JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF SETTLEMENT AND REGIONAL DEVELOPMENT
THE REPUBLIC OF INDONESIA

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

FINAL REPORT

COMPONENT 1:
JATIBARANG MULTIPURPOSE DAM CONSTRUCTION

VOLUME IV Work Quantity Calculation

AUGUST 2000

CTI ENGINEERING INTERNATIONAL CO., LTD.
IN ASSOCIATION WITH
PACIFIC CONSULTANTS INTERNATIONAL
AND
PASCO INTERNATIONAL INC.

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CONSTITUTION OF THE REPORT

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VOLUME II	DESIGN CRITERIA
VOLUME III	DESIGN NOTES
VOLUME IV	WORK QUANTITY CALCULATION
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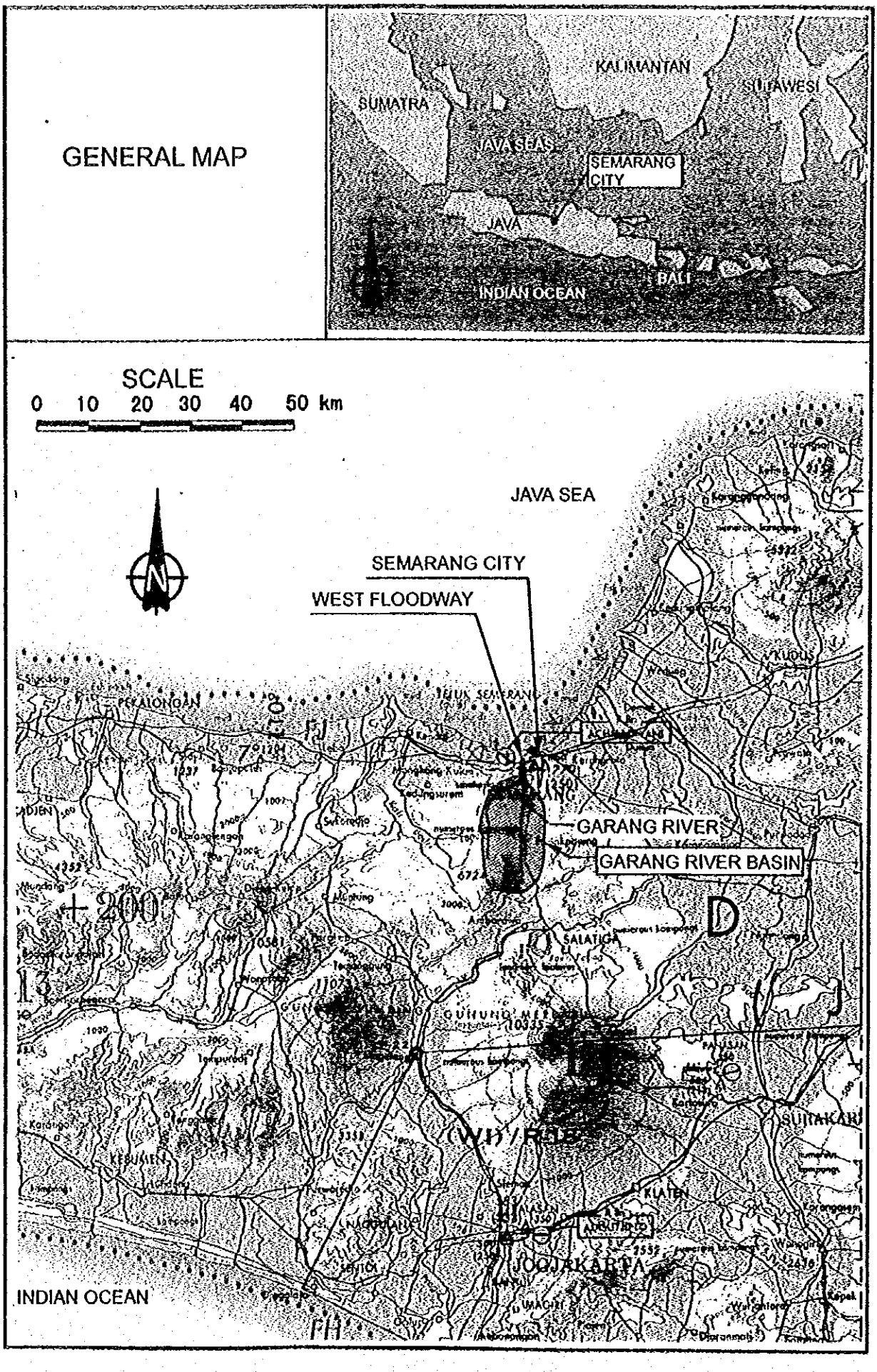
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SUMATRA
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SEMARANG CITY
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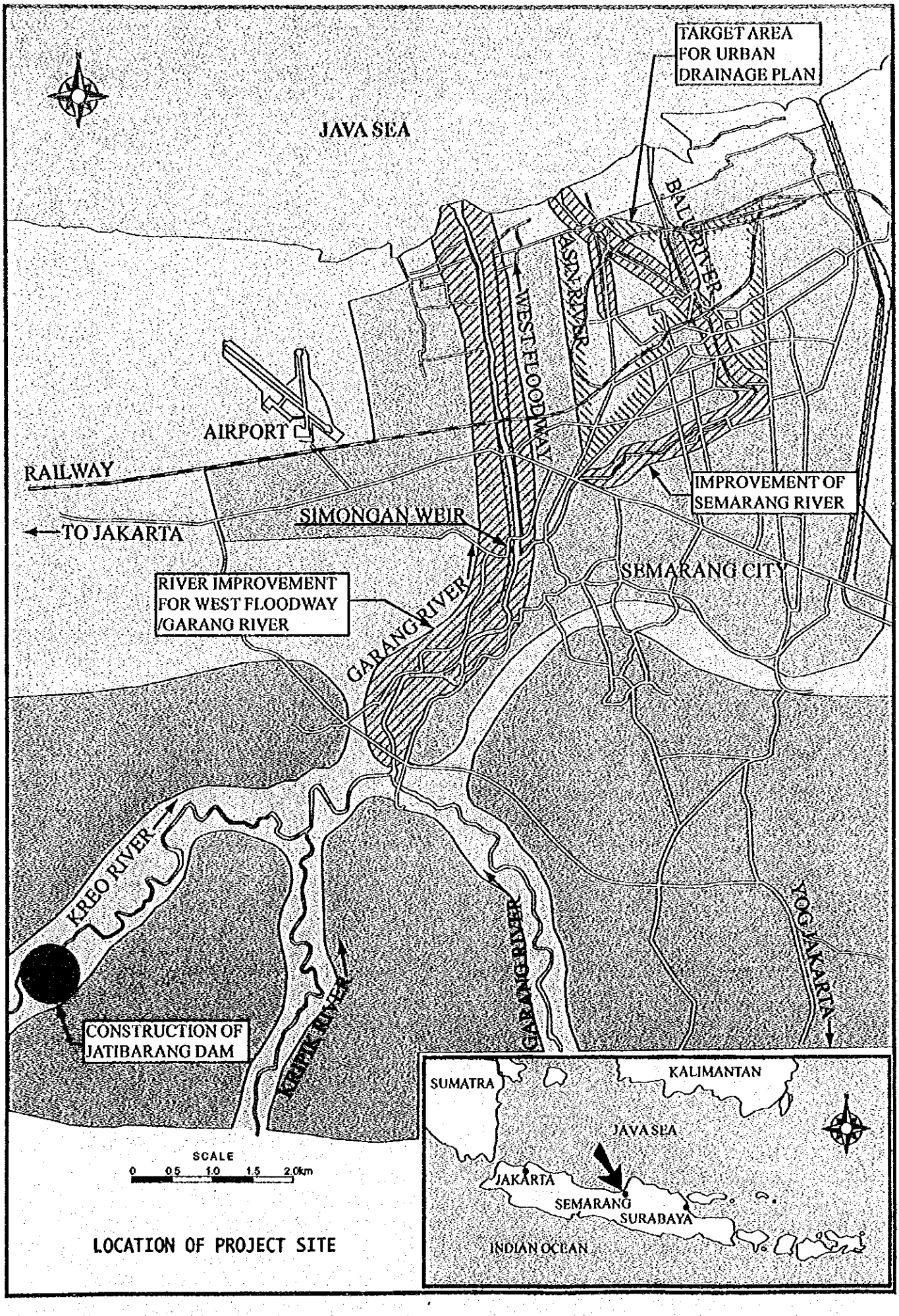
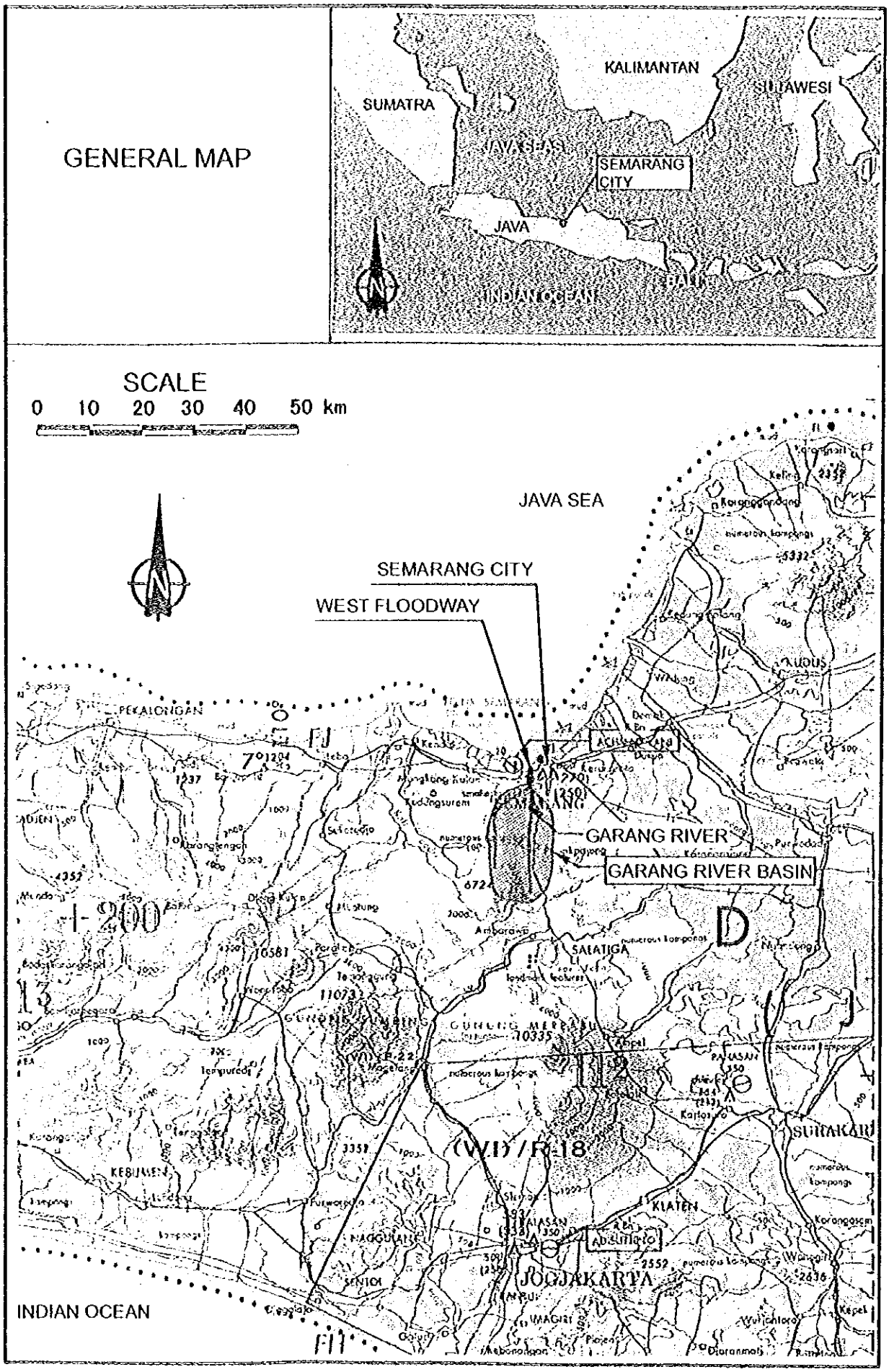


