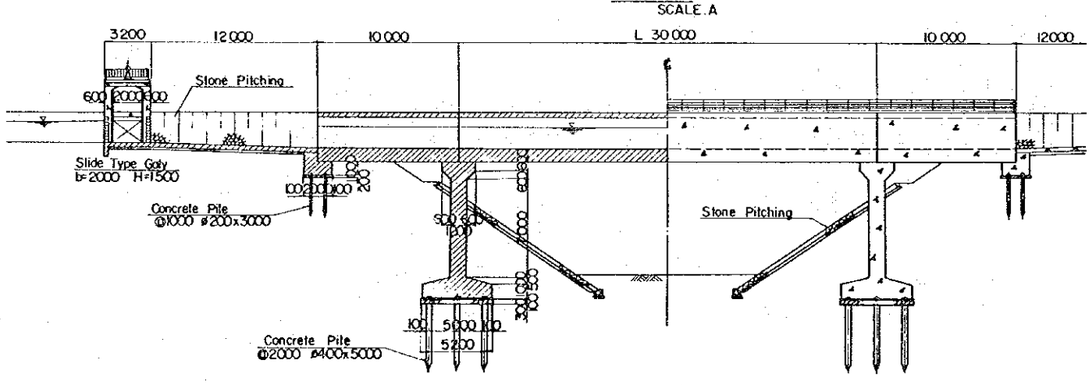
Section B - B
SCALE.B



Section C - C
SCALE.B



Profile
SCALE . A



Data Table

TYPE	CANAL TYPE	SPAN L	WASTE WAY	Nos
I - 1	V	20000	O	2
I - 2	"	30000	O	1
I - 3	"	20000	X	1
I - 4	"	30000	X	1

SCALE A 0 5 10 15 20M

SCALE B 0 5 10M

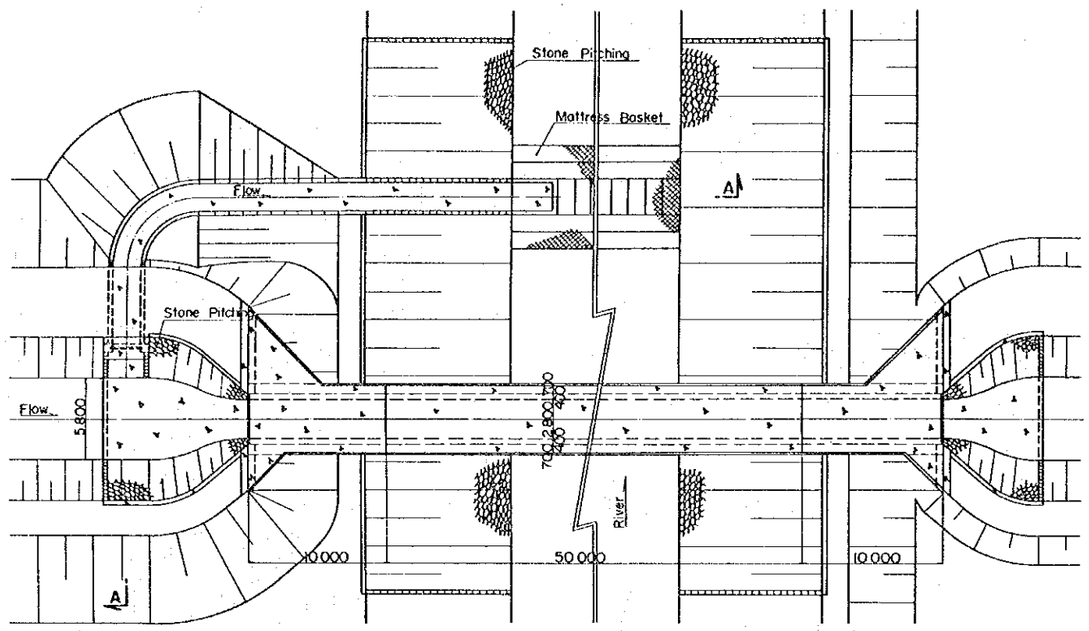
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

AQUEDUCT (TYPE.I)

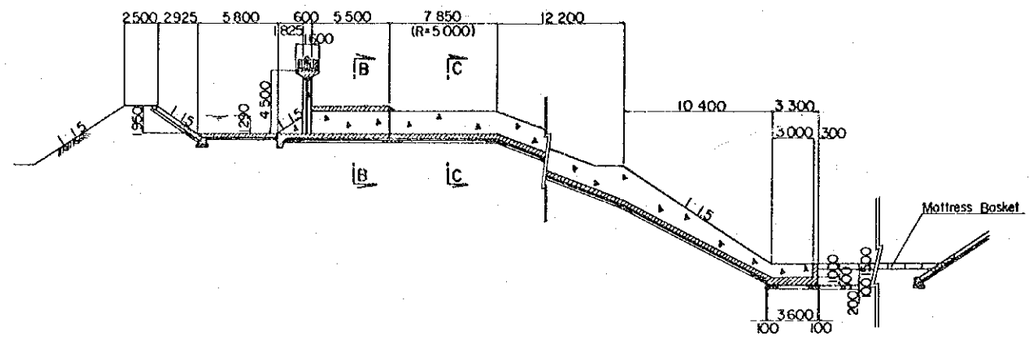
Date : July 31. 1976 | D.W.G. NO WI - 018

AQUEDUCT TYPE 2

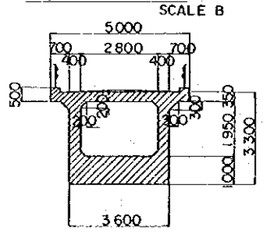
Plan
SCALE A



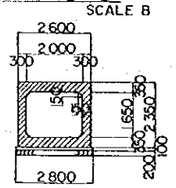
Waste Way (Section A—A)
SCALE A



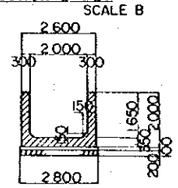
Aqueduct Section
SCALE B



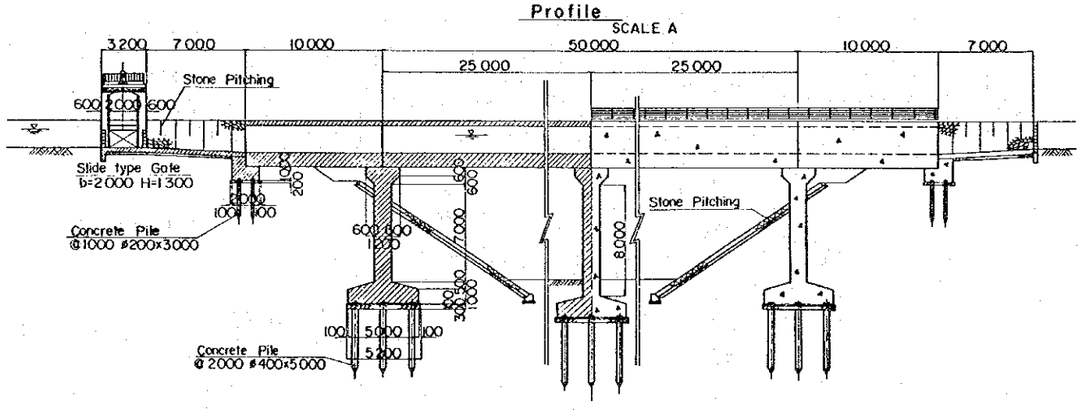
Section B—B
SCALE B



Section C—C
SCALE B



Profile
SCALE A



SCALE A 0 5 10 15 20M

SCALE B 0 5 10M

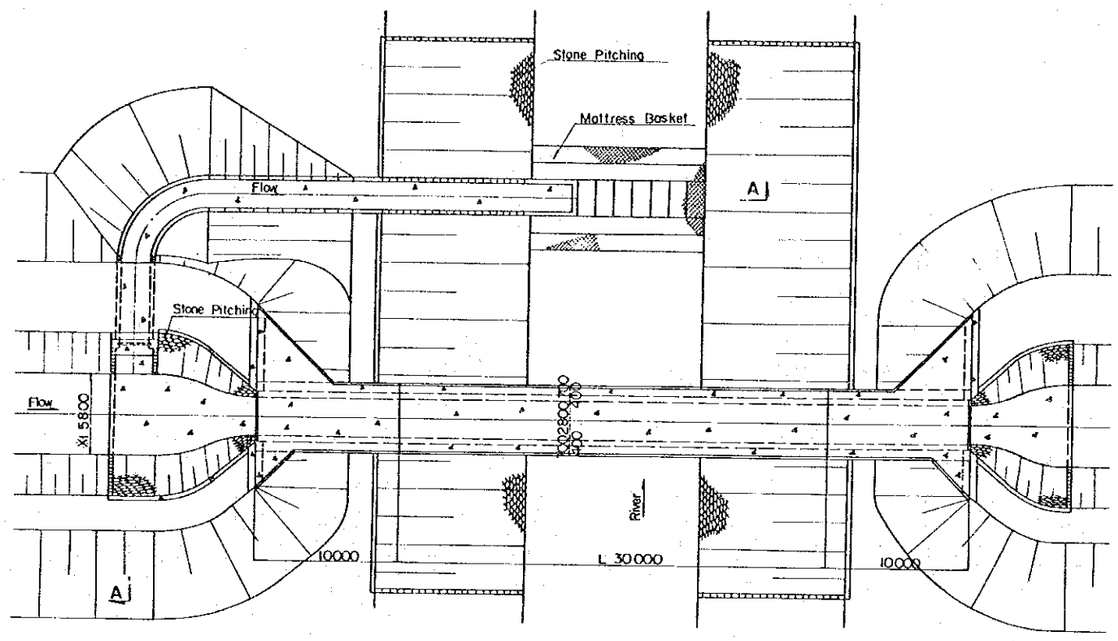
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

AQUEDUCT (TYPE 2)

