5. BANDAR SIDORAS INTAKE WEIR

SUM

	UNIT	MAIN BODY	DOWNSTREAM APRON	UPSTREAM APRON	SLUICE RIGHT	SLUICE LEFT	INTAKE GATE RIGHT	INTAKEGATE LEFT	SUBTOTAL (1)
CONCRETE Type-C1	m3	905	718	509	414	198	160	152	3056
CONCRETE Type-C2	m3						3.181	2.993	6.174
LEVELLING CON. E1	m3	35	46	58	17	16	12	11	195
FORMS (CNCRT) H<2.0	m2	531.6	234.9	245.2	972.6	472.5	129.5	129.4	2715.7
FORMS (CNCRT) H>2.0	m2	293.8	60.8	112.1	72.5	44.4	106.5	104.2	794.3
RE-BAR	kg	27295.2	42675.8	9137.4	26195.4	11633.2	7477.3	7269.2	131683.5
WATER STOP	m	70.5		36.3	57.65	24.35	11.4	10.4	210.6
ELASTIC JOINT FILLER	m2	81		24.4	34.9	16.9	18.7	17.3	193.2
DOWEL BAR	kg	456.8		279	353.3	94.5			1183.6
PC PILE dia600 total	m	516	528	384			210	210	1848
PC PILE dia400 total	m			216					216
LOG PILE L=3m total	m				249	114			363
STEEL SHEET PILE Type-II	m2	136	68	85.6	59.2	56	24	24	452.8
EXCAVATION	m3	1826.6	2128.6	1963.5	1210.7	421.3			7550.7
BACKFILL	m3	154.3	135.2	123.4	721.2	287.9			1422

Back fill of present channel : (m3) 15000

MAIN BODY

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(18.9+20.5)×1.6×2.0×2	m³	126.08	
2	1/2×(18.9+20.4)×1.5×7.1	m³	209.2725	
3	1/2×(18.9+20.5)×1.6×2.9×2	m³	182.816	
4	1/2×(3.75+1.5)×4.5×(2.0+2.9)×2	m³	115.7625	
5	1/2×(0.5+1.5)×0.5×(2.0+2.9)×2	m³	4.9	
6	1/2×(3.526+3.676)×0.1×7.1×2	m³	5.11342	
7	1/2×(1.276+3.576)×4.5×7.1×2	m³	153.4239	
8	0.5×0.5×7.1×2	m³	3.55	
9	1/2×0.776×0.338×7.1×2	m³	1.862245	
10	1/2×(6.75+7.55)×1.6×1.5×4	m³	68.64	
11	1/2×1.5×1.0×1.0×4	m³	3	
12	1/2×6.75×4.5×0.5×4	m³	30.375	
TOTAL		m³	904.7956	

DOWNSTREAM APRON

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(17.05+18.25)×1.2×16.0	m³	338.88	
2	1/2×(4.1+4.25)×0.1×16.0×2	m³	13.36	
3	1/2×(1.5+2.625)×4.5×16.0×2	m³	297	
4	1/2×(0.5+1.5)×0.5×16.0×2	m³	16	
5	1/2×(0.5+4.5)×6.125×0.5×2	m³	15.3125	
6	1/2×1.75×1.0×0.5×2	m³	0.875	
7	1/2×(7.875+8.525)×1.3×1.5×2	m³	31.98	
8	1/2×(0.6+0.8)×0.2×34.0	m³	4.76	
TOTAL		m³	718.1675	

SLUICE RIGHT

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	$(4.15\times2.4-1.5^2\times2+1/2\times0.2^2\times4\times2)\times5.98$	m³	33.6076	
2	(0.4×2.9+0.5×1.0)×2.25	m³	3.735	
	1.0×0.4×4.15	m³	1.66	
	$1/2\times0.2^2\times4.15\times2$	m³	0.166	
3	1/2×(0.6+1.0)×0.2×(6.4+7.2)	m³	2.176	
4	$(7.2\times3.0-1.425\times2.0\times2-1.5^2\times2+1/2\times0.2^2\times4\times2)\times1.90$	m³	21.964	
5	$(7.2\times3.0-1.025\times2.0\times2-1.5^2\times2+1/2\times0.2^2\times4\times2)\times0.2$	m³	2.632	
	$1/2\times0.2^2\times1.025\times2$	m³	0.041	
6	$(7.2\times3.79-1.5^2\times2+1/2\times0.2^2\times4\times2)\times0.4$	m³	9.1792	
7	$(7.2\times3.3-1.025\times2.3\times2-4.15\times2.4)\times0.5$	m³	4.7075	
	$1/2\times0.2^2\times1.025\times2$	m³	0.041	
8	$(6.4\times2.6-1.025\times2.0\times2-1.5^2\times2+1/2\times0.2^2\times4\times2)\times3.0$	m³	24.6	
	$1.025\times2.0\times0.5\times2$	m³	2.05	
	$1/2\times0.2^2\times1.025\times2$	m³	0.041	
	$-(0.1\times2.1\times0.05\times4+0.1^2\times1.5\times2)$	m³	-0.072	
9	1/2×(0.6+0.8)×0.2×6.4	m³	0.896	
10	(3.5×3.625-1.625×1.5)×0.5×2	m³	10.25	
11	1/2×(0.35+0.5)×1.9×(3.325+2.95)×2	m³	10.13413	
12	2.35×0.35×3.5	m³	2.87875	
13	$(4.15\times2.4-1.5^2\times2+1/2\times0.2^2\times4\times2)\times(45.0+5.4)$	m³	283.248	
TOTAL		m³	413.9352	

SLUICE LEFT

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	(3.65×2.4-1.5×1.25×2+1/2×0.2²×4×2)×5.98	m³	30.9166	
2	(0.4×2.9+0.5×1.0)×2.35	m³	3.901	
	1.0×0.4×3.65	m³	1.46	
	1/2×0.2²×3.65×2	m³	0.146	
3	1/2×(0.6+1.0)×0.2×(6.0+6.8)	m³	2.048	
4	(6.8×3.0-1.475×2.0×2-1.5×1.25×2+1/2×0.2²×4×2)×	m³	20.729	
5	(6.8×3.0-1.075×2.0×2-1.5×1.25×2+1/2×0.2²×4×2)×	m³	2.502	
	1/2×0.2²×1.075×2	m³	0.043	
6	(6.8×3.79-1.5*1.25×2+1/2×0.2²×4×2)×0.4	m³	8.8728	
7	(6.8×3.3-1.075×2.3×2-3.65×2.4)×0.5	m³	4.3675	
	1/2×0.2²×1.075×2	m³	0.043	
8	(6.0×2.6-1.075×2.0×2-1.5×1.25×2+1/2×0.2²×4×2)×	m³	23.13	
	1.075×2.0×0.5×2	m³	2.15	
	1/2×0.2²×1.075×2	m³	0.043	
	-(0.1×2.1×0.05×4+0.1²×1.25×2)	m³	-0.067	
9	1/2×(0.6+0.8)×0.2×6.0	m³	0.84	
10	(3.5×3.675-1.675×1.5)×0.5×2	m³	10.35	
11	1/2×(0.35+0.5)×1.9×(3.325+3.0)×2	m³	10.21488	
12	1.85×0.35×3.5	m³	2.26625	
13	(3.65×2.4-1.5×1.25×2+1/2×0.2²×4×2)×14.4	m³	74.448	
TOTAL		m³	198.404	

UPSTREAM APRON

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	13.0×8.0	m³	104	
2	1/2×(1.0+2.98)×3.96×8.0	m³	63.0432	
3	0.34×2.98×8.0	m³	8.1056	
4	1.98×4.0×8.0	m³	63.36	
5	0.8×2.2×8.0	m³	14.08	
6	1/2×6.04×3.02×2.575	m³	23.48503	
7	1/2×6.04×3.02×2.575	m³	23.48503	
8	0.5×3.02×2.575	m³	3.88825	
9	0.5×3.02×2.575	m³	3.88825	
10	1/3×(1/2×0.20²)×0.34+1/2×0.20²×6.2	m³	0.126267	
11	1/3×(1/2×0.20²)×0.34+1/2×0.20²×6.2	m³	0.126267	
12	1/2×(0.6+0.8)×0.2×4.3	m³	0.602	
13	1/2×(0.6+0.8)×0.2×4.0	m³	0.56	
14	1/2×(0.6+0.8)×0.2×3.2	m³	0.448	
15	1/2×(1.0+2.98)×3.96×8.0	m³	63.0432	
16	0.34×2.98×8.0	m³	8.1056	
17	1.98×4.0×8.0	m³	63.36	
18	0.8×2.2×8.0	m³	14.08	
19	1/2×6.04×3.02×2.325	m³	21.20493	
20	1/2×6.04×3.02×2.325	m³	21.20493	
21	0.5×3.02×2.325	m³	3.51075	
22	0.5×3.02×2.325	m³	3.51075	
23	1/3×(1/2×0.20²)×0.34+1/2×0.20²×6.2	m³	0.126267	
24	1/3×(1/2×0.20²)×0.34+1/2×0.20²×6.2	m³	0.126267	
25	1/2×(0.6+0.8)×0.2×4.3	m³	0.602	
26	1/2×(0.6+0.8)×0.2×4.0	m³	0.56	
TOTAL		m³	508.6326	

INTAKE GATE RIGHT

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	0.45×6.975×2.5	m^3	7.846875	
	1/2×(1.6×2.5+0.8×1.05)×0.15×2	m^3	0.726	
	1/2×(1.45×2.5+0.85×1.05)×0.15	m^3	0.338813	
2	((0.8×0.35+0.55×0.7)×4.77)×2	m^3	6.3441	
	(0.85×0.35+0.35×0.7)×4.77	m^3	2.587725	
3	6.95×0.8×4.95	m^3	27.522	
	1/2×(0.15+0.35)×0.2×4.95	m^3	0.2475	
	4.95×0.4×1.0+0.4×0.8×1.0	m^3	2.3	
4	8.0×6.25×0.8-1.75×0.7×0.2×2	m^3	39.51	
	1/2×(0.6+0.8)×0.2×6.25	m^3	0.875	
5	2.15×4.95×0.8	m^3	8.514	
	1/2×(0.8+1.03)×2.3×4.95	m^3	10.41728	
	1.0×4.95×0.53+0.4×0.5×1.0×2	m^3	3.0235	
6	1.49×1.25×0.35×2	m^3	1.30375	
7	4.65×1.73×0.8+1/2×(1.5+1.73)×2.3×0.8+1.5×0.4×1.C	m^3	10.0072	
8	4.65×1.73×0.8+1/2×(1.5+1.73)×2.3×0.8+1.5×0.4×1.C	m^3	10.0072	
9	1/2×(0.35+0.85)×2.5×1.73-1/2×(0.15+0.35)×0.2×0.83	m^3	2.5535	
	2.15×0.35×1.73	m^3	1.301825	
	1/2×(1.5+1.73)×2.3×0.35	m^3	1.300075	
10	0.8×2.7×3.02-0.1×0.2×2.275	m^3	6.4777	
11	0.8×2.7×3.02-0.1×0.2×2.275	m^3	6.4777	
12	(0.85×3.02-0.1×0.2×2)×2.275	m^3	5.748925	
	1/2×(π/4)×0.85^2×3.02	m^3	0.85685	
13	1/2×0.4^2×4.95	m^3	0.396	
14	1/2×0.5^2×6.25	m^3	0.78125	
15	1/2×0.5^2×6.25	m^3	0.78125	
16	1/2×0.2^2×2.7	m^3	0.054	
17	1/2×0.2^2×2.7	m^3	0.054	
18	1/2×0.2^2×2.275×2	m^3	0.091	
19	1/2×0.2^2×7.3	m^3	0.146	
20	1/2×0.2^2×7.3	m^3	0.146	
21	(1/2×0.2^2×(0.35+4.45+2.512))×2	m^3	0.29248	
22	1/2×0.2^2×7.3×2	m^3	0.292	
	1/2×0.2^2×(4.45+2.612)×2	m^3	0.28248	
TOTAL		m^3	159.604	

INTAKE GATE LEFT

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	0.45×6.725×2.5	m^3	7.565625	
	1/2×(1.6×2.5+0.8×1.05)×0.15×2	m^3	0.726	
	1/2×(1.45×2.5+0.85×1.05)×0.15	m^3	0.338813	
2	((0.8×0.35+0.55×0.7)×4.77)×2	m^3	6.3441	
	(0.85×0.35+0.35×0.7)×4.77	m^3	2.587725	
3	6.95×0.8×4.45	m^3	24.742	
	1/2×(0.15+0.35)×0.2×4.45	m^3	0.2225	
	4.45×0.4×1.0+0.4×0.8×1.0	m^3	2.1	
4	8.0×6.25×0.8-1.5×0.7×0.2×2	m^3	39.58	
	1/2×(0.6+0.8)×0.2×6.25	m^3	0.875	
5	2.15×4.45×0.8	m^3	7.654	
	1/2×(0.8+1.03)×2.3×4.45	m^3	9.365025	
	1.0×4.45×0.53+0.4×0.5×1.0×2	m^3	2.7585	
6	1.49×1.0×0.35×2	m^3	1.043	
7	4.65×1.73×0.8+1/2×(1.5+1.73)×2.3×0.8+1.5×0.4×1.C	m^3	10.0072	
8	4.65×1.73×0.8+1/2×(1.5+1.73)×2.3×0.8+1.5×0.4×1.C	m^3	10.0072	
9	1/2×(0.35+0.85)×2.5×1.73-1/2×(0.15+0.35)×0.2×0.83	m^3	2.5535	
	2.15×0.35×1.73	m^3	1.301825	
	1/2×(1.5+1.73)×2.3×0.35	m^3	1.300075	
10	0.8×2.7×3.02-0.1×0.2×1.55	m^3	6.4922	
11	0.8×2.7×3.02-0.1×0.2×1.55	m^3	6.4922	
12	(0.85×3.02-0.1×0.2×2)×1.55	m^3	3.91685	
	1/2×(π/4)×0.85^2×3.02	m^3	0.85685	
13	1/2×0.4^2×4.45	m^3	0.356	
14	1/2×0.5^2×6.25	m^3	0.78125	
15	1/2×0.5^2×6.25	m^3	0.78125	
16	1/2×0.2^2×2.7	m^3	0.054	
17	1/2×0.2^2×2.7	m^3	0.054	
18	1/2×0.2^2×2.275×2	m^3	0.091	
19	1/2×0.2^2×7.3	m^3	0.146	
20	1/2×0.2^2×7.3	m^3	0.146	
21	(1/2×0.2^2×(0.35+4.45+2.512))×2	m^3	0.29248	
22	1/2×0.2^2×7.3×2	m^3	0.292	
	1/2×0.2^2×(4.45+2.612)×2	m^3	0.28248	
TOTAL		m^3	152.1066	

INTAKE GATE (RIGHT) SECONDARY CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	$(0.25\times0.7-0.131\times0.215)\times3.02\times4$	m3	1.774	
2	$0.7\times1.75\times0.2\times2$	m3	0.49	
3	$1/2\times(0.2+0.53)\times0.235\times1.25\times2$	m3	0.214	
4	$(1.25\times0.53+1/2\times0.20^{2}\times2)\times0.5\times2$	m3	0.703	
TOTAL		m3	3.181	

INTAKE GATE (LEFT) SECONDARY CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	$(0.25\times0.7-0.131\times0.19)\times3.02\times4$	m3	1.813	
2	$0.7\times1.5\times0.2\times2$	m3	0.42	
3	$1/2\times(0.2+0.53)\times0.26\times1.0\times2$	m3	0.19	
4	$(1.0\times0.53+1/2\times0.20^{2}\times2)\times0.5\times2$	m3	0.57	
TOTAL		m3	2.993	

MAIN BODY

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	10.276×19.1×0.1	m³	19.62716	
2	0.738×7.55×0.1×4	m³	2.22876	
3	1/2×(0.6+0.662)×0.15×34.2×2	m³	6.47406	
	0.283×0.162×34.2×2	m³	3.135866	
	1/2×0.662×0.15×34.2×2	m³	3.39606	
TOTAL		m³	34.86191	

DOWNSTREAM APRON

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(4.2+4.262)×0.15×2×14.4	m³	18.27792	
	0.141×0.15×2×14.4	m³	0.60912	
	1/2×(8.55+8.426)×0.15×14.4	m³	18.33408	
2	1/2×(12.725+12.787)×0.15×2×0.738	m³	2.824178	
	0.141×0.15×2×0.738	m³	0.031217	
	1/2×(8.55+8.426)×0.15×0.738	m³	0.939622	
3	1/2×(0.7+0.762)×0.15×(12.756×2+0.141×2+8.488)	m³	3.759021	
	0.283×0.15×(12.756×2+0.141×2+8.488)	m³	1.455271	
	1/2×0.062×0.15×(12.756×2+0.141×2+8.488)	m³	0.159411	
TOTAL		m³	46.38984	

SLUICE RIGHT

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(0.23+0.3)×0.15×7.4	m³	0.29415	
	0.283×0.15×7.4×2	m³	0.62826	
	1/2×(0.6+1.0)×0.15×7.4	m³	0.888	
	1/2×(1.838+1.9)×0.15×7.4	m³	2.07459	
2	0.1×0.5×4.35	m³	0.2175	
	1/2×(0.15+0.5)×0.35×4.35	m³	0.494813	
	0.15×1.35×4.35	m³	0.880875	
3	1/2×(0.038+0.1)×0.15×6.6×2	m³	0.13662	
	0.283×0.15×6.6×2	m³	0.56034	
	1/2×(0.6+1.0)×0.15×6.6	m³	0.792	
4	2.78×0.15×4.35	m³	1.81395	
	1/2×(0.15+0.25)×0.1×4.35	m³	0.087	
	0.1×0.1×4.35	m³	0.0435	
5	1/2×(2.238+2.265)×0.15×6.6	m³	2.228985	
	0.283×0.15×6.6	m³	0.28017	
	1/2×(0.7+0.762)×0.15×6.6	m³	0.72369	
6	0.45×0.1×6.55	m³	0.29475	
	1/2×(0.15+0.45)×0.3×6.55	m³	0.5895	
	0.15×1.0×6.55	m³	0.9825	
7	1/2×(1.238+1.3)×0.15×9.8	m³	1.86543	
	0.283×0.15×9.8	m³	0.41601	
	1/2×(0.7+0.762)×0.15×9.8	m³	1.07457	
TOTAL		m³	17.3672	

SLUICE LEFT

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(0.23+0.3)×0.15×7.0	m³	0.27825	
	0.283×0.15×7.0×2	m³	0.5943	
	1/2×(0.6+1.0)×0.15×7.0	m³	0.84	
	1/2×(1.838+1.9)×0.15×7.0	m³	1.96245	
2	0.1×0.5×3.85	m³	0.1925	
	1/2×(0.15+0.5)×0.35×3.85	m³	0.437938	
	0.15×1.35×3.85	m³	0.779625	
3	1/2×(0.038+0.1)×0.15×6.2×2	m³	0.12834	
	0.283×0.15×6.2×2	m³	0.52638	
	1/2×(0.6+1.0)×0.15×6.2	m³	0.744	
4	2.78×0.15×3.85	m³	1.60545	
	1/2×(0.15+0.25)×0.1×3.85	m³	0.077	
	0.1×0.1×3.85	m³	0.0385	
5	1/2×(2.238+2.265)×0.15×6.2	m³	2.093895	
	0.283×0.15×6.2	m³	0.26319	
	1/2×(0.7+0.762)×0.15×6.2	m³	0.67983	
6	0.45×0.1×6.05	m³	0.27225	
	1/2×(0.15+0.45)×0.3×6.05	m³	0.5445	
	0.15×1.0×6.05	m³	0.9075	
7	1/2×(1.238+1.3)×0.15×9.4	m³	1.78929	
	0.283×0.15×9.4	m³	0.39903	
	1/2×(0.7+0.762)×0.15×9.4	m³	1.03071	
TOTAL		m³	16.18493	

UPSTREAM APRON

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(7.2+7.138)×0.15×(13.0+4.5+4.1+2.2)	m³	25.59333	
2	0.238×0.15×(13.0+4.5+4.1+2.2)	m³	0.84966	
3	1/2×(0.7+0.762)×0.15×(13.0+4.5+4.1+2.2)	m³	2.60967	
4	1/2×(7.2+7.138)×0.15×(13.0+4.5+4.1+2.2)	m³	25.59333	
5	0.238×0.15×(13.0+4.5+4.1+2.2)	m³	0.84966	
6	1/2×(0.7+0.762)×0.15×(13.0+4.5+4.1+2.2)	m³	2.60967	
TOTAL		m³	58.10532	

INTAKE GATE RIGHT

NO.	EXPRESSION	UNIT	VOLUME
1	1/2×(7.138+7.2)×0.15×6.35	m^3	6.828473
2	0.238×0.15×6.35	m^3	0.226695
3	1/2×(0.6+0.662)×0.15×6.35	m^3	0.601028
4	5.15×5.45×0.15	m^3	4.210125
TOTAL		m^3	11.86632

INTAKE GATE LEFT

NO.	EXPRESSION	UNIT	VOLUME
1	1/2×(6.638+6.7)×0.15×6.35	m^3	6.352223
2	0.238×0.15×6.35	m^3	0.226695
3	1/2×(0.6+0.662)×0.15×6.35	m^3	0.601028
4	4.65×5.45×0.15	m^3	3.801375
TOTAL		m^3	10.98132

MAIN BODY
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(10.1+10.5)×0.2×2×2	m^2	8.24	
	1.8×34.0×2	m^2	122.4	
2	1/2×(4.472+4.449)×0.1×4	m^2	1.7842	
3	1/2×(13.047+13.0)×0.1×2	m^2	2.6047	
4	0.112×7.1×2	m^2	1.5904	
5	(1.0×5.25+1/2×(3.75+5.25)×2.0)×4	m^2	57	
6	1.0×1.0×4	m^2	4	
7	1/2×(0.9+1.5)×0.4×4	m^2	1.92	
8	1/2×(7.55+6.75)×1.6×4	m^2	163.08	
9	1.789×9.0×2	m^2	32.202	
10	0.5×2.0×4	m^2	4	
11	1.0×1.6×4	m^2	6.4	
12	1/2×(0.6+0.8)×0.2×4	m^3	0.56	
13	12×4.472×2	m^3	107.328	
TOTAL		m^2	513.1093	

LEVELLING CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	0.15×34.2×2	m^2	10.26	
2	0.15×7.55×4	m^2	4.53	
3	0.15×8.8×2	m^2	2.64	
4	0.15×0.738×4	m^2	0.4428	
5	1/2×(0.6+0.662)×0.15×4	m^2	0.3786	
	0.283×0.162×4	m^2	0.183384	
	1/2×0.062×0.15×4	m^2	0.0186	
TOTAL		m^2	18.45338	

DOWNSTREAM APRON
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	34.0×1.4×2	m^2	95.2	
	1/2×(12.625+12.725)×0.1×2	m^2	2.535	
	1/2×(9.5+10.5)×0.5×2	m^2	10	
2	1/2×(4.375+6.125)×1.0×2	m^2	10.5	
	6.125×1.0×2	m^2	12.25	
3	1/2×(0.525+1.75)×0.7×2	m^2	1.5925	
4	1/2×(7.875+8.525)×1.3×2	m^2	21.32	
5	1.0×1.0×2	m^2	2	
6	0.5×2.0×2	m^2	2	
7	1.0×1.3×2	m^2	2.6	
8	1.453×14.5×2	m^2	42.137	
9	0.5×15.5×2	m^2	15.5	
10	1/2×(0.6+0.8)×0.2×34.0	m^2	4.76	
TOTAL		m^2	222.3945	

DOWNSTREAM APRON
LEVELLING CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(12.275+12.878)×0.15×2	m²	3.77295	
	0.141×0.15×2	m²	0.0423	
	1/2×(8.55+8.426)×0.15	m²	1.2732	
2	1/2×(0.7+0.762)×0.15×2	m²	0.2193	
	0.283×0.15×2	m²	0.0849	
	1/2×0.062×0.15×2	m²	0.0093	
	0.738×0.15×2	m²	0.2214	
3	8.525×0.15×2	m²	2.5575	
4	14.4×0.15×2	m²	4.32	
TOTAL		m²	12.50085	

SLUICE RIGHT
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	(2.0×4.98+1.9×0.3×2)×2	m²	22.2	
2	0.5×1.125×4	m²	2.25	
3	(0.4×1.5+0.5×1.0+1/2×(0.6+1.0)×0.2)×2	m²	2.52	
4	2.0×1.125×4	m²	9	
5	0.8×4.15×2	m²	6.64	
6	0.283×4.15×2	m²	2.3489	
7	(0.6×1.025+0.1×2.6)×2	m²	1.75	
8	(2.0×2.5-1/2×0.2²)×2	m²	9.96	
9	1.8×1.025×2	m²	3.69	
10	0.283×1.025×2	m²	0.58015	
11	(0.5×1.4+0.6×3.0+1/2×0.2²+1/2×(0.6+0.8)×0.2)×	m²	5.32	
12	6.4×2.0-1.5×1.2×2+1/2×0.2²×2×2	m²	9.28	
13	2.1×0.05×8+1.5×0.1×4	m²	1.44	
14	(1.0×1.425+3.0×0.1)×2	m²	3.45	
15	(2.0×1.9+0.4×2.0)×2	m²	9.2	
16	1.025×1.8×2+0.79×5.15	m²	7.7585	
17	(0.283×1.025+2.0×0.2-1/2×0.20²)×2	m²	1.34015	
18	(0.4×1.0+1.0×3.0+1/2×0.2²×2+1/2×(0.6+1.0)×0.2)×2	m²	7.2	
19	1.025×1.8×2+0.49×5.15	m²	6.2135	
20	(0.283×1.025+0.5×2.3-1/2×0.2²)×2	m²	2.84015	
21	5.15×2.0-1.0×1.5×2+1/2×0.2²×2×2+1.025+1.0×2	m²	10.405	
22	(1.1×4+1.1×2+0.283×8)×11.48	m²	101.7587	
23	2.0×0.5×2+4.15×0.5	m²	4.075	
24	0.5×3.5×2	m²	3.5	
25	1.9×3.5×2	m²	13.3	
26	1.906×5.775×2	m²	22.0143	
27	(0.5×(1.5+1.625))×2	m²	3.125	
28	(2.0×0.5+1/2×(0.38+0.5)×1.5+1/2×(0.6+0.8)×0.2)×2	m²	3.6	
29	(3.125×2.0+0.5×0.7)×2+0.55×2.35	m²	14.4925	
30	(4.15×2.0-1.5²×2+1/2×0.2²×8)×3	m²	11.88	
31	2.0×48.9×2	m²	195.6	
32	(1.1×4+1.1×2+0.283×8)×50.4	m²	446.7456	
TOTAL		m²	945.4775	

LEVELLING CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(0.23+0.3)×0.15×2	m^2	0.0795	
	0.283×0.15×2×2	m^2	0.62826	
	1/2×(0.6+1.0)×0.15×2	m^2	0.24	
	1/2×(1.838+1.9)×0.15×2	m^2	0.5607	
	0.15×(7.4+1.525×2)	m^2	1.5675	
2	0.1×0.5×2	m^2	0.1	
	1/2×(0.15+0.5)×0.35×2	m^2	0.2275	
	0.15×1.35×2	m^2	0.405	
3	1/2×(0.038+0.1)×0.15×2×2	m^2	0.0414	
	0.283×0.15×2×2	m^2	0.1698	
	1/2×(0.6+1.0)×0.15×2	m^2	0.24	
	0.15×(1.125×4)	m^2	0.675	
4	2.78×0.15×2	m^2	0.834	
	1/2×(0.15+0.25)×0.1×2	m^2	0.04	
	0.1×0.1×2	m^2	0.02	
5	1/2×(2.238+2.265)×0.15×2	m^2	0.67545	
	0.283×0.15×2	m^2	0.0849	
	1/2×(0.7+0.762)×0.15×2	m^2	0.2193	
	0.15×(1.125×2+6.6)	m^2	1.3275	
6	0.3×0.1×4	m^2	0.12	
	1/2×(0.15+0.30)×0.15×4	m^2	0.135	
	0.15×1.15×4	m^2	0.69	
7	1/2×(1.238+1.3)×0.15×4	m^2	0.7614	
	0.283×0.15×4	m^2	0.1698	
	1/2×(0.7+0.762)×0.15×4	m^2	0.4386	
	0.15×(1.625×2+9.8)	m^2	1.9575	
8	0.15×48.9×2	m^2	14.67	
TOTAL		m^2	27.07811	

SLUICE LEFT
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	(2.0×4.98+1.9×0.3×2) ×2	m^2	22.2	
2	0.5×1.175×4	m^2	2.35	
3	(0.4×1.5+0.5×1.0+1/2× (0.6+1.0) ×0.2) ×2	m^2	2.52	
4	2.0×1.175×4	m^2	9.4	
5	0.8×3.65×2	m^2	5.84	
6	0.283×3.65×2	m^2	2.0659	
7	(0.6×1.075+0.1×2.6) ×2	m^2	1.81	
8	(2.0×2.5-1/2×0.2²) ×2	m^2	9.96	
9	1.8×1.075×2	m^2	3.87	
10	0.283×1.075×2	m^2	0.60845	
11	(0.5×1.4+0.6×3.0+1/2×0.2²+1/2× (0.6+0.8) ×0.2) :	m^2	5.32	
12	6.0×2.0-1.2×1.25×2+1/2×0.2²×2×2	m^2	9.08	
13	2.1×0.05×8+1.25×0.1×4	m^2	1.34	
14	(1.0×1.475+3.0×0.1) ×2	m^2	3.55	
15	(2.0×1.9+0.4×2.0) ×2	m^2	9.2	
16	1.075×1.8×2+0.79×4.65	m^2	7.5435	
17	(0.283×1.075+2.0×0.2-1/2×0.2²) ×2	m^2	1.36845	
18	(0.4×1.0+1.0×3.0+1/2×0.2²×2+1/2× (0.6+1.0) ×0.2) ×2	m^2	7.2	
19	1.075×1.8×2+0.49×4.65	m^2	6.1485	
20	(0.283×1.075+0.5×2.3-1/2×0.2²) ×2	m^2	2.86845	
21	4.65×2.0-1.0×1.25×2+1/2×0.2²×2×2+1.075+1.0×	m^2	9.955	
22	(1.1×4+0.85×2+0.283×8) ×11.48	m^2	96.01872	
23	2.0×0.5×2+3.65×0.5	m^2	3.825	
24	0.5×3.5×2	m^2	3.5	
25	1.9×3.5×2	m^2	13.3	
26	1.906×5.825×2	m^2	22.2049	
27	(0.5× (1.5+1.675)) ×2	m^2	3.175	
28	(2.0×0.5+1/2× (0.38+0.5) ×1.5+1/2× (0.6+0.8) ×0.2) ×2	m^2	3.6	
29	(3.175×2.0+0.5×0.7) ×2+0.55×1.85	m^2	14.4175	
30	2.0×12.9×2	m^2	51.6	
31	(1.1×4+0.85×2+0.283×8) ×14.4	m^2	120.4416	
TOTAL		m^2	456.281	

LEVELLING CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(0.23+0.3)×0.15×2	m^2	0.0795	
	0.283×0.15×2×2	m^2	0.62826	
	1/2×(0.6+1.0)×0.15×2	m^2	0.24	
	1/2×(1.838+1.9)×0.15×2	m^2	0.5607	
	0.15×(7.0+1.575×2)	m^2	1.5225	
2	0.1×0.5×2	m^2	0.1	
	1/2×(0.15+0.5)×0.35×2	m^2	0.2275	
	0.15×1.35×2	m^2	0.405	
3	1/2×(0.038+0.1)×0.15×2×2	m^2	0.0414	
	0.283×0.15×2×2	m^2	0.1698	
	1/2×(0.6+1.0)×0.15×2	m^2	0.24	
	0.15×(1.175×4)	m^2	0.705	
4	2.78×0.15×2	m^2	0.834	
	1/2×(0.15+0.25)×0.1×2	m^2	0.04	
	0.1×0.1×2	m^2	0.02	
5	1/2×(2.238+2.265)×0.15×2	m^2	0.67545	
	0.283×0.15×2	m^2	0.0849	
	1/2×(0.7+0.762)×0.15×2	m^2	0.2193	
	0.15×(1.175×2+6.2)	m^2	1.2825	
6	0.3×0.1×4	m^2	0.12	
	1/2×(0.15+0.30)×0.15×4	m^2	0.135	
	0.15×1.15×4	m^2	0.69	
7	1/2×(1.238+1.3)×0.15×4	m^2	0.7614	
	0.283×0.15×4	m^2	0.1698	
	1/2×(0.7+0.762)×0.15×4	m^2	0.4386	
	0.15×(1.675×2+9.4)	m^2	1.9125	
8	0.15×12.9×2	m^2	3.87	
TOTAL		m^2	16.17311	

UPSTREAM APRON
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	0.8×13.0	m^2	10.4	
2	1.0×8.0+1/2×(0.6+0.8)×0.2	m^2	8.14	
3	1/2×(1.2+2.0)×1.6×2+2.0×2.7×2	m^2	15.92	
4	2.0×4.0	m^2	8	
5	4.427×8.0+1/2×0.447×0.2×2	m^2	35.5054	
6	1.0×8.0+1/2×(0.6+0.8)×0.2	m^2	8.14	
7	2.0×2.2×2	m^2	8.8	
8	1.18×8.0	m^2	9.44	
9	$2.0\times8.0-2.85\times1.2+1/2\times0.20^2\times2+1/2\times(0.6+0.8)\times0.2$	m^2	12.76	
10		m^2		
11	(1/2×3.6×1.8+1.8×2.54)×2×2	m^2	31.248	
12	(1/2×0.34×0.283+0.283×(6.04×0.5-0.34))×2	m^2	1.6131	
13	1.0×8.0+1/2×(0.6+0.8)×0.2	m^2	8.14	
14	4.427×8.0+1/2×0.447×0.2×2	m^2	35.5054	
15	1.0×8.0+1/2×(0.6+0.8)×0.2	m^2	8.14	
16	1.18×8.0	m^2	9.44	
17	$2.0\times8.0-3.35\times1.2+1/2\times0.20^2\times2+1/2\times(0.6+0.8)\times0.2$	m^2	12.16	
18		m^2		
19		m^2		
20	(1/2×0.34×0.283+0.283×(6.04×0.5-0.34))×2	m^2	1.6131	
TOTAL		m^2	224.965	

LEVELING CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	0.15×13.0×2	m^2	3.9	
2	0.15×0.1×2	m^2	0.03	
3	(0.15×4.5×2)×2	m^2	2.7	
4	(0.15×4.1×2)×2	m^2	2.46	
5	(0.15×2.2×2)×2	m^2	1.32	
6	(1/2×(7.2+7.138)×0.15×4)×2	m^2	8.6028	
7	(0.283×0.15×4)×2	m^2	0.3396	
8	(1/2×(0.7+0.762)×0.15×4)×2	m^2	0.8772	
TOTAL		m^2	20.2296	

INTAKE GATE RIGHT
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1.0×6.25	m^2	6.25	
2	1.05×1.75×2	m^2	3.675	
	3.75×0.7×2	m^2	5.25	
	7.95×0.7×2	m^2	11.13	
	1.5×5.45+1.3×5.45	m^2	15.26	
3		m^2		
4	4.95×2.0-4.15×1.47	m^2	3.7995	
5	$4.15\times2.0-1.5^2\times2+1/2\times0.2^2\times8$	m^2	3.96	
6		m^2		
7	(1.8+0.283)×2.275×2	m^2	9.47765	
8		m^2		
9	π×0.85×1/2×2.0	m^2	2.670354	
10	(1.8+0.283)×2.275×2	m^2	9.47765	
11		m^2		
12	(1.75×2+0.7×2)×0.2×2	m^2	1.96	
13		m^2		
14		m^2		
15	1.75×0.25×4	m^2	1.75	
16		m^2		
17	(0.283×2+1.33×2+1.25)×0.6×2	m^2	5.3712	
	1/2×((0.283×4+1.33×2+0.85)+(0.284×4+1.13×2+1.1))×2.6×2	m^2	23.7588	
	1/2×((0.283×4+1.1×3)+(0.284×4+1.13×2+1.1))×2	m^2	10.2672	
18		m^2		
19		m^2		
20		m^2		
21	0.707×6.25×2	m^2	8.8375	
22	1.525×0.8×2	m^2	2.44	
	$1/2\times0.5^2\times2$	m^2	0.25	
	1/2×(0.6+0.8)×0.2	m^2	0.14	
TOTAL		m^2	125.7249	