LOCATION OF PROJECT SITE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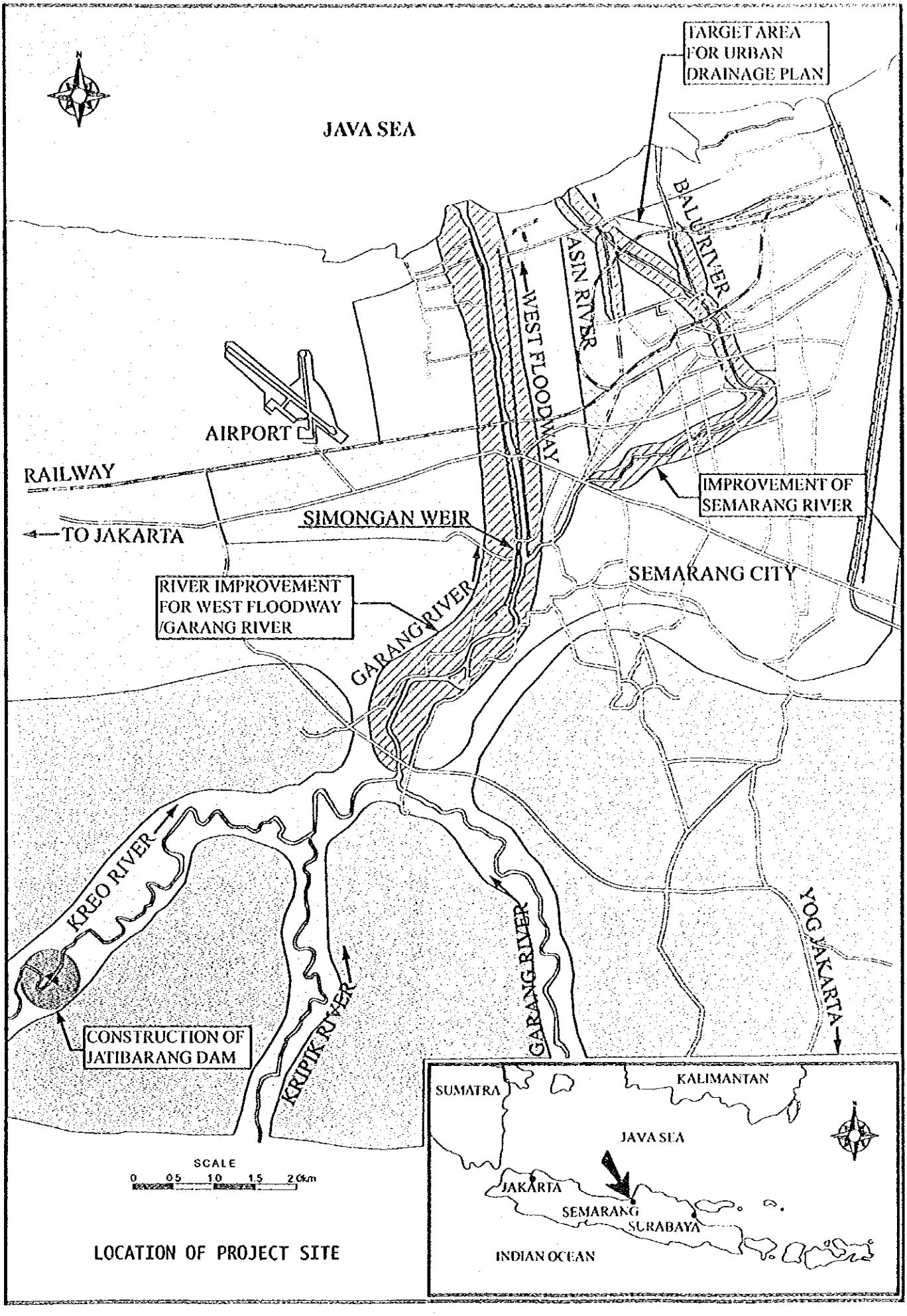