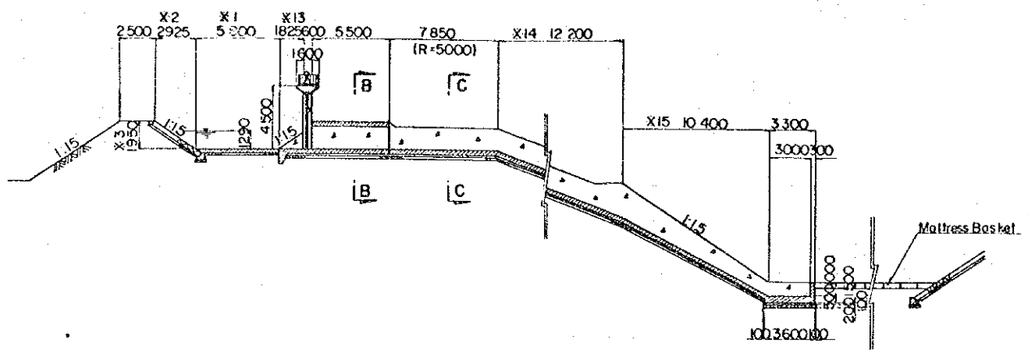
Date July. 31. 1976 | D.W.G. NO. WI-019

AQUEDUCT TYPE 3
(For TYPE 3-2)

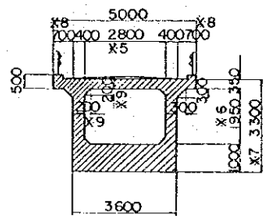
Plan
SCALE . A



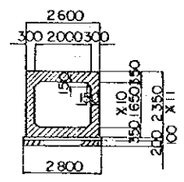
Waste Way (Section A-A)
SCALE . A



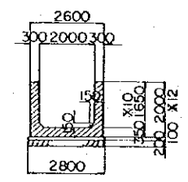
Aqueduct Section
SCALE .B



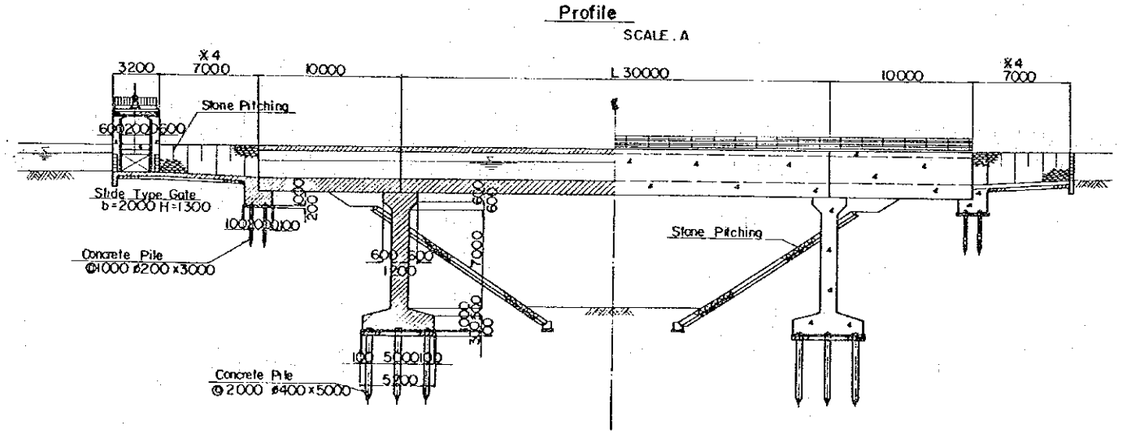
Section B-B
SCALE .B



Section C-C
SCALE B



Profile
SCALE . A



Data Table

TYPE / MARK	3-1	3-2	4	5-1	5-2	5-3
CANAL TYPE	VI	VI	VI	VII	VII	VII
SPAN L	20000	30000	20000	20000	30000	20000
1	5800	5800	4800	3600	3600	3600
2	2925	2925	2700	1550	1550	1550
3	1950	1950	1800	1550	1550	1550
4	7000	7000	6000	4500	4500	4500
5	2800	2800	2500	1800	1800	1800
6	1950	1950	1800	1550	1550	1550
7	3300	3300	2950	2700	2700	2700
8	700	700	850	1200	1200	1200
9	200	200	200	150	150	150
WASTE WAY	x	x	O	O	O	x
10	—	—	1450	1200	1200	—
11	—	—	2150	1900	1900	—
12	—	—	1800	1550	1550	—
13	—	—	1600	450	450	—
14	—	—	11200	9700	9700	—
15	—	—	7400	7400	10400	—
Nos	4	2	1	1	1	1

SCALE A 0 5 10 15 20M

SCALE B 0 5 10M

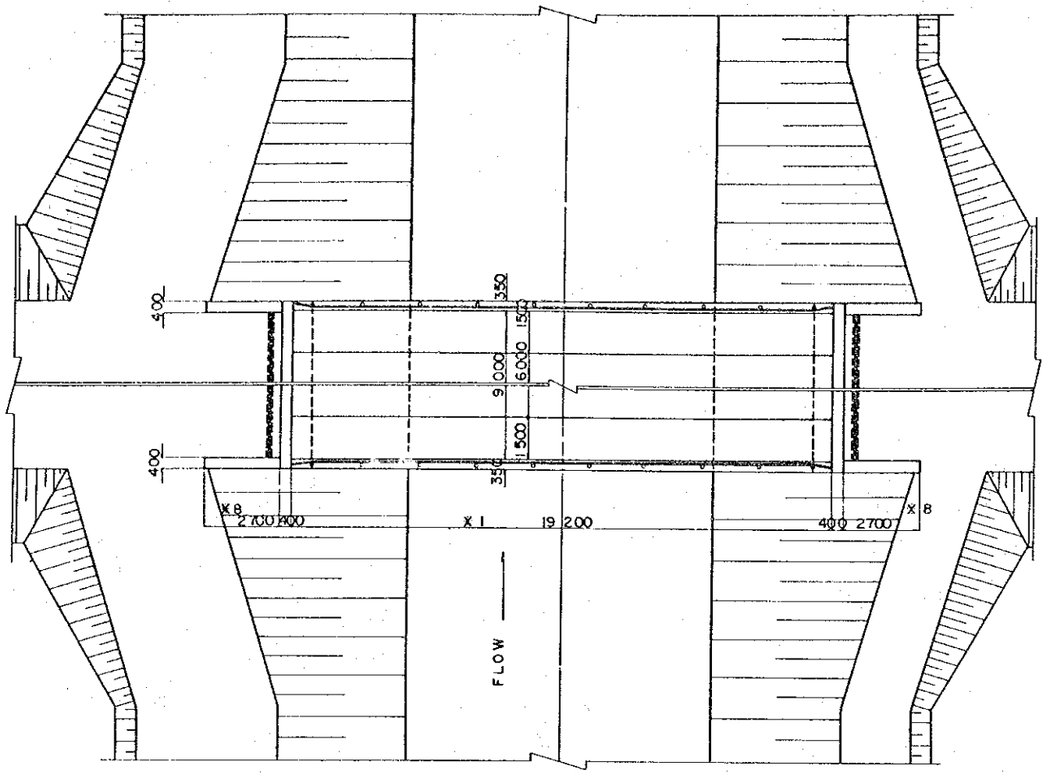
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

AQUEDUCT (TYPE3.4.5)

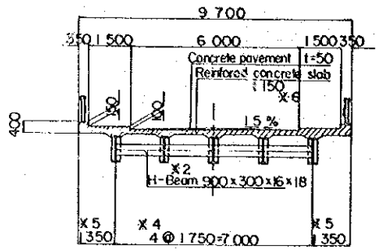
Date : July. 31. 1976 | D.W.G. NO WI - 020

BRIDGE TYPE I
(For TYPE I-1)

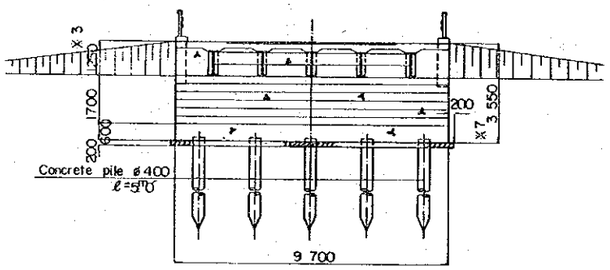
Plan



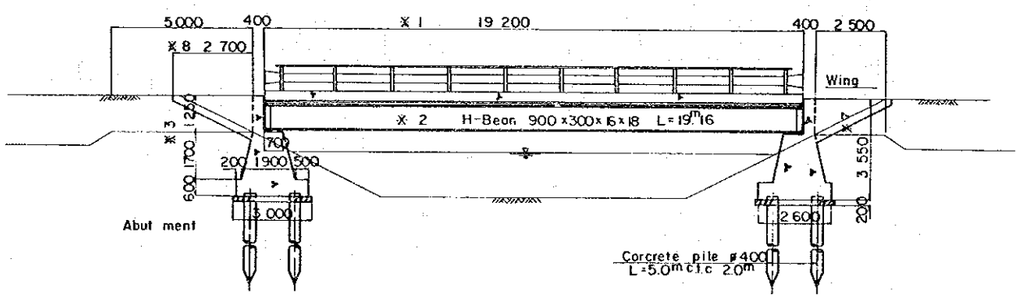
Cross Section



Abutment



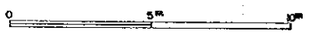
Profile



Data Table

TYPE	1	2	3	4	5	6	7	8	Nos
I - 1	19 200	H-Beam #916 900×300×16×18 #416 792×300×12×22	1 250	4@1750 =7.000	1 350	150	3 550	2 700	1
I - 2	10 200		1 170	3@2300 =6.900	1 400	170	3 470	1 950	1

SCALE



WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

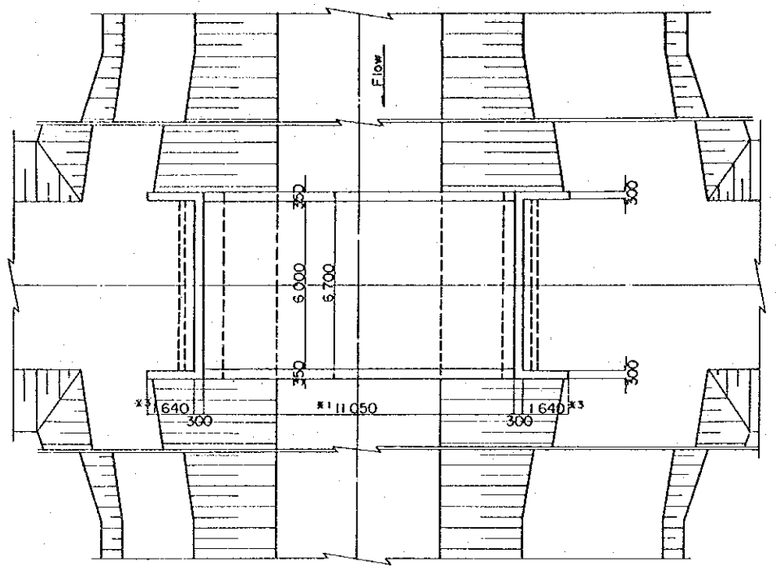
BRIDGE (TYPE I)