INTAKE GATE LEFT
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1.0×6.25		6.25	
2	1.05×1.75×2		3.675	
	3.75×0.7×2		5.25	
	7.95×0.7×2		11.13	
	1.5×5.45+1.3×5.45		15.26	
3				
4	4.45×2.0-3.65×1.47		3.5345	
5	$3.65\times2.0-1.5\times1.25\times2+1/2\times0.2^2\times8$		3.71	
6				
7	(1.82+0.283)×2.275×2		9.56865	
8				
9	$\pi\times0.85\times1/2\times2.0$		2.670354	
10	(1.82+0.283)×2.275×2		9.56865	
11				
12	(1.5×2+0.7×2)×0.2×2		1.76	
13				
14				
15	1.75×0.25×4		1.75	
16				
17	(0.283×2+1.33×2+1.25)×0.6×2		5.3712	
	1/2×((0.283×4+1.33×2+0.85)+(0.284×4+1.13×2+1.1))×2.6×2		23.7588	
	1/2×((0.283×4+1.1×3)+(0.284×4+1.13×2+1.1))×2.3		10.2672	
18				
19				
20				
21	0.707×6.25×2		8.8375	
22	1.775×0.8×2		2.84	
	$1/2\times0.5^2\times2$		0.25	
	1/2×(0.6+0.8)×0.2		0.14	
TOTAL			125.5919	

INTAKE GATE RIGHT
LEVELLING CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	6.35×0.15	m^2	0.9525	
2	1.525×0.15	m^2	0.22875	
3	1/2×(0.663+0.725)×0.15	m^2	0.1041	
	0.283×0.15	m^2	0.04245	
	1/2×(0.6+0.663)×0.15	m^2	0.094725	
4	5.45×0.15×2	m^2	1.635	
5	4.95×0.15	m^2	0.7425	
TOTAL		m^2	3.800025	

INTAKE GATE LEFT
LEVELLING CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	6.35×0.15		0.9525	
2	1.775×0.15		0.26625	
3	1/2×(0.913+0.975)×0.15		0.1416	
	0.283×0.15		0.04245	
	1/2×(0.6+0.663)×0.15		0.094725	
4	5.45×0.15×2		1.635	
5	4.45×0.15		0.6675	
TOTAL			3.800025	

MAIN BODY
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	4.8×0.5×2×2	m^2	9.6	
	1/2×4.8×9.6×2×2	m^2	92.16	
2	1/2×(6.682+6.732)×0.1×4	m^2	2.6828	
3		m^2		
4		m^2		
5	1/2×2.5×3.75×4	m^2	18.75	
6		m^2		
7	1/2×0.9×0.6×4	m^2	1.08	
8		m^2		
9		m^2		
10	0.5×4.6×4	m^2	9.2	
11				
12		m^2		
13	12×6.682×2	m^3	160.368	
TOTAL		m^2	293.8408	

DOWNSTREAM APRON
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	1/2×(0.5+9.5)×4.5×2	m^2	45	
2	1/2×4.375×2.5×2	m^2	10.9375	
3	1/2×0.7×0.525×2	m^2	0.3675	
4		m^2		
5		m^2		
6	0.5×4.5×2	m^2	4.5	
7		m^2		
8		m^2		
9		m^2		
10		m^2		
TOTAL		m^2	60.805	

SLUICE RIGHT
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	0.4×4.98×2	m^2	3.984	
2		m^2		
3	0.4×1.4×2	m^2	1.12	
4	0.9×1.125×4	m^2	4.05	
5		m^2		
6		m^2		
7		m^2		
8		m^2		
9		m^2		
10		m^2		
11	0.5×0.6×2	m^2	0.6	
12	6.4×0.8-1.5×0.3×2+1/2×0.2^2×2×2	m^2	4.3	
13		m^2		
14		m^2		
15		m^2		
16	1.025×0.79×2	m^2	1.6195	
17		m^2		
18	0.4×1.79×2	m^2	1.432	
19	1.025×0.79×2	m^2	1.6195	
20		m^2		
21	5.15×1.3-1.5×0.5×2+1/2×0.2^2×2×2	m^2	5.275	
22		m^2		
23	0.4×0.5×2	m^2	0.4	
24		m^2		
25		m^2		
26		m^2		
27		m^2		
28	1/2×(0.35+0.38)×0.4×2	m^2	0.292	
29	3.125×0.6×2	m^2	3.75	
30	4.15×0.4×3	m^2	4.98	
31	0.4×48.9×2	m^2	39.12	
32		m^2		
TOTAL		m^2	72.542	

SLUICE LEFT
CONCRETE

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	0.4×4.98×2	m^2	3.984	
2		m^2		
3	0.4×1.4×2	m^2	1.12	
4	0.9×1.175×4	m^2	4.23	
5		m^2		
6		m^2		
7		m^2		
8		m^2		
9		m^2		
10		m^2		
11	0.5×0.6×2	m^2	0.6	
12	$6.0\times0.8-1.25\times0.3\times2+1/2\times0.2^2\times2\times2$	m^2	4.13	
13		m^2		
14		m^2		
15		m^2		
16	1.075×1.8×2+0.79×4.65	m^2	7.5435	
17		m^2		
18	0.4×1.79×2	m^2	1.432	
19	1.075×0.79×2	m^2	1.6985	
20		m^2		
21	$4.65\times1.3-1.25\times0.5\times2+1/2\times0.2^2\times2\times2$	m^2	4.875	
22		m^2		
23	0.4×0.5×2	m^2	0.4	
24		m^2		
25		m^2		
26		m^2		
27		m^2		
28	1/2×(0.35+0.38)×0.4×2	m^2	0.292	
29	3.175×0.6×2	m^2	3.81	
30	0.4×12.9×2	m^2	10.32	
31		m^2		
TOTAL		m^2	44.435	

UPSTREAM APRON
CONCRETE

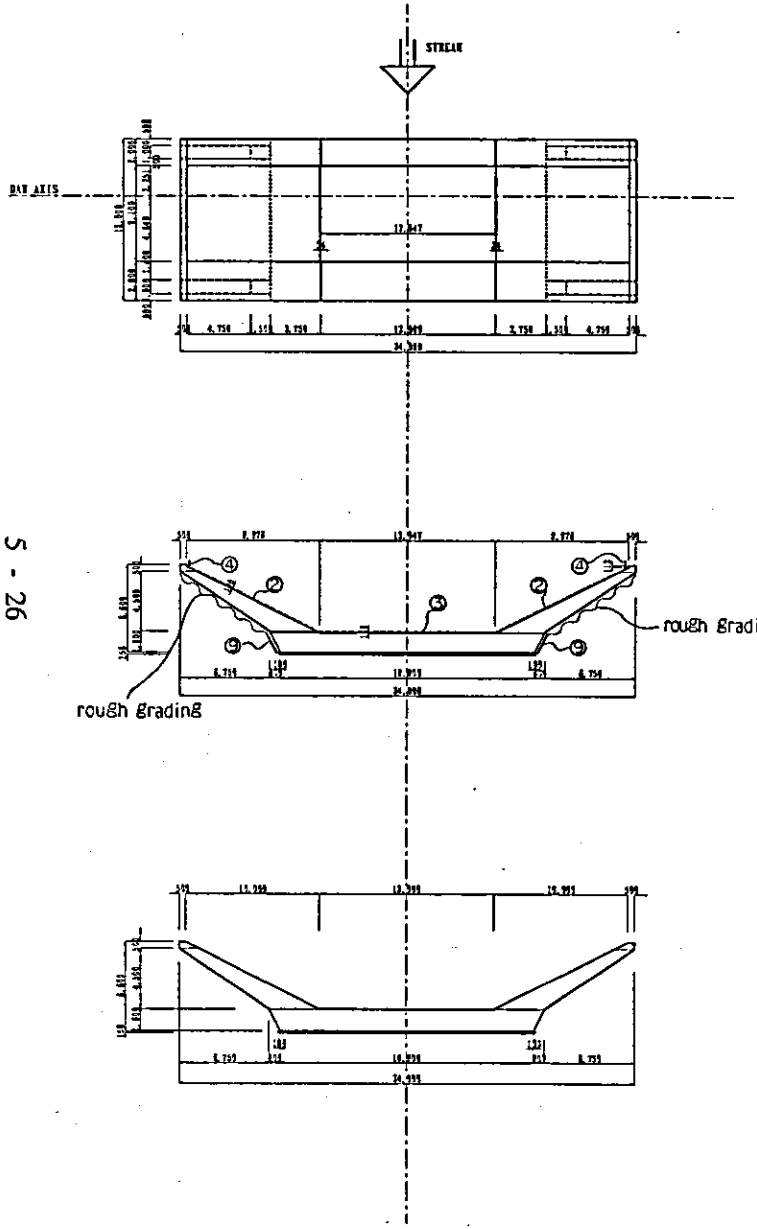
NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1		m^2		
2		m^2		
3	1/2×2.7×1.35×2	m^2	3.645	
4	1/2×(0.35+2.35)×4.0×2	m^2	10.8	
5		m^2		
6		m^2		
7	(1/2×(0.5+2.2)×0.85+2.2×1.17)×2	m^2	7.443	
8		m^2		
9	1.82×8.0-2.85×1.82	m^2	9.373	
10	6.753×2.575×2	m^2	34.77795	
11	1/2×(0.5+2.54)×1.02×2×2	m^2	6.2016	
12		m^2		
13		m^2		
14		m^2		
15		m^2		
16		m^2		
17	1.82×8.0-3.35×1.82	m^2	8.463	
18	6.753×2.325×2	m^2	31.40145	
19		m^2		
20		m^2		
TOTAL		m^2	112.105	

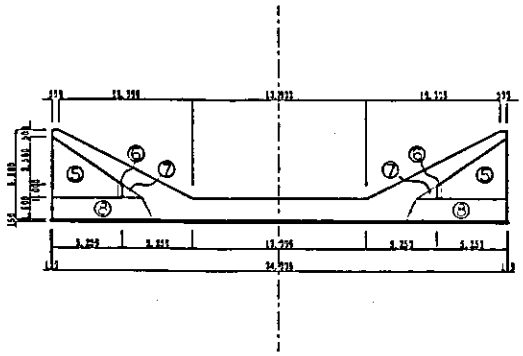
INTAKE GATE RIGHT
CONCRETE

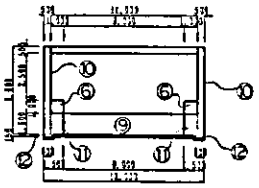
NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1		m^2		
2	$3.75 \times 1.82 \times 2$	m^2	13.65	
	$1/2 \times 0.4^2 \times 2$	m^2	0.16	
	$7.95 \times 1.33 \times 2$	m^2	21.147	
3	$0.45 \times (2.5 \times 2 + 6.975 \times 2)$	m^2	8.5275	
4	$4.95 \times 1.33 - 4.15 \times 0.93$	m^2	2.724	
5	4.15×0.4	m^2	1.66	
6	$2.82 \times 0.425 \times 2$	m^2	2.397	
7	$0.62 \times 2.275 \times 2$	m^2	2.821	
8	$0.2 \times 2.275 \times 2 + 0.2 \times 0.1 \times 2$	m^2	0.95	
9	$\pi \times 0.85 \times 1/2 \times 1.02$	m^2	1.36188	
10	$0.62 \times 2.275 \times 2$	m^2	2.821	
11	$0.2 \times 2.275 \times 2 + 0.2 \times 0.1 \times 2$	m^2	0.95	
12		m^2		
13	$4.77 \times 0.7 \times 4$	m^2	13.356	
14	$1.75 \times 0.35 \times 4$	m^2	2.45	
15		m^2		
16	$1.49 \times 1.25 \times 2$	m^2	3.725	
17		m^2		
18	$1/2 \times (1.05 + 2.5) \times 0.522 \times 2$	m^2	1.8531	
	$1/2 \times (1.05 + 2.5) \times 0.335 \times 4$	m^2	2.3785	
	$1/2 \times (0.8 + 1.6) \times 0.74 \times 4$	m^2	3.552	
	$1/2 \times (0.85 + 1.45) \times 0.74 \times 2$	m^2	1.702	
	$0.65 \times 2.5 \times 2 + 0.25 \times 0.7 \times 4$	m^2	3.95	
	1.025×2.5	m^2	2.5625	
19	$1.75 \times 0.55 \times 2$	m^2	1.925	
	1.75×0.35	m^2	0.6125	
	$1.75 \times 0.25 \times 4$	m^2	1.75	
20	0.656×4.95	m^2	3.2472	
	$1.75 \times (0.8 \times 2 + 0.85)$	m^2	4.2875	
21		m^2		
22		m^2		
		m^2		
		m^2		
TOTAL		m^2	106.5207	

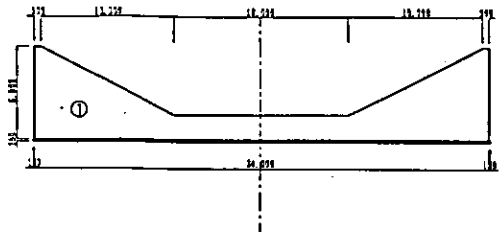
INTAKE GATE LEFT
CONCRETE

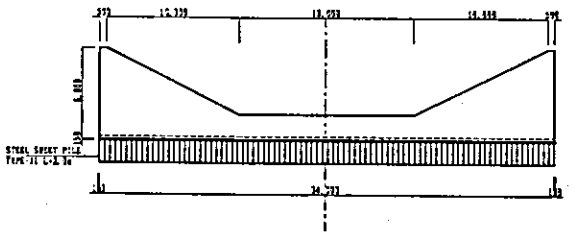
NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1				
2	3.75×1.82×2		13.65	
	1/2×0.4²×2		0.16	
	7.95×1.33×2		21.147	
3	0.45×(2.5×2+6.725×2)		8.3025	
4	4.45×1.33-3.65×0.93		2.524	
5	3.65×0.4		1.46	
6	2.82×0.425×2		2.397	
7	0.62×2.275×2		2.821	
8	0.2×2.275×2+0.2×0.1×2		0.95	
9	π×0.85×1/2×1.02		1.36188	
10	0.62×2.275×2		2.821	
11	0.2×2.275×2+0.2×0.1×2		0.95	
12				
13	4.77×0.7×4		13.356	
14	1.75×0.35×4		2.45	
15				
16	1.49×1.0×2		2.98	
17				
18	1/2×(1.05+2.5)×0.522×2		1.8531	
	1/2×(1.05+2.5)×0.335×4		2.3785	
	1/2×(0.8+1.6)×0.74×4		3.552	
	1/2×(0.85+1.45)×0.74×2		1.702	
	0.4×2.5×2+0.25×0.7×4		2.7	
	1.275×2.5		3.1875	
19	1.75×0.55×2		1.925	
	1.75×0.35		0.6125	
	1.75×0.25×4		1.75	
20	0.656×4.45		2.9192	
	1.75×(0.8×2+0.85)		4.2875	
21				
22				
TOTAL			104.1977	





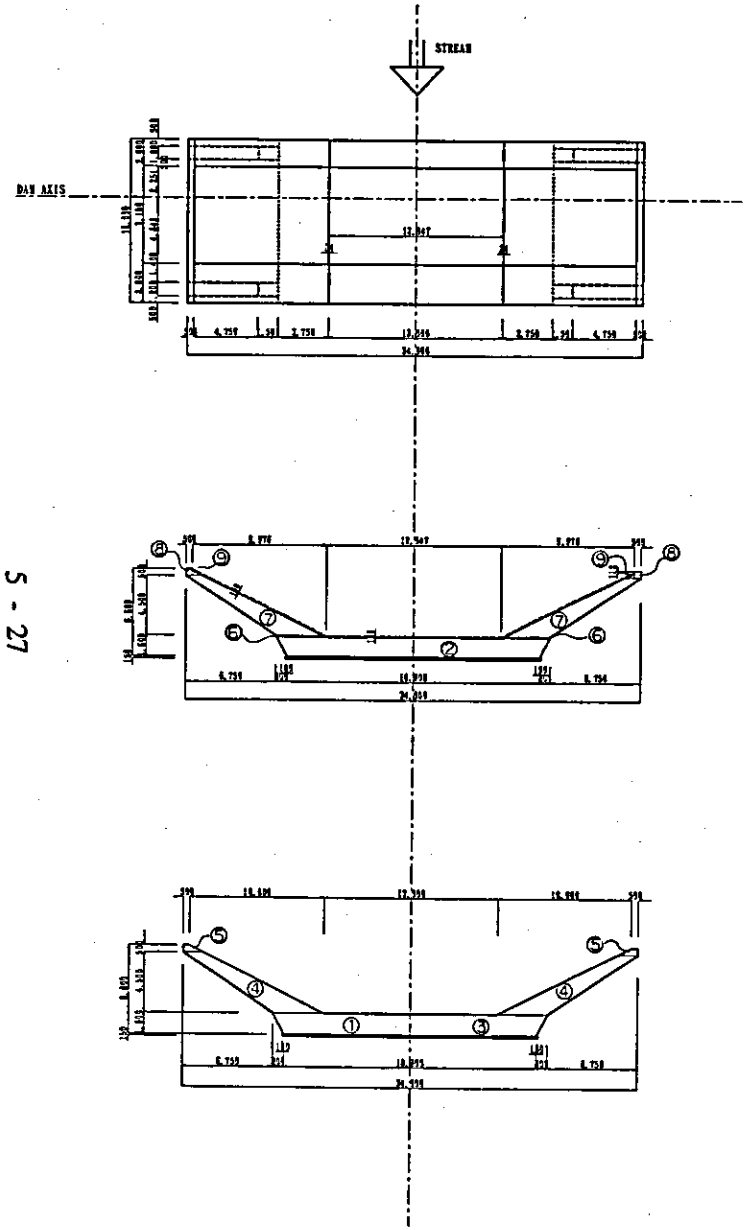


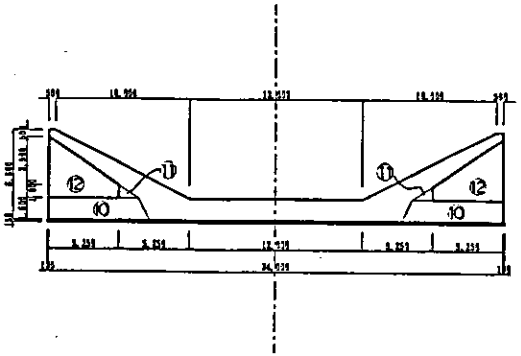


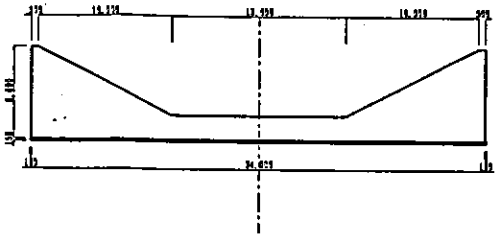


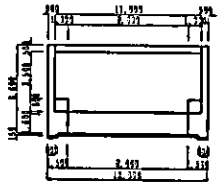
Main Body

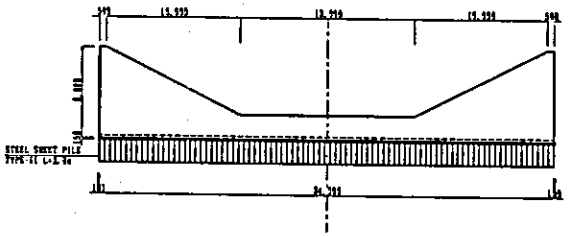
concrete
levelling concrete





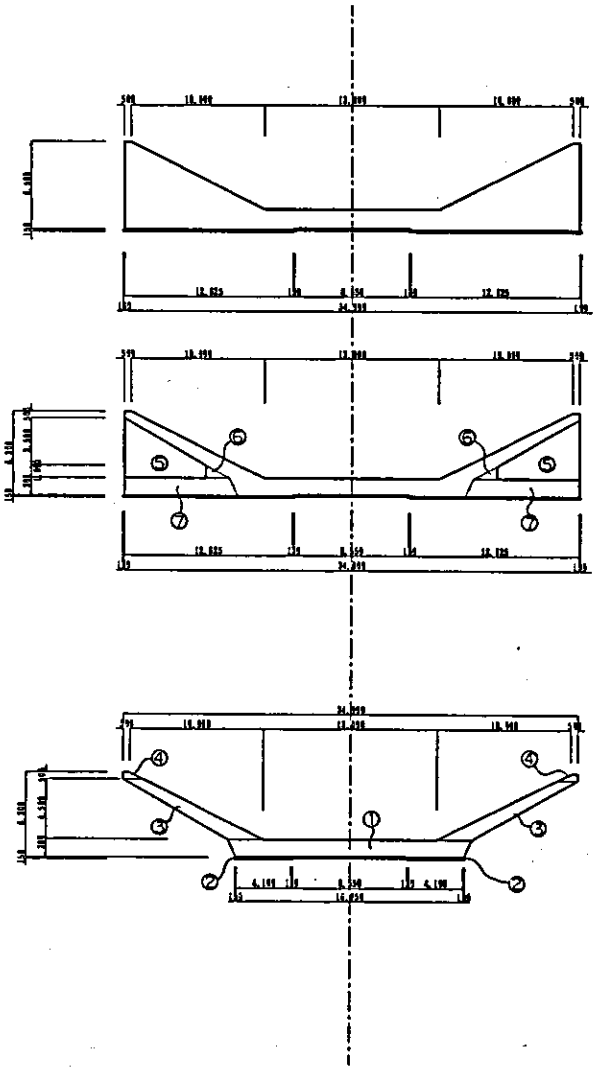


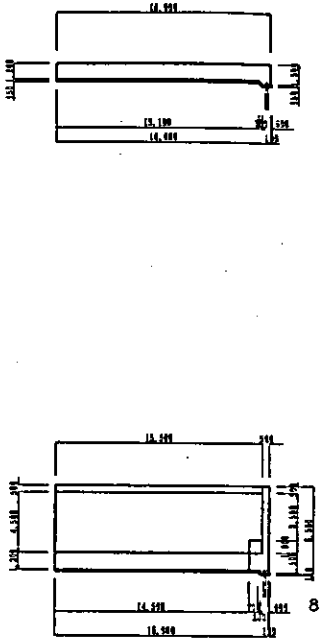


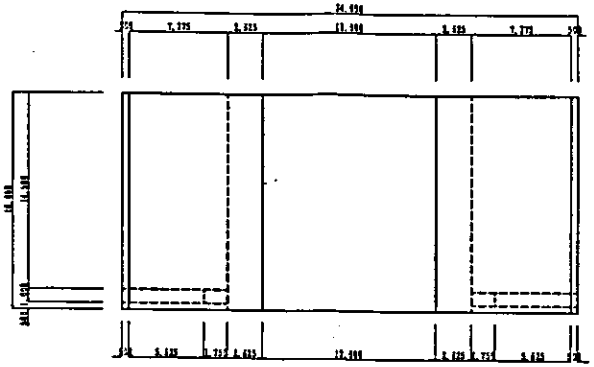


Main Body

concrete

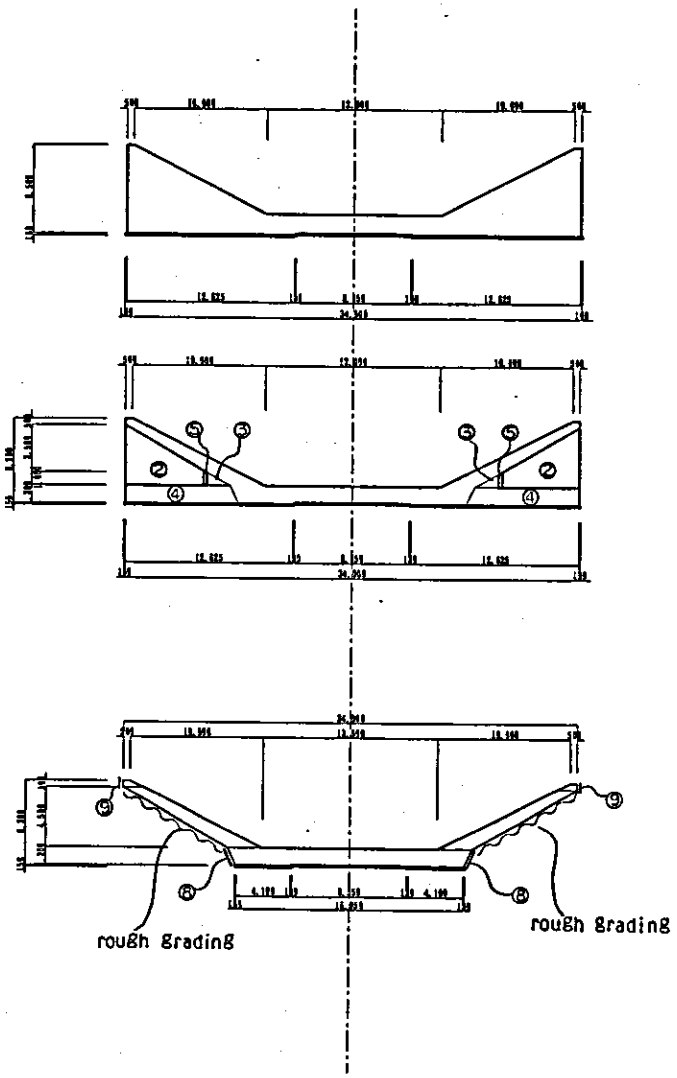


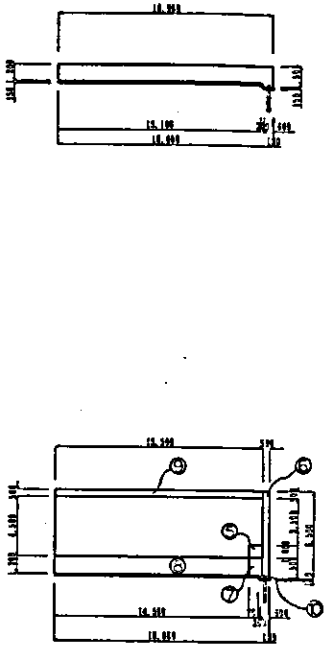


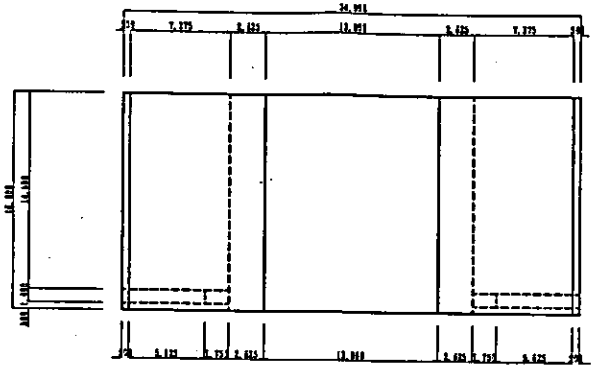


8

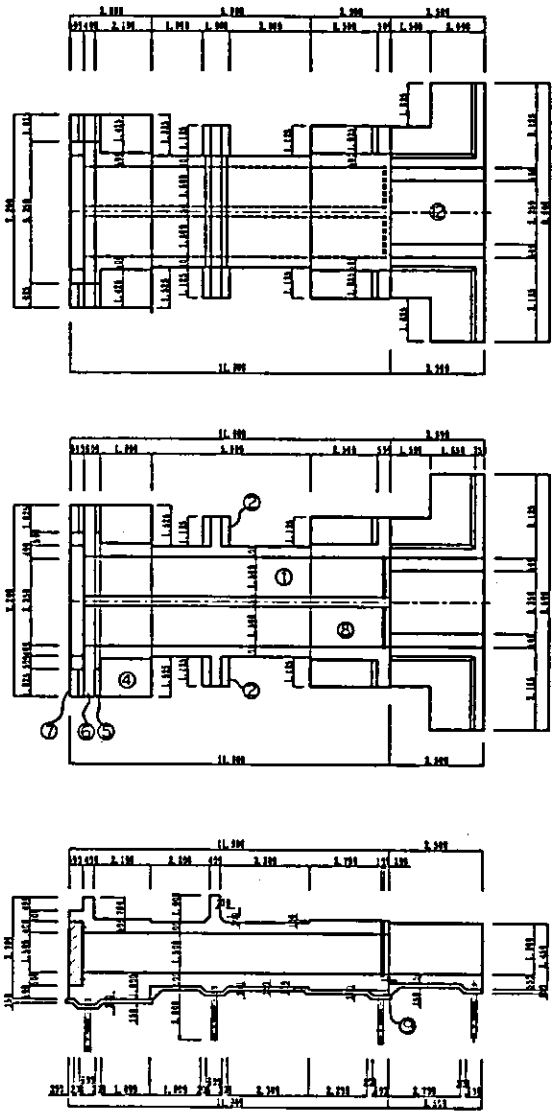
Downstream Apron

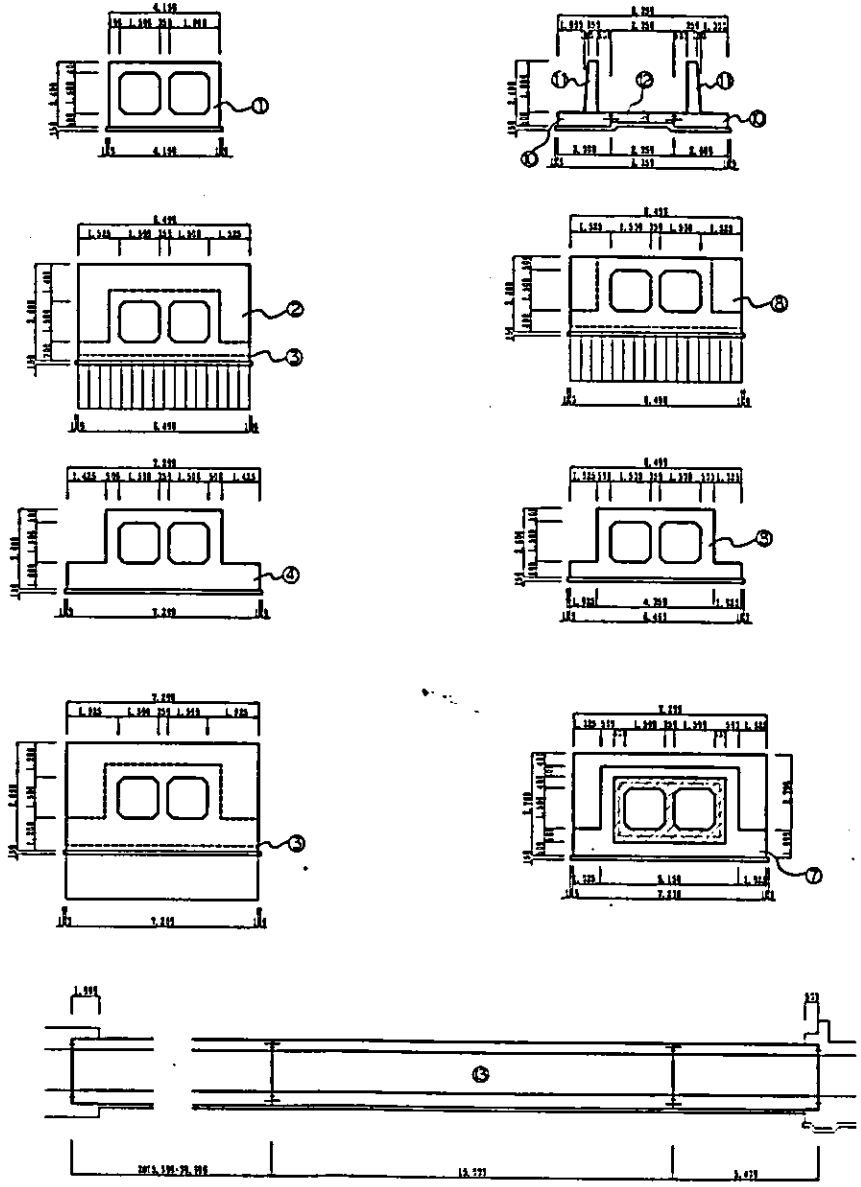




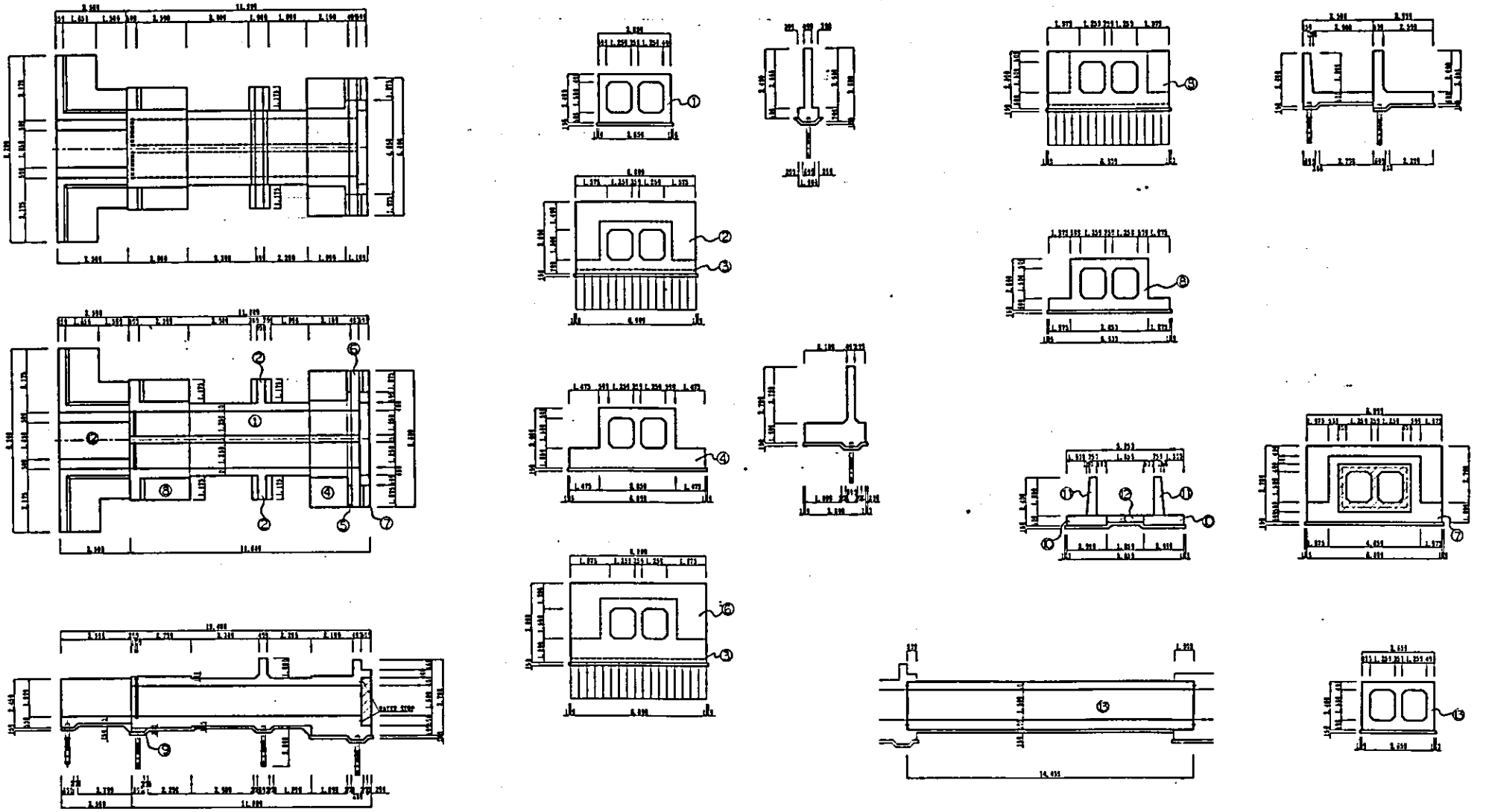


Downstream Apron

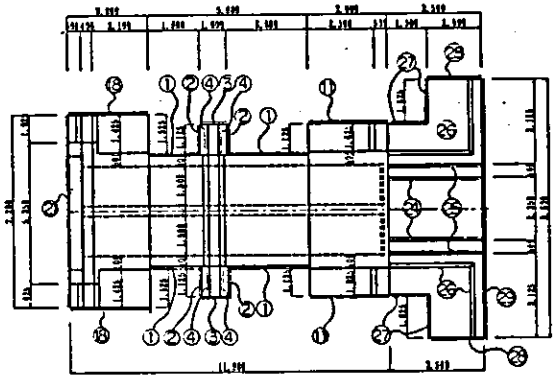


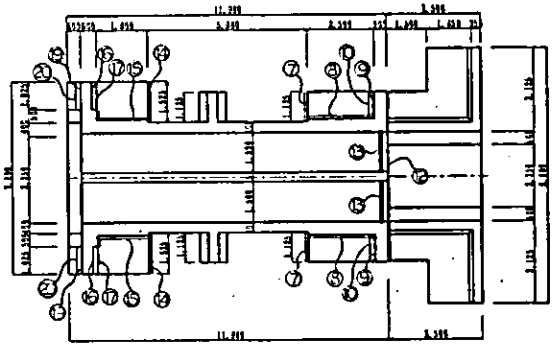


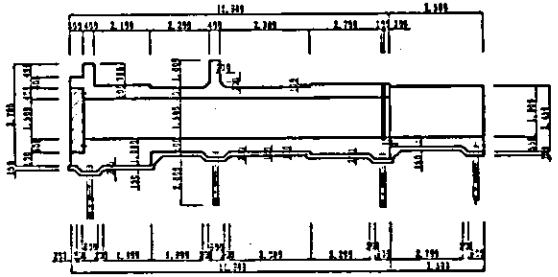
Sluice (right)