LOCATION OF PROJECT SITE

VOLUME IV WORK QUANTITY CALCULATION

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Item No.	Description	Unit	Quantity
A.	GENERAL		
B.	WATER CONTROL		
C.	SURFACE EXCAVATION AND EARTH WORKS		
C.1	Clearing and Grubbing :		
C.1.1	for Areas to be Excavated	m^2	320,000
C.1.2	for Reservoir	ha	70
C.2	Stripping of Topsoil	m^2	320,000
C.3	Surface Excavation :		
C.3.1	for Diversion Facilities (Cofferdam, Upstream and Downstream Portals)	m^3	8,000
C.3.2	for Embankment Dam	m^3	174,000
C.3.3	for Gallery	m^3	7,000
C.3.4	for Spillway	m^3	453,500
C.3.5	for Inclined Intake Structure	m^3	11,000
C.3.6	for Hydropower Station (below EL.60.0m)	m^3	400
C.3.7	for Dam management Complex	m^3	36,000
C.4	Exploratory Trench Excavation in Common	m^3	6,000
C.5	Exploratory Trench Excavation in Rock	m^3	500
C.6	Construction of Common Fill or Backfill	m^3	22,000
C.7	Construction of Backfill Gravel or Gravel Bedding (Crushed Stone)	m^3	3,000
C.8	Clearing Surfaces in Exposed Foundation for Inspection	m^2	6,000
C.9	Construction of Random Fill for Temporary Cofferdam	m^3	24,000
D.	TUNNELLING		
D.1	Underground Excavation :		
D.1.1	for Diversion Tunnel	m^3	18,300
D.1.2	for Outlet Tunnel	m^3	2,300
D.2	Furnishing and Installing Steel Rib Supports and Accessories :		
D.2.1	for Diversion Tunnel	tonne	200
D.2.2	for Outlet Tunnel	tonne	37
D.3	Production and Placing Shotcrete Lining :		
D.3.1	for Diversion Tunnel	m^3	1,800
D.3.2	for Outlet Tunnel	m^3	360
D.4	Furnishing and Installing Steel Mesh Reinforcement :		
D.4.1	for Diversion Tunnel	kg	11,400
D.4.2	for Outlet Tunnel	kg	5,400
D5	Furnishing and Installing Rock Bolts :		
D.5.1	for Diversion Tunnel (25 mm dia.)	m	17,400
D.5.2	for Outlet Tunnel (22 mm dia.)	m	1,200

PACKAGE 1: JATIBARANG MULTIPURPOSE DAM INCLUDING APPURTENANT STRUCTURES

Item No.	Description	Unit	Quantity
E.	DRILLING AND GROUTING		
E.1	Core Drilling (66 mm dia) :		
E.1.1	from within Gallery	m	1,200
E.1.2	from Surface	m	4,900
E.2	Rotary Drilling Holes for Grouting (46 mm dia) :		
E.2.1	from within Gallery	m	5,200
E.2.2	from Surface	m	14,400
E.2.3	from Tunnels	m	1,100
E.3	Drill set-up for drilling grout hole	No.	4,100
E.4	Wash and Water Pressure Testing	No.	4,100
E.5	Cement used in Pressure Grouting	tonne	410
E.6	Fine aggregate used in Pressure Grouting	tonne	2
E.7	Hook-up to Holes and Connections for Grouting	No.	4,100
E.8	Casing pipe for pressure grouting	tonne	10
F.	EMBANKMENT CONSTRUCTION		
F.1	Dam Embankment Impervious Zone including Contact Slurry and Contact Material	m^3	119,000
F.2	Dam Embankment Semi-pervious Zone :		
F.2.1	In Upstream Semi-pervious Zone	m^3	33,000
F.2.2	In Downstream Fine Semi-pervious Zone	m^3	24,000
F.2.3	In Downstream Coarse Semi-pervious Zone	m^3	25,000
F.3	Dam Embankment Pervious Zone :		
F.3.1	In Inner Pervious Zone	m^3	96,000
F.3.2	In Outer Pervious Zone including Surface Treatment	m^3	495,000
F.3.3	In Riprap Zone	m^3	10,000
F.4	Special Compaction for Dam Embankment :		
F.4.1	In Impervious Zone Embankment	m^3	1,600
F.4.2	In Upstream and Downstream Semi-pervious Zone	m^3	3,000
G.	PROTECTION AND SUPPORT OF EXCAVATION		
G.1	Construction of Wet Stone Masonry	m^3	500
G.2	Construction of Stone Pitched Slope Protection	m^3	300
G.3	Construction of Cobble Stone Foundation	m^3	200
G.4	Construction of Mat Gabions	m^3	100
G.5	Shotcrete Concrete in Surface Excavation including Drain Pipe and Gravel; 10 cm in Thickness	m^2	13,000
G.6	Furnishing and Installing Steel Mesh Reinforcement in Surface Excavation	kg	34,000
G.7	Furnishing and Placing Full Face Sodding and Strip Sodding including Maintenance Watering	m^2	35,000
G.8	Furnishing and Installing Grouted Anchor Bar including Drilling and Grouting; 25 mm in Diameter	m	12,500
H.	DRAINAGE		
H.1	Construction of Surface Drains :		
H.1.1	Type 1-1 (Wet Stone Masonry)	m	2,700
H.1.2	Type 1-2 (Wet Stone Masonry)	m	2,700
H.1.3	Type 2-1 (Wet Stone Masonry) with Concrete Cover	m	80
H.1.4	Type 2-2 (Wet Stone Masonry) with Grating Cover	m	50
H.1.5	Type 3-1 (Reinforced Concrete)	m	420
H.1.6	Type 3-2 (Reinforced Concrete) with Grating Cover	m	30
H.2	Construction of Catch Basins (Wet Stone Masonry)	m^3	50