Date July. 31. 1976 | D.W.G NO WI - 021

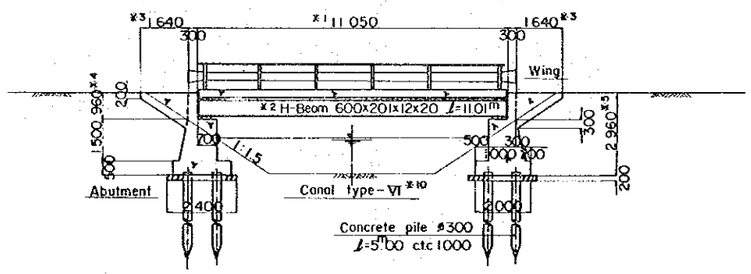
BRIDGE

TYPE 2
(For TYPE 2-2)

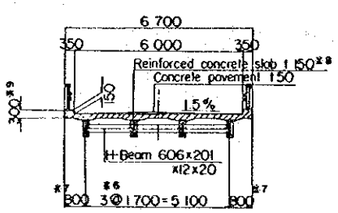
Plan



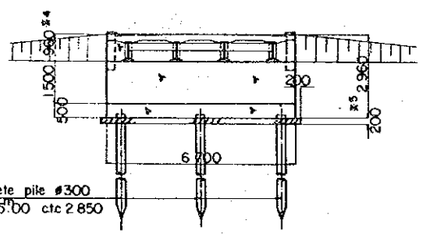
Profile



Cross section

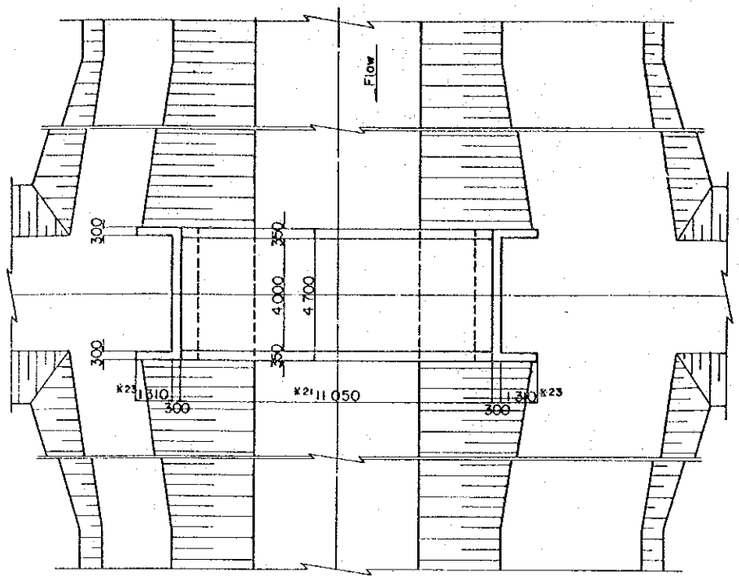


Abutment

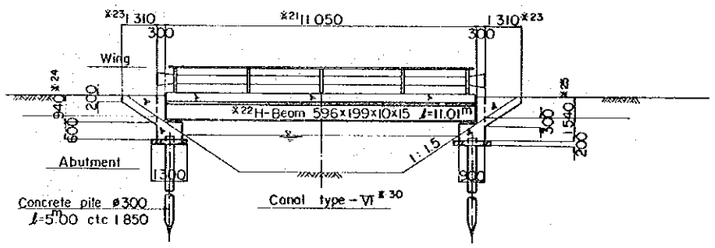


TYPE 3
(For TYPE 3-2)

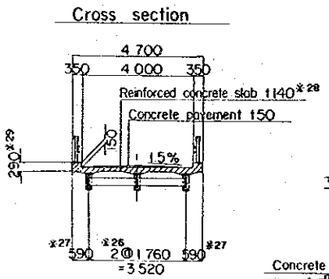
Plan



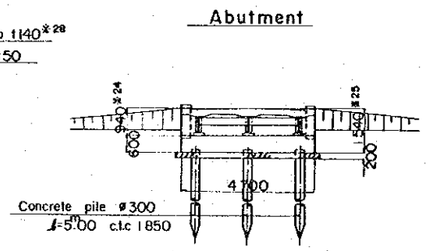
Profile



Cross section



Abutment



Data Table

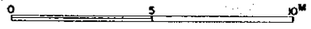
TYPE 2

Mark \ Type	2-1	2-2	2-3
1	21 500	11 050	6 800
2	H-Beam ℓ=21.46m 600×300×12×20	H-Beam ℓ=11.01m 606×201×12×20	H-Beam ℓ=6.76m 596×199×10×15
3	2 500	1 640	1 130
4	1 150	960	930
5	3 150	2 960	2 930
6	4@1 350 =5 400	3@1 700 =5 100	2@2 500 =5 000
7	650	800	850
8	150	150	160
9	300	300	310
10	Upper sala II	Upper sala VI	Dengkeng II
Appicable Canal type	Upper sala I ~ IV	Upper sala V ~ VI	Upper sala VII, IX
		Dengkeng I	Dengkeng II ~ V
Nos.	14	24	18

TYPE 3

Mark \ Type	3-1	3-2	3-3
21	21 500	11 050	5 700
22	H-Beam =21.46m 602×304×16×27	H-Beam =11.01m 596×199×10×15	H-Beam =5.66m 354×176×8×13
23	1 700	1 310	670
24	950	940	670
25	1 550	1 540	1 170
26	3@1 240 =3 720	2@1 760 =3 520	2@1 600 =3 200
27	490	590	750
28	140	140	140
29	290	290	290
30	Upper sala I	Upper sala VI	Dengkeng II
Appicable Canal type	Upper sala I ~ VI	Upper sala V ~ VI	Upper sala VII, IX
		Dengkeng I	Dengkeng I ~ V
Nos.	63	61	60

SCALE



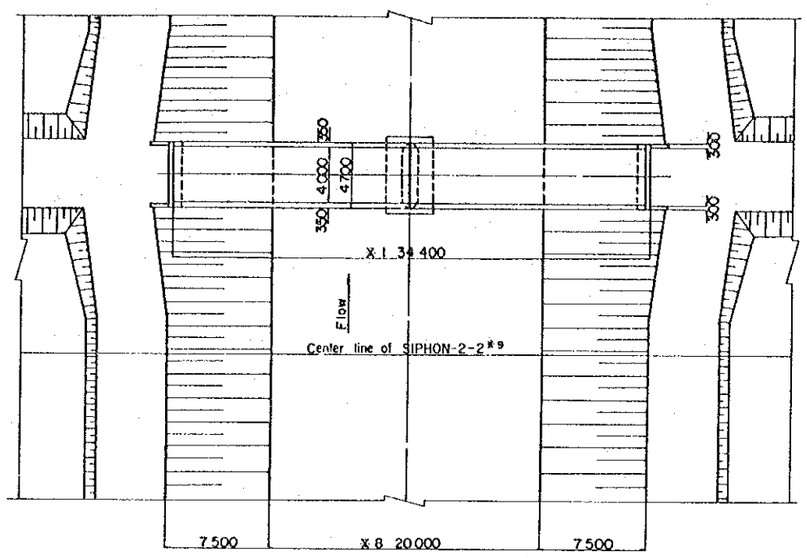
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

BRIDGE (TYPE 2,3)

Date July. 31. 1976 | D.W.G NO W1-022

BRIDGE TYPE 4
(For TYPE 4-2)

Plan
SCALE A



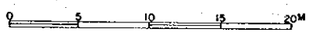
Data Table

TYPE	Profile	l	2	3	4	5	6	7	8	9	Nos.
4 – 1	1 span	24 400	H-Beam 594×302×14×23 I_x=117.17m	–	900	1 600	3@1 240 =3 720	490	10 000	1 250	22
" – 2	2 "	34 400	H-Beam 594×302×14×23 I_x=117.17m	0.5	"	"	2@1 760 =3 520	590	20 000	1 250	3
" – 3	"	44 400	H-Beam 594×302×14×23 I_x=117.17m	"	950	1 650	3@1 240 =3 720	490	30 000	1 630	3

SIPHON TYPE (9)

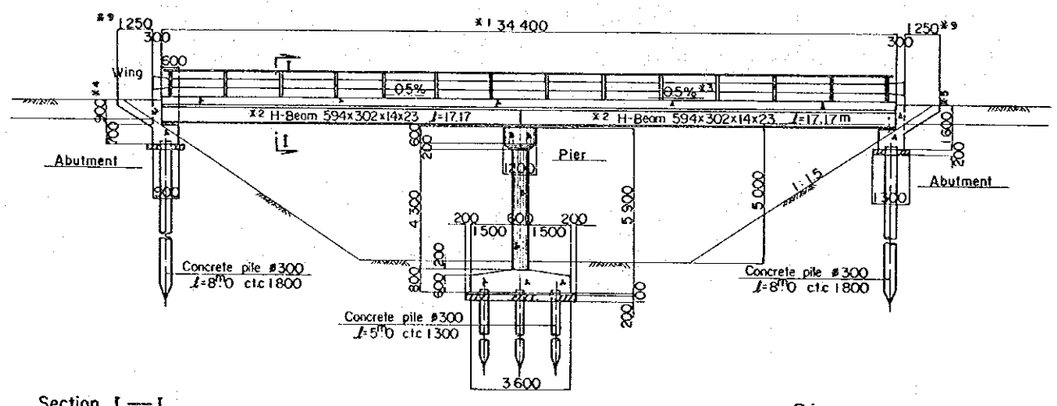
Type / Siphon Type	4 – 1	4 – 2	4 – 3
1 – 1	4	–	–
" – 2	–	–	1
2 – 1	3	–	–
" – 2	–	1	–
" – 3	–	–	1
3 – 1	2	–	–
" – 2	–	2	–
" – 3	–	–	1
4 – 1	4	–	–
" – 2	9	–	–
No.	22	3	3