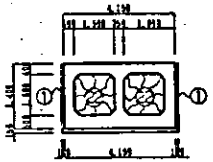


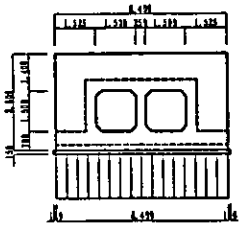
Sluice (left)

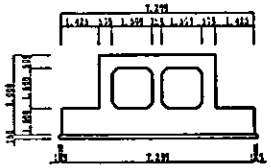


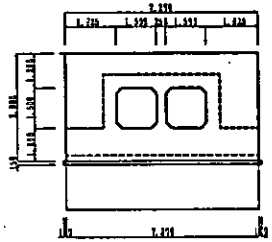


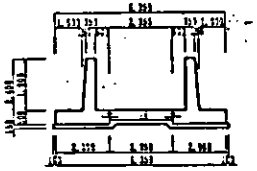


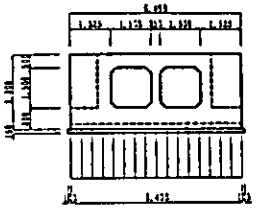


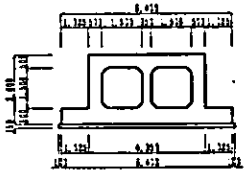


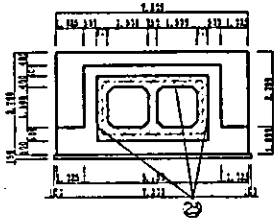


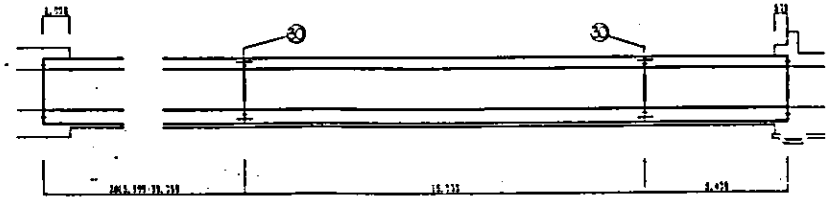


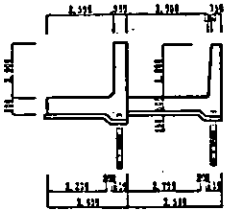


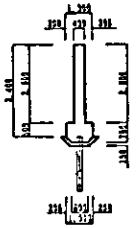


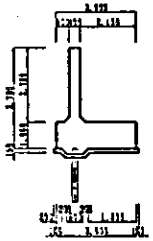


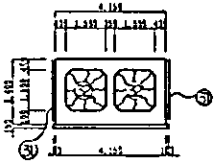




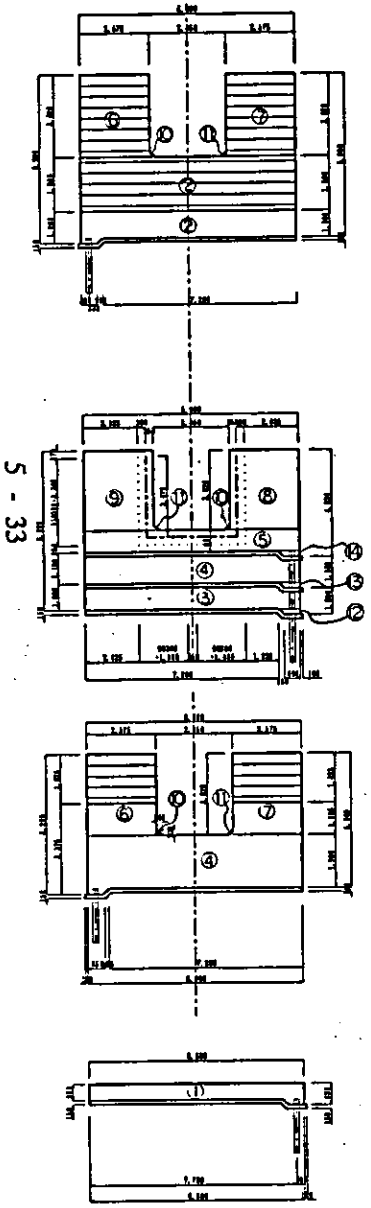


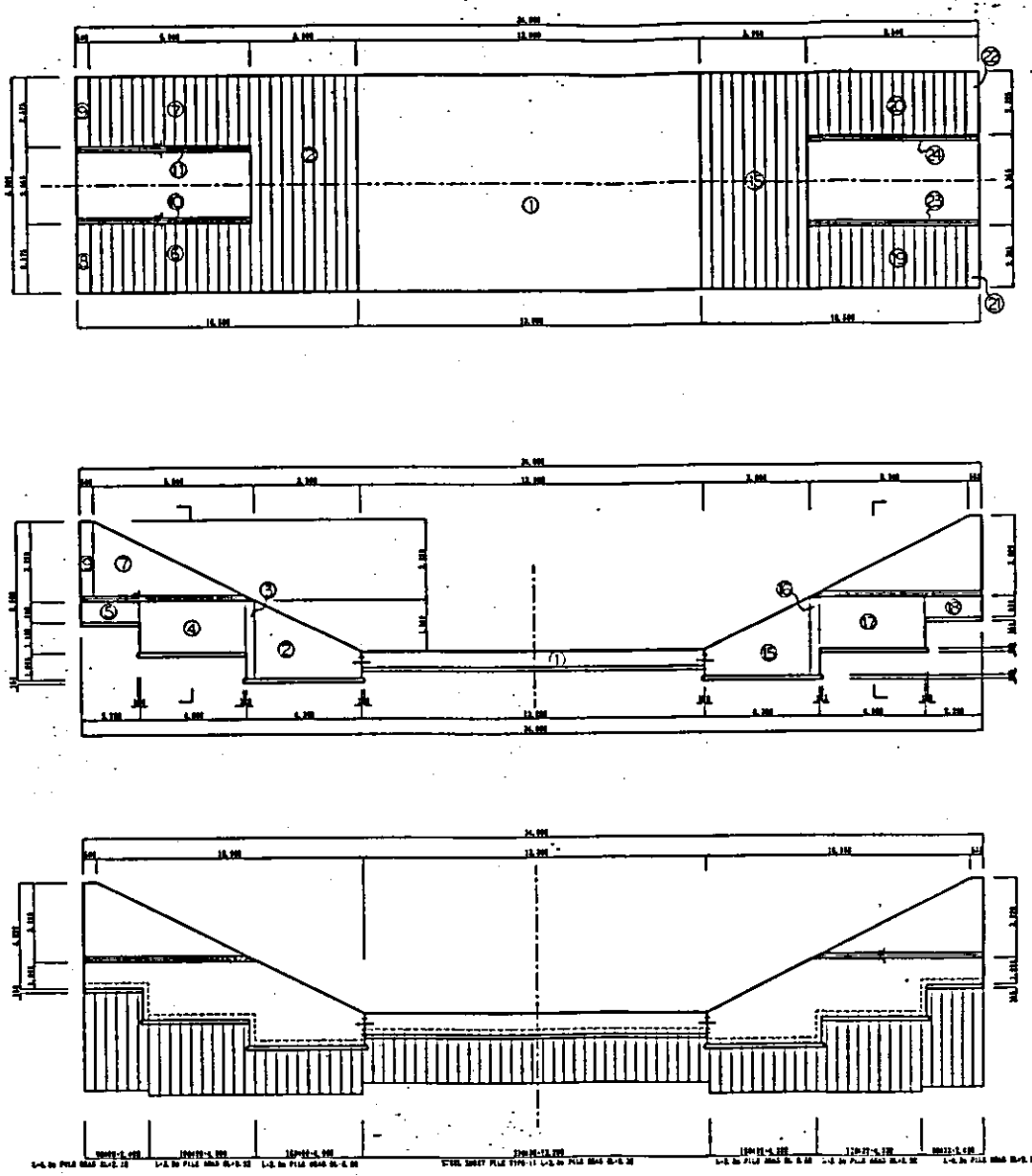


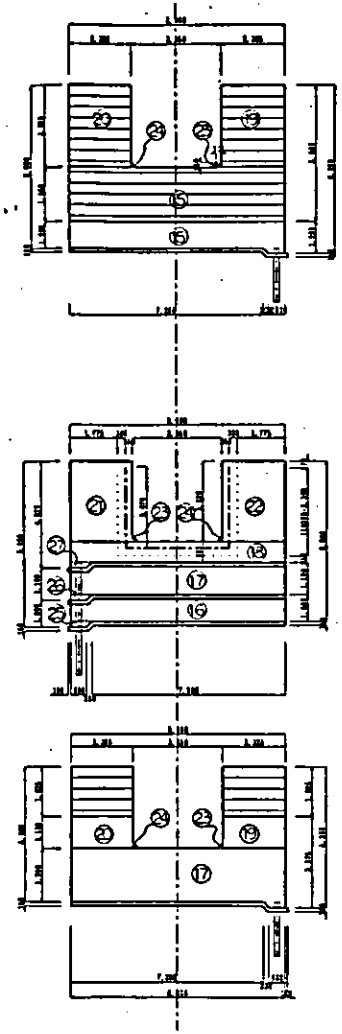




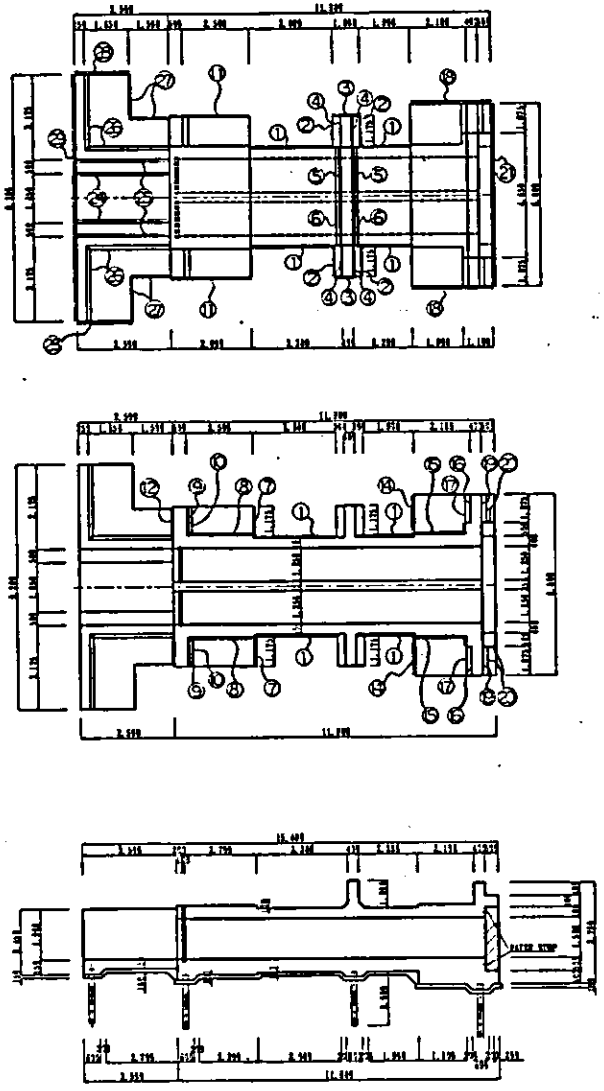
Sluice (right)



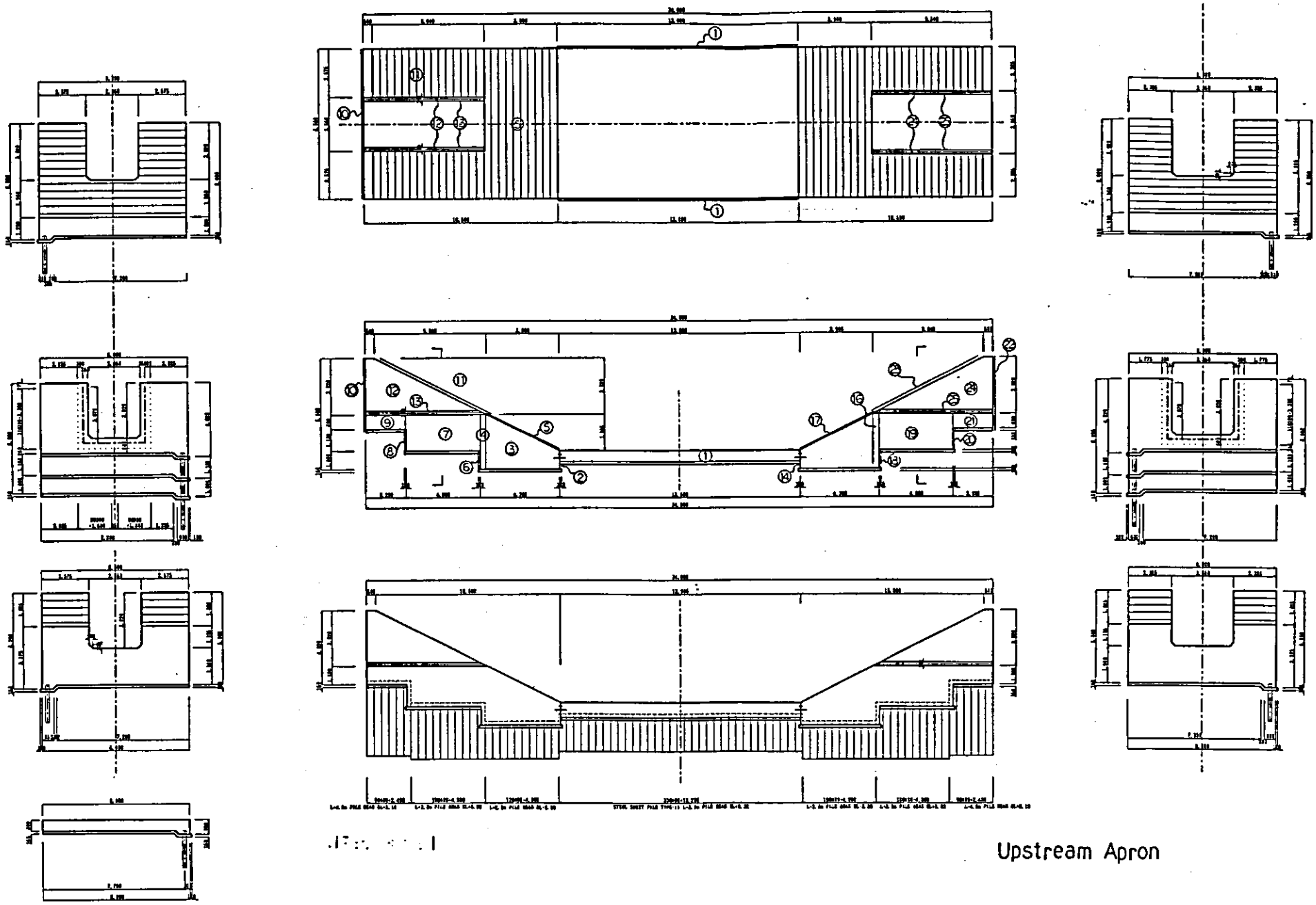




Upstream · Apron

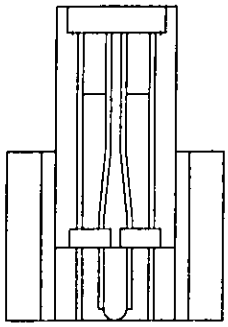


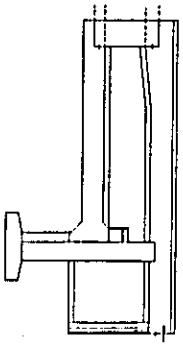
Sluice (left)

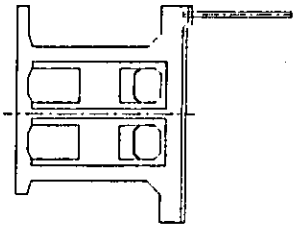


Upstream Apron

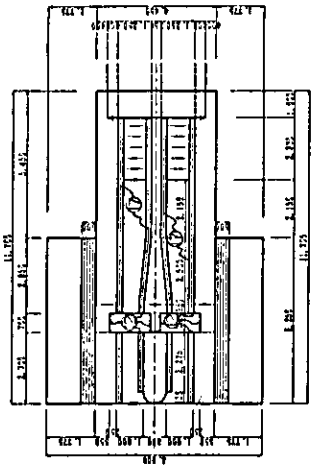
forms

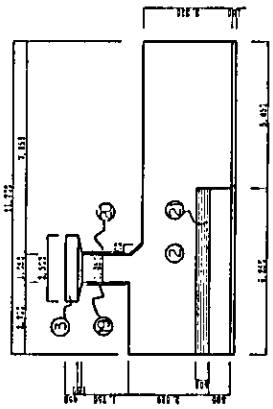


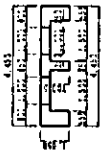


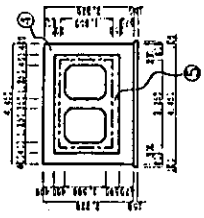


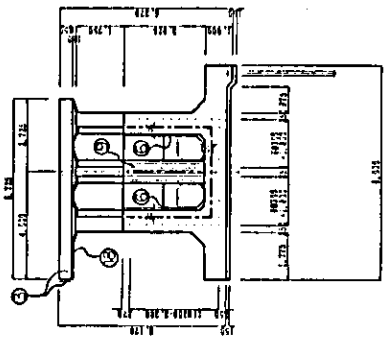
Intake Gate (left)

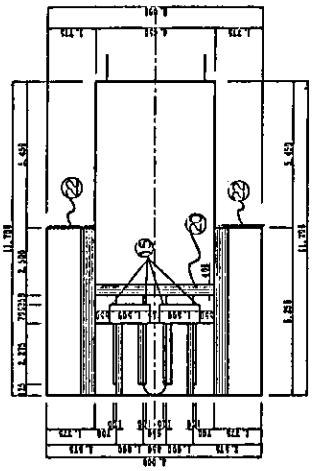


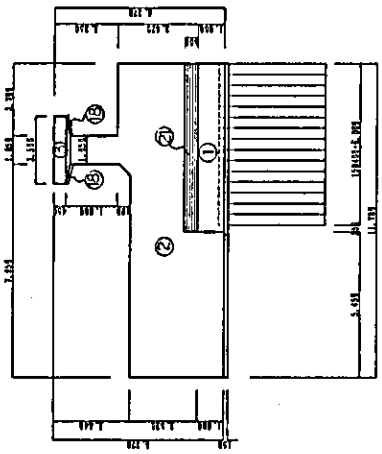


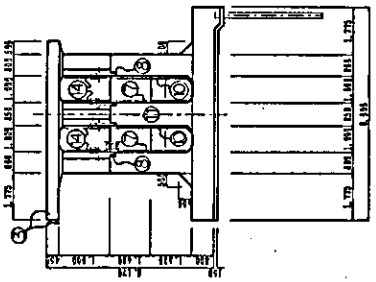


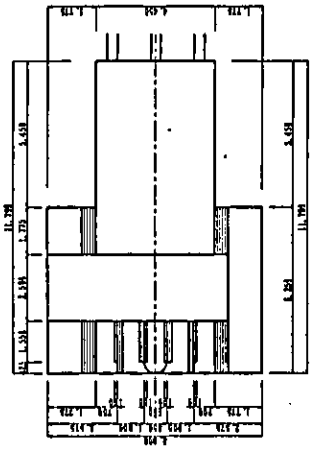


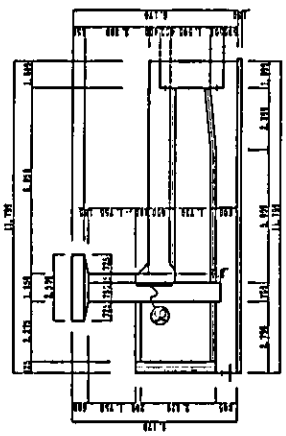


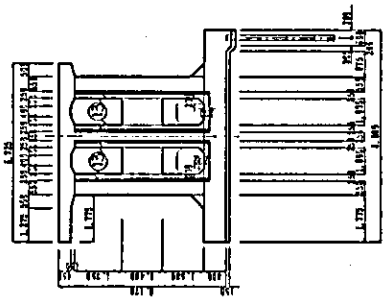


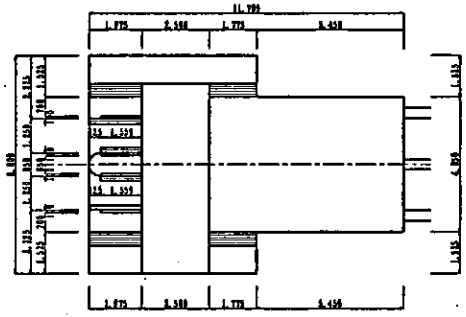


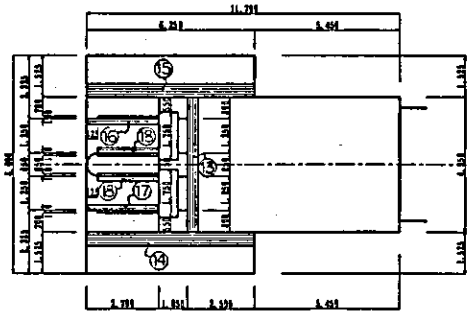


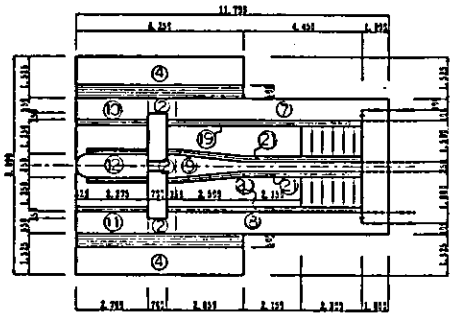


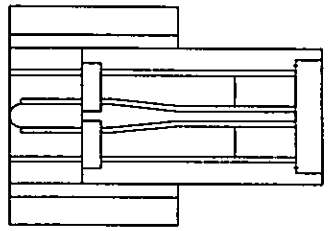


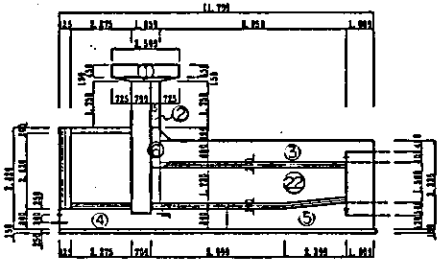


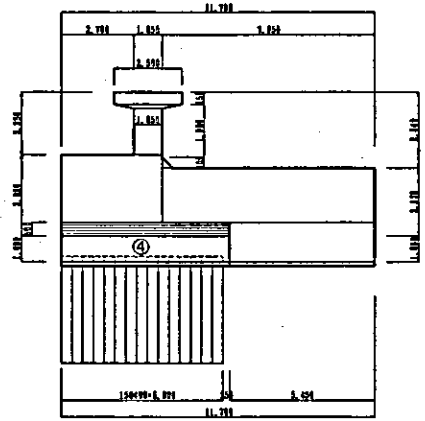


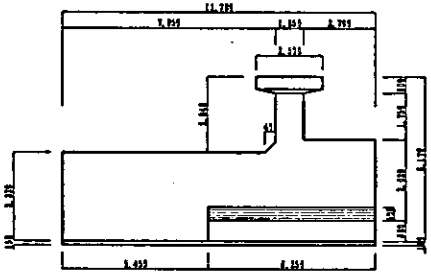


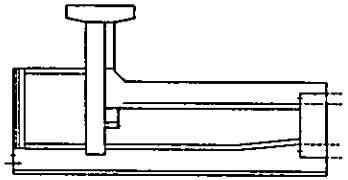


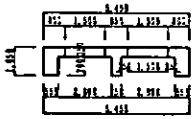


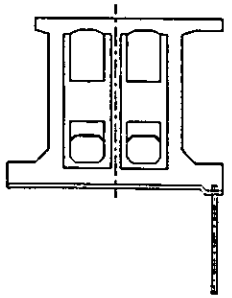


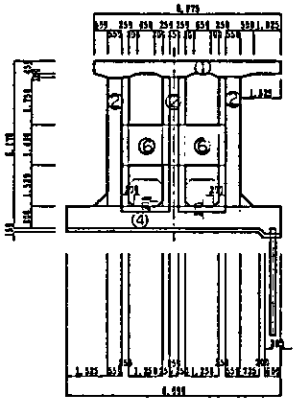


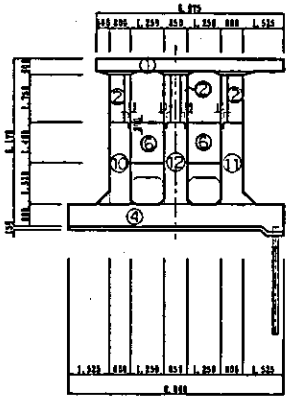


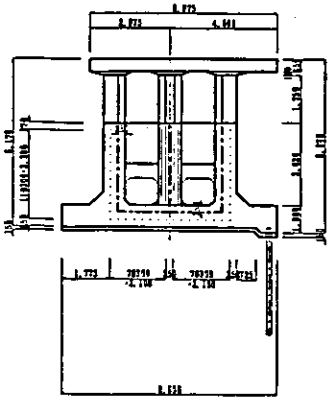


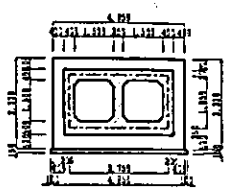












Intake Gate (right)

BETWEEN MAIN-BODY AND DOWNSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	11.275×2+13.189	m	35.739	
TOTAL		m	35.739	

BETWEEN MAIN-BODY AND UPSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	10.828×2+13.189	m	34.845	
TOTAL		m	34.845	

BETWEEN UPSTREAM-APRON AND GATE (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	3.17×2+3.85	m	10.19	
TOTAL		m	10.19	

BETWEEN UPSTREAM-APRON AND GATE (LEFT)

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	3.17×2+3.35	m	9.69	
TOTAL		m	9.69	

BETWEEN UPSTREAM-APRON AND UPSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	(7.7+0.5)×2	m	16.4	
TOTAL		m	16.4	

BETWEEN GATE AND BOX-CULVERT (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	(3.75+1.95)×2	m	11.4	
TOTAL		m	11.4	

BETWEEN GATE AND BOX-CULVERT (LEFT)

NO.	EXPRESSION	UNIT	VOLUME	REMARKS
1	(3.25+1.95)×2	m	10.4	
TOTAL		m	10.4	

BETWEEN BOX-CULVERT AND BOX-CULVERT (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	(3.55+1.75)×2×3	m	31.8
TOTAL		m	31.8

BETWEEN BOX-CULVERT AND SLUICE (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	(3.75+1.95)×2	m	11.4
TOTAL		m	11.4

BETWEEN BOX-CULVERT AND SLUICE (LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	(3.25+1.95)×2	m	10.4
TOTAL		m	10.4

BETWEEN SLUICE AND WING-WALL (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	3.55+1.9×2	m	7.35
TOTAL		m	7.35

BETWEEN SLUICE AND WING-WALL (LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	3.05+1.9×2	m	6.85
TOTAL		m	6.85

BETWEEN WING-APRON AND WING-WALL (RIGHT AND LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	((3.2+0.35)×2)×2	m	14.2
TOTAL		m	14.2

BETWEEN MAIN-BODY AND DOWNSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME
1	1/2×(0.5+1.5)×0.5×2	m²	1
2	1/2×(1.5+2.625)×4.5×2	m²	18.5625
3	1/2×(17.05+18.25)×1.2	m²	21.18
4	1/2×(4.1+4.25)×0.1×2	m²	0.835
TOTAL		m²	41.5775

BETWEEN MAIN-BODY AND UPSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME
1	13.0×0.6	m²	7.8
	1/2×(0.5+1.5)×0.5×2	m²	1
	1/2×(1.5+3.75)×4.5×2	m²	23.625
	1/2×(3.25+3.75)×1.0×2	m²	7
TOTAL		m²	39.425 ✓

BETWEEN UPSTREAM-APRON AND GATE (RIGHT AND LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	0.8×3.02×2	m²	4.832
2	1/2×0.5×0.5×2	m²	0.25
3	8.0×0.8	m²	6.4
4	1/2×(0.6+0.8)×0.2	m²	0.14
SUBTOTAL1		m²	11.622
5	SUBTOTAL×1	m²	11.622
TOTAL		m²	23.244 ✓

BETWEEN UPSTREAM-APRON AND UPSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME
1	0.8×0.6×2	m²	0.96
2	1/2×(0.6+0.8)×0.2×2	m²	0.28
TOTAL		m²	1.24 ✓

BETWEEN GATE AND BOX-CULVERT (RIGHT AND LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	4.15×2.4-1.5×1.5×2+1/2×0.2×0.2×8	m²	5.62 ✓
2	(2.4+4.15)×2×1.0	m²	13.1 ✓
3	3.65×2.4-1.25×1.5×2+1/2×0.2×0.2×8	m²	5.17
4	(2.4+3.65)×2×1.0	m²	12.1
TOTAL		m²	35.99 ✓

BETWEEN BOX-CULVERT AND BOX-CULVERT (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	(4.15×2.4-1.5×1.5×2+1/2×0.2×0.2×8)×3	m²	16.86
TOTAL		m²	16.86

BETWEEN BOX-CULVERT AND SLUICE (RIGHT AND LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	4.15×2.4-1.5×1.5×2+1/2×0.2×0.2×8	m²	5.62
2	(2.4+4.15)×2×0.5	m²	6.55
3	3.65×2.4-1.25×1.5×2+1/2×0.2×0.2×8	m²	5.17
4	(2.4+3.65)×2×0.5	m²	6.05
TOTAL		m²	23.39

BETWEEN SLUICE AND WING-WALL (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	2.35×0.35	m²	0.8225
2	1/2×(0.35+0.5)×1.9×2	m²	1.615
3	2.0×0.5×2	m²	2
TOTAL		m²	4.4375

BETWEEN SLUICE AND WING-WALL (LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	1.85×0.35	m²	0.6475
2	1/2×(0.35+0.5)×1.9×2	m²	1.615
3	2.0×0.5×2	m²	2
TOTAL		m²	4.2625

BETWEEN WING-APRON AND WING-WALL (RIGHT AND LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	3.5×0.35×2	m²	2.45
2	1/2×(0.6+0.8)×0.2×2	m²	0.28
TOTAL		m²	2.73

BETWEEN MAIN-BODY AND DOWNSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME
1	24×2+(43+1)+2	pieces	94
TOTAL		pieces	94
	94×2.25	kg	211.5

BETWEEN MAIN-BODY AND UPSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME
1	29×2+(48+1)+2	pieces	109
TOTAL		pieces	109
	109×2.25	kg	245.25

BETWEEN UPSTREAM-APRON AND GATE (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	11×2+(7+1)×2	pieces	38
TOTAL		pieces	38
	38×2.25	kg	85.5

BETWEEN UPSTREAM-APRON AND GATE (LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	11×2+(6+1)×2	pieces	36
TOTAL		pieces	36
	36×2.25		81

BETWEEN UPSTREAM-APRON AND UPSTREAM-APRON

NO.	EXPRESSION	UNIT	VOLUME
1	(24+1)×2	pieces	50
TOTAL		pieces	50
	50×2.25	kg	112.5

BETWEEN BOX-CULVERT AND BOX-CULVERT (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	(6×2+((10+1)+2)×2)×3	pieces	114
TOTAL		pieces	114
	114×2.25	kg	256.5

BETWEEN SLUICE AND WING-WALL (RIGHT AND LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	6+1+(6+1)×2	pieces	21
2	5+1+(6+1)×2	pieces	20
TOTAL		pieces	41
	41×2.25	kg	92.25

BETWEEN WING-APRON AND WING-WALL (RIGHT AND LEFT)

NO.	EXPRESSION	UNIT	VOLUME
1	(10+1)×2×2	pieces	44
TOTAL		pieces	44
	44×2.25	kg	99

MAIN BODY

NO.	EXPRESSION	UNIT	VOLUME
1	34×2÷0.4	sheets	170
	170×2	m	340
	340×0.048	ton	16.32
	340×0.4	m2	136

DOWNSTREAM APRON

NO.	EXPRESSION	UNIT	VOLUME
1	34÷0.4	sheets	85
	85×2	m	170
	170×0.048	ton	8.16
	170×0.4	m2	68

UPSTREAM APRON

NO.	EXPRESSION	UNIT	VOLUME
1	21.2÷0.4	sheets	53
	53×2	m	106
	106×0.048	ton	5.088
2	8.0÷0.4	sheets	20
	20×3	m	60
	60×0.048	ton	2.88
3	4.8÷0.4	sheets	12
	12×4	m	48
	48×0.048	ton	2.304
TOTAL		sheets	85
		m	214
		ton	10.272
	214×0.4	m2	85.6

INTAKE GATE (RIGHT)

NO.	EXPRESSION	UNIT	VOLUME
1	6.0÷0.4	sheets	15
	15×4	m	60
	60×0.048	ton	2.88
	60×0.4	m2	24

INTAKE GATE (LEFT)

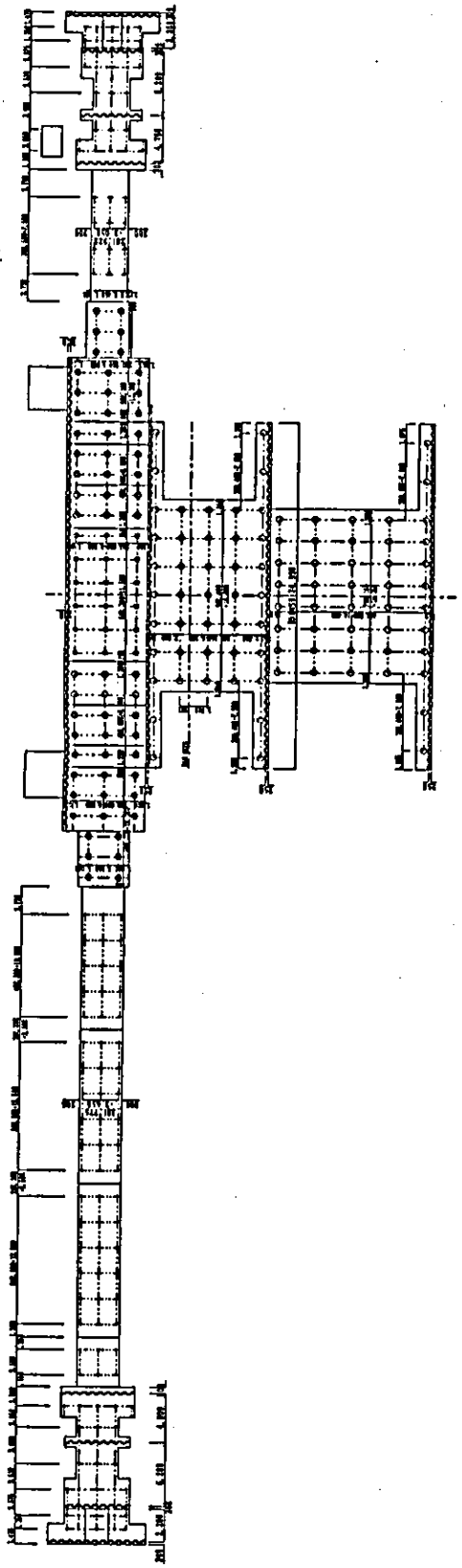
NO.	EXPRESSION	UNIT	VOLUME
1	6.0÷0.4	sheets	15
	15×4	m	60
	60×0.048	ton	2.88
	60×0.4	m2	24

SLUICE (RIGHT)

NO.		EXPRESSION	UNIT	VOLUME
1	7.2÷0.4		sheets	18
	18×2		m	36
	36×0.048		ton	1.728
2	6.4÷0.4		sheets	16
	16×2		m	32
	32×0.048		ton	1.536
3	6.4÷0.4		sheets	16
	16×2		m	32
	32×0.048		ton	1.536
4	9.6÷0.4		sheets	24
	24×2		m	48
	48×0.048		ton	2.304
TOTAL			pieces	74
			m	148
			ton	7.104
	148×0.4		m2	59.2

SLUICE (LEFT)

NO.		EXPRESSION	UNIT	VOLUME
1	6.8÷0.4		sheets	17
	17×2		m	34
	34×0.048		ton	1.632
2	6.0÷0.4		sheets	15
	15×2		m	30
	30×0.048		ton	1.44
3	6.0÷0.4		sheets	15
	15×2		m	30
	30×0.048		ton	1.44
4	9.2÷0.4		sheets	23
	23×2		m	46
	46×0.048		ton	2.208
TOTAL			pieces	70
			m	140
			ton	6.72
	140×0.4		m2	56



MARK	DIA OF PILE	LENGTH OF PILE	REMARKS
○	PC D1400	12.0 m	
●	PC D1400	13.0 m	
◆	PC D1400	14.0 m	
◆	PC D1400	12.0 m	
-	LOC D1159	3.0 m	
~	TYPE-II	2.0 m	