PACKAGE 1: JATIBARANG MULTIPURPOSE DAM INCLUDING APPURTENANT STRUCTURES

Item No.	Description	Unit	Quantity
I.	CONCRETE PRODUCTION AND CONCRETE CONSTRUCTION		
I.1	Furnishing and Placing PVC Waterstop; 300mm wide	m	4,500
I.2	Furnishing and Installing PVC Pipe Drains 50 mm dia. :		
I.2.1	50 mm in Diameter as Weephole	m	100
I.2.2	100 mm in Diameter for Bridge	m	15
I.3	Furnishing and Installing Perforated PVC Pipe 250 mm dia.	m	900
I.4	Furnishing and Installing Perforated PVC Pipe 200 mm dia.	m	300
I.5	Furnishing and Placing Joint Filler or Joint Sealant :		
I.5.1	Elastic Joint Filer; 10 mm in Thickness	m²	350
I.5.2	Polysulphide Mastic Joint Sealant	litre	600
I.5.3	Bitumen-Rubber Mastic Joint Filler (IGAS or equivalent)	litre	6,400
I.6	Furnishing and Installing Deformed Reinforcement Bars :		
I.6.1	in Diversion Tunnel	tonne	290
I.6.2	in Spillway	tonne	500
I.6.3	in Gallery	tonne	260
I.6.4	in Hydropower Station	tonne	140
I.6.5	in Other Structures	tonne	100
I.7	Furnishing and Placing Dowel Bars 25 mm dia including PVC sleeve	tonne	3
I.8	Furnishing and Placing Metal Seals	m	40
I.9	Production and Construction of Concrete Type A for Diversion Tunnel Lining	m³	6,800
I.10	Production and Construction of Concrete Type B :		
I.10.1	in Gallery and Entrance	m³	5,700
I.10.2	in Inclined Intake Structure	m³	900
I.10.3	in Hydropower Station	m³	4,500
I.10.3	in Other Structures	m³	50
I.11	Production and Construction of Concrete Type C	m³	120
I.12	Production and Construction of Concrete Type D :		
I.12.1	in Spillway	m³	52,000
I.12.2	in Outlet Tunnel	m³	1,400
I.12.3	in Concrete Plug in Diversion Tunnel	m³	1,000
I.12.4	in Adit	m³	100
I.12.5	in Other Structures	m³	2,500
I.13	Production and Construction of Concrete Type E :		
I.13.1	in Structures	m³	1,000
I.13.2	Backfill Concrete in Seams, Defects and Faults :	m³	200
I.14	Furnishing and Installing Precast Prestressed Concrete Beams Spillway Bridge including Tensioning and Erection	L.S.	
I.15	Furnishing and Installing Precast Concrete Diaphragms for Spillway Bridge including Tensioning and Erection	L.S.	
I.16	Furnishing and Installing Precast Concrete Panels for Spillway Bridge including Erection	L.S.	
J.	ROAD CONSTRUCTION		
J.1	Excavation for Road Construction	m³	152,000
J.2	Placing and Compacting Suitable Fill for Common Embankment	m³	6,100
J.3	Production and Construction of Crushed Stone Sub-Base Course	m³	7,300
J.4	Production and Construction of Penetration Macadam Base Course	m³	2,000
J.5	Production and Construction of Hot Asphalt Mix Surface Course; Minimum 50 mm thick	m²	17,000
J.6	Production and Construction of Concrete Pavement; 150 mm thick	m²	1,700
J.7	Furnishing and Installing Guard Rail	m	1,000