SCALE A

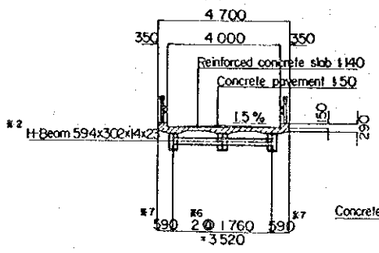


SCALE B

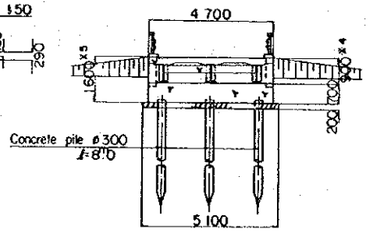
Profile
SCALE B



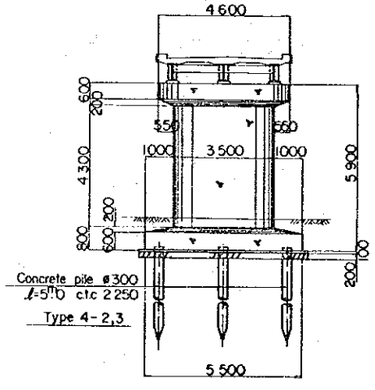
Section I — I
SCALE B



Abutment
SCALE B



Pier
SCALE B



WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

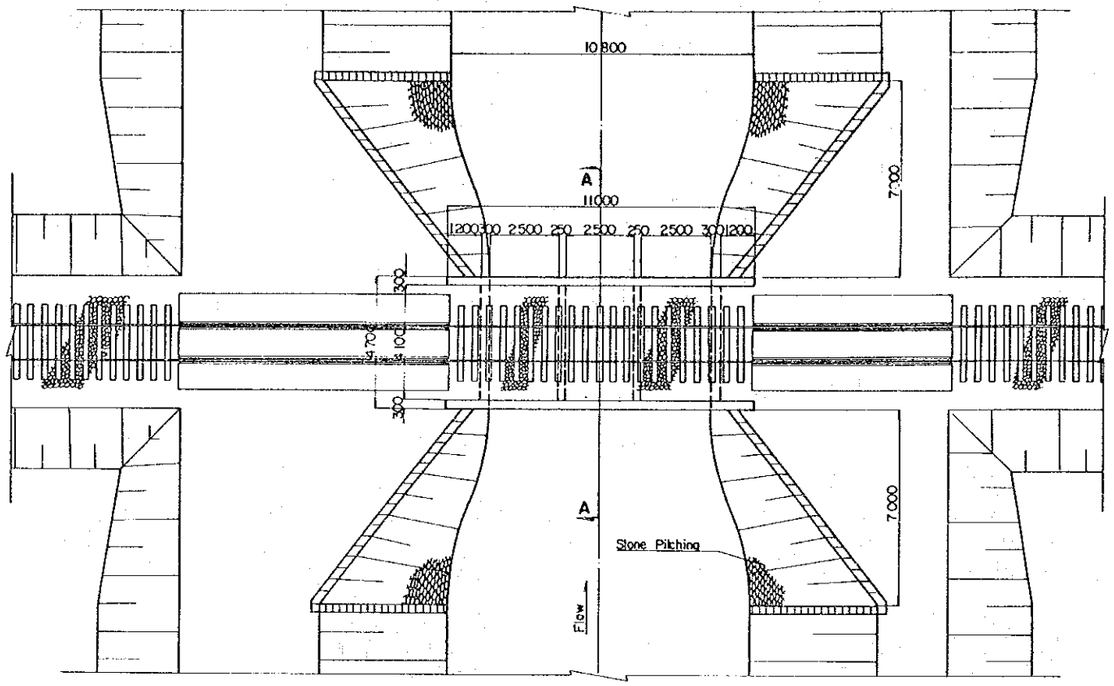
BRIDGE (TYPE 4)

Date : July. 31. 1976 | D.W.G. NO. WI-023

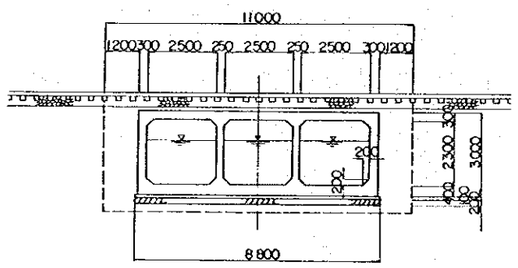
CULVERT

TYPE 1

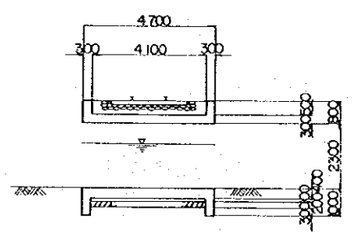
Plan



Profile

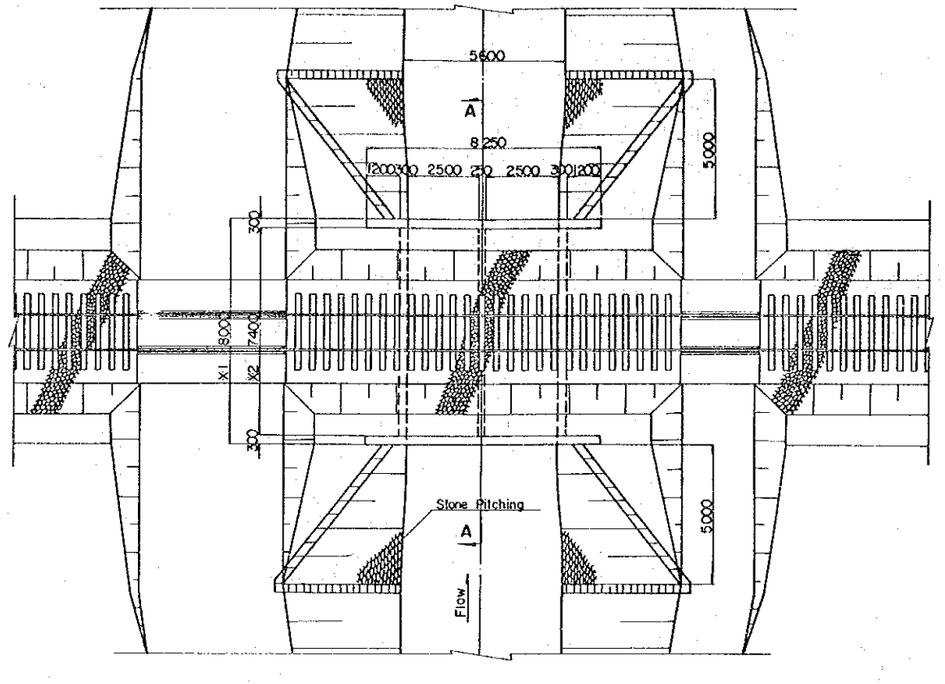


Section A - A

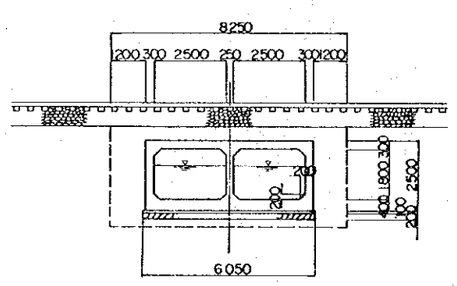


TYPE 2
(For TYPE 2-1)

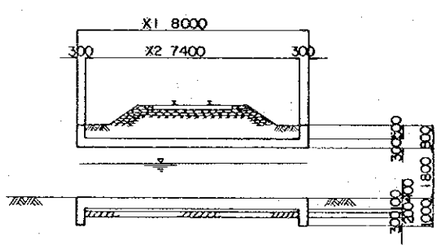
Plan



Profile



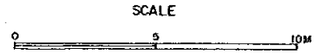
Section A - A



Data Table

TYPE	2 - 1	2 - 2
1	8000	4700
2	7400	4100
Remark	Public	Private For Sugar Cane

SCALE



WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

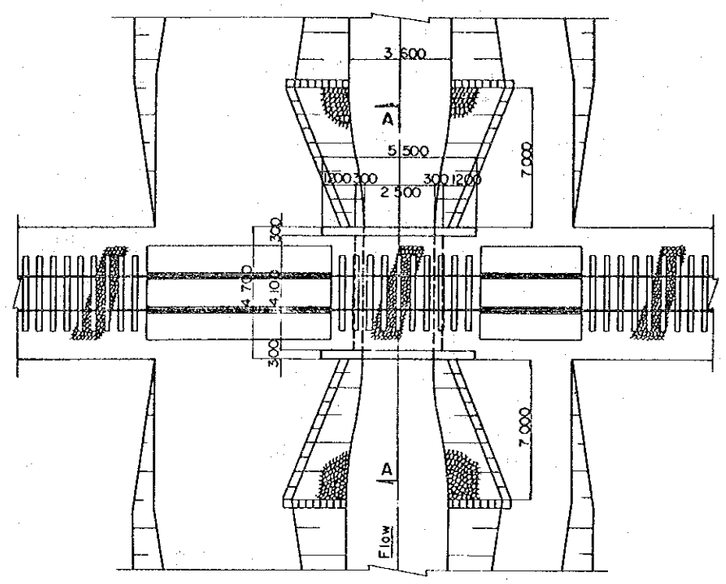
CULVERT (TYPE 1.2)