MAIN BODY

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D25	48	kg	3.98	20.11	80.04	3841.9	
	②	D25	48	kg	3.98	20.985	83.52	4009	
B-2	①	D16	24	kg	1.56	6.855	10.69	256.6	
	②	D16	24	kg	1.56	7.73	12.06	289.4	
B-3	①	D16	88	kg	1.56	1.32	2.06	181.3	
	②	D16	88	kg	1.56	1.32	2.06	181.3	
B-4	①	D16	54	kg	1.56	11.82	18.44	995.8	
	②	D16	54	kg	1.56	12.38	19.31	1042.7	
B-5	①	D25	94	kg	3.98	8.76	34.86	3276.8	
	②	D25	94	kg	3.98	8.76	34.86	3276.8	
B-6	①	D19	48	kg	2.25	18.864	42.44	2037.1	
	②	D19	48	kg	2.25	19.529	43.94	2109.1	
B-7	①	D16	24	kg	1.56	7.478	11.67	280.1	
	②	D16	24	kg	1.56	8.143	12.7	304.8	
B-8	①	D16	116	kg	1.56	1.32	2.06	239	
	②	D16	116	kg	1.56	1.32	2.06	239	
S-1	①	D16	16	kg	1.56	1.32	2.06	33	
	②	D16	16	kg	1.56	1.32	2.06	33	
S-2	①	D16	20	kg	1.56	3.803	5.93	118.6	
	②	D16	20	kg	1.56	3.803	5.93	118.6	
S-3	①	D22	96	kg	3.04	14.364	43.67	4192.3	
	②	D22	96	kg	3.04	15.134	46.01	4417	
S-4	①	D22	94	kg	3.04	10.815	32.88	3090.7	
	②	D22	94	kg	3.04	11.585	35.22	3310.7	
S-5	①	D16	152	kg	1.56	5.365	8.37	1272.2	AVERAGE
	②	D16	152	kg	1.56	5.365	8.37	1272.2	AVERAGE
S-6	①	D16	328	kg	1.56	3.904	6.09	1997.5	AVERAGE
	②	D16	328	kg	1.56	3.904	6.09	1997.5	AVERAGE
S-7	①	D19	96	kg	2.25	4.008	9.02	865.9	AVERAGE
	②	D19	96	kg	2.25	4.008	9.02	865.9	AVERAGE
S-8	①	D16	96	kg	1.56	10.876	16.97	1629.1	AVERAGE
	②	D16	96	kg	1.56	11.436	17.84	1712.6	AVERAGE
S-9	①	D16	94	kg	1.56	11.82	18.44	1733.4	
	②	D16	94	kg	1.56	12.38	19.31	1815.1	
S-10	①	D16	68	kg	1.56	11.82	18.44	1253.9	
	②	D16	68	kg	1.56	12.38	19.31	1313.1	
TOTAL	①			kg				27295.2	
	②			kg				28307.8	

UPSTREAM APRON (CENTER)

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D16	66	kg	1.56	12.8	19.97	1318	
	②	D16	66	kg	1.56	13.36	20.84	1375.4	
B-2	①	D16	106	kg	1.56	7.8	12.17	1290	
	②	D16	106	kg	1.56	7.8	12.17	1290	
TOTAL	①			kg				2608	
	②			kg				2665.4	

DOWNSTREAM APRON

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D22	64	kg	3.04	9.042	27.49	1759.4	
	②	D22	64	kg	3.04	9.042	27.49	1759.4	
B-2	①	D22	128	kg	3.04	4.186	12.73	1629.4	
	②	D22	128	kg	3.04	4.956	15.07	1929	
B-3	①	D16	12	kg	1.56	8.453	13.19	158.3	
	②	D16	12	kg	1.56	9.223	14.39	172.7	
B-4	①	D16	36	kg	1.56	15.82	24.68	888.5	
	②	D16	36	kg	1.56	16.38	25.55	919.8	
B-5	①	D16	34	kg	1.56	15.82	24.68	839.1	
	②	D16	34	kg	1.56	16.38	25.55	868.7	
B-6	①	D29	64	kg	5.04	17.958	90.51	5792.6	
	②	D29	64	kg	5.04	18.973	95.62	6119.7	
B-7	①	D29	126	kg	5.04	6.769	34.12	4299.1	
	②	D29	126	kg	5.04	6.769	34.12	4299.1	
B-8	①	D16	36	kg	1.56	15.82	24.68	888.5	
	②	D16	36	kg	1.56	16.38	25.55	919.8	
B-9	①	D16	12	kg	1.56	7.931	12.37	148.4	
	②	D16	12	kg	1.56	8.946	13.96	167.5	
B-10	①	D16	52	kg	1.56	1.32	2.06	107.1	
	②	D16	52	kg	1.56	1.32	2.06	107.1	
B-11	①	D16	68	kg	1.56	1.32	2.06	140.1	
	②	D16	68	kg	1.56	1.32	2.06	140.1	
S-1	①	D29	128	kg	5.04	13.879	69.95	8953.6	
	②	D29	128	kg	5.04	14.894	75.07	9609	
S-2	①	D29	126	kg	5.04	8.843	44.57	5615.8	
	②	D29	126	kg	5.04	8.843	44.57	5615.8	
S-3	①	D22	128	kg	3.04	11.463	34.85	4460.8	
	②	D22	128	kg	3.04	12.478	37.93	4855	
S-4	①	D16	92	kg	1.56	15.82	24.68	2270.6	
	②	D16	92	kg	1.56	16.38	25.55	2350.6	
S-5	①	D16	10	kg	1.56	3.177	4.96	49.6	
	②	D16	10	kg	1.56	3.177	4.96	49.6	
S-6	①	D16	8	kg	1.56	1.32	2.06	16.5	
	②	D16	8	kg	1.56	1.32	2.06	16.5	
S-7	①	D16	168	kg	1.56	3.726	5.81	976.1	AVERAGE
	②	D16	168	kg	1.56	3.726	5.81	976.1	AVERAGE
S-8	①	D16	76	kg	1.56	5.389	8.41	639.2	AVERAGE
	②	D16	76	kg	1.56	5.389	8.41	639.2	AVERAGE
S-9	①	D22	128	kg	3.04	3.001	9.12	1167.4	
	②	D22	128	kg	3.04	3.001	9.12	1167.4	
S-10	①	D16	76	kg	1.56	15.82	24.68	1875.7	
	②	D16	76	kg	1.56	16.38	25.55	1941.8	
TOTAL	①			kg				42675.8	
	②			kg				44623.9	

UPSTREAM APRON (LEFT)

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D16	16	kg	1.56	6.419	10.01	160.2	
B-2	①	D16	28	kg	1.56	7.82	12.2	341.6	
B-3	①	D16	16	kg	1.56	2.76	4.31	69	
B-4	①	D16	16	kg	1.56	4.56	7.11	113.8	
B-5	①	D16	16	kg	1.56	4.1	6.4	102.4	
B-6	①	D16	16	kg	1.56	1.725	2.69	43	
B-7	①	D16	16	kg	1.56	1.56	2.43	38.9	
B-8	①	D16	16	kg	1.56	0.784	1.22	19.5	
B-9	①	D16	16	kg	1.56	4.339	6.77	108.3	
B-10	①	D16	11	kg	1.56	7.82	12.2	134.2	
B-11	①	D16	17	kg	1.56	7.82	12.2	207.4	
B-12	①	D16	18	kg	1.56	7.82	12.2	219.6	
B-13	①	D16	4	kg	1.56	7.82	12.2	48.8	
B-14	①	D16	3	kg	1.56	7.82	12.2	36.6	
B-15	①	D16	2	kg	1.56	7.82	12.2	24.4	
B-16	①	D16	18	kg	1.56	7.82	12.2	219.6	
B-17	①	D16	42	kg	1.56	1.688	2.63	110.5	
S-1	①	D16	26	kg	1.56	2.395	3.74	97.2	
S-2	①	D16	20	kg	1.56	3.555	5.55	111	
S-3	①	D16	104	kg	1.56	3.009	4.69	487.8	AVERAGE
S-4	①	D16	52	kg	1.56	3.357	5.24	272.5	AVERAGE
S-5	①	D16	4	kg	1.56	7.291	11.37	45.5	
S-6	①	D16	56	kg	1.56	2.395	3.74	209.4	
TOTAL	①			kg				3221.2	

UPSTREAM APRON (RIGHT)

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D16	18	kg	1.56	6.419	10.01	180.2	
B-2	①	D16	28	kg	1.56	7.82	12.2	341.6	
B-3	①	D16	18	kg	1.56	2.76	4.31	77.6	
B-4	①	D16	18	kg	1.56	4.56	7.11	128	
B-5	①	D16	18	kg	1.56	4.1	6.4	115.2	
B-6	①	D16	14	kg	1.56	1.725	2.69	37.7	
B-7	①	D16	14	kg	1.56	1.56	2.43	34	
B-8	①	D16	18	kg	1.56	0.784	1.22	22	
B-9	①	D16	18	kg	1.56	4.339	6.77	121.9	
B-10	①	D16	11	kg	1.56	7.82	12.2	134.2	
B-11	①	D16	17	kg	1.56	7.82	12.2	207.4	
B-12	①	D16	18	kg	1.56	7.82	12.2	219.6	
B-13	①	D16	4	kg	1.56	7.82	12.2	48.8	
B-14	①	D16	3	kg	1.56	7.82	12.2	36.6	
B-15	①	D16	2	kg	1.56	7.82	12.2	24.4	
B-16	①	D16	18	kg	1.56	7.82	12.2	219.6	
B-17	①	D16	42	kg	1.56	1.688	2.63	110.5	
S-1	①	D16	26	kg	1.56	2.145	3.35	87.1	
S-2	①	D16	20	kg	1.56	3.555	5.55	111	
S-3	①	D16	104	kg	1.56	3.009	4.69	487.8	AVERAGE
S-4	①	D16	52	kg	1.56	3.357	5.24	272.5	AVERAGE
S-5	①	D16	4	kg	1.56	7.291	11.37	45.5	
S-6	①	D16	56	kg	1.56	2.145	3.35	187.6	
TOTAL	①			kg				3250.8	

SLUICE (LEFT)

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D16	14	kg	1.56	11.39	17.77	248.8	
	②	D16	14	kg	1.56	11.95	18.64	261	
B-2	①	D16	2	kg	1.56	7.1	11.08	22.2	
	②	D16	2	kg	1.56	7.1	11.08	22.2	
B-3	①	D16	14	kg	1.56	7.1	11.08	155.1	
	②	D16	14	kg	1.56	7.1	11.08	155.1	
B-4	①	D16	14	kg	1.56	2.9	4.52	63.3	
	②	D16	14	kg	1.56	2.9	4.52	63.3	
B-5	①	D16	14	kg	1.56	3.3	5.15	72.1	
	②	D16	14	kg	1.56	3.3	5.15	72.1	
B-6	①	D16	14	kg	1.56	0.96	1.5	21	
	②	D16	14	kg	1.56	0.96	1.5	21	
B-7	①	D16	12	kg	1.56	2.9	4.52	54.2	
	②	D16	12	kg	1.56	2.9	4.52	54.2	
B-8	①	D16	12	kg	1.56	2.8	4.37	52.4	
	②	D16	12	kg	1.56	2.8	4.37	52.4	
B-9	①	D16	16	kg	1.56	2.8	4.37	69.9	
	②	D16	16	kg	1.56	2.8	4.37	69.9	
B-10	①	D16	16	kg	1.56	2.8	4.37	69.9	
	②	D16	16	kg	1.56	2.8	4.37	69.9	
B-11	①	D16	4	kg	1.56	2.31	3.6	14.4	
	②	D16	4	kg	1.56	2.31	3.6	14.4	
T-1	①	D16	14	kg	1.56	7.1	11.08	155.1	
	②	D16	14	kg	1.56	7.1	11.08	155.1	
T-2	①	D16	16	kg	1.56	10.99	17.14	274.2	
	②	D16	16	kg	1.56	11.55	18.02	288.3	
T-3	①	D16	16	kg	1.56	2.6	4.06	65	
	②	D16	16	kg	1.56	2.6	4.06	65	
T-4	①	D16	16	kg	1.56	2.41	3.76	60.2	
	②	D16	16	kg	1.56	2.41	3.76	60.2	
K-1	①	D16	20	kg	1.56	0.77	1.2	24	
	②	D16	20	kg	1.56	0.77	1.2	24	
K-2	①	D16	12	kg	1.56	5.8	9.05	108.6	
	②	D16	12	kg	1.56	5.8	9.05	108.6	
K-3	①	D16	4	kg	1.56	5.8	9.05	36.2	
	②	D16	4	kg	1.56	5.8	9.05	36.2	
K-4	①	D16	8	kg	1.56	1.945	3.03	24.2	
	②	D16	8	kg	1.56	1.945	3.03	24.2	
K-5	①	D16	4	kg	1.56	9.649	15.05	60.2	
	②	D16	4	kg	1.56	9.649	15.05	60.2	
K-6	①	D16	14	kg	1.56	3.185	4.97	69.6	
	②	D16	14	kg	1.56	3.185	4.97	69.6	
K-7	①	D16	10	kg	1.56	1.21	1.89	18.9	
	②	D16	10	kg	1.56	1.21	1.89	18.9	
K-8	①	D16	24	kg	1.56	1.385	2.16	51.8	
	②	D16	24	kg	1.56	1.385	2.16	51.8	
K-9	①	D16	16	kg	1.56	1.889	2.95	47.2	
	②	D16	16	kg	1.56	1.889	2.95	47.2	
K-10	①	D16	16	kg	1.56	2.101	3.28	52.5	
	②	D16	16	kg	1.56	2.101	3.28	52.5	
S-1	①	D16	92	kg	1.56	0.71	1.11	102.1	
	②	D16	92	kg	1.56	0.71	1.11	102.1	
S-2	①	D16	20	kg	1.56	1.1	1.72	34.4	
	②	D16	20	kg	1.56	1.1	1.72	34.4	

S-3	①	D16	44	kg	1.56	3.575	5.58	245.5
	②	D16	44	kg	1.56	3.575	5.58	245.5
S-4	①	D16	16	kg	1.56	6.6	10.3	164.8
	②	D16	16	kg	1.56	6.6	10.3	164.8
S-5	①	D16	4	kg	1.56	4.47	6.97	27.9
	②	D16	4	kg	1.56	4.47	6.97	27.9
S-6	①	D16	24	kg	1.56	1.785	2.78	66.7
	②	D16	24	kg	1.56	1.785	2.78	66.7
S-7	①	D16	20	kg	1.56	6.6	10.3	206
	②	D16	20	kg	1.56	6.6	10.3	206
S-8	①	D16	10	kg	1.56	8.848	13.8	138
	②	D16	10	kg	1.56	8.848	13.8	138
S-9	①	D16	40	kg	1.56	2.795	4.36	174.4
	②	D16	40	kg	1.56	2.795	4.36	174.4
S-10	①	D16	40	kg	1.56	3.656	5.7	228
	②	D16	40	kg	1.56	3.656	5.7	228
S-11	①	D16	40	kg	1.56	2.313	3.61	144.4
	②	D16	40	kg	1.56	2.313	3.61	144.4
S-12	①	D16	4	kg	1.56	6.6	10.3	41.2
	②	D16	4	kg	1.56	6.6	10.3	41.2
S-13	①	D16	8	kg	1.56	3.095	4.83	38.6
	②	D16	8	kg	1.56	3.095	4.83	38.6
S-14	①	D16	4	kg	1.56	1.385	2.16	8.6
	②	D16	4	kg	1.56	1.385	2.16	8.6
S-15	①	D16	4	kg	1.56	1.263	1.97	7.9
	②	D16	4	kg	1.56	1.263	1.97	7.9
S-16	①	D16	4	kg	1.56	1.05	1.64	6.6
	②	D16	4	kg	1.56	1.05	1.64	6.6
S-17	①	D16	4	kg	1.56	1.934	3.02	12.1
	②	D16	4	kg	1.56	1.934	3.02	12.1
S-18	①	D16	4	kg	1.56	1.722	2.69	10.8
	②	D16	4	kg	1.56	1.722	2.69	10.8
D-1	①	D16	8	kg	1.56	5.8	9.05	72.4
	②	D16	8	kg	1.56	5.8	9.05	72.4
D-2	①	D16	24	kg	1.56	1.385	2.16	51.8
	②	D16	24	kg	1.56	1.385	2.16	51.8
D-3	①	D16	32	kg	1.56	2.395	3.74	119.7
	②	D16	32	kg	1.56	2.395	3.74	119.7
D-4	①	D16	8	kg	1.56	2.213	3.45	27.6
	②	D16	8	kg	1.56	2.213	3.45	27.6
D-5	①	D16	8	kg	1.56	2.425	3.78	30.2
	②	D16	8	kg	1.56	2.425	3.78	30.2
D-6	①	D16	20	kg	1.56	5.8	9.05	181
	②	D16	20	kg	1.56	5.8	9.05	181
D-7	①	D16	40	kg	1.56	2.395	3.74	149.6
	②	D16	40	kg	1.56	2.395	3.74	149.6
D-8	①	D16	10	kg	1.56	3.67	5.73	57.3
	②	D16	10	kg	1.56	3.67	5.73	57.3
D-9	①	D16	10	kg	1.56	8.314	12.97	129.7
	②	D16	10	kg	1.56	8.314	12.97	129.7
D-10	①	D16	20	kg	1.56	1.213	1.89	37.8
	②	D16	20	kg	1.56	1.213	1.89	37.8
D-11	①	D16	20	kg	1.56	1	1.56	31.2
	②	D16	20	kg	1.56	1	1.56	31.2
D-12	①	D16	20	kg	1.56	1.106	1.73	34.6
	②	D16	20	kg	1.56	1.106	1.73	34.6
D-13	①	D16	20	kg	1.56	1.319	2.06	41.2
	②	D16	20	kg	1.56	1.319	2.06	41.2

W-1	①	D16	30	kg	1.56	1.65	2.57	77.1
	②	D16	30	kg	1.56	1.65	2.57	77.1
W-2	①	D16	16	kg	1.56	3.3	5.15	82.4
	②	D16	16	kg	1.56	3.3	5.15	82.4
W-3	①	D16	32	kg	1.56	3.31	5.16	165.1
	②	D16	32	kg	1.56	3.31	5.16	165.1
W-4	①	D16	28	kg	1.56	1.81	2.82	79
	②	D16	28	kg	1.56	1.81	2.82	79
W-5	①	D16	32	kg	1.56	3.475	5.42	173.4
	②	D16	32	kg	1.56	3.475	5.42	173.4
W-6	①	D16	32	kg	1.56	3.31	5.16	165.1
	②	D16	32	kg	1.56	3.31	5.16	165.1
W-7	①	D16	25	kg	1.56	2.192	3.42	85.5
	②	D16	25	kg	1.56	2.192	3.42	85.5
W-8	①	D16	50	kg	1.56	2.185	3.41	170.5
	②	D16	50	kg	1.56	2.185	3.41	170.5
H-1	①	D16	21	kg	1.56	11.038	17.22	361.6
	②	D16	21	kg	1.56	11.598	18.09	379.9
H-2	①	D16	84	kg	1.56	2.195	3.42	287.3
	②	D16	84	kg	1.56	2.195	3.42	287.3
H-3	①	D16	42	kg	1.56	3.47	5.41	227.2
	②	D16	42	kg	1.56	3.47	5.41	227.2
H-4	①	D16	42	kg	1.56	0.98	1.53	64.3
	②	D16	42	kg	1.56	0.98	1.53	64.3
H-5	①	D16	42	kg	1.56	0.909	1.42	59.6
	②	D16	42	kg	1.56	0.909	1.42	59.6
H-6	①	D16	42	kg	1.56	1.086	1.69	71
	②	D16	42	kg	1.56	1.086	1.69	71
H-7	①	D16	42	kg	1.56	1.015	1.58	66.4
	②	D16	42	kg	1.56	1.015	1.58	66.4
I-1	①	D16	58	kg	1.56	7.908	12.34	715.7
	②	D16	58	kg	1.56	8.468	13.21	766.2
I-2	①	D16	232	kg	1.56	2.195	3.42	793.4
	②	D16	232	kg	1.56	2.195	3.42	793.4
I-3	①	D16	116	kg	1.56	3.47	5.41	627.6
	②	D16	116	kg	1.56	3.47	5.41	627.6
I-4	①	D16	116	kg	1.56	0.98	1.53	177.5
	②	D16	116	kg	1.56	0.98	1.53	177.5
I-5	①	D16	116	kg	1.56	0.909	1.42	164.7
	②	D16	116	kg	1.56	0.909	1.42	164.7
I-6	①	D16	116	kg	1.56	1.086	1.69	196
	②	D16	116	kg	1.56	1.086	1.69	196
I-7	①	D16	116	kg	1.56	1.015	1.58	183.3
	②	D16	116	kg	1.56	1.015	1.58	183.3
I-8	①	D16	28	kg	1.56	14.2	22.15	620.2
	②	D16	28	kg	1.56	14.76	23.03	644.8
I-9	①	D16	68	kg	1.56	14.2	22.15	1506.2
	②	D16	68	kg	1.56	14.76	23.03	1566
TOTAL	①			kg				11633.2
	②			kg				11812.7

SLUICE (RIGHT)

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D16	16	kg	1.56	11.39	17.77	284.3	
	②	D16	16	kg	1.56	11.95	18.64	298.2	
B-2	①	D16	2	kg	1.56	7.1	11.08	22.2	
	②	D16	2	kg	1.56	7.1	11.08	22.2	
B-3	①	D16	16	kg	1.56	7.1	11.08	177.3	
	②	D16	16	kg	1.56	7.1	11.08	177.3	
B-4	①	D16	16	kg	1.56	2.9	4.52	72.3	
	②	D16	16	kg	1.56	2.9	4.52	72.3	
B-5	①	D16	16	kg	1.56	3.3	5.15	82.4	
	②	D16	16	kg	1.56	3.3	5.15	82.4	
B-6	①	D16	16	kg	1.56	0.96	1.5	24	
	②	D16	16	kg	1.56	0.96	1.5	24	
B-7	①	D16	12	kg	1.56	2.9	4.52	54.2	
	②	D16	12	kg	1.56	2.9	4.52	54.2	
B-8	①	D16	12	kg	1.56	2.8	4.37	52.4	
	②	D16	12	kg	1.56	2.8	4.37	52.4	
B-9	①	D16	16	kg	1.56	2.8	4.37	69.9	
	②	D16	16	kg	1.56	2.8	4.37	69.9	
B-10	①	D16	16	kg	1.56	2.8	4.37	69.9	
	②	D16	16	kg	1.56	2.8	4.37	69.9	
B-11	①	D16	4	kg	1.56	2.31	3.6	14.4	
	②	D16	4	kg	1.56	2.31	3.6	14.4	
T-1	①	D16	16	kg	1.56	7.1	11.08	177.3	
	②	D16	16	kg	1.56	7.1	11.08	177.3	
T-2	①	D16	18	kg	1.56	10.99	17.14	308.5	
	②	D16	18	kg	1.56	11.55	18.02	324.4	
T-3	①	D16	18	kg	1.56	2.6	4.06	73.1	
	②	D16	18	kg	1.56	2.6	4.06	73.1	
T-4	①	D16	18	kg	1.56	2.4	3.74	67.3	
	②	D16	18	kg	1.56	2.4	3.74	67.3	
K-1	①	D16	20	kg	1.56	0.77	1.2	24	
	②	D16	20	kg	1.56	0.77	1.2	24	
K-2	①	D16	12	kg	1.56	6.2	9.67	116	
	②	D16	12	kg	1.56	6.2	9.67	116	
K-3	①	D16	4	kg	1.56	6.2	9.67	38.7	
	②	D16	4	kg	1.56	6.2	9.67	38.7	
K-4	①	D16		kg	1.56		0	0	
	②	D16		kg	1.56		0	0	
K-5	①	D16	4	kg	1.56	6.2	9.67	38.7	
	②	D16	4	kg	1.56	6.2	9.67	38.7	
K-6	①	D16	16	kg	1.56	3.185	4.97	79.5	
	②	D16	16	kg	1.56	3.185	4.97	79.5	
K-7	①	D16	12	kg	1.56	1.21	1.89	22.7	
	②	D16	12	kg	1.56	1.21	1.89	22.7	
K-8	①	D16	24	kg	1.56	1.335	2.08	49.9	
	②	D16	24	kg	1.56	1.335	2.08	49.9	
K-9	①	D16	16	kg	1.56	1.889	2.95	47.2	
	②	D16	16	kg	1.56	1.889	2.95	47.2	
K-10	①	D16	16	kg	1.56	2.1	3.28	52.5	
	②	D16	16	kg	1.56	2.1	3.28	52.5	
S-1	①	D16	98	kg	1.56	0.71	1.11	108.8	
	②	D16	98	kg	1.56	0.71	1.11	108.8	
S-2	①	D16	24	kg	1.56	1.1	1.72	41.3	
	②	D16	24	kg	1.56	1.1	1.72	41.3	

S-3	①	D16	44	kg	1.56	3.575	5.58	245.5
	②	D16	44	kg	1.56	3.575	5.58	245.5
S-4	①	D16	16	kg	1.56	7	10.92	174.7
	②	D16	16	kg	1.56	7	10.92	174.7
S-5	①	D16	4	kg	1.56	4.97	7.75	31
	②	D16	4	kg	1.56	4.97	7.75	31
S-6	①	D16	24	kg	1.56	1.735	2.71	65
	②	D16	24	kg	1.56	1.735	2.71	65
S-7	①	D16	20	kg	1.56	7	10.92	218.4
	②	D16	20	kg	1.56	7	10.92	218.4
S-8	①	D16	10	kg	1.56	9.614	15	150
	②	D16	10	kg	1.56	9.614	15	150
S-9	①	D16	40	kg	1.56	2.795	4.36	174.4
	②	D16	40	kg	1.56	2.795	4.36	174.4
S-10	①	D16	40	kg	1.56	3.656	5.7	228
	②	D16	40	kg	1.56	3.656	5.7	228
S-11	①	D16	40	kg	1.56	2.313	3.61	144.4
	②	D16	40	kg	1.56	2.313	3.61	144.4
S-12	①	D16	4	kg	1.56	7	10.92	43.7
	②	D16	4	kg	1.56	7	10.92	43.7
S-13	①	D16	8	kg	1.56	3.095	4.83	38.6
	②	D16	8	kg	1.56	3.095	4.83	38.6
S-14	①	D16	4	kg	1.56	1.335	2.08	8.3
	②	D16	4	kg	1.56	1.335	2.08	8.3
S-15	①	D16	4	kg	1.56	1.263	1.97	7.9
	②	D16	4	kg	1.56	1.263	1.97	7.9
S-16	①	D16	4	kg	1.56	1.05	1.64	6.6
	②	D16	4	kg	1.56	1.05	1.64	6.6
S-17	①	D16	4	kg	1.56	1.934	3.02	12.1
	②	D16	4	kg	1.56	1.934	3.02	12.1
S-18	①	D16	4	kg	1.56	1.722	2.69	10.8
	②	D16	4	kg	1.56	1.722	2.69	10.8
D-1	①	D16	8	kg	1.56	6.2	9.67	77.4
	②	D16	8	kg	1.56	6.2	9.67	77.4
D-2	①	D16	24	kg	1.56	1.335	2.08	49.9
	②	D16	24	kg	1.56	1.335	2.08	49.9
D-3	①	D16	32	kg	1.56	2.395	3.74	119.7
	②	D16	32	kg	1.56	2.395	3.74	119.7
D-4	①	D16	8	kg	1.56	2.313	3.61	28.9
	②	D16	8	kg	1.56	2.313	3.61	28.9
D-5	①	D16	8	kg	1.56	2.525	3.94	31.5
	②	D16	8	kg	1.56	2.525	3.94	31.5
D-6	①	D16	20	kg	1.56	2.8	4.37	87.4
	②	D16	20	kg	1.56	2.8	4.37	87.4
D-7	①	D16	40	kg	1.56	2.395	3.74	149.6
	②	D16	40	kg	1.56	2.395	3.74	149.6
D-8	①	D16	10	kg	1.56	4.17	6.51	65.1
	②	D16	10	kg	1.56	4.17	6.51	65.1
D-9	①	D16	10	kg	1.56	8.814	13.75	137.5
	②	D16	10	kg	1.56	8.814	13.75	137.5
D-10	①	D16	20	kg	1.56	1.263	1.97	39.4
	②	D16	20	kg	1.56	1.263	1.97	39.4
D-11	①	D16	20	kg	1.56	1.05	1.64	32.8
	②	D16	20	kg	1.56	1.05	1.64	32.8
D-12	①	D16	20	kg	1.56	1.156	1.8	36
	②	D16	20	kg	1.56	1.156	1.8	36
D-13	①	D16	20	kg	1.56	1.369	2.14	42.8
	②	D16	20	kg	1.56	1.369	2.14	42.8

W-1	①	D16	30	kg	1.56	2.15	3.35	100.5
	②	D16	30	kg	1.56	2.15	3.35	100.5
W-2	①	D16	20	kg	1.56	3.31	5.16	103.2
	②	D16	20	kg	1.56	3.31	5.16	103.2
W-3	①	D16	32	kg	1.56	3.31	5.16	165.1
	②	D16	32	kg	1.56	3.31	5.16	165.1
W-4	①	D16	28	kg	1.56	1.81	2.82	79
	②	D16	28	kg	1.56	1.81	2.82	79
W-5	①	D16	32	kg	1.56	3.675	5.73	183.4
	②	D16	32	kg	1.56	3.675	5.73	183.4
W-6	①	D16	32	kg	1.56	3.31	5.16	165.1
	②	D16	32	kg	1.56	3.31	5.16	165.1
W-7	①	D16	48	kg	1.56	2.192	3.42	164.2
	②	D16	48	kg	1.56	2.192	3.42	164.2
W-8	①	D16	52	kg	1.56	2.185	3.41	177.3
	②	D16	52	kg	1.56	2.185	3.41	177.3
H-1	①	D16	21	kg	1.56	12.038	18.78	394.4
	②	D16	21	kg	1.56	12.598	19.65	412.7
H-2	①	D16	84	kg	1.56	2.195	3.42	287.3
	②	D16	84	kg	1.56	2.195	3.42	287.3
H-3	①	D16	42	kg	1.56	3.97	6.19	260
	②	D16	42	kg	1.56	3.97	6.19	260
H-4	①	D16	42	kg	1.56	0.98	1.53	64.3
	②	D16	42	kg	1.56	0.98	1.53	64.3
H-5	①	D16	42	kg	1.56	0.909	1.42	59.6
	②	D16	42	kg	1.56	0.909	1.42	59.6
H-6	①	D16	42	kg	1.56	1.015	1.58	66.4
	②	D16	42	kg	1.56	1.105	1.72	72.2
H-7	①	D16	42	kg	1.56	1.086	1.69	71
	②	D16	42	kg	1.56	1.086	1.69	71
I-1	①	D16	205	kg	1.56	12.038	18.78	3849.9
	②	D16	205	kg	1.56	12.598	19.65	4028.3
I-2	①	D16	820	kg	1.56	2.195	3.42	2804.4
	②	D16	820	kg	1.56	2.195	3.42	2804.4
I-3	①	D16	410	kg	1.56	3.97	6.19	2537.9
	②	D16	410	kg	1.56	3.97	6.19	2537.9
I-4	①	D16	410	kg	1.56	0.98	1.53	627.3
	②	D16	410	kg	1.56	0.98	1.53	627.3
I-5	①	D16	410	kg	1.56	0.909	1.42	582.2
	②	D16	410	kg	1.56	0.909	1.42	582.2
I-6	①	D16	410	kg	1.56	1.105	1.72	705.2
	②	D16	410	kg	1.56	1.015	1.58	647.8
I-7	①	D16	410	kg	1.56	1.086	1.69	692.9
	②	D16	410	kg	1.56	1.086	1.69	692.9
I-8	①	D16	84	kg	1.56	14.8	23.09	1939.6
	②	D16	84	kg	1.56	15.36	23.96	2012.6
I-9	①	D16	204	kg	1.56	14.8	23.09	4710.4
	②	D16	204	kg	1.56	15.36	23.96	4887.8
I-10	①	D16	28	kg	1.56	5.2	8.11	227.1
	②	D16	28	kg	1.56	5.2	8.11	227.1
I-11	①	D16	68	kg	1.56	5.2	8.11	551.5
	②	D16	68	kg	1.56	5.2	8.11	551.5
TOTAL	①							26195.4
	②							26620.7

GATE (RIGHT)

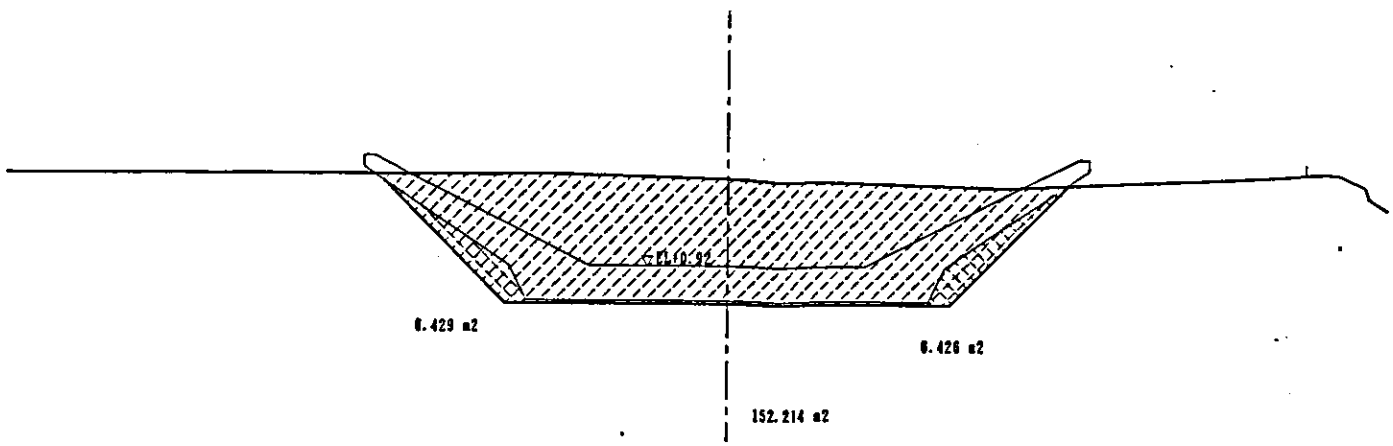
NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D19	12	kg	2.25	7.82	17.6	211.2	
	②	D19	12	kg	2.25	7.82	17.6	211.2	
B-2	①	D19	17	kg	2.25	7.82	17.6	299.2	
	②	D19	17	kg	2.25	7.82	17.6	299.2	
B-3	①	D16	29	kg	1.56	7.82	12.2	353.8	
	②	D16	29	kg	1.56	7.82	12.2	353.8	
B-4	①	D16	28	kg	1.56	6.04	9.42	263.8	
	②	D16	28	kg	1.56	6.04	9.42	263.8	
B-5	①	D16	16	kg	1.56	4.894	7.63	122.1	
	②	D16	16	kg	1.56	4.894	7.63	122.1	
B-6	①	D16	16	kg	1.56	1.82	2.84	45.4	
	②	D16	16	kg	1.56	1.82	2.84	45.4	
B-7	①	D16	16	kg	1.56	2.51	3.92	62.7	
	②	D16	16	kg	1.56	2.51	3.92	62.7	
B-8	①	D16	16	kg	1.56	11.5	17.94	287	
	②	D16	16	kg	1.56	12.06	18.81	301	
B-9	①	D16	2	kg	1.56	2.1	3.28	6.6	
	②	D16	2	kg	1.56	2.1	3.28	6.6	
B-10	①	D16	2	kg	1.56	1	1.56	3.1	
	②	D16	2	kg	1.56	1	1.56	3.1	
B-11	①	D16	16	kg	1.56	1.46	2.28	36.5	
	②	D16	16	kg	1.56	1.46	2.28	36.5	
C-1	①	D16	15	kg	1.56	5.23	8.16	122.4	
	②	D16	15	kg	1.56	5.23	8.16	122.4	
C-2	①	D19	15	kg	2.25	2.19	4.93	74	
	②	D19	15	kg	2.25	2.19	4.93	74	
C-3	①	D16	15	kg	1.56	6.755	10.54	158.1	
	②	D16	15	kg	1.56	6.755	10.54	158.1	
C-4	①	D16	60	kg	1.56	2.37	3.7	222	
	②	D16	60	kg	1.56	2.37	3.7	222	
R-1	①	D16	22	kg	1.56	15.318	23.9	525.8	
	②	D16	22	kg	1.56	15.878	24.77	544.9	
R-2	①	D16	88	kg	1.56	3.075	4.8	422.4	
	②	D16	88	kg	1.56	3.075	4.8	422.4	
R-3	①	D16	44	kg	1.56	4.73	7.38	324.7	
	②	D16	44	kg	1.56	4.73	7.38	324.7	
R-4	①	D16	44	kg	1.56	1.446	2.26	99.4	
	②	D16	44	kg	1.56	1.446	2.26	99.4	
R-5	①	D16	44	kg	1.56	2.083	3.25	143	
	②	D16	44	kg	1.56	2.083	3.25	143	
R-6	①	D16	44	kg	1.56	1.977	3.08	135.5	
	②	D16	44	kg	1.56	1.977	3.08	135.5	
R-7	①	D16	44	kg	1.56	1.34	2.09	92	
	②	D16	44	kg	1.56	1.34	2.09	92	
G-1	①	D19	4	kg	2.25	7.464	16.79	67.2	
	②	D19	4	kg	2.25	7.464	16.79	67.2	
G-2	①	D16	4	kg	2.25	5.94	13.37	53.5	
	②	D16	4	kg	2.25	5.94	13.37	53.5	
G-3	①	D16	32	kg	1.56	5.94	9.27	296.6	
	②	D16	32	kg	1.56	5.94	9.27	296.6	
G-4	①	D13	22	kg	0.995	3.68	3.66	80.5	
	②	D13	22	kg	0.995	4.59	4.57	100.5	
G-5	①	D13	26	kg	0.995	3.98	3.96	103	
	②	D13	26	kg	0.995	4.54	4.52	117.5	