Date : July. 31. 1976 | D.W.G. NO WI - 024

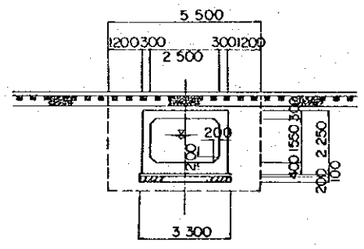
CULVERT

TYPE 3

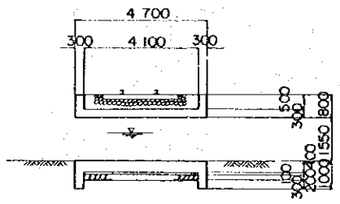
Plan



Profile



Section A—A



SCALE

0 5 10m

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

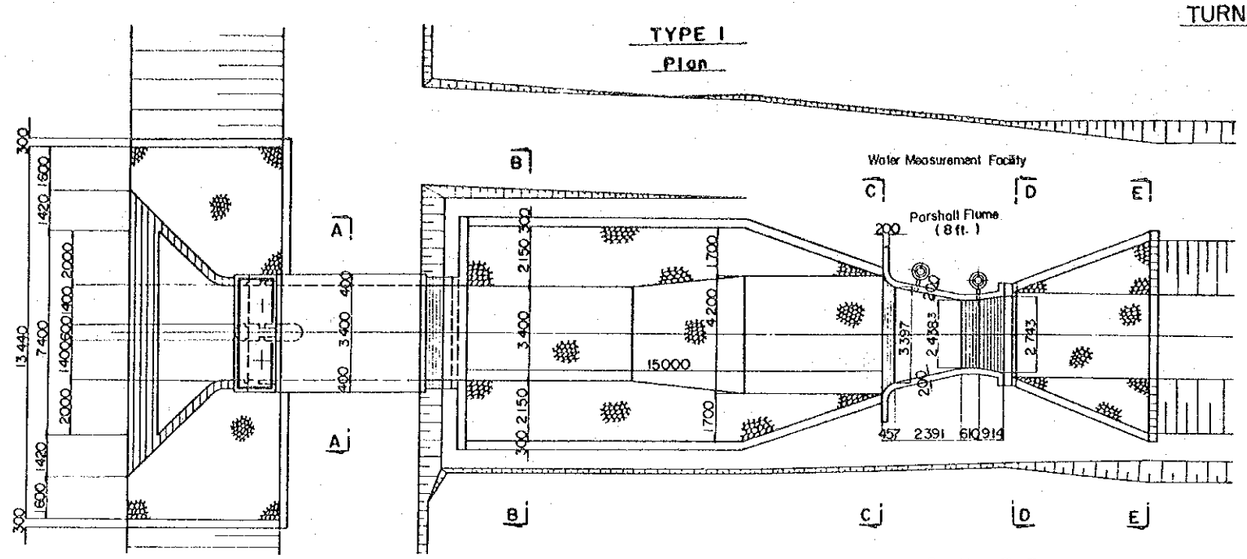
CULVER (TYPE 3)

Date July 31. 1976 | D.W.G NO WI - 025

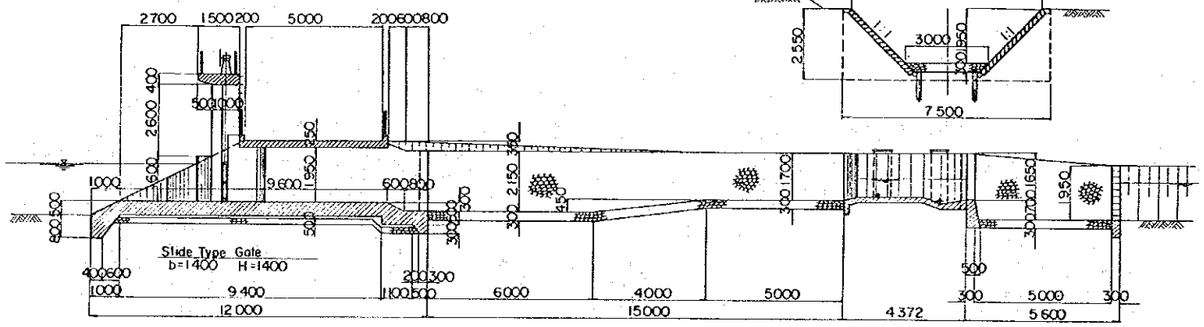
TURNOUT

TYPE 1

Plan

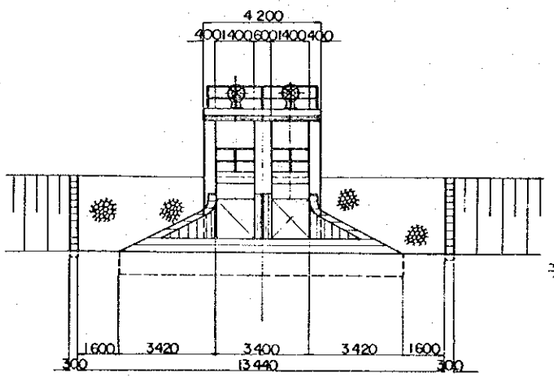


Profile

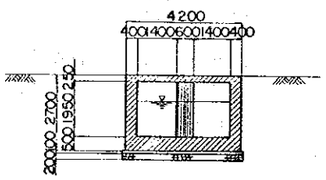


Section E-E

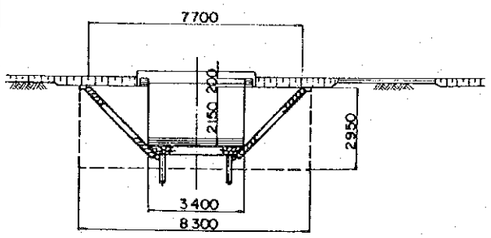
Front Elevation



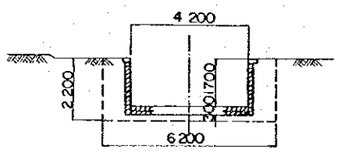
Section A-A



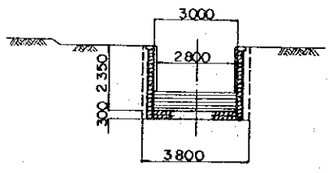
Section B-B



Section C-C

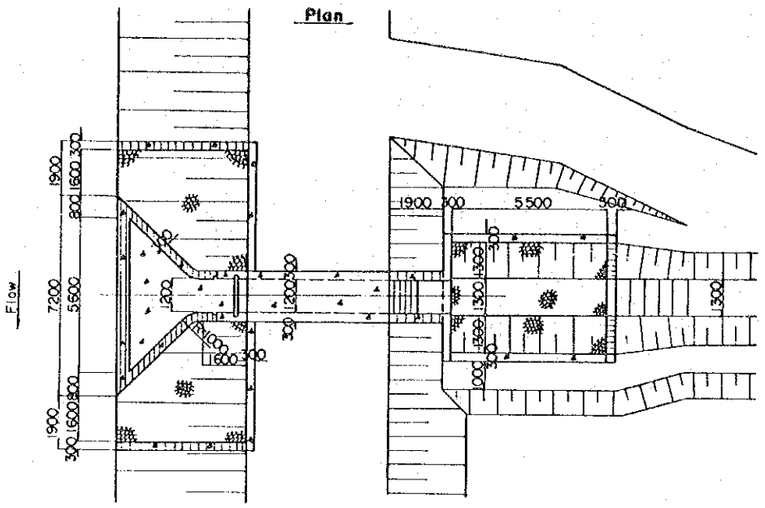


Section D-D

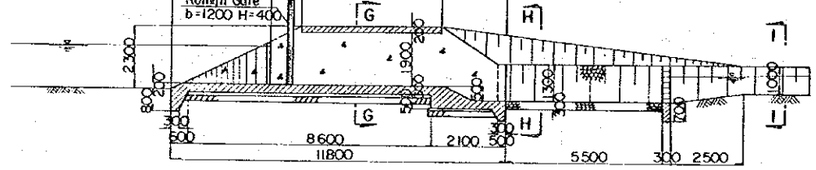


TYPE 4

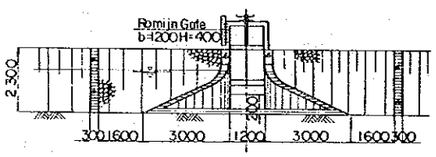
Plan



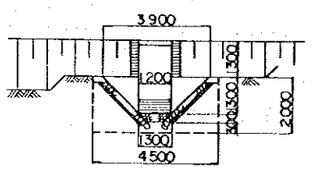
Front Elevation



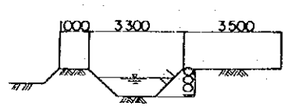
Section G-G



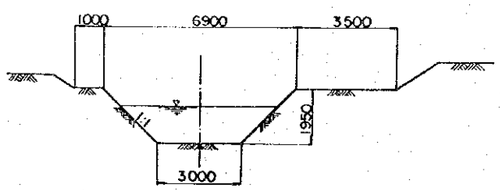
Section H-H



Section I-I



Section F-F



SCALE

0 5 10M

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

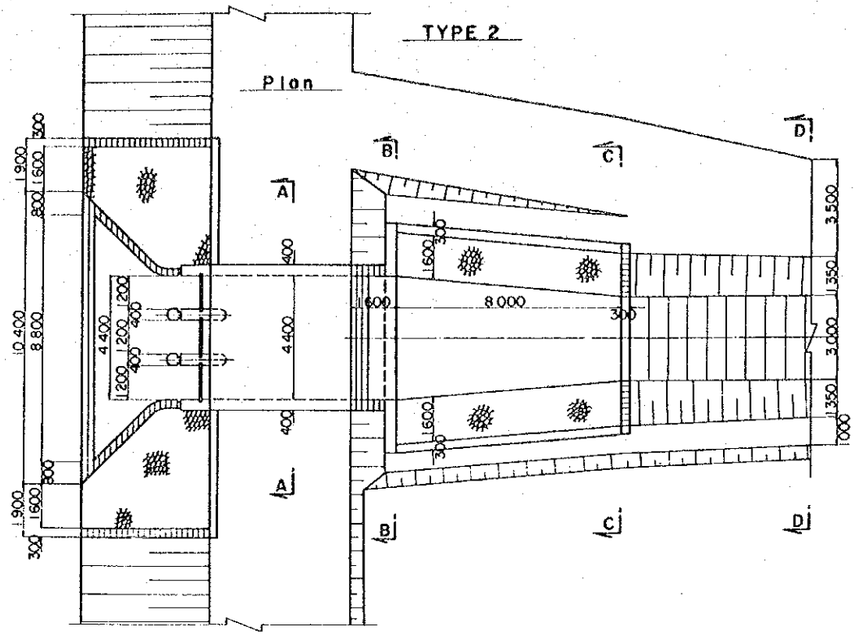
TURNOUT (TYPE I.4)

Date : July. 31. 1976 | D.W.G. NO WI - 026

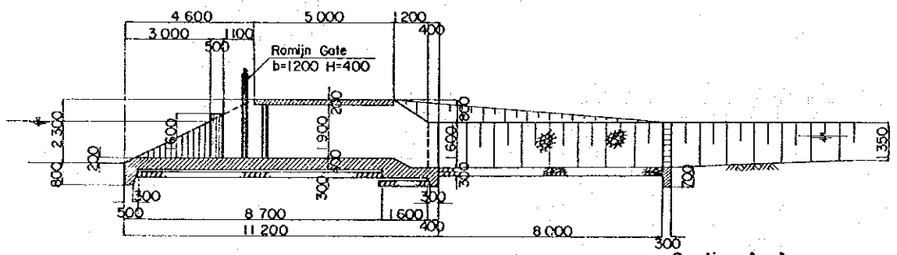
TURNOUT

TYPE 2

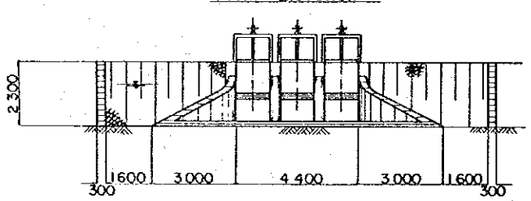
Plan



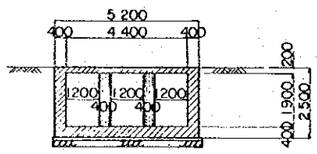
Profile



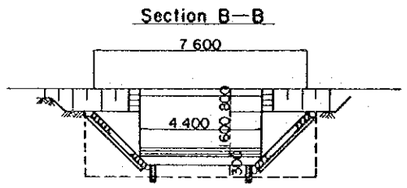
Front Elevation



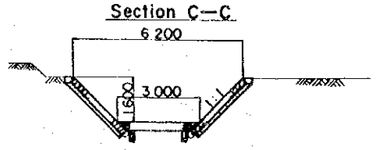
Section A—A



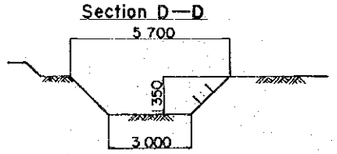
Section B—B



Section C—C

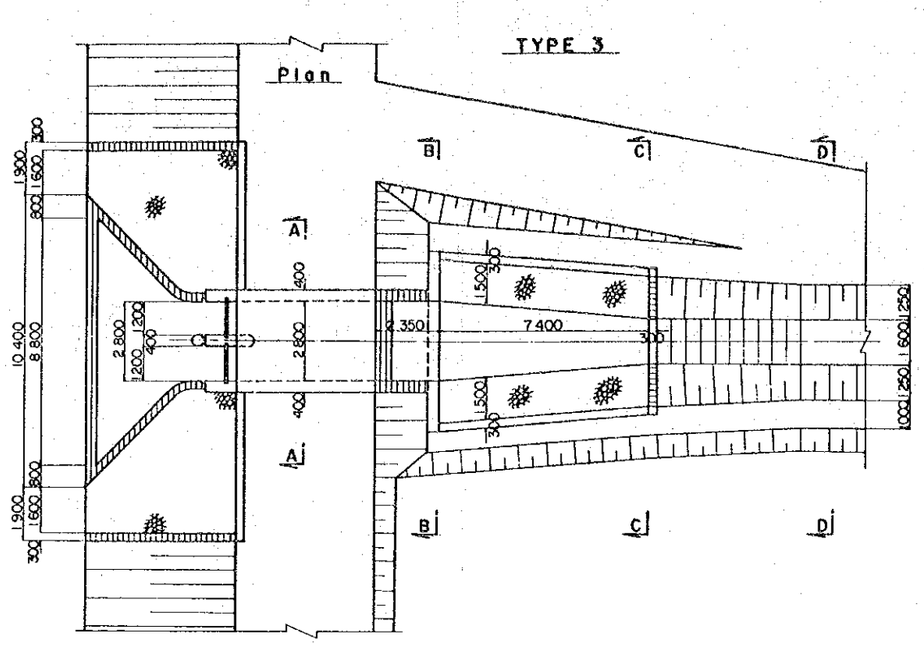


Section D—D

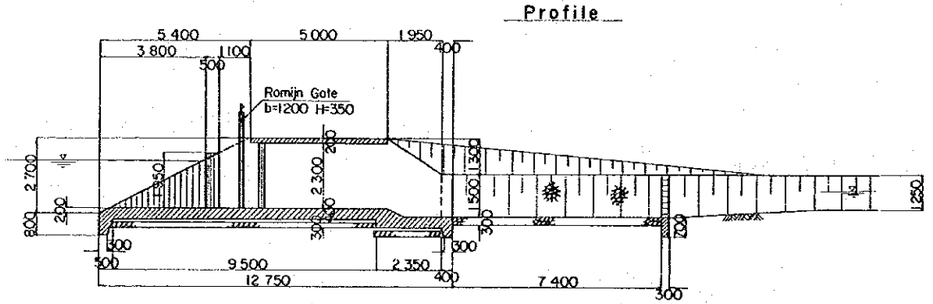


TYPE 3

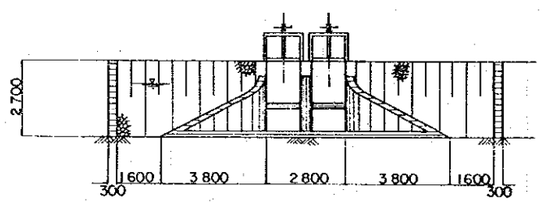
Plan



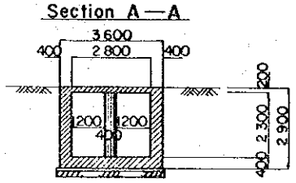
Profile



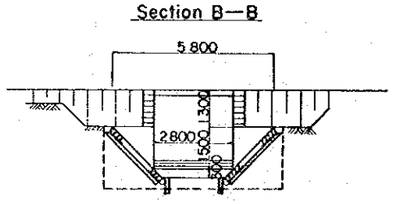
Front Elevation



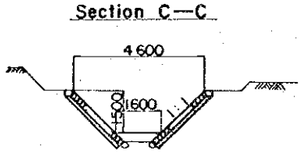
Section A—A



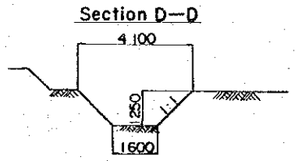
Section B—B



Section C—C



Section D—D



WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

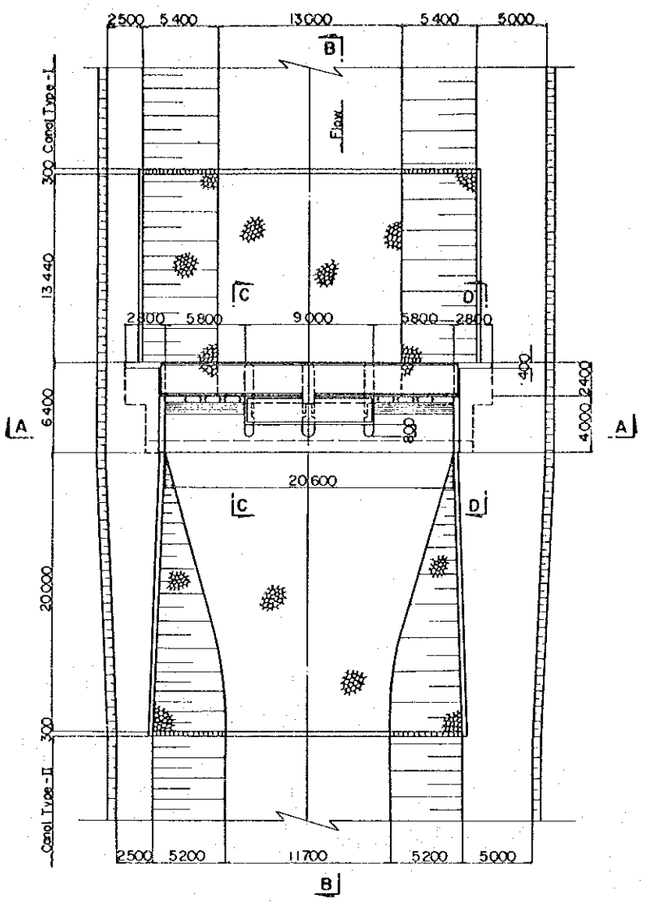
TURNOUT (TYPE 2,3)