G-6	①	D16	10	kg	1.56	7.254	11.32	113.2
	②	D16	10	kg	1.56	7.254	11.32	113.2
G-7	①	D16	14	kg	1.56	2.047	3.19	44.7
	②	D16	14	kg	1.56	2.047	3.19	44.7
G-8	①	D16	4	kg	1.56	3.692	5.76	23
	②	D16	4	kg	1.56	3.692	5.76	23
H-1	①	D16	16	kg	1.56	8.428	13.15	210.4
	②	D16	16	kg	1.56	8.428	13.15	210.4
H-2	①	D16	18	kg	1.56	8.49	13.24	238.3
	②	D16	18	kg	1.56	8.49	13.24	238.3
H-3	①	D16	18	kg	1.56	7.102	11.08	199.4
	②	D16	18	kg	1.56	7.102	11.08	199.4
H-4	①	D16	18	kg	1.56	3.425	5.34	96.1
	②	D16	18	kg	1.56	3.985	6.22	112
H-5	①	D16	9	kg	1.56	3.45	5.38	48.4
	②	D16	9	kg	1.56	4.01	6.26	56.3
H-6	①	D16	22	kg	1.56	6.3	9.83	216.3
	②	D16	22	kg	1.56	6.86	10.7	235.4
H-7	①	D16	11	kg	1.56	6.097	9.51	104.6
	②	D16	11	kg	1.56	6.657	10.38	114.2
U-1	①	D16	12	kg	1.56	3.54	5.52	66.2
	②	D16	12	kg	1.56	3.54	5.52	66.2
U-2	①	D16	48	kg	1.56	3.665	5.72	274.6
	②	D16	48	kg	1.56	3.665	5.72	274.6
U-3	①	D16	34	kg	1.56	2.047	3.19	108.5
	②	D16	34	kg	1.56	2.047	3.19	108.5
U-4	①	D16	34	kg	1.56	1.977	3.08	104.7
	②	D16	34	kg	1.56	1.977	3.08	104.7
U-5	①	D16	34	kg	1.56	2.401	3.75	127.5
	②	D16	34	kg	1.56	2.401	3.75	127.5
U-6	①	D16	2	kg	1.56	4.21	6.57	13.1
	②	D16	2	kg	1.56	4.21	6.57	13.1
U-7	①	D16	34	kg	1.56	4.222	6.59	224.1
	②	D16	34	kg	1.56	4.222	6.59	224.1
T-1	①	D16	16	kg	1.56	8.11	12.65	202.4
	②	D16	16	kg	1.56	8.11	12.65	202.4
T-2	①	D16	18	kg	1.56	8.11	12.65	227.7
	②	D16	18	kg	1.56	8.11	12.65	227.7
T-3	①	D16	16	kg	1.56	1.46	2.28	36.5
	②	D16	16	kg	1.56	1.46	2.28	36.5
T-4	①	D16	18	kg	1.56	1.57	2.45	44.1
	②	D16	18	kg	1.56	1.57	2.45	44.1
T-5	①	D16	18	kg	1.56	0.651	1.02	18.4
	②	D16	18	kg	1.56	0.651	1.02	18.4
T-5	①	D16	8	kg	1.56	4.73	7.38	59
	②	D16	8	kg	1.56	4.73	7.38	59
W-1	①	D16	20	kg	1.56	1.325	2.07	41.4
	②	D16	20	kg	1.56	1.325	2.07	41.4
Z-1	①	D16	2	kg	1.56	2.072	3.23	6.5
	②	D16	2	kg	1.56	2.072	3.23	6.5
Z-2	①	D16	6	kg	1.56	1.346	2.1	12.6
	②	D16	6	kg	1.56	1.346	2.1	12.6
Z-3	①	D16	1	kg	1.56	2.609	4.07	4.1
	②	D16	1	kg	1.56	2.609	4.07	4.1
TOTAL	①							7477.3
	②							7597.4

GATE (LEFT)

NO.		RE-BAR	Number	UNIT	Weight /1m	Length	Weight /n	Weight	REMARKS
B-1	①	D19	12	kg	2.25	7.82	17.6	211.2	
	②	D19	12	kg	2.25	7.82	17.6	211.2	
B-2	①	D19	17	kg	2.25	7.82	17.6	299.2	
	②	D19	17	kg	2.25	7.82	17.6	299.2	
B-3	①	D16	29	kg	1.56	7.82	12.2	353.8	
	②	D16	29	kg	1.56	7.82	12.2	353.8	
B-4	①	D16	32	kg	1.56	6.04	9.42	301.4	
	②	D16	32	kg	1.56	6.04	9.42	301.4	
B-5	①	D16	14	kg	1.56	4.894	7.63	106.8	
	②	D16	14	kg	1.56	4.894	7.63	106.8	
B-6	①	D16	14	kg	1.56	1.82	2.84	39.8	
	②	D16	14	kg	1.56	1.82	2.84	39.8	
B-7	①	D16	14	kg	1.56	2.51	3.92	54.9	
	②	D16	14	kg	1.56	2.51	3.92	54.9	
B-8	①	D16	14	kg	1.56	11.5	17.94	251.2	
	②	D16	14	kg	1.56	12.06	18.81	263.3	
B-9	①	D16	2	kg	1.56	2.1	3.28	6.6	
	②	D16	2	kg	1.56	2.1	3.28	6.6	
B-10	①	D16	2	kg	1.56	1	1.56	3.1	
	②	D16	2	kg	1.56	1	1.56	3.1	
B-11	①	D16	14	kg	1.56	1.46	2.28	31.9	
	②	D16	14	kg	1.56	1.46	2.28	31.9	
C-1	①	D16	15	kg	1.56	4.73	7.38	110.7	
	②	D16	15	kg	1.56	4.73	7.38	110.7	
C-2	①	D19	15	kg	2.25	2.44	5.49	82.4	
	②	D19	15	kg	2.25	2.44	5.49	82.4	
C-3	①	D16	15	kg	1.56	6.505	10.15	152.3	
	②	D16	15	kg	1.56	6.505	10.15	152.3	
C-4	①	D16	54	kg	1.56	2.37	3.7	199.8	
	②	D16	54	kg	1.56	2.37	3.7	199.8	
R-1	①	D16	22	kg	1.56	14.318	22.34	491.5	
	②	D16	22	kg	1.56	14.878	23.21	510.6	
R-2	①	D16	88	kg	1.56	3.075	4.8	422.4	
	②	D16	88	kg	1.56	3.075	4.8	422.4	
R-3	①	D16	44	kg	1.56	4.23	6.6	290.4	
	②	D16	44	kg	1.56	4.23	6.6	290.4	
R-4	①	D16	44	kg	1.56	1.446	2.26	99.4	
	②	D16	44	kg	1.56	1.446	2.26	99.4	
R-5	①	D16	44	kg	1.56	2.083	3.25	143	
	②	D16	44	kg	1.56	2.083	3.25	143	
R-6	①	D16	44	kg	1.56	1.977	3.08	135.5	
	②	D16	44	kg	1.56	1.977	3.08	135.5	
R-7	①	D16	44	kg	1.56	1.34	2.09	92	
	②	D16	44	kg	1.56	1.34	2.09	92	
G-1	①	D19	4	kg	2.25	7.464	16.79	67.2	
	②	D19	4	kg	2.25	7.464	16.79	67.2	
G-2	①	D16	4	kg	2.25	5.94	13.37	53.5	
	②	D16	4	kg	2.25	5.94	13.37	53.5	
G-3	①	D16	32	kg	1.56	5.94	9.27	296.6	
	②	D16	32	kg	1.56	5.94	9.27	296.6	
G-4	①	D13	22	kg	0.995	3.68	3.66	80.5	
	②	D13	22	kg	0.995	4.59	4.57	100.5	
G-5	①	D13	26	kg	0.995	3.98	3.96	103	
	②	D13	26	kg	0.995	4.54	4.52	117.5	

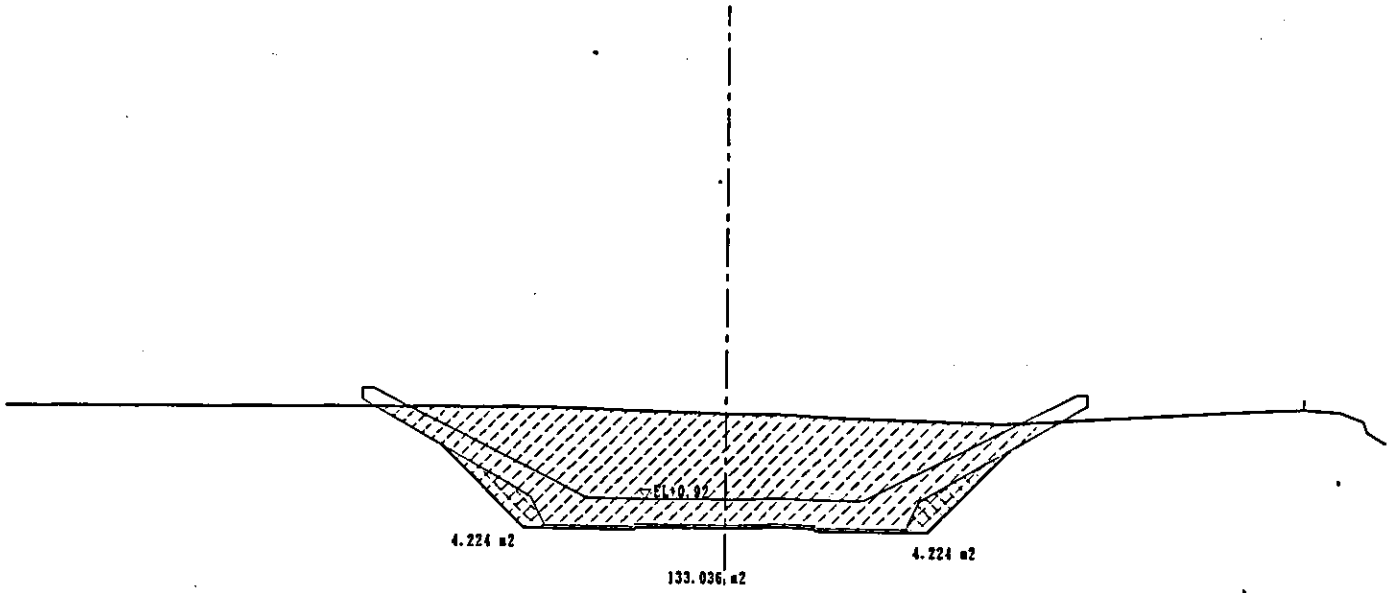
G-6	①	D16	10	kg	1.56	7.254	11.32	113.2
	②	D16	10	kg	1.56	7.254	11.32	113.2
G-7	①	D16	14	kg	1.56	2.047	3.19	44.7
	②	D16	14	kg	1.56	2.047	3.19	44.7
G-8	①	D16	4	kg	1.56	3.692	5.76	23
	②	D16	4	kg	1.56	3.692	5.76	23
H-1	①	D16	16	kg	1.56	8.428	13.15	210.4
	②	D16	16	kg	1.56	8.428	13.15	210.4
H-2	①	D16	18	kg	1.56	8.49	13.24	238.3
	②	D16	18	kg	1.56	8.49	13.24	238.3
H-3	①	D16	18	kg	1.56	7.102	11.08	199.4
	②	D16	18	kg	1.56	7.102	11.08	199.4
H-4	①	D16	18	kg	1.56	3.425	5.34	96.1
	②	D16	18	kg	1.56	3.985	6.22	112
H-5	①	D16	9	kg	1.56	3.45	5.38	48.4
	②	D16	9	kg	1.56	4.01	6.26	56.3
H-6	①	D16	22	kg	1.56	6.3	9.83	216.3
	②	D16	22	kg	1.56	6.86	10.7	235.4
H-7	①	D16	11	kg	1.56	6.097	9.51	104.6
	②	D16	11	kg	1.56	6.657	10.38	114.2
U-1	①	D16	12	kg	1.56	3.54	5.52	66.2
	②	D16	12	kg	1.56	3.54	5.52	66.2
U-2	①	D16	48	kg	1.56	3.665	5.72	274.6
	②	D16	48	kg	1.56	3.665	5.72	274.6
U-3	①	D16	34	kg	1.56	2.047	3.19	108.5
	②	D16	34	kg	1.56	2.047	3.19	108.5
U-4	①	D16	34	kg	1.56	1.977	3.08	104.7
	②	D16	34	kg	1.56	1.977	3.08	104.7
U-5	①	D16	34	kg	1.56	2.401	3.75	127.5
	②	D16	34	kg	1.56	2.401	3.75	127.5
U-6	①	D16	2	kg	1.56	4.21	6.57	13.1
	②	D16	2	kg	1.56	4.21	6.57	13.1
U-7	①	D16	34	kg	1.56	4.222	6.59	224.1
	②	D16	34	kg	1.56	4.222	6.59	224.1
T-1	①	D16	14	kg	1.56	8.11	12.65	177.1
	②	D16	14	kg	1.56	8.11	12.65	177.1
T-2	①	D16	16	kg	1.56	8.11	12.65	202.4
	②	D16	16	kg	1.56	8.11	12.65	202.4
T-3	①	D16	14	kg	1.56	1.46	2.28	31.9
	②	D16	14	kg	1.56	1.46	2.28	31.9
T-4	①	D16	16	kg	1.56	1.57	2.45	39.2
	②	D16	16	kg	1.56	1.57	2.45	39.2
T-5	①	D16	16	kg	1.56	0.651	1.02	16.3
	②	D16	16	kg	1.56	0.651	1.02	16.3
T-5	①	D16	8	kg	1.56	4.23	6.6	52.8
	②	D16	8	kg	1.56	4.23	6.6	52.8
W-1	①	D16	16	kg	1.56	1.325	2.07	33.1
	②	D16	16	kg	1.56	1.325	2.07	33.1
Z-1	①	D16	2	kg	1.56	2.072	3.23	6.5
	②	D16	2	kg	1.56	2.072	3.23	6.5
Z-2	①	D16	6	kg	1.56	1.346	2.1	12.6
	②	D16	6	kg	1.56	1.346	2.1	12.6
Z-3	①	D16	1	kg	1.56	2.609	4.07	4.1
	②	D16	1	kg	1.56	2.609	4.07	4.1
TOTAL	①							7269.2
	②							7387.4



$C = 152.214 \times 12.0 = 1826.6\ m^3$

$B = (6.429+6.426) \times 12.0 = 154.26\ m^3$

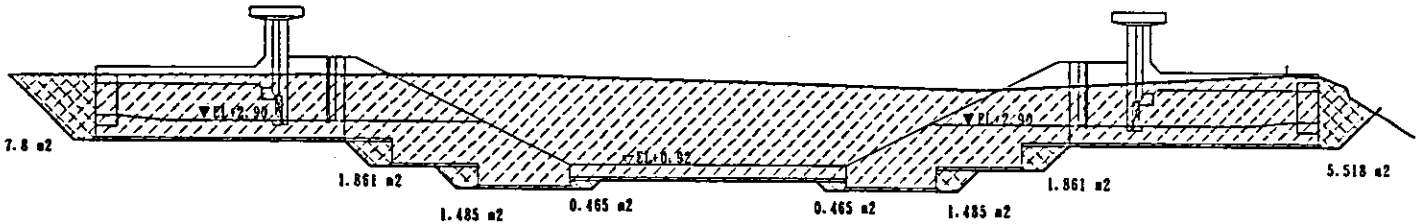
$G = (7.526+6.838) \times 12.0 = 172.4\ m^2$



$C = 133.036 \times 16.0 = 2128.6\ m^3$

$B = 4.224 \times 2 \times 16.0 = 135.2\ m^3$

$G = (8.419+7.624) \times 16.0 = 256.688\ m^2$



245.434 m2

$C = 245.434 \times 8.0 = 1963.472\ m^3$

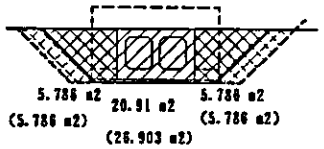
$B = (7.8 + (1.861 + 1.485 + 0.465) \times 2) \times 8.0 = 123.376\ m^3$

$C = \frac{1}{2} \times 20.91 \times 12.9 = 134.9\ m^3$

$B = 5.786 \times 2 \times 12.9 = 149.3$

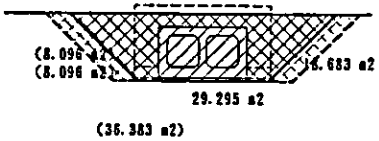
$C = 29.295 \times 27.9 = 817.3\ m^3$

$B = 18.683 \times 27.9 = 521.3\ m^3$



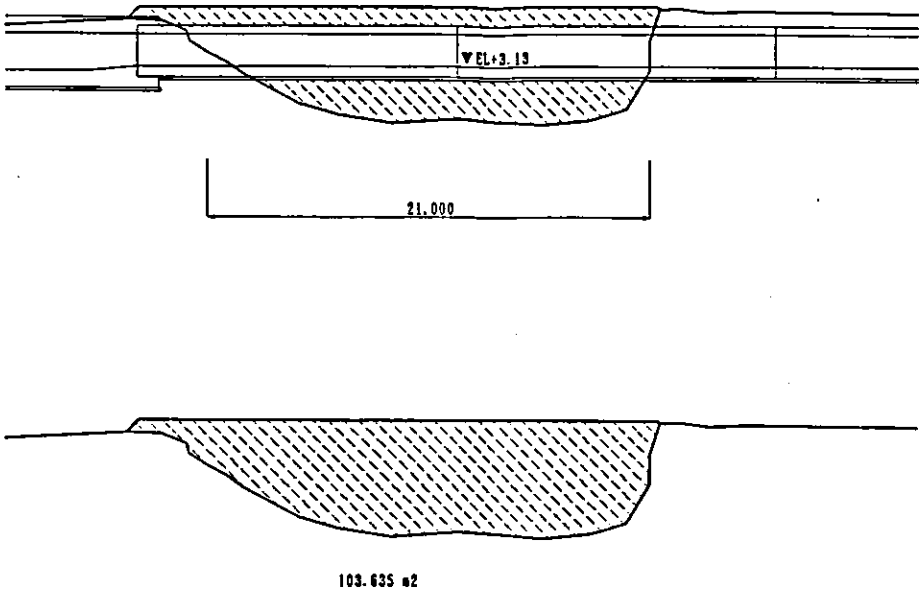
$C = \frac{1}{2} \times (20.91 + 26.903) \times 11.98 = 286.4\ m^3$

$B = 5.786 \times 2 \times 11.98 = 138.6$



$C = \frac{1}{2} \times (29.295 + 36.383) \times 11.98 = 393.4\ m^3$

$B = \frac{1}{2} \times (18.683 + 8.096 \times 2) \times 11.98 = 208.9\ m^3$



$B = 103.635 \times (8.0+12.0+16.0) - (9.15 \times 2.9 + 0.15 \times 4.35) \times 21.0 = 6508.0\ m^3$

5.2 Connecting Channel for Irrigation Facilities

Summary of Quantities for Conecting Irrigation Channel

			B=2.8m	B=2.8m	B=1.1m	B=3.3m	B=3.3m	subtotal	Drop Structure	Total
			w/ C.Prot	w/o C.Pro	w/o C.Pro	w/ C.Prot	w/o C.Prot			
Channel Length		m	5.0	24.0	190.0	5.0	253.0	477.0	0.0	477.0
Clearing		m^3	42.5	204.0	1,311.0	45.0	2,277.0	3,879.5	0.0	3,879.5
Excavation		m^3	45.0	216.0	1,140.0	50.0	2,530.0	3,981.0	0.0	3,981.0
Backfill		m^3	0.0	0.0	0.0	0.0	0.0	600.0	0.0	600.0
Wet Ston Masonry		m^3	4.5	21.7	172.1	4.5	229.2	432.2	0.0	432.2
Crusher Run Bedding		m^3	4.3	20.8	164.9	4.3	219.6	414.0	0.0	414.0
Mortor Plastering		m^2	17.0	81.5	644.9	17.0	858.7	1,618.9	0.0	1,618.9
Concrete Type C1		m^3	0.0	0.0	0.0	0.0	0.0	0.0	7.2	7.2
Concrete Type C2	Base Conc	m^3	1.9	9.3	73.7	1.9	98.2	185.1	0.0	185.1
Re-Bars		kg	232.4	187.6	1,485.2	268.9	1,977.7	4,151.8	248.2	4,400.0
Form FW1		m^2	8.4	40.4	319.6	8.4	425.5	802.3	20.5	822.9
Joint Filler		m^2	1.7	3.3	29.2	2.4	59.0	95.5	0.0	95.5
PVC Pipe Drain		m	1.0	4.8	38.0	1.0	50.6	95.4	0.0	95.4

Correcting Irrigation Channel.

1. Wet Stone Masonry.

$0.453 m^2 \times 2 = 0.906 \ m^3/m$

A =

2. Crusher Run Bedding

$(0.3 + 0.134) \times 2 = 0.868 \ m^3/m$

3. Base Concrete. Type C2.

$\{0.35 \times 0.5 - (0.25 \times 0.3)/2\} \times 2 = 0.275 \ m^3/m$

4. Top Concrete.

$0.566 \times 0.1 \times 2 = 0.113 \ m^3/m$

5. Cement Mortor. Plastering.

$1.2 \times \sqrt{2} \times 2 = 3.394 \ m^2/m$.

6. Channel Bed Linning.

B = 2.8 m. $0.15 \times 2.4 = 0.360 \ m^3/m$

B = 1.1 m $0.15 \times 0.7 = 0.105 \ m^3/m$

B = 3.8 m $0.15 \times 2.9 \ m = 0.435 \ m^3/m$

7. Inlet. Channel Bed Protection

B = 2.8 $1.116 \ m^3/m$

B = 3.3 $1.290 \ m^3/m$

8 Re-Bars.

- Base Conc. $(1.157/0.3 + 4) \times 0.995 = 7.817 \ kg/m$
- Channel Bed Protection

B = 2.8. $(6.814/0.3 + 24) \times 0.995 = 46.480 kg/m$

B = 3.3 $(7.812/0.3 + 28) \times 0.995 = 53.770 kg/m$

9. Form FW/

(1) Base Conc. $(0.491+0.35)\times 2 = 1.682\ m^2/m$.

10. Channel Length

B = 2.8m	W/ CB. Protection	5m
B = 2.8m	W/o "	23.468m ≒24m
B = 1.1m		190m
B = 3.3m	W/ CB Protection	5m
B = 3.3m	W/o "	252.935m = 253m

11. PVC. PIPE DRAIN.

L = 0.4 m

2m. pitch.

$L = .477/2 = 238$ nos. $\ell = 95.4$ m.

12. Joint Filler

B = 2.8 m	$1.654\ m^2$/nos
B = 1.1m	$1.536\ m^2$/nos
B = 3.3m	$2.306\ m^2$/nos.

Drop Structure .

1. Conc. Type C1 .

UPSTREAM .

$A_1 = 1.114\ m^2$

$A_2 = 3.622\ m^2$.

$V = 1.114 \times 0.275 + (1.114 + 3.622)/2 \times 0.425 + 3.622 \times 0.3$

$= 2.3994\ m^3$

Wall

$V = (5.023 \times 2) \times 0.3 = 3.014\ m^3$.

DownStream .

$A_1 = 0.894$.

$A_2 = 0.52$.

$V = (0.894 + 0.52)/2 \times (0.22 + 0.25) + 0.52 \times 2.23 + 0.894 \times 0.3$

$= 1.760\ m^3$.

Total $V = 2.399 + 3.014 + 1.760 = 7.173\ m^3$.

2. Re-Bars .

1. Wall

D13 1.1 $(1.1m \times 2 + 2.4m \times 2 + (2.33m + 0.23m)/2 \times 8) \times 4) \times 0.995 = 68.6kg$

D13 — $(2.63m + (2.55 + 1.65)/2 \times 4 + (2.13 + 1.03)/2 \times 5 \times 4) \times 0.995 = 42.4kg$.

2 UPSTREAM .

D13 ⌓ 6.783×4 $\times 0.995$ $= 27.0\ kg$.

D13 — 1.2×24 $\times 0.995$ $= 28.7kg$.

3. DownStream

D13 ⌓ 3.415×11 $\times 0.995$ $= 37.4\ kg$

D13 — $(3.754 + 3.629)/2 \times 0.995 \times 12 = 44.1\ kg$

Total 248.2kg .

3. Form Work (FW1)

• Wall	U.S.	3.043 m² × 2	6.086
	D.S.		8.523 m²
• U.S. Apron	Front		1.114 m².
	Side	0.491 m × 1 m × 2	= 0.982 m²
• D.S Apron	Front		0.894 m²
	Side	0.491 m × 3 m × 2	= 2.946 m².
	Total		20.545 m²

3 EARTH WORK.

Left.	B=2.8	9 m² × 29 m	= 261
	B=1.1	6 m² × 190 m	= 1140
Right.		10 m² × 258 m	= 2580
		Total	3.981 m³.

Clearing.	L	8.5 m × 29	= 246.5
Left.		6.9 m × 190	= 1311
	R	9.0 × 258	= 2322
			3879.5 m².

BACKFILL.

A=	.10 m² × .60 m	600 m³

6. DIVERSION WEIRS

Summary of Quantities for Diversion Weirs

Name of Structures / Work Items		Unit	DELI RIVER WEIR	FLOODWAY WEIR
Earth Works				
Excavation		m^3	15,000.0	27,000.0
Backfill by Selected Soil		m^3	3,800.0	4,500.0
Backfill by Impermeable Soil		m^3	250.0	90.0
Foundation Improvement Work		m^3	0.0	1,700.0
Concrete Works				
Concrete Type C1		m^3	5,841.0	3,360.0
Concrete Type D		m^3	811.0	880.0
Concrete Type E		m^3	60.0	54.0
Reinforcement Bar		kg	64,200.0	40,770.0
Form Works (h≤2.5m)	FW1	m^2	2,100.0	1,020.0
(h>2.5m)	FW2	m^2	3,400.0	3,270.0
Water Stop, PVC	t=300	m	152.0	140.0
Dowel Bar w/ PVC Pipe	Φ19	kg	746.0	780.0
Elastic Joint Filler	t=10	m^2	137.0	156.0
Surface Caulking Material	t=10	m	85.0	88.0
Drain Works				
Conc. Drain Ditch	U300	m	69.0	135.0
Backfill Gravel		m^3	650.0	450.0
Weep Hole, PVC Pipe	Φ50	nos	181.0	106.0
PVC P. Drain, w/ CP Valve	Φ100	nos	2.0	2.0
Stone/Cocn. Block Works				
Gabion Mattress	Type A	m^3	87.0	0.0
Concrete Block 980x980x400		nos	470.0	598.0
Crib Type Block		nos	151.0	112.0
Cobble Stone Filling		m^3	95.0	70.0
Crusher Run Bedding		m^3	90.0	100.0
Metal Works				
Steel Handrail		kg	700.0	2,300.0
Steel Ladder		kg	0.0	130.0

6.1 Deli River Weir

1. Deli Weir. Excavation & Backfill.

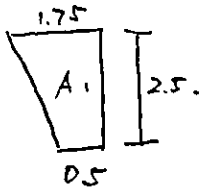
Excavation				Backfill				
DRW	L	A	V	B1	B2	H	A	V
	m	m2	m3	m	m	m	m2	m3
STA.0		52					0	
STA.10	10.0	46	491				0	0
STA.20	10.0	71	583				0	0
STA.30	10.0	84	774				0	0
STA.40	10.0	99	917	6.0	0.5	8.2	27	133
STA.50	10.0	175	1,373	6.0	0.5	9.0	29	280
STA.60	10.0	160	1,676	6.0	0.5	9.0	29	293
STA.68	10.0	163	1,615	6.0	0.5	9.0	29	293
STA.80	10.0	222	1,925	6.0	0.5	9.0	29	293
STA.90	10.0	247	2,343	6.0	0.5	9.0	29	293
STA.100	10.0	0	1,234					146
			12,930					1,729
			14,223					1,902
							Total	3,804

×1.2

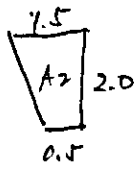
≒ 15,000 m³

≒ 3,800 m³

Impervious Soil



$A_1 = (1.75+0.5) \times 2.5/2 = 2.82\ m^2$



$A_2 = (1.5+0.5) 2.0/2 = 2.00\ m^2$.

$V = 2.82 \times 12.3 \times 2 + 2.0 \times 27.5 \times 2 = 179.3 = 180\ m^3$.

Back fill Gravel.

(1). Wing Wall . UPStream

Left. $\{10.6 \times 8.142^{86.3} + (10.6+5.8)/2 \times 4.8^{39.4} + (5.8+1)/2 \times 14.2^{48.3}\} \times 0.5$

$= 87 m^3$

Right . $\{10.6 \times 14.546 + (10.6+2.0)/2 \times 12.6\} \times 0.5$

$= 117 m^3$.

(2). Wing Wall Down Stream

$(4.9+1.5)/2 \times 6.8 \times 0.5 \times 2$

$= 22 m^3$

Total $(87+117+22) \times 1.1 = 249. m^3$

~~Weep Hole for Wing Wall~~

~~$n = 3 \times 9 + 3 \times 12 = 63$~~

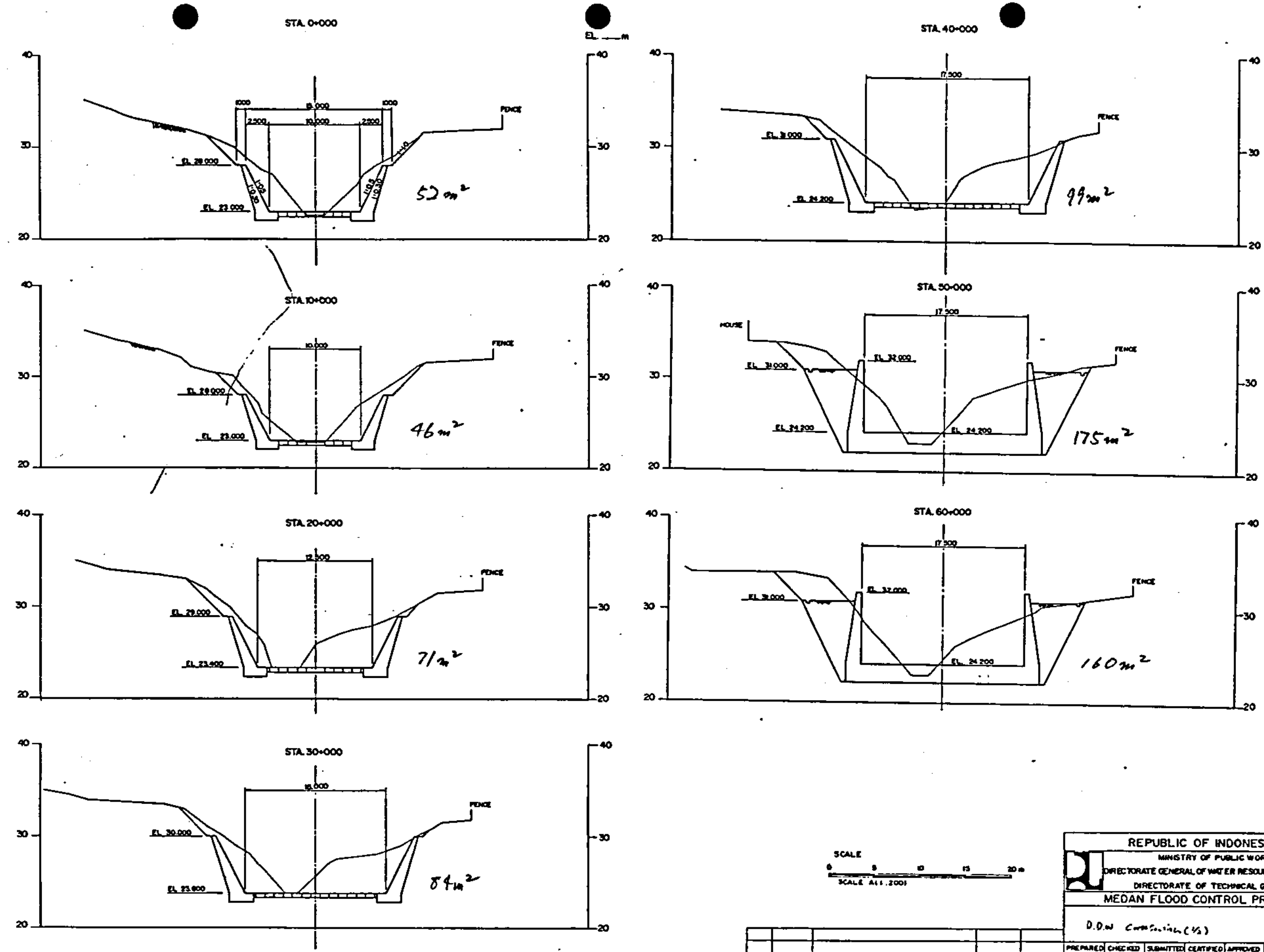
Weep Hole for Wing Wall

Left	20	
Right	25	45

Gabion Mattress.

$n = 58$ nos.

$V = 58 \times 3 \times 1.5 \times 0.5 = 87 m^3$.



REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE
MEDAN FLOOD CONTROL PROJECT

D.D.W Construction (1/2)

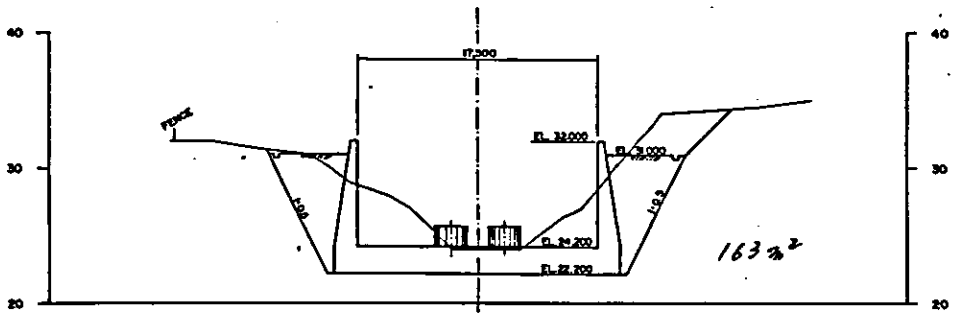
PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					DW-005

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

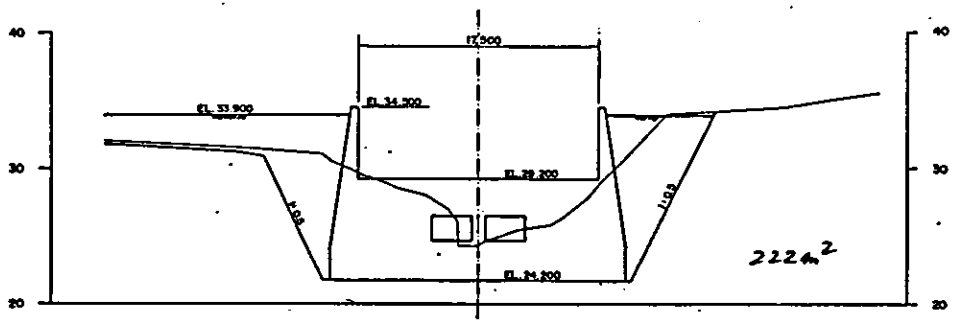
NO.	DATE	REVISIONS	ORIGINATED	APPROVED

SHEET NO. | REV.

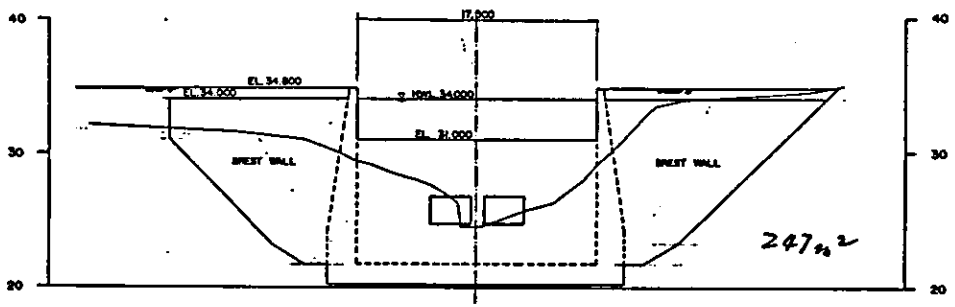
STA. 70+000



STA. 80+000



STA. 83+300
(Section of Deli River)



6 - 7

SCALE

0 5 10 15 20 m

SCALE A1 : 200

REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE
MEDAN FLOOD CONTROL PROJECT

DDW. Cross Section (3/3)

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					PW-006

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA

SHEET NO. | REV.

NO.	DATE	REVISIONS	ORIGINAT	PROVED

Deli River Weir Concrete Works

			A (m2)	L (m)	V (m3)	Sub-total	Note
BL1	Weir		77.08	17.50	1,348.94		
	Orifice		-17.27	6.00	-103.62		
	Wall		18.95	4.20	159.20		x2
				5.60	176.90		x2
			12.64	2.50	63.19	1,644.61	x2
BL2	Wall+Apron		58.61	13.50	791.18		
	Buffle Block				13.53	804.71	
BL3	Wall+Apron		58.61	14.00	820.48		
	Dentated Sill				22.50		
	Cutoff		0.75	20.06	15.05	858.03	
Upstream Wing wall	Right	A1	36.96	14.55	537.61		
		A2	34.06	1.50	53.26		
		A3	18.09	3.10	80.82		
		A4	10.89	3.00	43.46		
		A5	5.33	1.50	12.17		
		A6	4.20	3.50	16.68	744.00	
	Left						
		A7	36.96	8.14	300.92		
		A8	9.88	4.80	112.41		
		A9	2.95	14.20	91.09	504.42	
Brest Wall			33.72	1.50	55.01		x2
			3.83	12.09	453.92	508.92	x2
Wing Wall	Downstream		33.61				x2
	Right & Left		0.00	6.57	220.82	220.82	
	Total					5,285.50	
						5,814.05	x1.05

No.

Deli River Weir

Conc. Type C1.

BL 1.

Weir $A = 77.082\ m^2$

$B = 17.5\ m$ $V = 1349\ m^3$

Orifice $A = -17.270\ m^2$

$B = 6.000\ m$ $V = -104\ m^3$

Wall $A_1 = 18.952\ m^2$

$A_2 = 12.638\ m^2$ $(8.463 + 2.5 \times 1.67)$

$l_1 = 4.20\ m$

$l_{12} = 5.60\ m$ $V = A_1 \times l_1 + (A_1 + A_2)/2 \times l_2 + A_2 \times l_2$

$l_2 = 2.50\ m$ $= 149\ m^3$

BL 2 Wall + Apron ~~58.606~~ $A = \ ,\ m^2$

$l = 13.500\ m$ $V = 731\ m^3$

Buffel $V = \frac{2.4^2}{4} \times \pi \times 1.5 \times 2 = 13.572\ m$

L 3 Wall + Apron ~~58.606~~ $A = \ m^2$

$l = 14.000\ m$ $V =$

Bottle $V = (0.5 \times 1.5 + 1.5^2/2) \times 2 \times 6 = 22.50$

Cut off $A = 0.75\ m$

$l = 20.06\ m$

No .....

Wing Wall

			l	
H=10.600	A_1 = 36.959 m^2	)	12.904 + 3.142	
H= 9.850	A_2 = 25.603 + 8.455	)	0.300 1.500	
6.750	A_3 12.111 + 5.975	)	3.100	
5.250	A_4 6.861 + 4.025	)	3.000	
2.750	A_5 2.509 + 2.825	)	1.500	
2.000	A_6 1.600 + 2.600	)	3.500	
H = 10.600	A_7 36.959		8.142	
5.056	A_8 6.362 + 3.517	)	4.800	
1.000	A_9 0.650 + 2.300	)	14.200	

Breast Wall

			l	
A_1	33.720	)	- 1.500	
A_2	3.825	)	1.590 + 10.500	) × 2.

Wing Wall

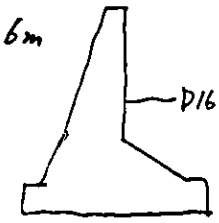
			l	
A_1	31.86 + 0.75 + 1.00 = 33.61 m^2	)	6,570 × 2	
A_2	= 0.0			

Re - Bars.

Wing Wall.

Par m

(1) H=11.6m



D16	35m × 3.333 × 1.56	= 182
D13	1.0m × 121 × 0.995	= 121
		303 kg/m

(2) H=6.8m

D16	18.8 × 3.333 × 1.56	= 98.
D13	1.0 × 63 × 0.995	= 63 kg
		161 kg/m

(3) H=3m

D16	9.9m × 3.333 × 1.56	= 52.
D13	1.0 × 36 (16+20=) × 0.995	= 36
		88kg/m

(4) H=2m

D16	8.2m × 3.333 × 1.56	= 43
D13	1.0 × 28 × 0.995	= 28.
		71 kg/m

Weight.

Left.

8.142m × 303.	= 2467.
4.800m × (303+161)/2.	= 1114.
14.200m × (161+71)/2	= 1647
	5228 kg.

Right.

16.046 × 303.	= 4,862
7.0 × (303+161)/2	= 1629
4.1 × (161+71)/2	= 476
	6962 kg.

(2) Block 1.

D19. Wall :	2.8m	×10	×4	× 2.25	=	252
	5.2m	×23	×4	× 2.25	=	1076
Apron	44.3m	×23		× 2.25	=	2293
D16 Wall	6.0m	×15	×4	× 1.56	=	562
	7.5	×10	×4	× 1.56	=	300
	5.7	×17	×4	× 1.56	=	388
D13. CREST.	31.3	×60		× 0.995	=	1869
Cross Bar.	21.0	×115		× 0.995	=	2403
Cutoff	6.7m	×70		× 0.995	=	467
D16 Orifice.	8.3m	× 32	×2	× 1.56	=	829
D13	2.5m	× 28	×4×2	× 0.995	=	558
	3.7m	× 28	×4×2	× 0.995	=	825.

11,822 kg.

(3) Block 2

D19. Apron.	43.3	× 89		× 2.25	=	8,671.
D19 Wall	2.9	× 89	×2	× 2.25	=	1,162.
D19 Wall	4.7	× 89	×2	× 2.25	=	1,883
D16 Wall	10.13	× 45	×2	× 1.56	=	1,423
D13 Haunch.	4.5	× 89	×2	× 0.995	=	797.

13,936 kg.

(4) Block 3.

D19 Apron	43.3	× 94		× 2.25	=	9,158
D19	2.9	× 94	×2	× 2.25	=	1,227
D19	4.7	× 94	×2	× 2.25	=	1,988
D16	10.13	× 47	×2	× 1.56	=	1,485
D13	4.5	× 94	×2	× 0.995	=	842

14,700.

(5) UPSTREAM APRON

D13	6.8	× 17	× 0.995	=	115
D13	4.8	× 23	× 0.995	=	110
					225

(6) Baffle.

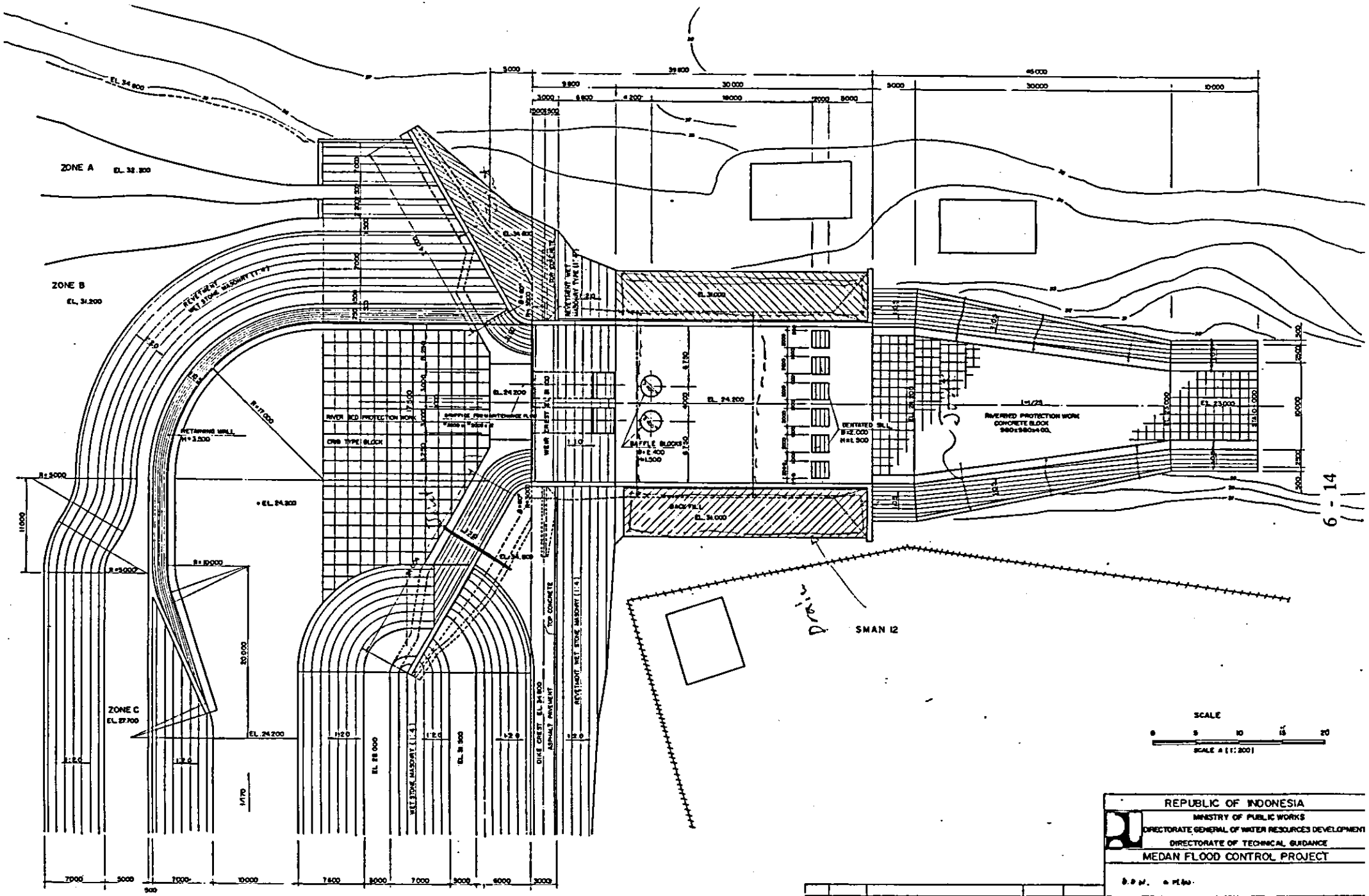
○	D13.	6.908 × 5. × 0.995 × 2 =	69
|	D13	2.5 × 24. × 0.995 × 2 =	119
卌	D13.	1.8 × 14 × 0.995 × 2 =	50
			238 kg.

(7). Dentated Sill

⌐¬	D13	6.1 × 6 × 0.995 × .6 =	219.
三		(1.56+0.66)/2 × 4 × 0.995 × 2 × 6 =	53
⋮∴		1.8 × .10 × 6 × 0.995 =	108
			380 kg.

Total.

			×1.2
Upstream Wing	Right	5228	6,274
	left	6962	8,359
	Apron	225	270
Block 1.	Wein&Wall	11822	14,186
Block 2	Wall	13936	16,723
	Battle	238	286
Block 3	Wall	14700	17,640
	Dentated Sill.	380	458
			64,189 ≒ 64,200 kg



6 - 14

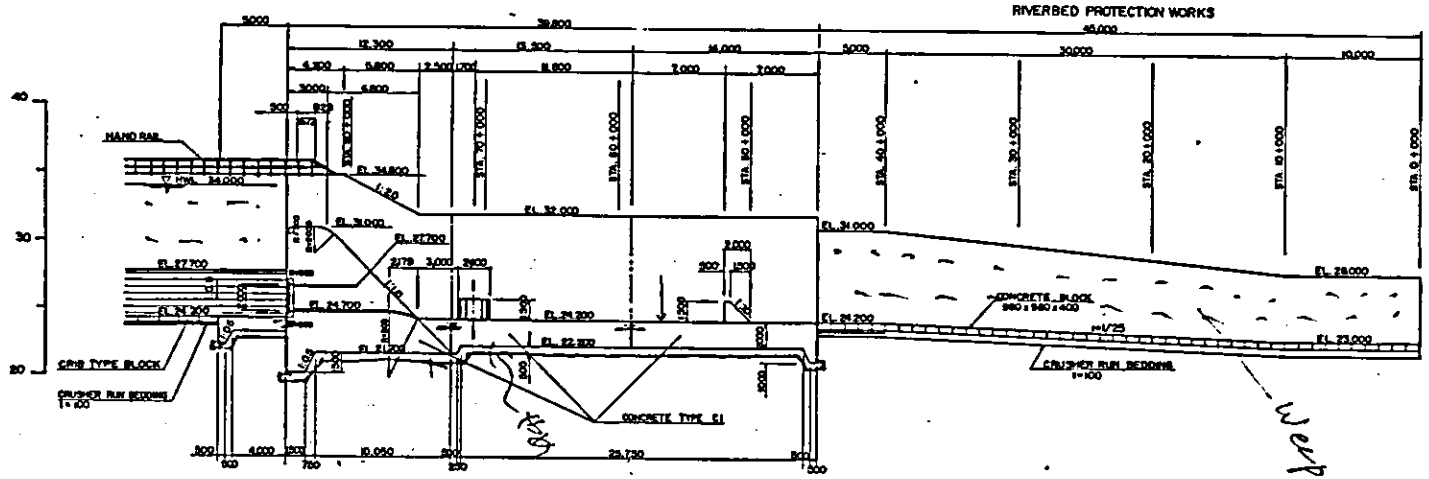
REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE
MEDAN FLOOD CONTROL PROJECT

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					DN-002

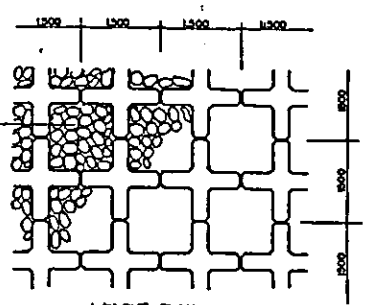
JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

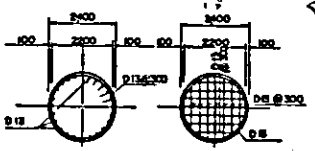
RIVERBED PROTECTION WORKS



PROFILE
SCALE A

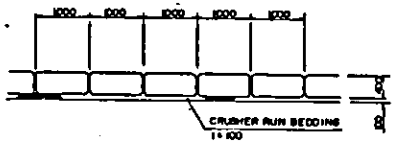


LAY OUT PLAN
SCALE B

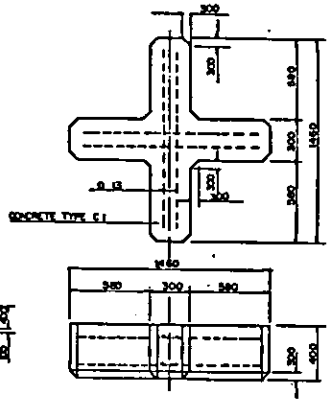


SECTION A-A
SCALE B

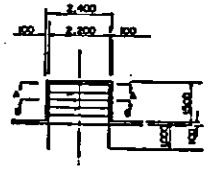
SECTION B-B
SCALE B



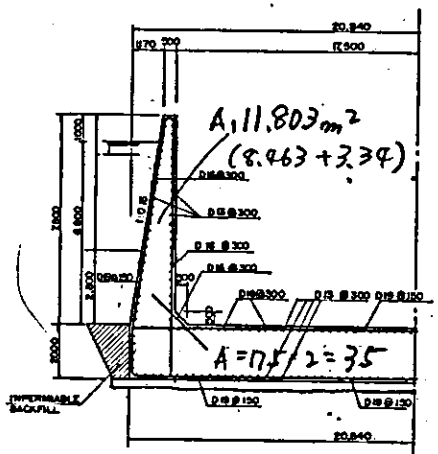
ELEVATION
SCALE D



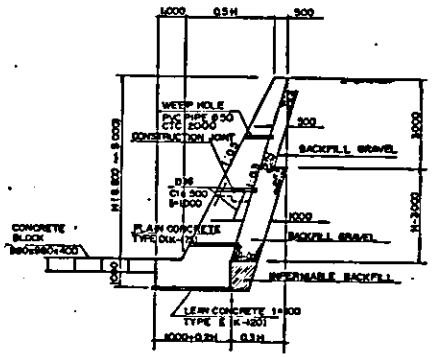
DETAIL OF CRIB TYPE BLOCK
SCALE E



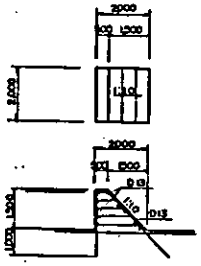
DETAIL OF BAFFLES
SCALE B



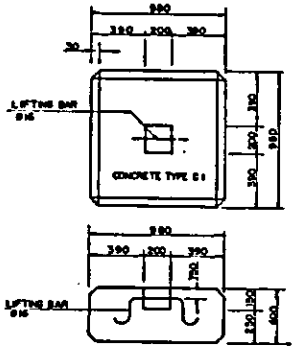
DETAIL OF APRON
SCALE B



DETAIL OF RETAINING WALL FOR DOWNSTREAM CHANNEL WORK
SCALE B

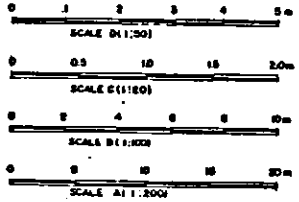


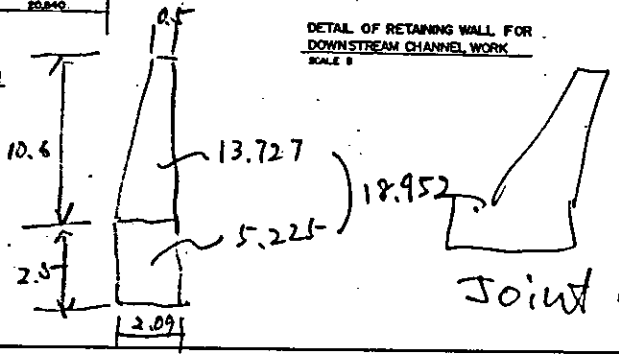
DETAIL OF DENTATED SILL
SCALE B



DETAILS OF CONCRETE BLOCK
980 x 980 x 400
SCALE C

SCALES





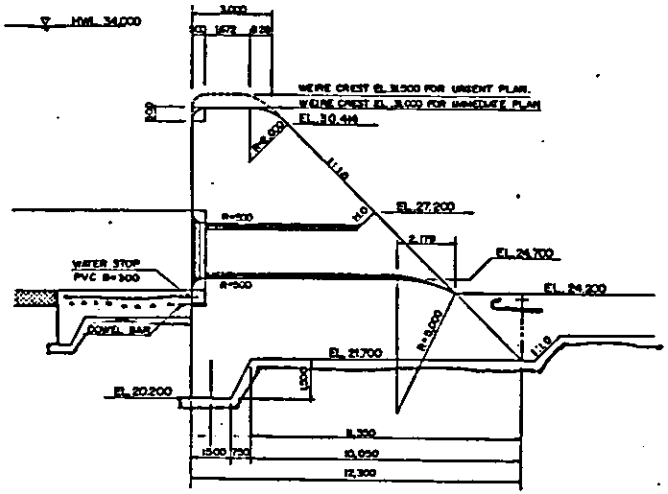
REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE
MEDAN FLOOD CONTROL PROJECT
D.D.J. Project 2. Structural Detail

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					pd-003

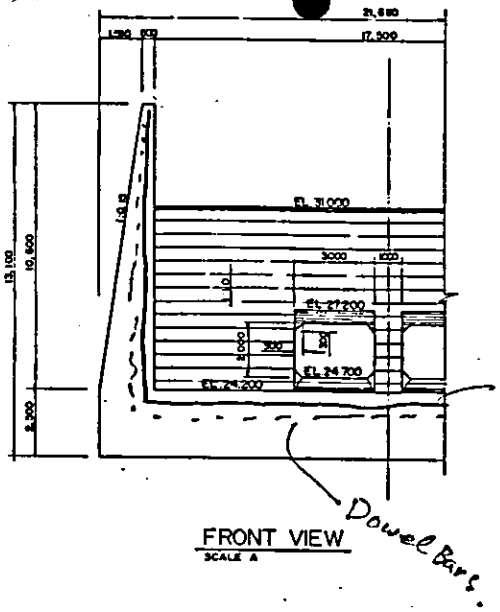
JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

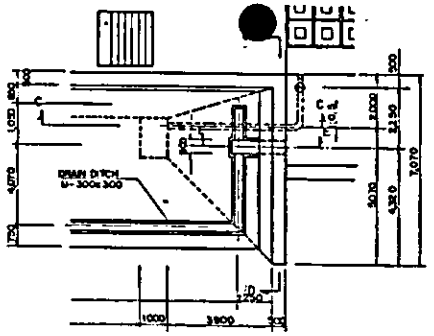
SHEET NO. | REV.



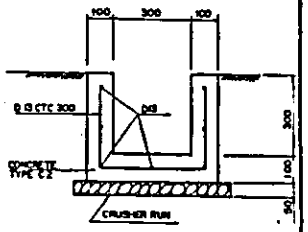
PROFILE
SCALE A



FRONT VIEW
SCALE A

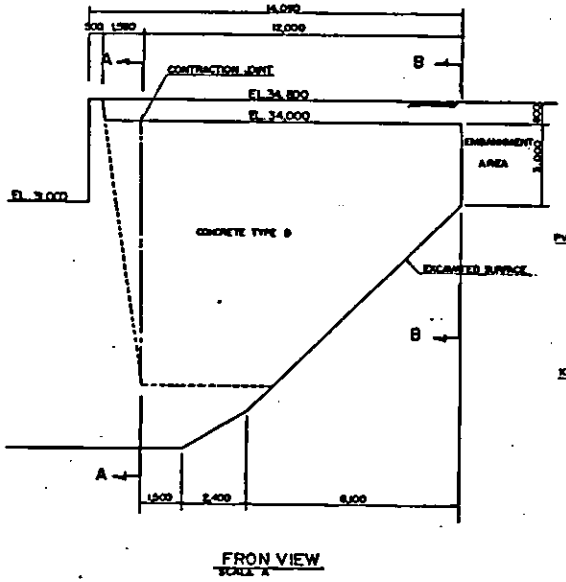


PLAN
SCALE A

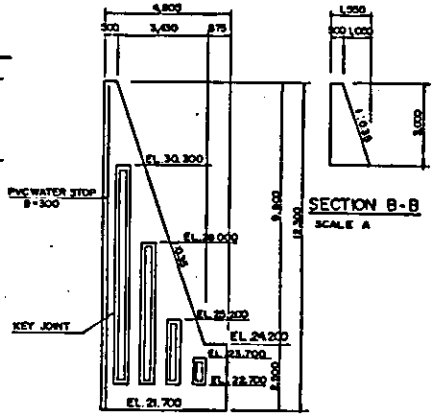


DETAIL OF DRAIN DITCH
U-300x300
SCALE E

DETAIL OF WEIR

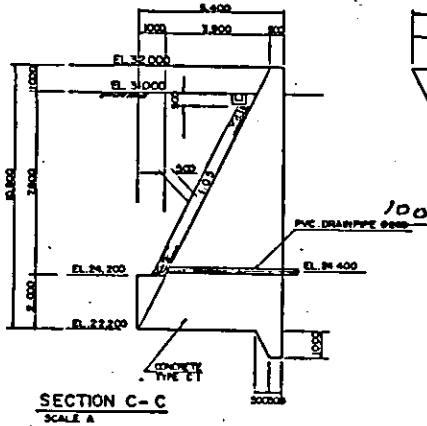


FRON VIEW
SCALE A

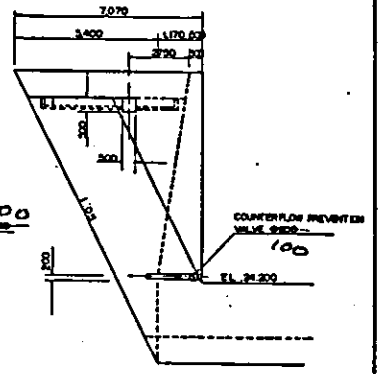


SECTION A-A
SCALE A

SECTION B-B
SCALE A

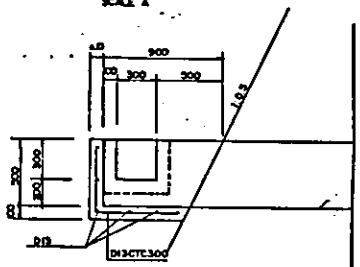


SECTION C-C
SCALE A



SECTION D-D
SCALE A

DETAIL OF WING WALL AND DRAINAGE WORK FOR WEIR



SECTION E-E
SCALE B

SCALE
0 2 4 6 8 10m
SCALE A (1:100)
0 5 10 15 20 m
SCALE B (1:200)
0 0.2 0.4 0.6 0.8 1.0 m
SCALE C (1:10)

DETAIL OF BREST WALL

NOTE : THE BASE OF BRESTWALL AND WING WALL SHOULD BE ON THE EXCAVATED SURFACE.

NO	DATE	REVISIONS	ORIGINATED	APPROVED

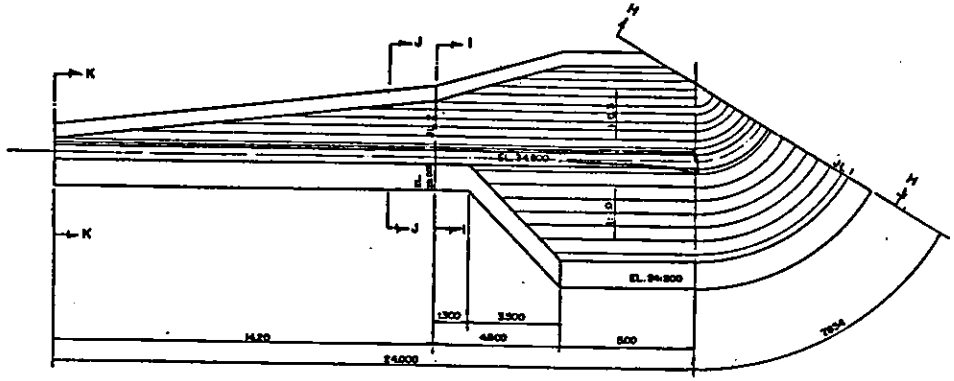
REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE

MEDAN FLOOD CONTROL PROJECT

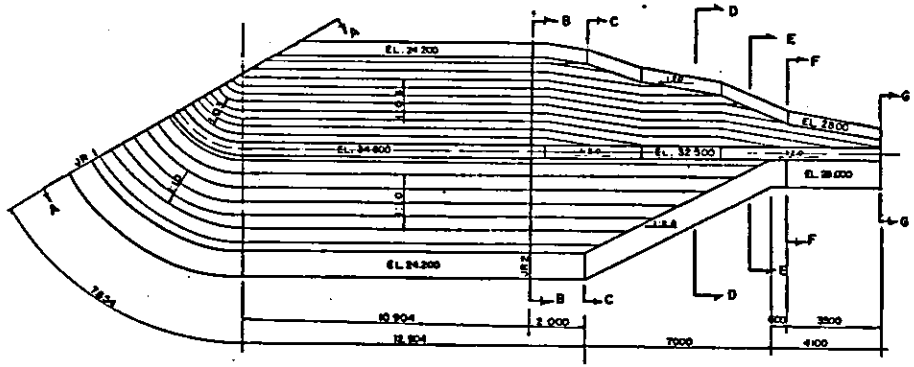
D.D.W. Structural Details

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					D4-004

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD
PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA
SHEET NO. | REV.

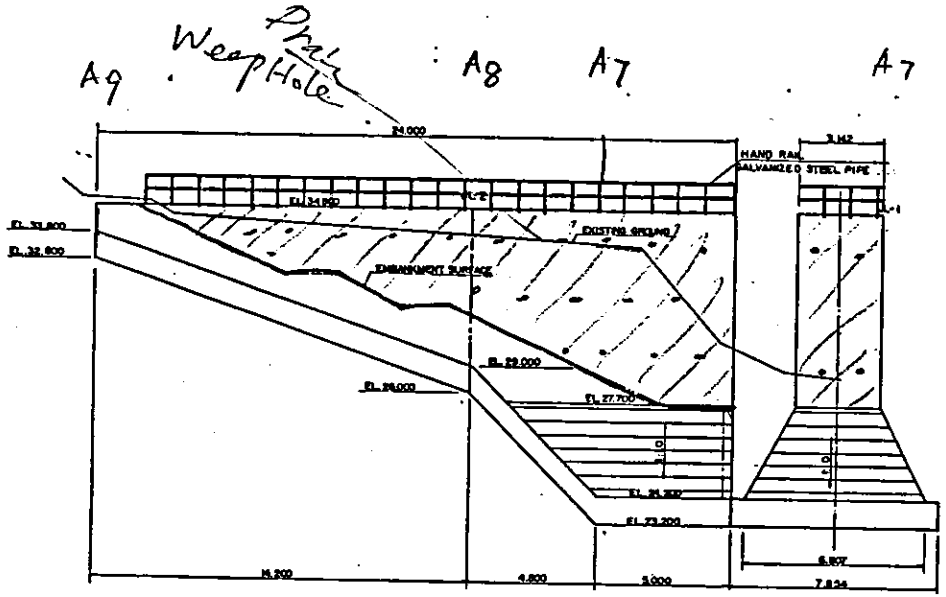


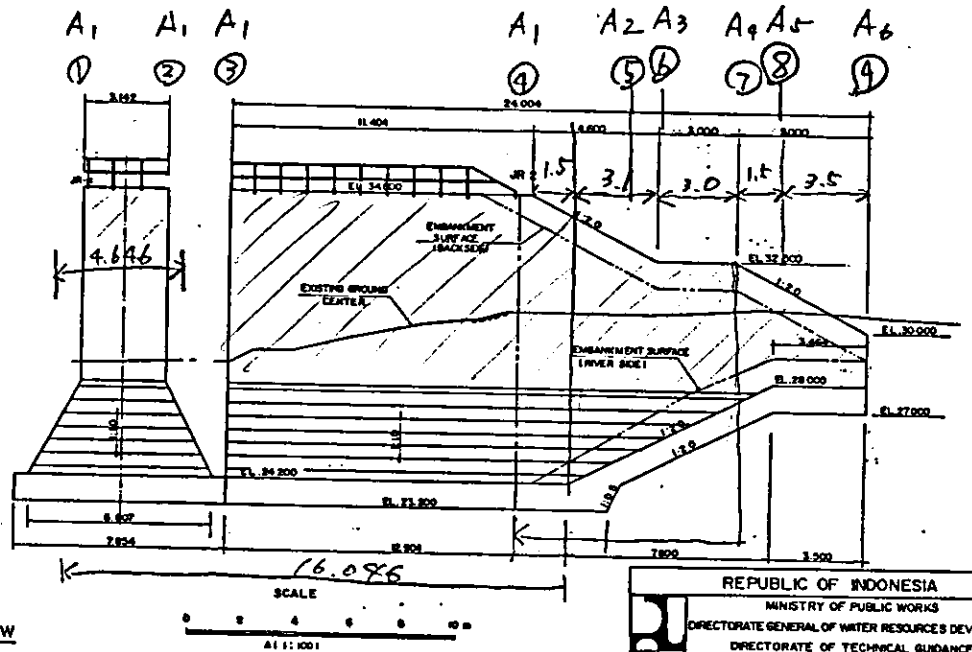
LEFT WING WALL



RIGHT WING WALL

PLAN





FRONT VIEW

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

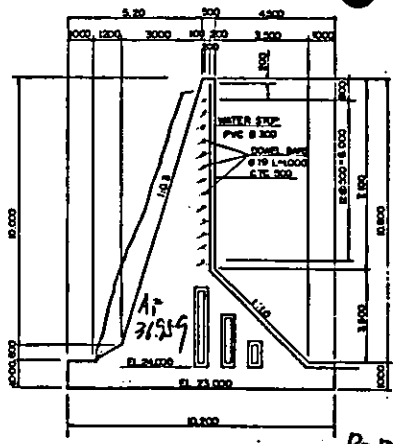
REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE
MEDAN FLOOD CONTROL PROJECT

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					DJ - 00

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

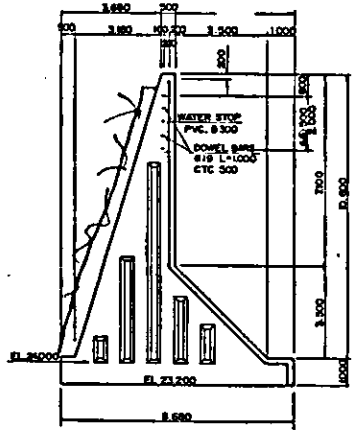
PROYEK PENGELOLAAN SUNGAI DAN PENGENDALIAN BANJIR SUMATERA UTARA

SHEET NO. | REV



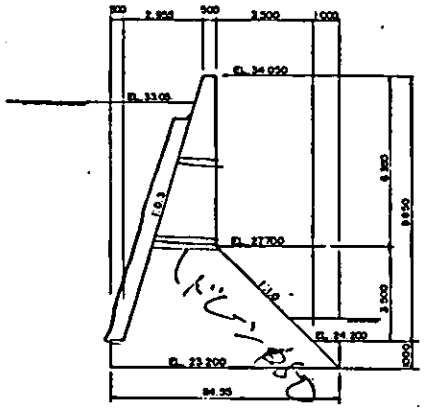
SECTION A-A & H-H
(JOINT JR-1 & JL-1)
SCALE A

(13) D-B

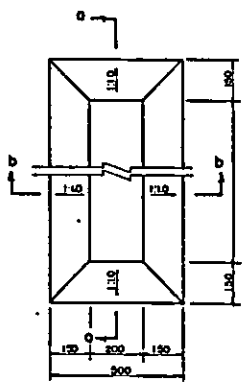


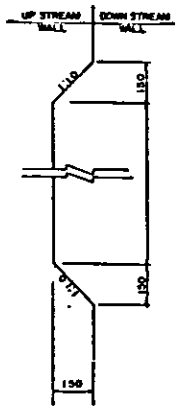
SECTION B-B
(JOINT JR-2)
SCALE A

(5) D-B

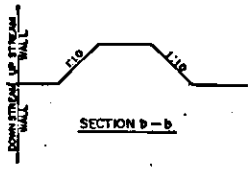


SECTION C-C
SCALE A



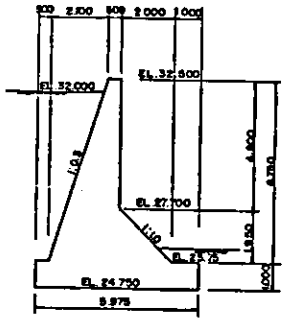


SECTION a-a
SCALE A

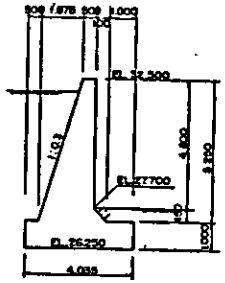


SECTION b-b

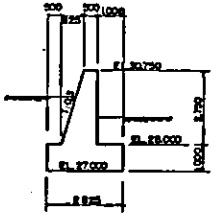
DETAIL OF KEY JOINT
SCALE B



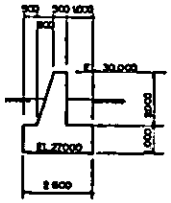
SECTION D-D
SCALE A



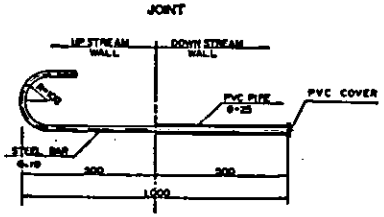
SECTION E-E
SCALE A



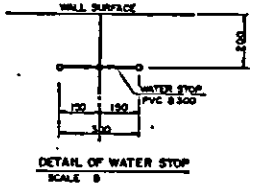
SECTION F-F
SCALE A



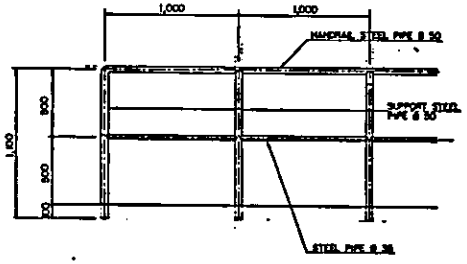
SECTION G-G
SCALE A



DETAIL OF DOWEL BAR
SCALE B

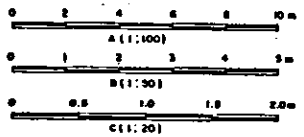


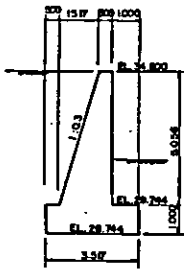
DETAIL OF WATER STOP
SCALE B



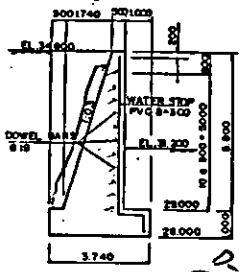
DETAIL OF HANDRAIL
SCALE C

SCALES



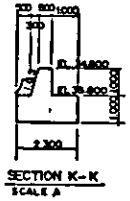


SECTION J-J
SCALE A



SECTION I-I
(JOINT JL-2)
SCALE A

(11) D-B



SECTION K-K
SCALE A

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE

MEDAN FLOOD CONTROL PROJECT

D.D.W.
L/P SUNGAI DELI

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					PW -009

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

SHEET NO. | REV.