Date : July. 31. 1976 | D.W.G. NO. WI-027

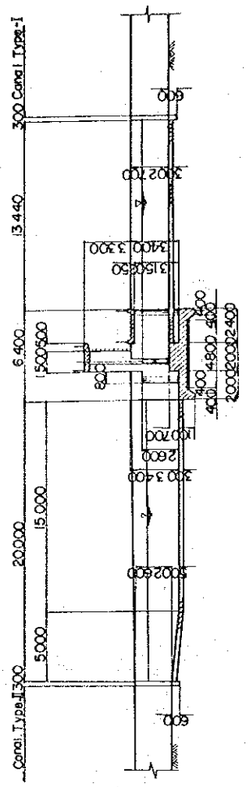
CHECK GATE

TYPE 1

Plan

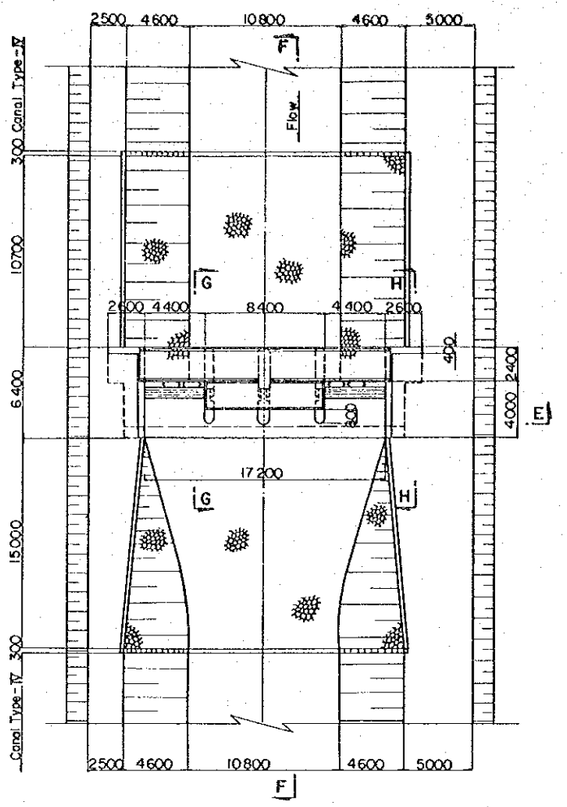


Section B-B

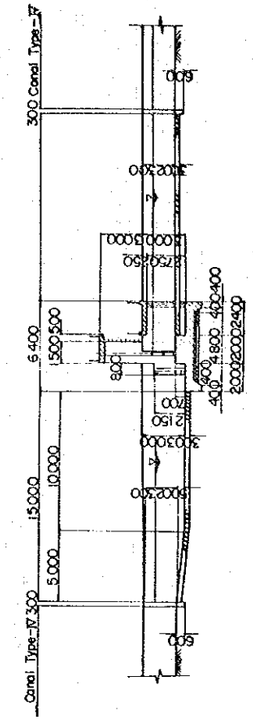


TYPE 2

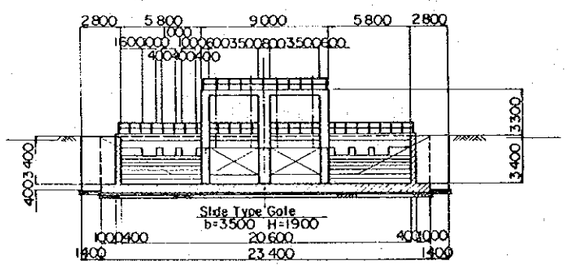
Plan



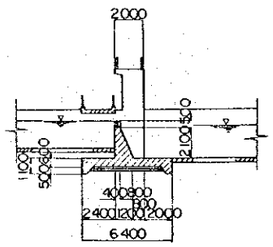
Section F-F



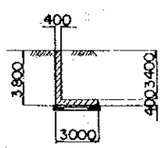
Section A-A



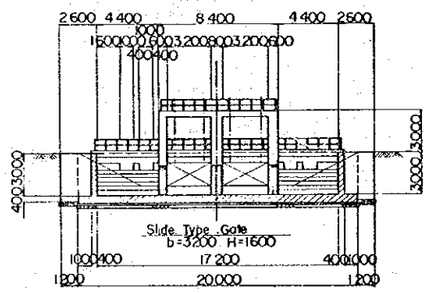
Section C-C



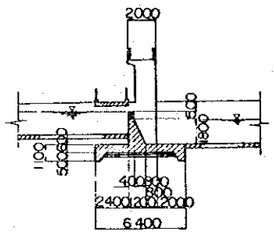
Section D-D



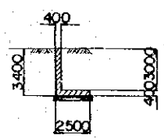
Section E-E



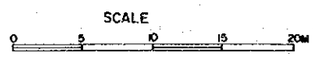
Section G-G



Section H-H



SCALE



WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA

IRRIGATION

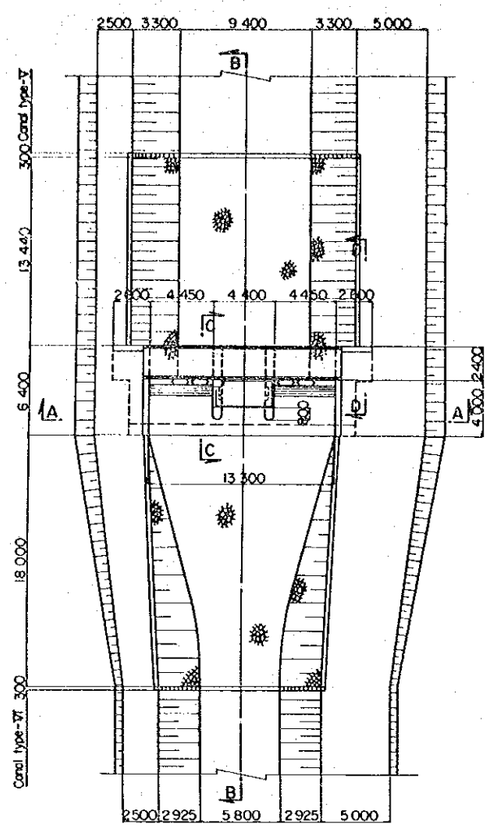
CHECK - GATE (TYPE I.2)

Date : July. 31. 1976	D.W.G. NO WI - 028

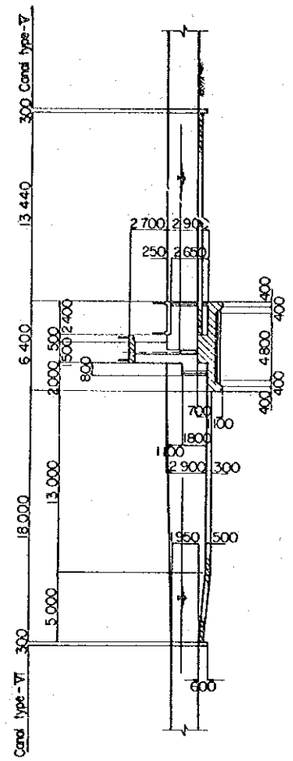
CHECK GATE

TYPE 3

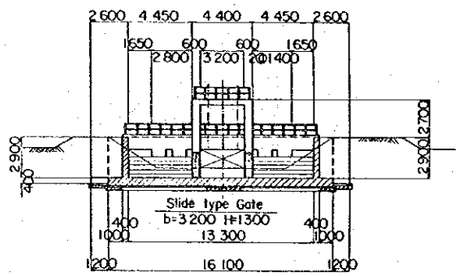
Plan



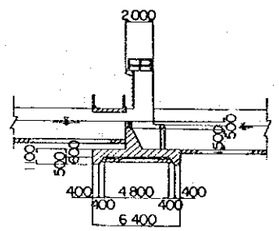
Section B—B



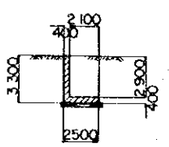
Section A—A



Section C—C



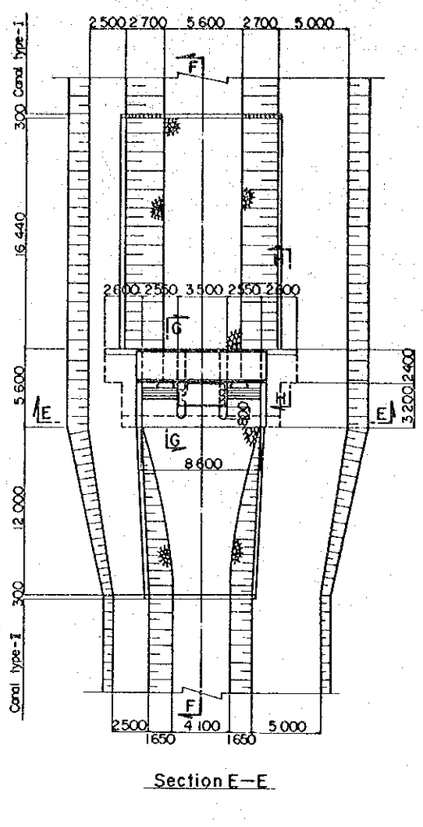
Section D—D



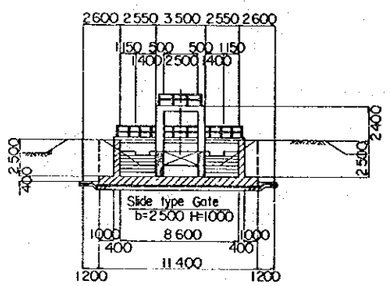
CHECK GATE

TYPE 4
(For Dengkeng)

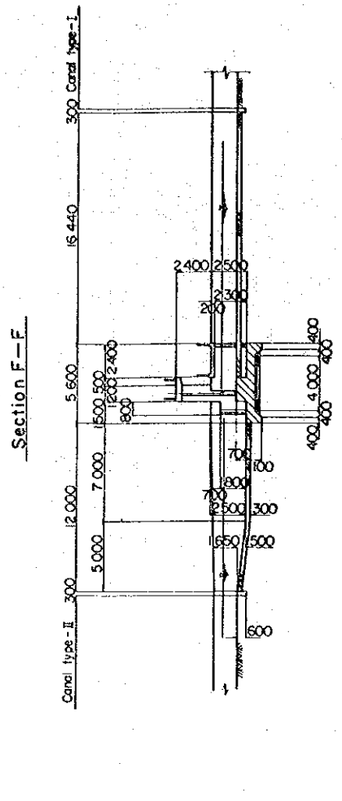
Plan



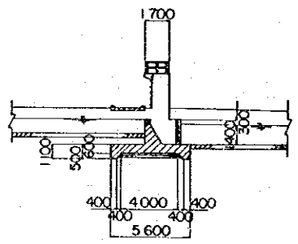
Section E—E



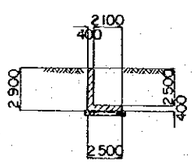
Section F—F



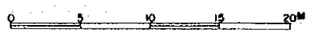
Section G—G



Section H—H



SCALE



WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

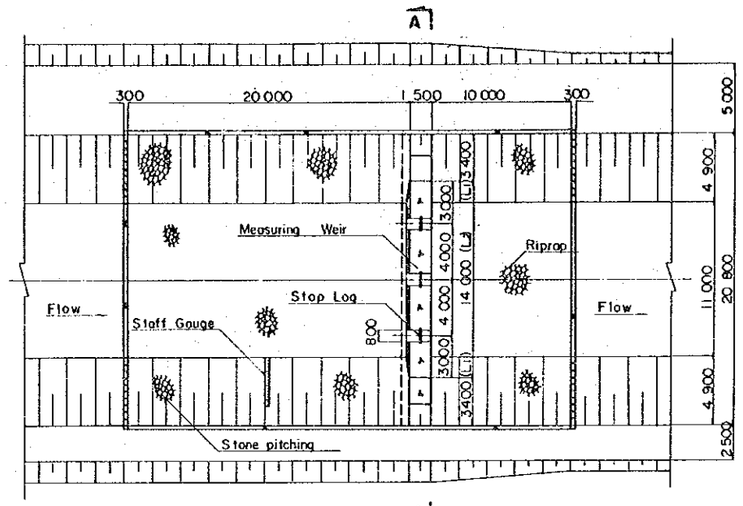
CHECK-GATE (TYPE 3,4)