6 - 18

FORMWORKS FOR DIVERSION WEIR.

ITEM NO	BQ ITEM	UNIT	
	DELI RIVER WEIR		
	FORMWORK (FW 1)	m^2	2005.77
	FORMWORK (FW 2)	m^2	3365.1
	FLOOD WAY		
	FORMWORK (FW 1)	m^2	1015.4
	FORMWORK (FW 2)	m^2	3265.72
			1.30

500

Pw = 5.4 ton^3

Fw = 3200

BILL OF QUANTITY

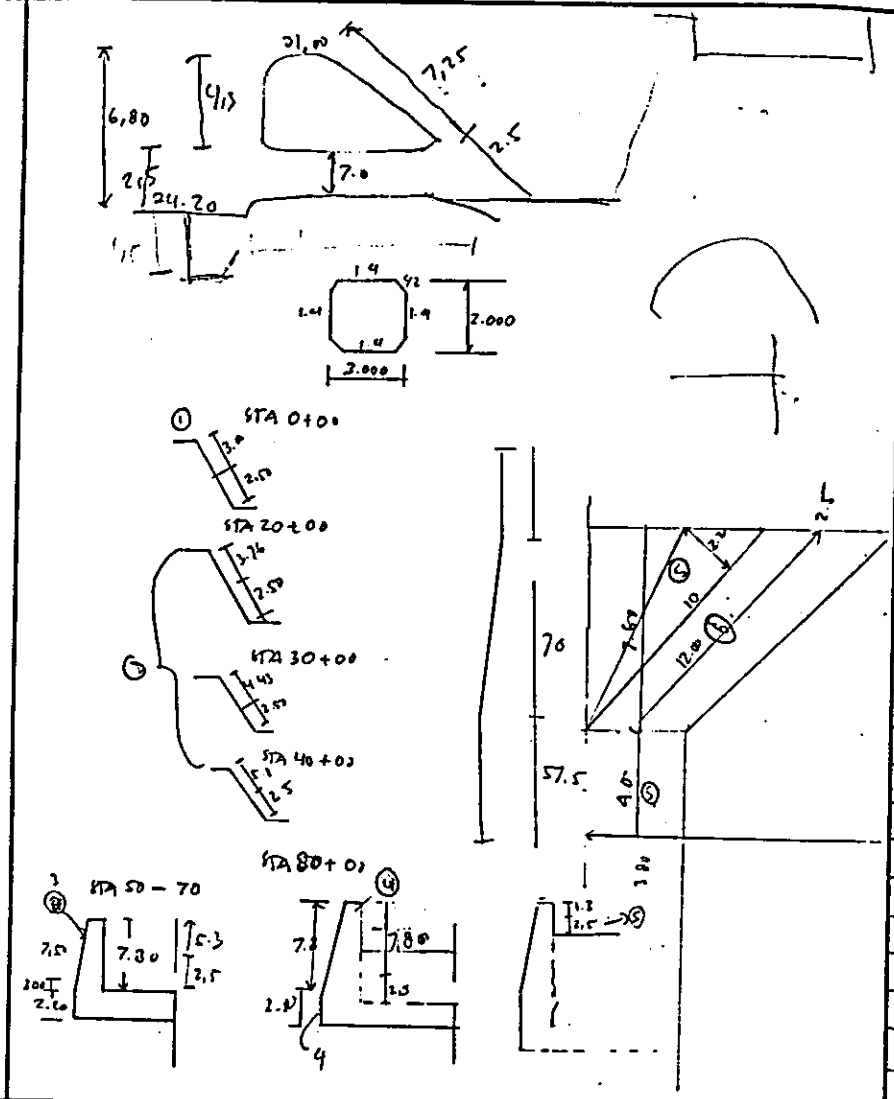
NAME OF STRUCTRURE : DIVERSION WEIR (DE Fo.
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUB TOTAL	VOLUME TOTAL
	FormWorks . FW1 .		FORMWORK ≤ 2,50		
			DELI . RIGTH WING WALL		
		1	1,00 × 34.623	34.623	
		2	2.50 × 7.854	19.625	
		3	(1,00 × 10,904) × 2	21,81	
		4	2.50 × 10,904	27,26	
		(5)	(1,00 × 2) × 2	4.00	
		(6)	2.50 × 2	5.00	
		7	$\left(\frac{2,30 + 0,65}{2} \times 7\right)$	11,72	
		8	(1,00 × 3,50) × 2	7.00	
		9	2 × 3,50	7,00	
		10	2,50 × 10,904	27.26	
		11	2,50 × 2	5.	
		12	2,50 × 7	17.5	
		13	$\frac{2,87 + 2,87}{2} \times 3,50$	8,66	
		14	$\frac{(2.6 \times 1)}{2} + \left(\frac{1,10 + 0,50}{2} \times 2\right)$	4,2	209,668
			LEFT WING WALL		
		1	1,00 × 34.623	34,623	
		2	2.50 × 12.874	32.18	
		3	$\frac{6,04 + 2,37}{2}$	8.15	
		4	2,5 × 6.78	16.95	
		5	10,20 × 2,50	25.5	
		6	1,00 × 2,50 × 4,110	7 7	
		7	$(1 \times \frac{2,30}{2}) + \left(\frac{0,80 + 0,50}{2} \times 1\right)$	2.95	
		(8)	1,00 × 25,065	25.065	
		9	9.00 × 3,30	27.7	
		10	(2,50 × 6.78)	16.95	
		11	2.50 × 10	25	
		12	$\frac{4.5 \times 1.4}{2} + 1,00 \times 4,2$	7.35	210.122
					420,79.

6 - 20

BILL OF QUANTITY

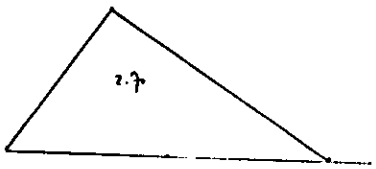
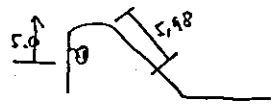
NAME OF STRUCTRURE : Deli Weir (Diversion)
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUB TOTAL	VOLUME TOTAL
			FORMWORK (FW ≤ 2,5		
			ORIFFICE		
			[(7.28 x 5,50) + (3 x 0,50) + (3 x 0,50)] x 2	86,08	
			CREST		
			2,50 x 17,50	43,75	
			2.50 x 17,50	43,75	
			OUT LET CHANNEL		
		①	(2,50 x 10,00) x2	50	
		②	(2,50 x 70.00) x2	350	
		③	[(2,50 x 57,5) + (2,50 x 87,5)] x2	575	
		4	(2,5 x 20) x 2	100	
		5	(2,50 x 4,00) x2	20	
		6	((2,50 + 2 x 12)/2) x2	54	1322,62
			Baffler		
			(2πR x H) x2		
			(2π x 1,2 x 1,50) x2	22,62	
			Baffles Block		
			[1,50 x 2) + (2,11 x 2) + ((0,50 + 2,7)/2 x 1,50) x2] x6	65,94	88,56
					1815,2
		①	3,00 x 17,50	25,00	
		2	3,00 x 17,50	52,5	
		3	3,00 x 17,50	52,5	
		1	[1 x 3,14) x2 + (2,5 x 3,40) x2	23,80	2005,77

BILL OF QUANTITY

NAME OF STRUCTRURE : DIVERSION WE (Deli

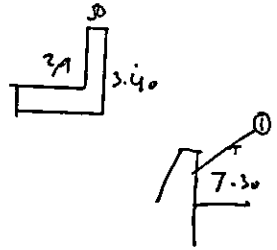
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUB TOTAL	VOLUME TOTAL
			FOR WORK ≫ 2,50		
		1	2,5 × 7,85	19,62	
		2	7,10 × 7,850	55.73	
		3	9,6 × 10,954	104.68	
		4	8,85 × 2	17.70	
		5	4,8 × 7	33,6	
		6	8,56 × 10,954	93,34	
		7	7,78 × 2	15.56	
		8	$\frac{4,56 + 3,07}{2} \times 7$	26,71	
			LEFT WING WALL		
		1	9,60 × 12,854	123,40	
		2	$\frac{3,3 + 9,6}{2} \times 4,80$	30,96	
		3	$\frac{10,40 + 2,10}{2}$	16.12	
		④	9,247 2,30	21,25	
		⑤	2.3 + 9,6 × 4,80	29,56	
		6	$\left(\frac{9.40 + 7.73}{2}\right) \times 4,80$	29.21	
		7	$\frac{10,50 \times 3,30}{2}$	17.32	633,75
		1	5 × 25	125	
		2	5,98 × 25	149,5	
					708,75

BILL OF QUANTITY

NAME OF STRUCTRURE : DELI DIVERSION WEIR
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUB TOTAL	VOLUME TOTAL
			FW2 >> 2,5 (UP ORIFICE)		
			4,3 x 17,5	75,25	
			7,25 x 17,5	126,87	
			OUTLET CHANNEL		
		①	(3 x 10) x 2	60.00	
		2	(4,0725 x 70) x 2	570 15	
		3	[(7,5 x 57,-) + (5,3 x 57,5)] x 2	1472	
		4	(7,80 x 2) x 2	31,2'	
		5	(10 x 2,2 / 2) x 2	22	2357,47
		1	(7,20 x 3,40) + (3,40 x 7,20) x 2	99.28	3365



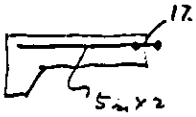
3. Water Stop

Wing Wall

JL1	13.2m	= 33.4m
JL2	7.0m	
JR1	13.2m	
JR2	13.2m	

Up-Stream Apron.

17.5 + 0.4 + 5 × 2. = 27.9m



Apron. (7.8 × 2 + 17.5) × 2 Joints = 66.2 m

Brest Wall 12.0m × 2. = 24.0 m.

Total. 151.5 m

4. Dowel Bars.

Wing Wall 13 × 2 + 5 + 11 = 42 nos.

Up-Stream Apron. (7 + 5 + 5) / 0.5 = 34 nos.

Apron. (7.8 × 2 + 17.5) / 0.5 × 2 = 133 nos.

Total 209 nos.

Weight 1.6m × 2.23 kg/m × 209 = 746 kg.

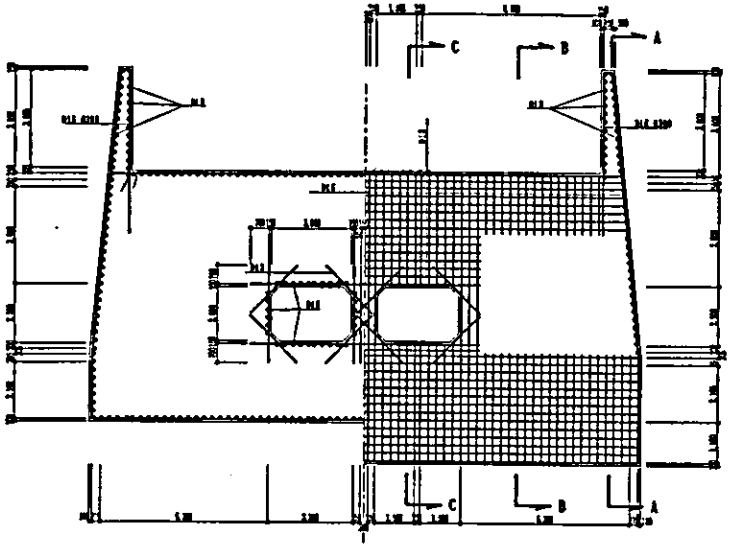
5. Elastic Joint Filler.

Up-Stream Apron (7m + 5m × 2) × 0.5 = 8.5 m².

Joint 1. 58.61m² + 0.5 × 20.84 69.03 m².
Joint 2. 58.61 m².

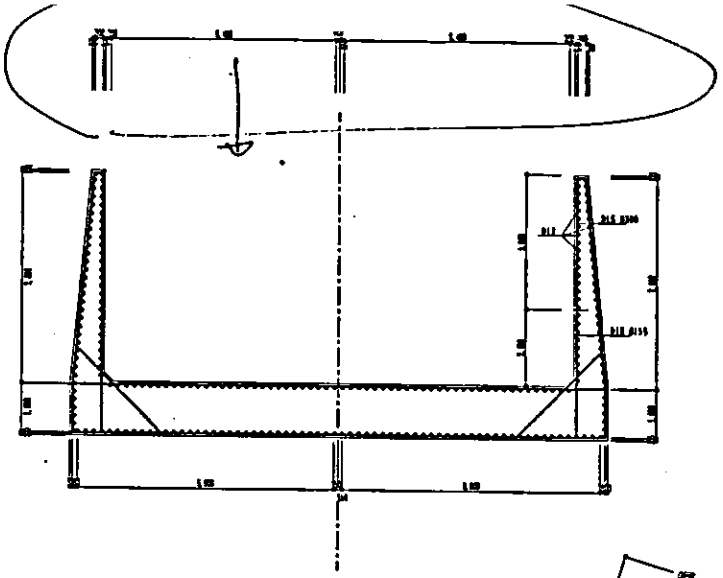
Total. 136.14 m².

Surface. Caulking (7 + 5 × 2) + (17.5 + 7.8 × 2 + 0.5 × 2) × 2 = 85.2m

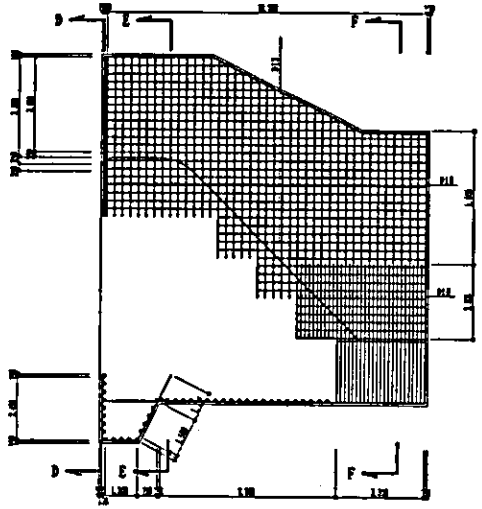


SECTION D-D
SCALE A

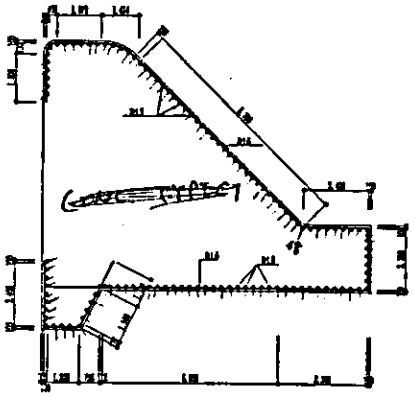
SECTION E-E
SCALE A



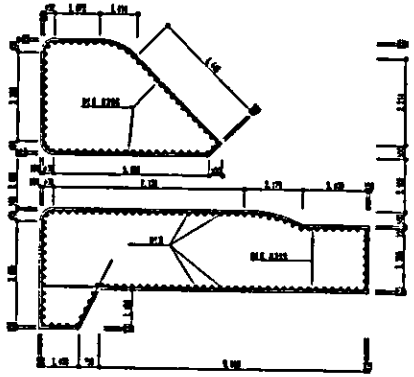
SECTION F-F
SCALE A



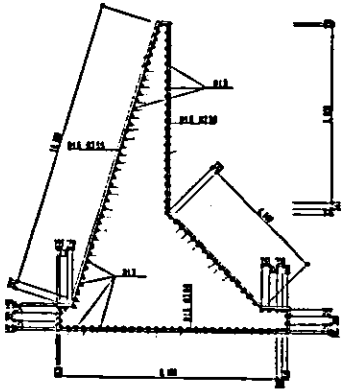
SECTION A-A
SCALE A



SECTION B-B
SCALE A



SECTION C-C
SCALE A



WING WALL
SCALE A

SCALES SCALE A (1:100)

REPUBLIC OF INDONESIA

MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE

MEDAN FLOOD CONTROL PROJECT

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

PROPOSED PENGELAKAN SUNGAI DAN PENGENDALIAN BANJIR SUMATERA UTARA

SHEET NO. | REV.

Leanning Wall

1. Concrete Type. D.

$H = 6.8m$ $A = (0.5 + 1.86) \times 6.8/2 + 1 \times (1.5 + 0.2 \times 6.8) = 10.9\,m^2$ (0.5+6.8×0.2; 2.86)

$H = 5.0m$ $A = (0.5 + 1.5) \times 5/2 + 1 \times (1.5 + 0.2 \times 5) = 7.5\,m^2$. (0.5+5×0.2; 2.5)

$$\nabla = \left(5 \times 10.9 + (10.9+7.5)/2 \times 30 + 7.5 \times 10\right) \times 2$$
$$= 405.5 \times 2 = \underline{\underline{811\,m^3}}.$$

2、Concrete TYPE. E.

$H = 6.8m$ $A = (2.86+0.4) \times 0.2 = 0.652\,m^2$

$H = 5.0m$ $A = (2.5+0.4) \times 0.2 = 0.580\,m^2$.

$$\nabla = \left(5 \times 0.652 + (0.652+0.580)/2 \times 30 + 0.580 \times 10\right) \times 2$$
$$= 55.08\,m^3.$$

3. Backfill Gravel.

$H = 6.8m$ $A = 2.5^m \times 0.5^m + 3.8^m \times 1.0^m = 5.05$.

$H = 5.0m$ $A = 2.5 \times 0.5 + 2.0 \times 1.0 = 3.25$.

$$\nabla = (5.05 \times 5 + (5.05+3.25)/2 \times 30 + 3.25 \times 10) \times 2$$
$$= 182.25 \times 2 = 364.5\,m^3 (\times 1.1) = 400$$

4. Impervious fill.

$A = (1+0.7)/2 \times 1.0 = 0.85\,m^2$.

$\nabla = 0.85 \times 40 \times 2 = \underline{\underline{68\,m^3}}$

5. Weep Hole. (leaning Wall).

Int(45m/2m) = 23.

$n = \{23 \times 2 + 22\} \times 2 = 136$.

Weep Hole. (Upstream Wing Wall).

6.2 Floodway Weir

Floodway Weir Excavation & Backfill

		Excavation					Backfill				
FWW	L	B1	B2	H	A	V	B1	B2	H	A	V
	m	m	m	m	m2	m3	m	m	m	m2	m3
STA.0	0.0	18.5	13.9	7.7	125					0	
STA.10	10.0	21.2	16.6	7.7	145	1,351				0	0
STA.20	10.0	26.6	22.0	7.7	187	1,662				0	0
STA.30	10.0	31.9	27.3	7.7	228	2,074				0	0
STA.40	10.0	34.6	29.7	8.2	264	2,457	5.5	0.6	8.2	25	125
STA.50	10.0	34.6	29.7	8.2	264	2,635	5.5	0.6	8.2	25	249
STA.60	10.0	46.0	36.5	8.2	338	3,009	8.5	4.0	8.2	51	381
STA.68	8.0	46.0	36.5	9.5	392	2,921	10.7	4.0	9.7	71	490
STA.80	12.0	42.0	32.0	6.0	222	3,683	6.0	3.0	4.5	20	549
STA.90	10.0	42.0	32.0	6.0	222	2,220	3.0	2.0	1.0	3	114
STA.100	10.0	34.6	31.9	4.5	150	1,858	34.6	34.6	0.0	0	13
						23,871					1,921
						26,258					2,113
										Total	4,225

⇓ 27,000 ⇓ 4,500

Foundation Improvement w/ Cement.

$(12.5 \times 31.98 + 15.5 \times 34.98) \times 3/2 = 1413\ (\times 1.1) = 1550\ m^3$

Back Fill Gravel.

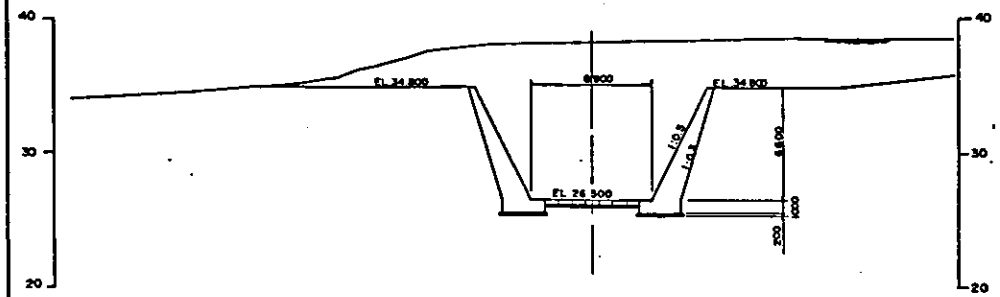
WEEP HOLE.

Wing. $n = 44$.

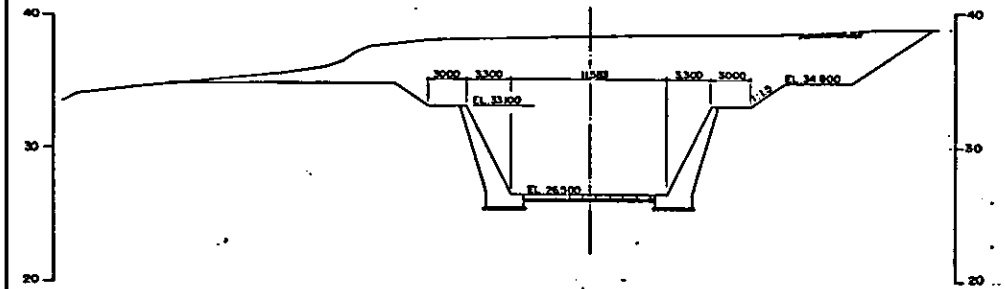
Leaning Wall $n = .41.016^{m} \times 2. \times 3\text{nos}/4_{m} = 62.$

Total $44+62 = 106$

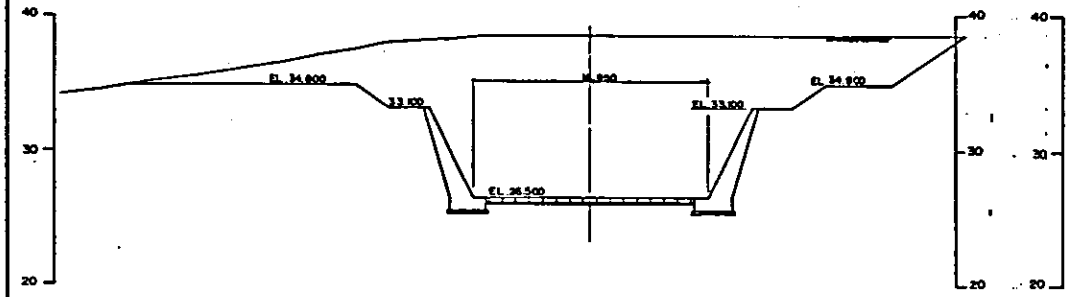
STA 0+000



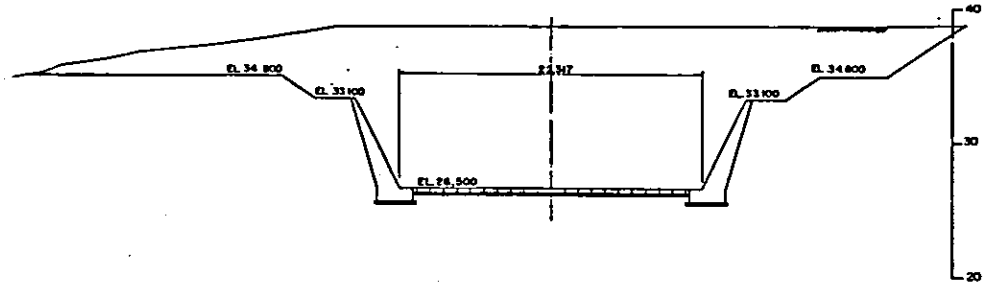
STA 10+000



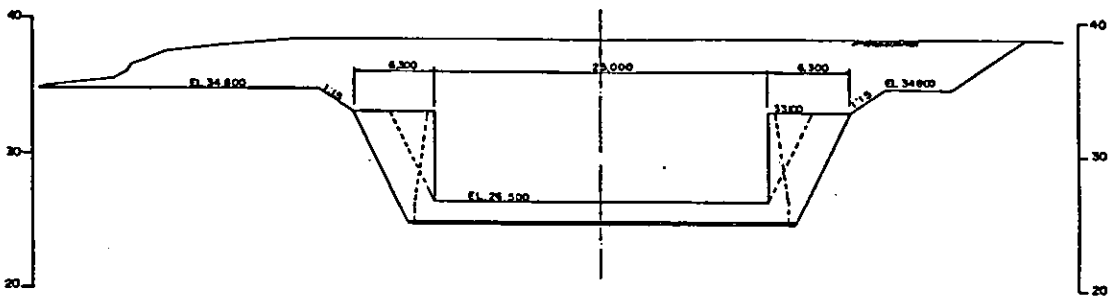
STA 20+000



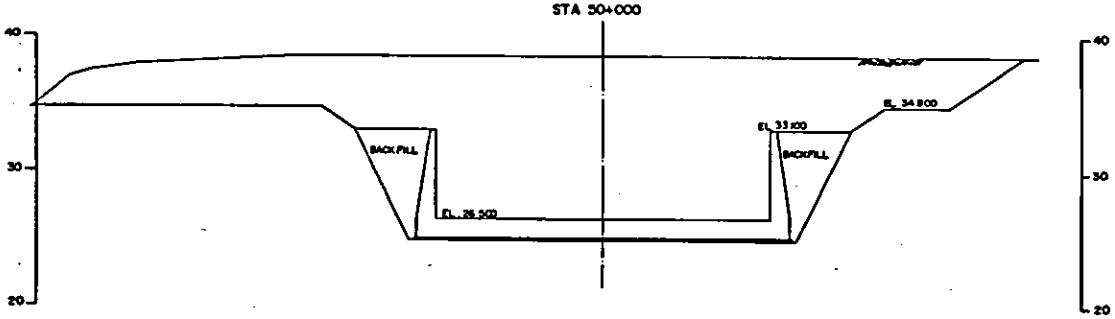
STA 30+000



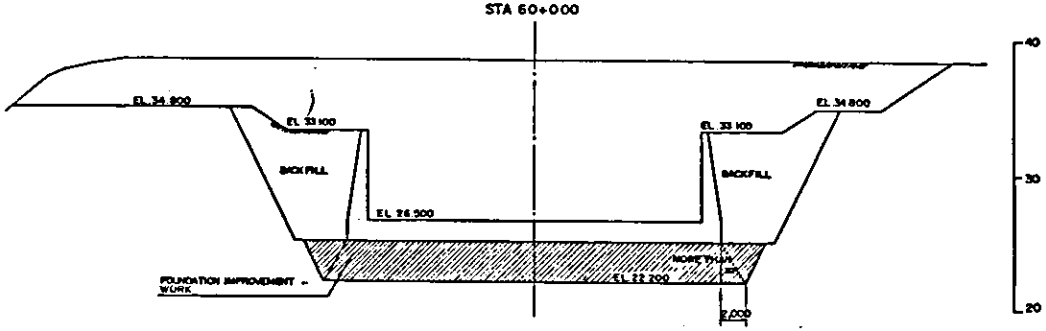
STA 40+000



STA 50+000



STA 60+000



SCALE

0 5 10 15 20 m

SCALE A1 : 200)

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

REPUBLIC OF INDONESIA

MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE

MEDAN FLOOD CONTROL PROJECT

F.D.U. CROSS SECTION (1/3)

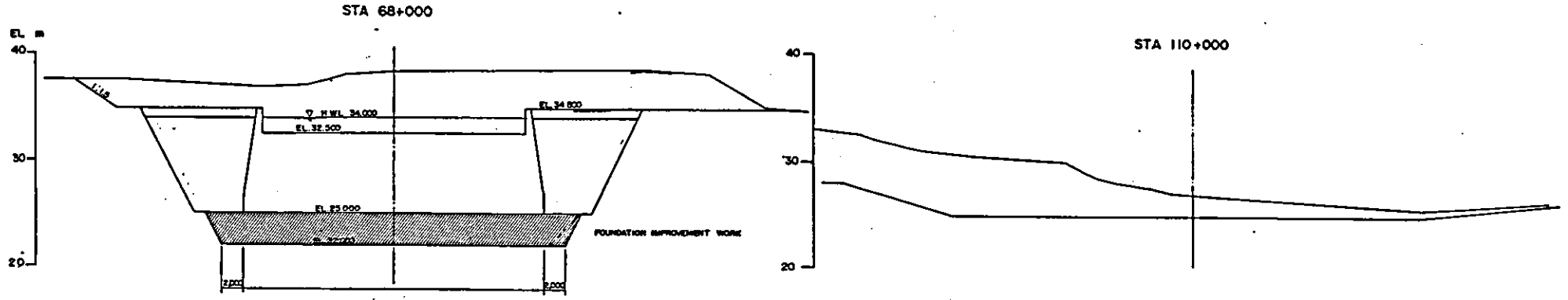
PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					DW-013

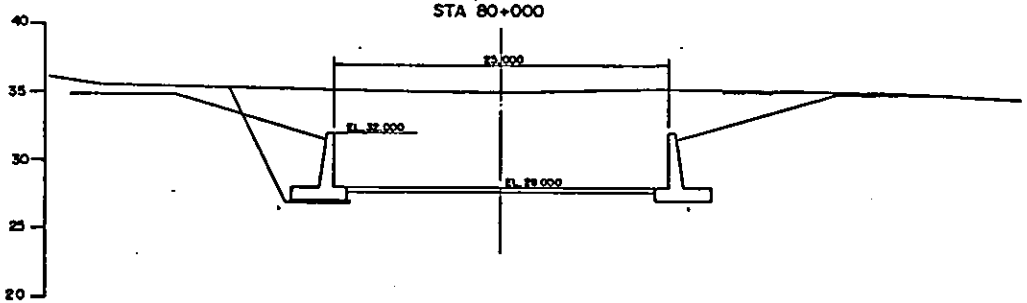
JAPAN INTERNATIONAL COOPERATION AGENCY

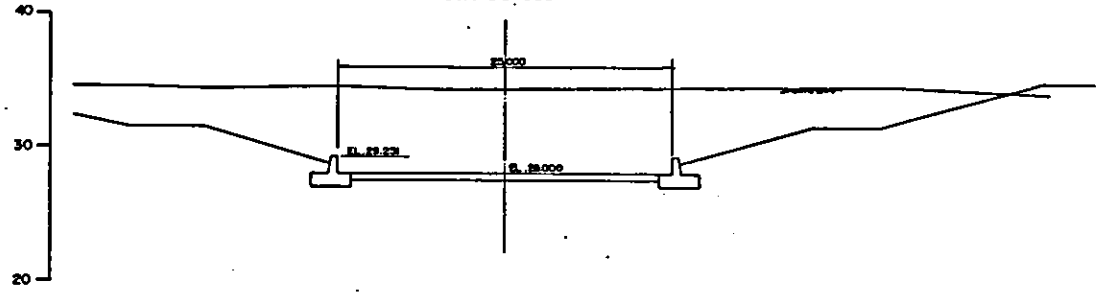
CTI ENGINEERING CO., LTD

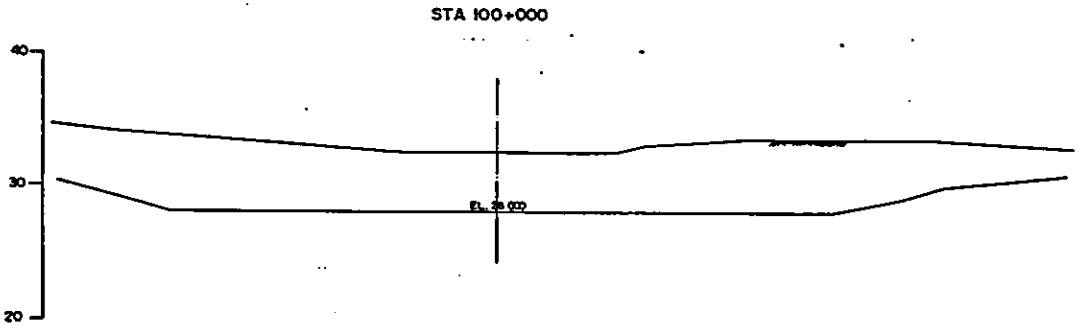
PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA

SHEET NO. | REV.









SCALE
0 5 10 15 20 m
SCALE 1:200

REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE
MEDAN FLOOD CONTROL PROJECT

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					2nd 014

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD
PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA

SHEET NO. | REV.

NO. DATE.

Floodway Weir.

Type C1 BL. 1., Weir: $A = 48.747\ m^2$

$B = 25\ m$

$V_1 = 48.747 \times 25.$

$= 1218.675\ m^3$

Wall $A_1 = 9.589\ m^2$ $A_2 = 8.802\ m^2$

$L = 10\ m$

$(L_1 = 4.6\ m \quad L_2 = 3.4 \quad L_3 = 2.0)$

$V_2 = 9.589 \times 4.6 + (9.589 + 8.802) \times \frac{1}{2} \times 3.4 + 8.802 \times 2.0$

$= 92.978\ m^3$

BL2. Wall $A = 19.302\ m^2$

$L = 18.0\ m$

$V_3 = 19.302 \times 18\ m \times 2$

$= 694.872\ m^3$

Apron $A = 16.5\ m^2$

$L = 18.0\ m$

$V_4 = 16.5 \times 18.\ m$

$= 297.000\ m^3$

Cut off $A = 0.75\ m^2$

$L = 13.99 \times 2\ m = 27.98$

$V_5 = 0.75 \times 27.98\ m$

$= 20.985\ m^3$

Wing (Up-S) A_1 $15.898\ m^2$ $l_1 = 4.895$

A_2 $8.050\ m^2$ $l_{12} = 6.794$

A_2' $7.300\ m^2$ $l_2 = 3.640$ $l_{23} = 8.493$

A_3 $2.813\ m^2$

$V_6 = 2 \times (15.898 \times 4.895 + (15.898 + 8.050) \times \frac{1}{2} \times 6.794 + 7.300 \times 3.640 + (7.300 + 2.813) \times \frac{1}{2} \times 8.493$

$= 457.378\ m^3$

77.821
81.351
26.572
42.945
228.689

NO. DATE.

Brest Wall

$A = 25.313\ m^2$

$l_1 = 0.830$

$l_2 = 3.232$

$l_3 = 4.500$

$$V_7 = \left\{\frac{25.313}{2} \times (0.830 + 4.500) + 25.313 \times 3.232\right\} \times$$

$$= 298.542\ m^3$$

Wing Wall (Down Stream)

$A = 21.015\ m^2$

$l_1 = 0.660$

$l_2 = 0.500$

$l_3 = 4.050$

$$V_8 = \left(\frac{21.015}{2} \times (0.660 + 4.050) + 0.5 \times 21.015\right) \times 2$$

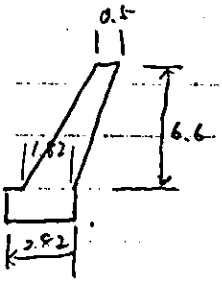
$$= 119.996\ m^3$$

Total. 3,200.425.

$(\times 1.05) = 3360\ m^3$

Type D

Reaining Wall. $H = 6.6\ m$

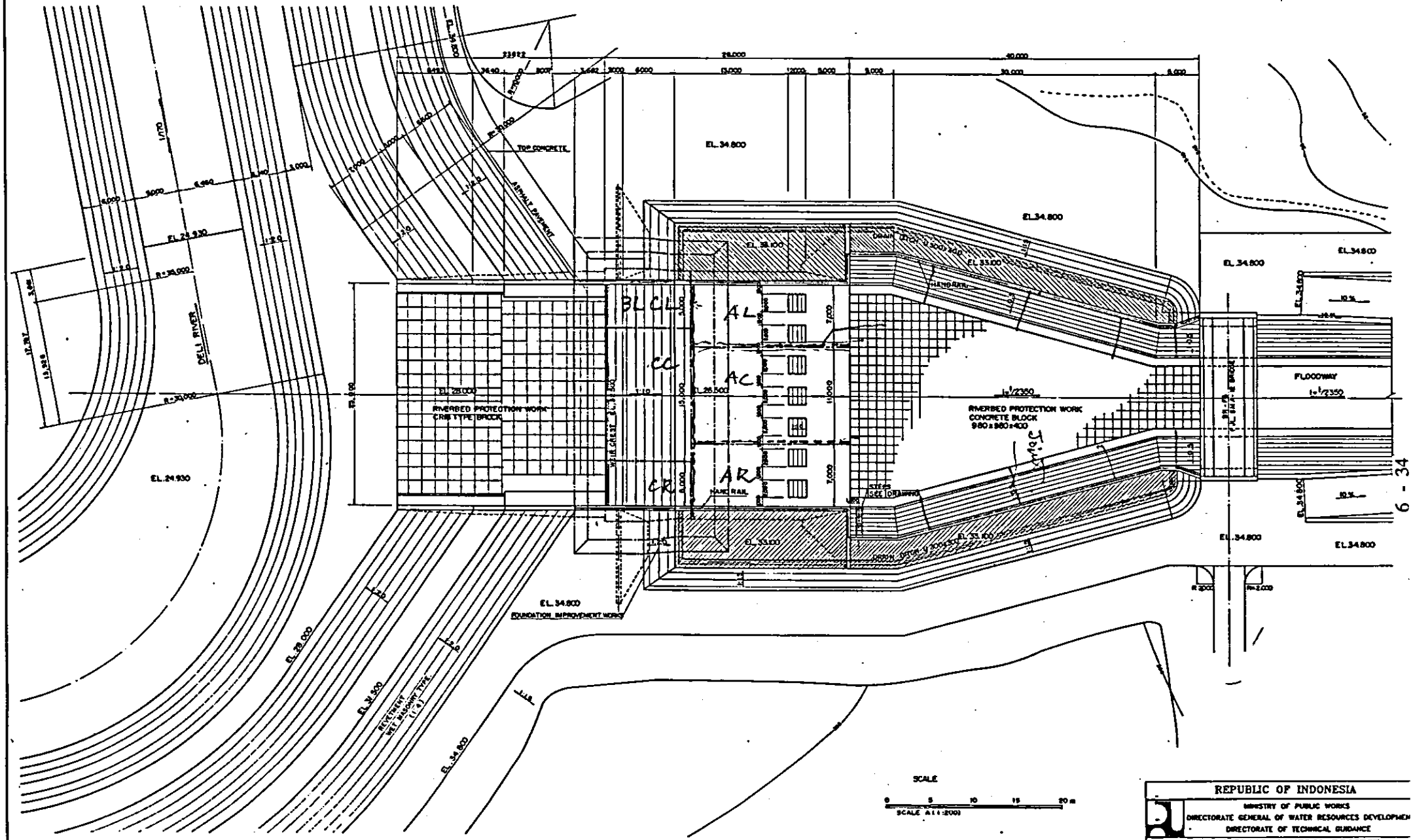


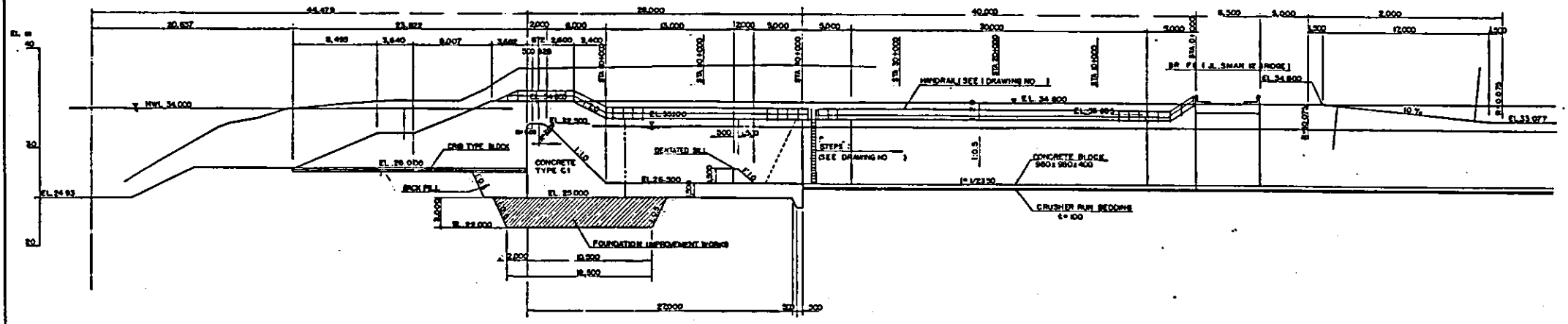
$A = (0.5 + 1.82) \times 6.6/2 + 2.82 \times 1.0 = 10.476\ m^2$

$V = 10.476 \times 40m \times 2 = 838\ (\times 1.05) = 880\ m^3$

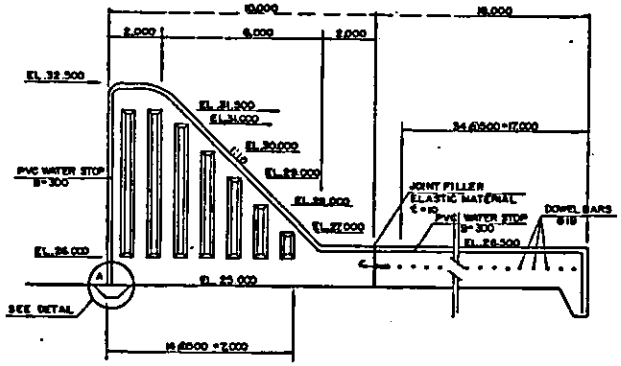
Leveling Conc. $\gamma = 200$.

$3.22 \times 0.2 \times 40 \times 2 = 51.52\ (\times 1.05 = 54\ m^3)$

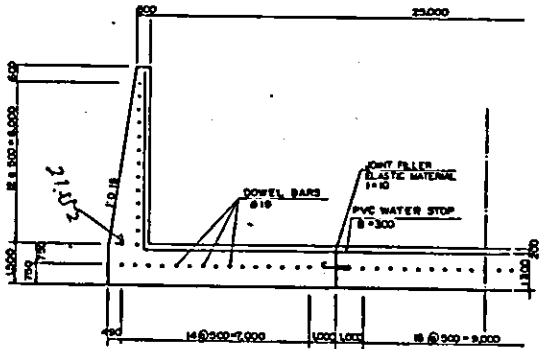

EL. 34.800
EL. 24.930
EL. 28.000
EL. 26.500
EL. 33.100
RIVERBED PROTECTION WORK
CRIB TYPE BRICK
RIVERBED PROTECTION WORK
CONCRETE BLOCK
980 x 980 x 400
FOUNDATION IMPROVEMENT WORKS
FLOODWAY
DELI RIVER
TOP CONCRETE
ASPHALT PAVEMENT
HAND RAIL
STEPS
REVETMENT
WET MASONRY TYPE
BL
CL
AL
CC
AC
CR
AR
SCALE
SCALE 1 : 200
REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMEN
DIRECTORATE OF TECHNICAL GUIDANCE
MEDAN FLOOD CONTROL PROJECT
FDJ. PLAN
PREPARED
CHECKED
SUBMITTED
CERTIFIED
APPROVED
DRAWING NO.
NO.
DATE
REVISIONS
APPROVED
JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD
PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA
SHEET NO.
REV.



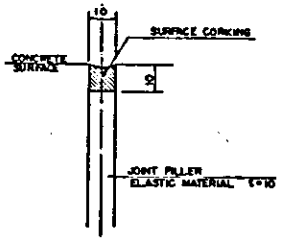
PLAN
SCALE A



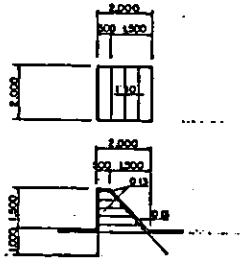
A–A
KEY CONTRACT JOINT & EXPANSION JOINT FOR APPRON
SCALE B



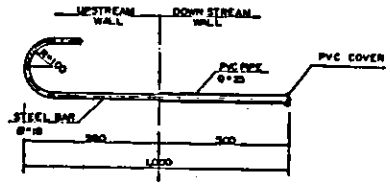
B–B
EXPANSION JOINT FOR APPRON
SCALE B



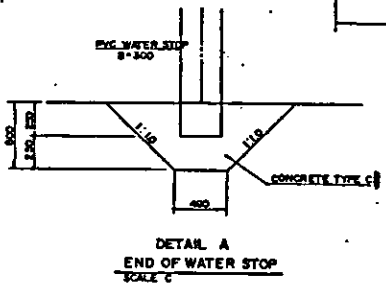
DETAIL OF JOINT FILLER



DETAIL OF DENTATED SILL
SCALE B

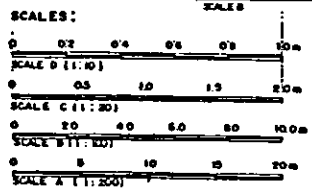


DETAIL OF DOWEL BAR
SCALE B



DETAIL A
END OF WATER STOP
SCALE C

SCALES:



NO.	DATE	REVISIONS	ORIGINATED	APPROVED		

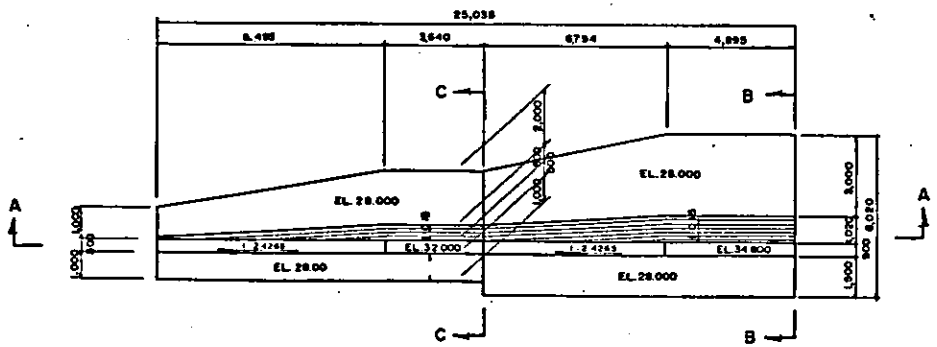
REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE

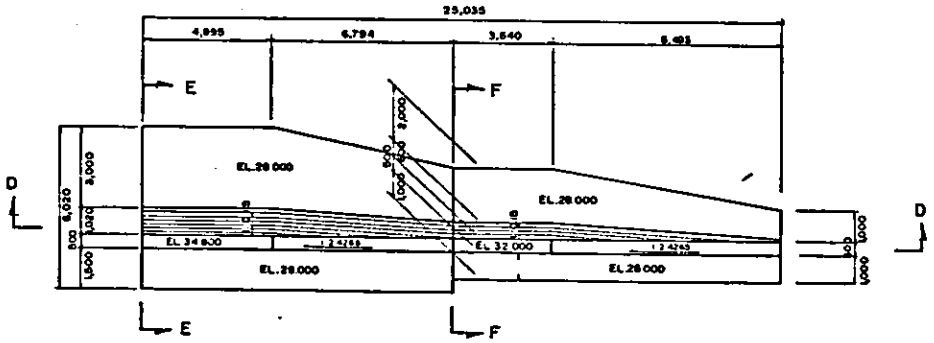
MEDAN FLOOD CONTROL PROJECT

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					DW-01

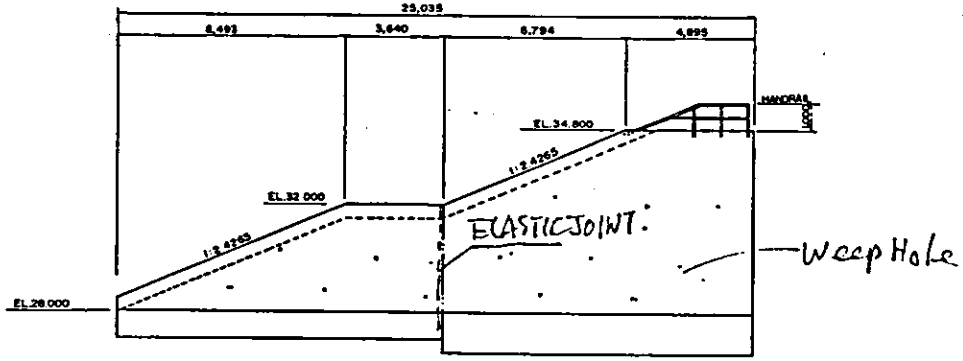
JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD
PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA

SHEET NO. | REV.

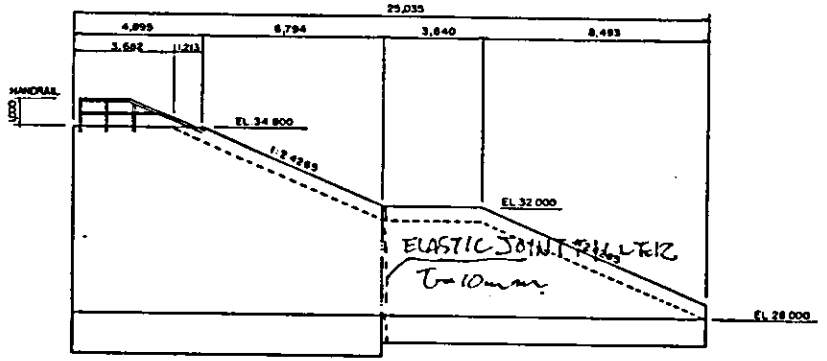




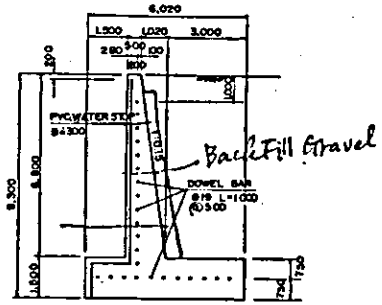
PLAN



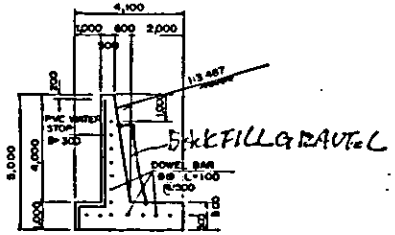
SECTION A-A



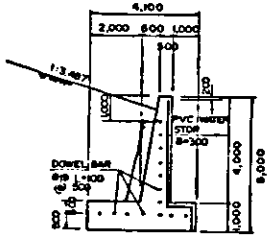
SECTION D-D



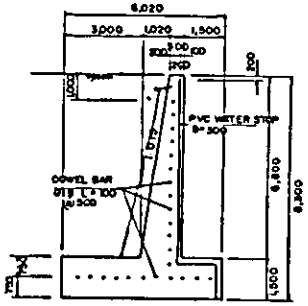
SECTION B-B



SECTION C-C



SECTION F-F



SECTION E-E

SCALE

0 2 4 6 8 10m

SCALE A 1 : 100

REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE

MEDAN FLOOD CONTROL PROJECT

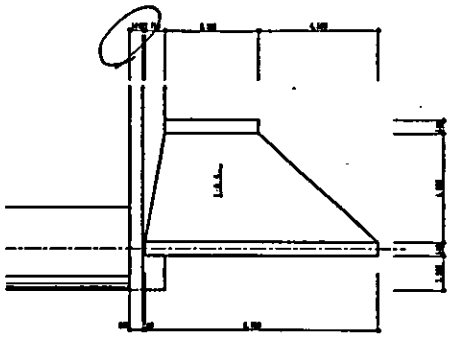
FOR UNDERWALL

NO.	DATE	REVISIONS	ORIGINATED	APPROVED

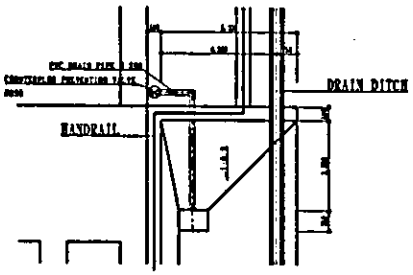
PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD
PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA

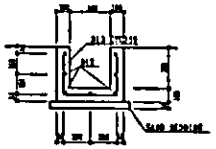
SHEET NO. | REV.



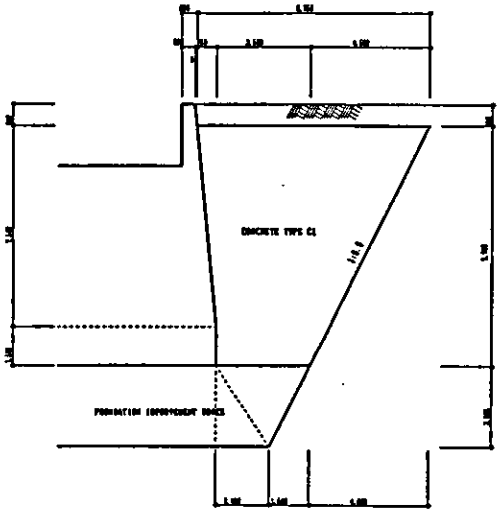
PLAN



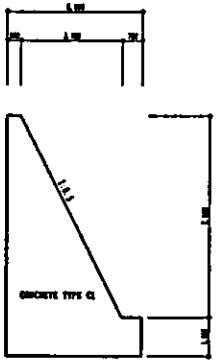
PLAN



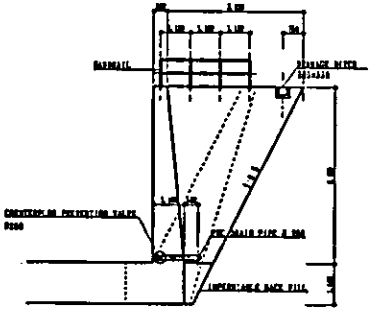
DETAIL OF DRAIN DITCH



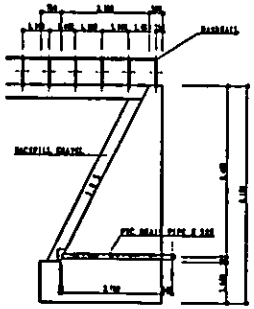
FRONT VIEW



SECTION

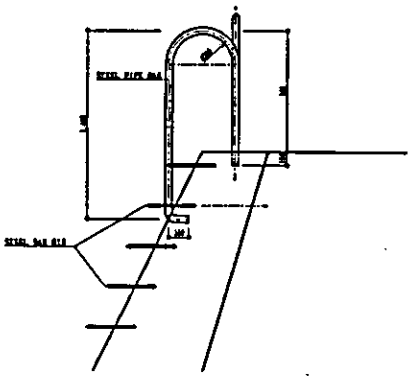


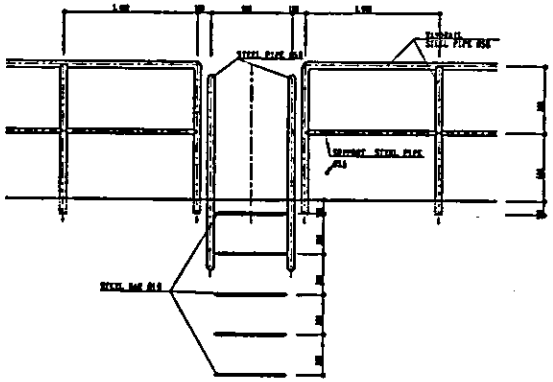
FRONT VIEW



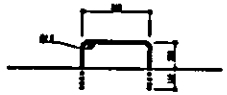
SECTION

DETAILE OF WING WALL

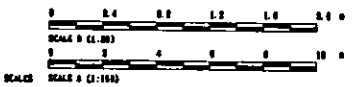




DETAILS OF BREST WALL



DETAILE OF STEPS & HANDRAIL



REPUBLIC OF INDONESIA

MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF TECHNICAL GUIDANCE

MEDAN FLOOD CONTROL PROJECT

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.
					12

JAPAN INTERNATIONAL COOPERATION AGENCY
CTI ENGINEERING CO., LTD

PROJECT PENGENDALIAN BANJIR KOTAMADYA MEDAN

SELECT NO. | REF.

NO.	DATE	REVISIONS	CHECKED

Re-Bars

1. UpStream Wing Wall

H=6.8m.

	D22.	14.24m × 3.333 × 3.04 mos.	=	144.3 kg/m
11		(4.247+4.2) × 3.333 × 3.04	=	85.6 kg/m
冂	D16	8.158m × 3.333 × 1.58	=	42.4 kg/m
—	D13	1.0 × 93 × 0.995	=	92.5 kg/m
				364.8 kg/m

H=4.0m (Down stream Block).

	D22..	11.4m × 3.333 × 3.04	=	155.5 kg/m
冂	D16	10.9m × 3.333 × 1.58	=	56.7
—	D13.	1.0 × 66 × 0.995	=	65.7
				277.9 kg/m

H=4.0m (Up stream Block).

	D16.	9.4 × 3.333 × 1.56	=	48.9.
冂	D16	9.968 × 3.333 × 1.56	=	51.8
—	D13	1 × 56 × 0.995	=	55.7
				156.4 kg/m

H=1.0m

	D16	7.5 3.333 × 1.56	=	39.0
冂	D16	4.434 × 3.333 × 1.56	=	23.1
—	D13	1 × 32 × 0.995	=	31.8
				93.9 kg/m

Weight

364.8 × 4.895	=	1786.
(364.8+277.9)/2 × 6.794.	=	2183
156.4 × 3.640	=	570
(156.4+93.9) × 2 × 8.493	=	1063
		5,602

5602 × 2 × 1.2 = 13445 kg.

Main Body.

BLock. CL & CR

	D13 crest	27.6m	× 17	×0.995	= 466.9		
	P13 crest	6.0m	× 94	×0.995	= 561.2.		
	Wall						
	D19.	8.0m	× 30	× 2.25	= 540.0		
	D16	10.1m	× 33	× 1.56	= 520.0		
	P13	6.3m	× 34	× 0.995	= 213.2.	2301.3kg×	

B Lock CC.

D13	27.6	× 36.	× 0.995	= 988.7	
D13	10.8	× 94	× 0.995.	= 1010.2	1998.9kg.

Block. AL & AR.

D19	(4.028+4.0)	× 119	×225.	= 1178.9	
D16	8.158	× 61.	× 1.56	= 776.3	
D19	19.182.	× 119	×2.25	= 5136.0.	7091.2kg ×2

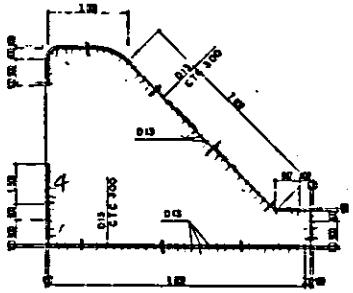
AC.

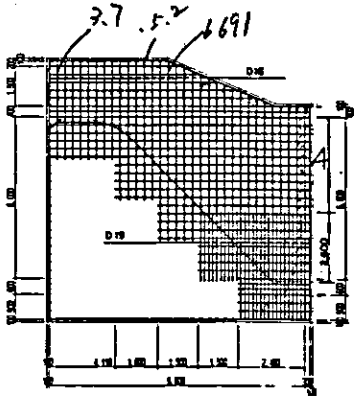
D13	24.2	× 61	×0.995	= 1476.2	
D13	17.8	× 37	×2×0.995	= 1310.6.	
				2786.8.	

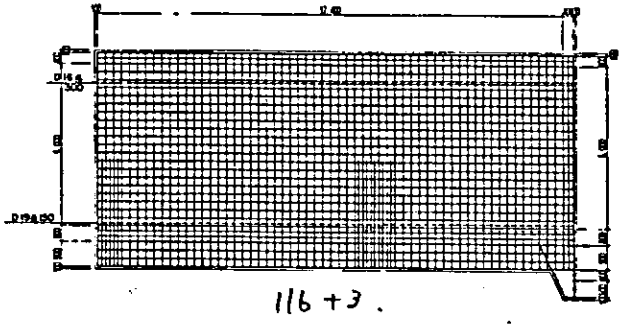
Total. BL. CL 2301.3
CR 2301.3
CC 1198.9.
AL 7091.2.
AR 7091.2
AC 2786.8

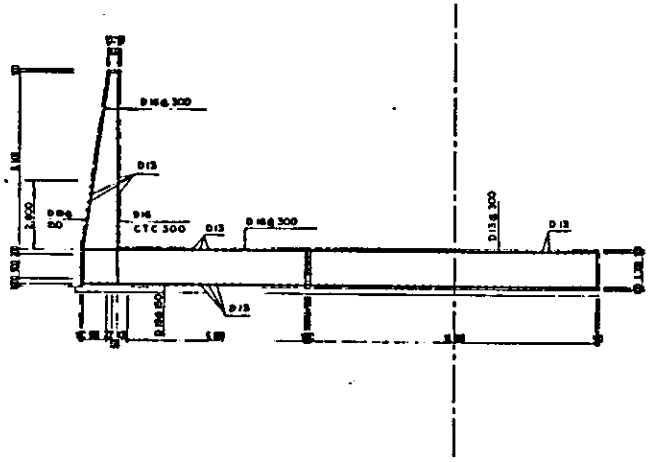
22770.7 × 1.2 = 27.325kg

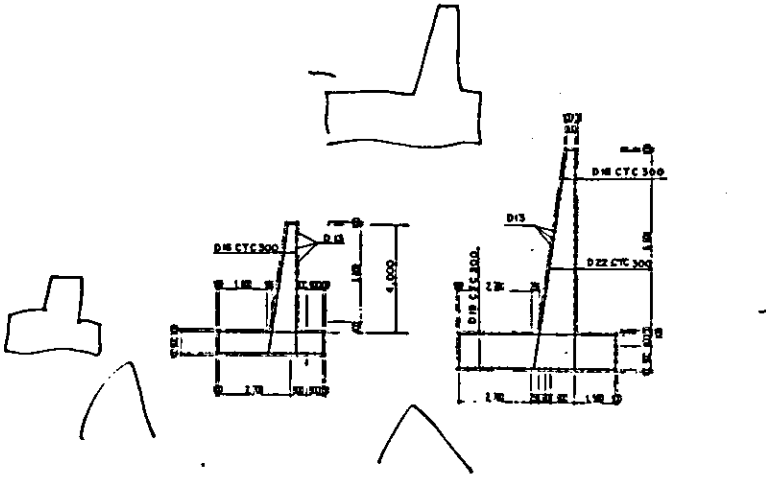
Re Bar Total. 13945 + 27325
= 40770kg.











SCALE

0 2.0 4.0 6.0 8.0 10.0m

SCALE 1:100

NO	DATE	REVISIONS	ORIGINATED	APPROVED

REPUBLIC OF INDONESIA

MINISTRY OF PUBLIC WORKS

DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT

DIRECTORATE OF TECHNICAL GUIDANCE

MEDAN FLOOD CONTROL PROJECT

PREPARED	CHECKED	SUBMITTED	CERTIFIED	APPROVED	DRAWING NO.

JAPAN INTERNATIONAL COOPERATION AGENCY

CTI ENGINEERING CO., LTD

PROYEK PENGELOLAAN SUMBER AIR DAN PENGENDALIAN BANJIR SUMATERA UTARA

SHEET NO. | REV.

FORMWORKS FOR DIVERSION WEIR.

ITEM NO	BQ ITEM	UNIT	
	DELI RIVER WEIR		
	FORMWORK (FW 1)	m²	2005,77
	FORMWORK (FW 2)	m²	3365[illegible]
			1,07
	FLOOD WAY		
	FORMWORK (FW 1)	m²	1015,4
	FORMWORK (FW 2)	m²	3265,72
			1,30

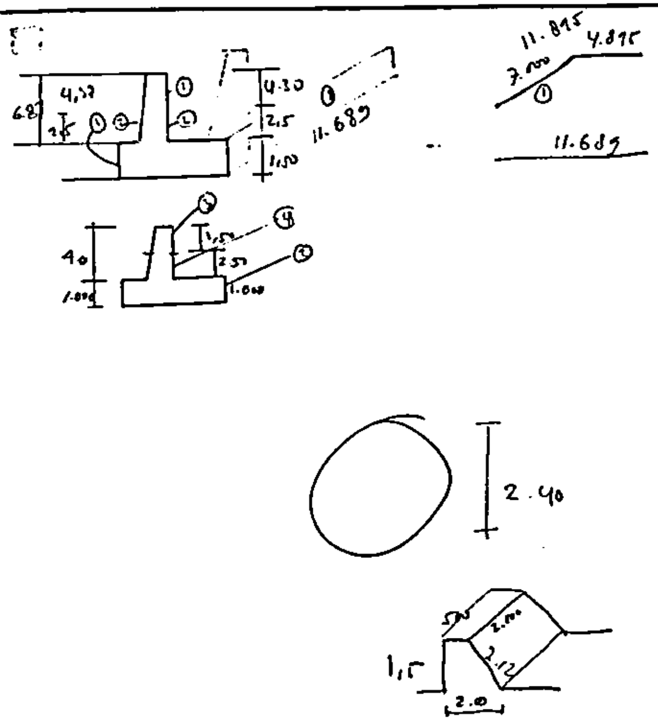
500

Pw = 5.4 Ton³

Fw = 3200

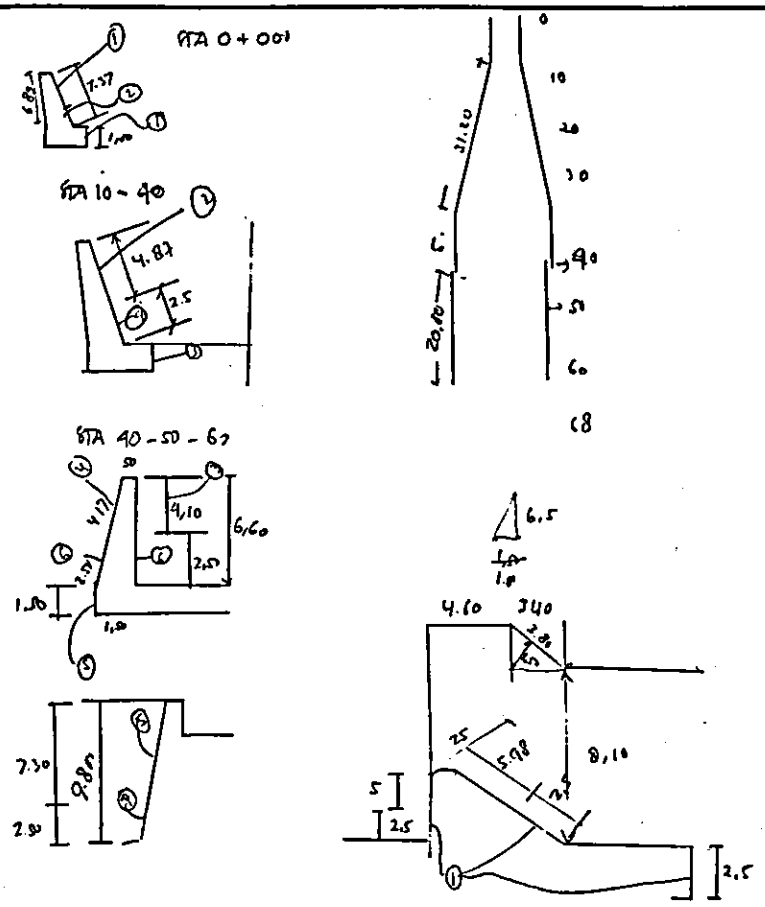
BILL OF QUANTITY

NAME OF STRUCTRURE : Flood way
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUBTOTAL	VOLUME TOTAL
			FW ≤ 2,5 m R		
		①	(1,50 × 11,689) × 2 + (1,5 × 11,895) × 2 L & R	70,75	
		②	(2,50 × 11,689) × 2 + (2,5 × 11,895) × 2 L & R	117 92	
		3	(1,00 × 3,640) × 2 + (1,00 × 3,641) × 2 L & R	14,56	
		4	(2,50 × 3,641) × 2 + (2,50 × 3,644) × 2 L & R	36,9	
		5	(1,00 × 8,495) × 2 + (1,00 × 8,657) × 2	33,90	
		6	(0,50 × 8,495) × 2 + (0,50 × 8,65) × 2	17.14	
		7	(3,6 × 2,00) × 2 + (3,60 × 2,00) × 2 + ((5.40 + 1.10)/2) × 4	49.32	340,07

BILL OF QUANTITY

NAME OF STRUCTRURE : Floodway 1
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUB TOTAL	VOLUME TOTAL
			FW 1 ≤ 2,5 m		
		①	(1 × 5) × 2 + (1,00 × 5) × 2	20	
		②	(2,50 × 5) × 2	25	
		③	(1,00 × 36,20) × 2	72,40	
		4	(2,50 × 36,20) × 2	181,00	
		5	(1,50 × 20) × 2	60	
		6	(2,50 × 20) × 2 + (2,50 × 20) × 2	200	
		7	(2,50 × 8,00) × 2	40	598,9
			Flood way		
			Waffles Block		
			$(1,50 \times L) + (2,12 \times L) + \left[\left(\frac{0,50 + L}{2} \times 1,50\right) \times L\right] \times 7$	76,93	76,93
					L
		1	(2,50 × 25) + (2,50 × 25) + (2,50 × 25)	187,50	

BILL OF QUANTITY

NAME OF STRUCTRURE : Floodway
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUB TOTAL	VOLUME TOTAL
			Fwl 7/ 2,5		
		1	$(4,30 \times 4.895) \times 2 + (4,37 \times 4,1875) \times 2$:	84.88	
		2	$\left(6,794 \times 1,50 + \frac{7,348 \times 2,65}{2}\right) \times 2 \times 2$	79,71	
		③	$(1,50 \times 3,674) \times 2 + (1,50 \times 3,674) \times 2$	21,84	
		4	$\left(\frac{3,78 \times 1,30}{2}\right) \times 4$	9,83	196,26

BILL OF QUANTITY

NAME OF STRUCTRURE : Floorway
LOCATION :

NO	SKETSA OF STRUCTURE	UNIT	QUANTITY CALCULATION	VOLUME SUB TOTAL	VOLUME TOTAL
			Fwa // 2,5 m		
		(1)	$(4,87 \times 5) \times 2$	48,70	
		(2)	$(4,87 + 36,20) \times 2$	303,89	
		(3)	$(4,10 \times 20) \times 2$	164	
		4	$(4,17 \times 20) \times 2$	166,8	
		(5)	$(7,30 \times 8,00) \times 2 - \left(\frac{3,80 \times 1,50}{2}\right) \times 4$	105,40	777,7
					985,05

6 - 45

No.

Floodway Weir

Water Stop.

Weir (Cross)	7.5+8.5+1.5+2.0 = 19.5m	× 2	= 39.0
Apron (Cross)	25.4 + 6.6×2	=	= 38.6
(Axis)	18m × 2		= 36.0
Wing J1	(8.1+1.5) × 2		= 19.2
J2	(4.8+1.0) × 2		11.6
			144.4 ≒ 150

Dawel Bars.

Wing ~~Apron~~ J1	24×2	= 48
J2	14×2 +	= 28
Apron (Cross)	75	= 75
(Axis)	33 × 2	= 66
		217 nos.

Weight 1.6m × 2.23kg/m × 217 = 780 kg.

Joint Filler.

Apron (Cross)	19.3+19.3+.11×1.5	= 55.1 m²
Apron (Axis)	18×1.5×2	54 m²
Wing J2	7.3×2	14.6
J1	15.898×2	31.8
		155.5

Water Stop.

ℓ =

Apron (Cross)	38.2 m	
(Axis)	18 ×2 = 36m	
Wing J1+J2	(8.3+5)×2 = 26.6m	100.8×1.1 = 110m

Drainag Ditch

6+25+33+3 = 67m × 2 = 134m

Surface Caulking Materials

Wing	6.8+1.5+4+1	= 13.3m	
Apron Cross	25 + 6.6×2	= 38.2m	
Axis.	18×2	= 36	87.5m.

No.

Floodway

Crib Type Concrete Blocks

A = 23 × 12.1 +

8 × 15 + 8 × 14 = 112

Cobble Stone.

1.2 × 1.2 × 112 × 0.4 = 64.5

Crusher Run

A = (23 × 12.1 + 22 × 11.6) × 0.1 = 31.19

Conc. Blocks · 1m × 1m

A = 23 × 5 + (23 + 6.9) × ½ × 30 + 6.9 × 5 · = 598 m²

598 個

Crusher Run 598 × 0.1 = 59.8

Hand Rail 76.3m × 2 = 152.6 m

152.6 × 15 kg/m = 2289 = 2,300 kg

*Steel Rudder. φ50 × t. ℓ = 9m × 2本 (5.31 kg/m × 9 × 2 = 96 kg)

φ19 B = 60cm 22本 (2.23 kg/m × 0.6 × 22 = 30 kg)

Total 96 + 30 = 126.