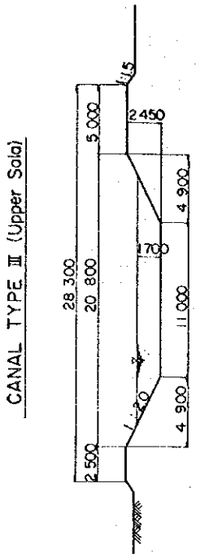
Date : July. 31. 1976 | D.W.G NO. WI-029

WATER MEASUREMENT FACILITY

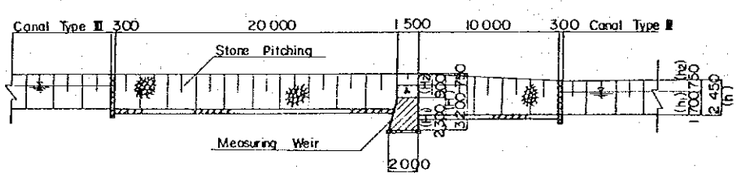
TYPE I

Plan

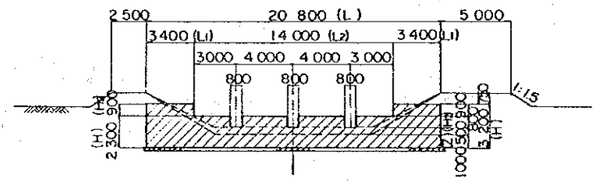




Profile



Section A–A

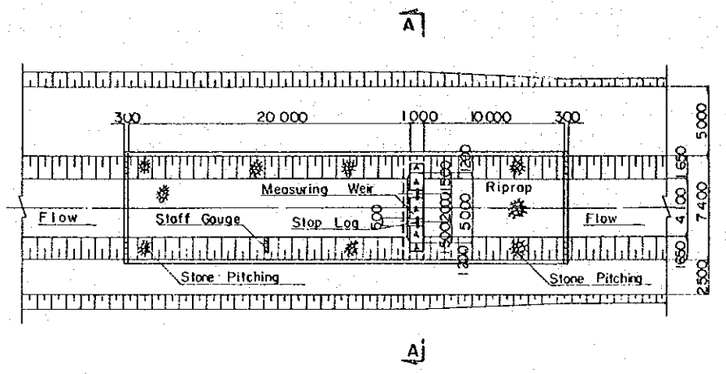


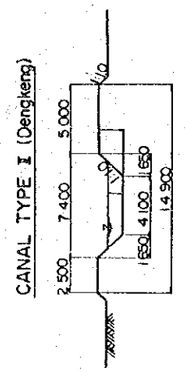
Data Table

Type	Canal Type	No	Z	L	L_1	L_2	H	H_1	H_2	H_3	h	h_1	h_2
			m	m	m	m	m	m	m	m	m	m	m
1	III	1	0.50	20.80	3.40	14.00	3.20	2.30	0.90	0.80	2.45	1.70	0.75
2	V	1	0.50	16.00	2.50	11.00	2.99	2.20	0.79	0.70	2.20	1.49	0.71
3	VI	1	0.40	11.66	2.08	7.50	2.69	2.00	0.69	0.60	1.95	1.29	0.66

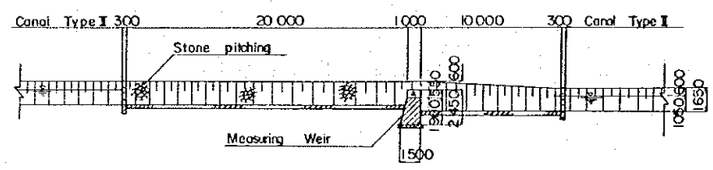
TYPE 4

Plan

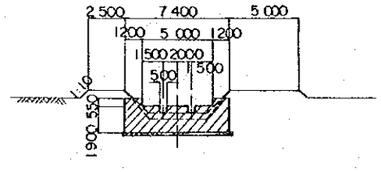




Profile



Section A–A



SCALE 0 5 10 15 20m

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION
WATER MEASUREMENT FACILITY
(TYPE 1,2,3,4)

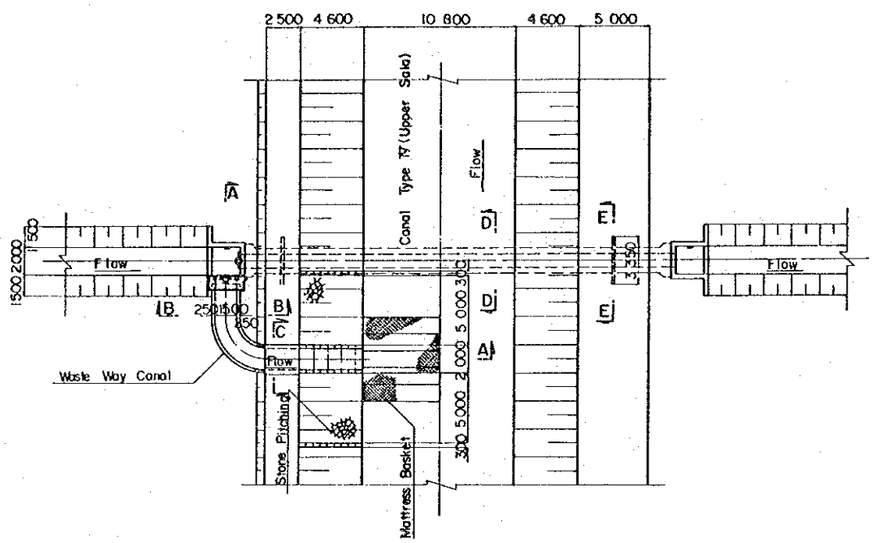
Date July 31, 1976 | D.W.G. NO WI-030

CROSS SIPHON

TYPE 1

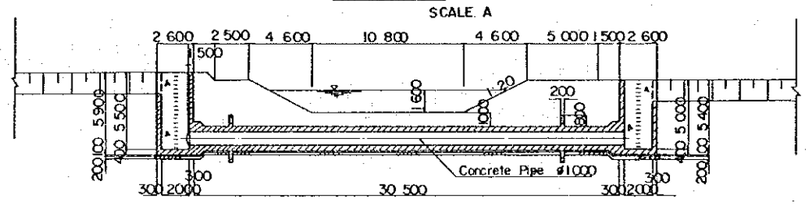
Plan

SCALE . A



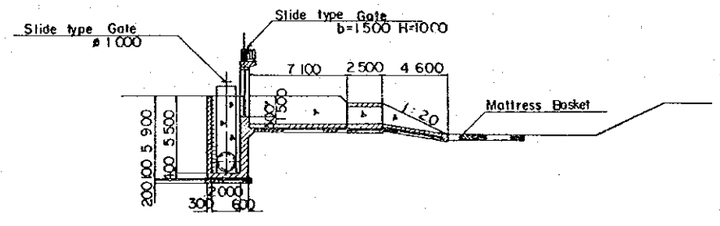
Profile

SCALE . A



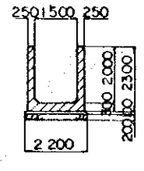
Section A—A

SCALE . A



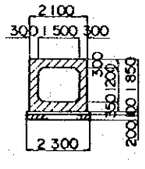
Section B—B

SCALE . B



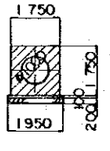
Section C—C

SCALE . B



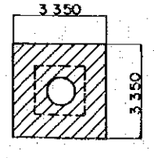
Section D—D

SCALE . B



Section E—E

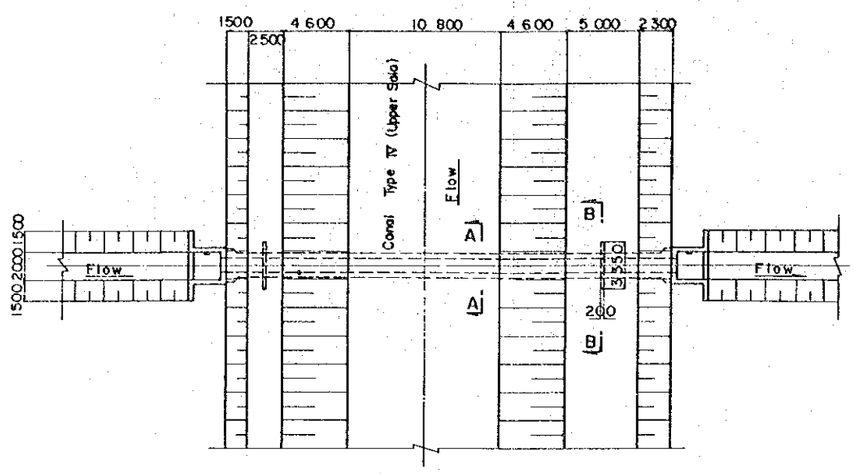
SCALE . B



TYPE 2

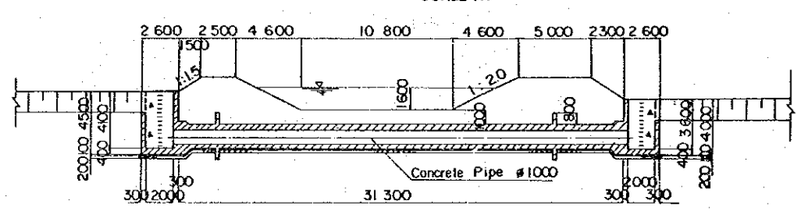
Plan

SCALE A



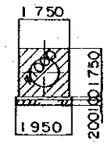
Profile

SCALE . A



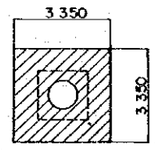
Section A—A

SCALE . B



Section B—B

SCALE . B



SCALE A 0 5 10 15 20m

SCALE B 0 5 10m

WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
IRRIGATION

CROSS SIPHON (TYPE 1, 2)

Date . July. 31 1976 | D.W.G NO WI—031