PACKAGE 1: JATIBARANG MULTIPURPOSE DAM INCLUDING APPURTENANT STRUCTURES

Item No.	Description	Unit	Quantity
K.	FURNISHING AND INSTALLING METALWORK		
K.1	Miscellaneous Metalwork (Galvanised)	kg	7,000
K.2	Miscellaneous Metalwork (Painted)	kg	4,500
K.3	Miscellaneous Metalwork (Stainless Steel)	kg	500
K.4	Miscellaneous Metal Work in Underground Works :		
K.4.1	for Diversion Tunnel Plugs (Grout and Cooling Pipes)	L.S.	
K.4.2	for Adit Concrete Filling (Grout Pipes)	L.S.	
L.	WATER CONTROL PLANT		
L.1	Furnishing and Installing Water Control Plant for Outlet Facilities :		
L.1.1	Bulkhead Gate; B 2.0 m x H 2.0 m including Gate Guide, Hoist, Air Vent, etc	L.S.	
L.1.2	Emergency Water Outlet Gate; B 2.0 m x H 1.65 m including Gate Guide, Lifting Beam, Hoist, etc	L.S.	
L.1.3	Trash Rack for Bulkhead Gate and Low Water Outlet Gate	L.S.	
L.1.4	Outlet Pipe;1400 mm dia., 650 mm dia., and 250 mm dia. including Transition Pipe, Reducer, Installation Stand, etc.	L.S.	
L.1.5	Control and Guard Gates with Auxiliary Facilities; for 650 mm dia. Outlet Pipe	L.S.	
L.1.6	Control and Guard Gates with Auxiliary Facilities; for 250 mm dia. Outlet Pipe	L.S.	
L.1.7	Overhead Travelling Crane (3 tonne) and Operating Stand in Control and Guard Gates Operation Room	L.S.	
L.1.8	Electrical Equipment for Control and Guard Gates including local control panels and ultrasonic flow meters.	L.S.	
L.2	Furnishing and Installing Water Control Plant for Hydropower Station :		
L.2.1	Outlet Pipe comprising 1400 mm dia. section, 1400 mm to 800 mm reducer, and 800 mm dia. section	L.S.	
L.2.2	Tailrace Gate; B 2.15 m x H 2.075 m including Gate Guide, Hoist, etc	L.S.	
L.2.3	Drainage Pipe Valve 150 mm dia.	L.S.	
L.3	Furnishing and Installing Flap Gate 600 mm dia.	L.S.	
L.4	Furnishing and Installing Closure Gate for Diversion Tunnel; B 6.2 m x H 5.8 m including Gate Guide, etc	L.S.	
M.	INSTRUMENTATION OF STRUCTURES		
M.1	Supplying and Installing Electrical Piezometers :		
M.1.1	In Embankment	No.	20
M.1.2	In Borehole	No.	4
M.2	Supplying and Installing Foundation Deformation Meter (including Drilling and Backfilling Drilled Hole)	No.	1
M.3	Supplying and Installing Electrical Tri-axial Joint Meters	No.	2
M.4	Supplying and Installing Probe Extensometer with Magnet/Reed Switch Transducer	No.	1
M.5	Supplying and Installing Strong Motion Accelerograph with Recorder	No.	2
M.6	Supplying and Installing Surface Movement Markers :		
M.6.1	on Upstream Surface of Embankment Dam	No.	6
M.6.2	on Downstream Surface of Embankment Dam	No.	9
M.6.3	on Dam Crest	No.	6
M.6.4	on Natural Ground	No.	4
M.6.5	Movement Marker Bench Mark	No.	3
M.6.6	Movement Marker Control Station	No.	2
M.7	Supplying and Installing Terminal Box for Instruments in gallery	No.	3
M.8	Supplying and Installing Digital Readout Unit	No.	2
M.9	Supplying and Installing Stand Pipe Piezometer in Borehole	No.	7
M.10	Supplying and Installing Seepage Measuring Facilities	No.	2

PACKAGE 1: JATIBARANG MULTIPURPOSE DAM INCLUDING APPURTENANT STRUCTURES

Item No.	Description	Unit	Quantity
N.	GENERATING PLANT		
N.1	Furnishing and Installing Turbines and Auxiliaries :		
N.1.1	Hydraulic Turbine (Horizontal Francis: 1,630kW, H= 64.3m, Q= 3m³/s)	Set	1
N.1.2	Governor (Electric governor Dn:30% Dp:60%)	Set	1
N.1.3	Inlet Valve (Butterfly or Biplane Valve Ø = 0.8m)	Set	1
N.1.4	Cooling Water System, if necessary	Set	1
N.1.5	Drainage & Dewatering System.	Set	1
N.1.6	Oil Storage & Transfer System, if necessary	Set	1
N.1.7	Compressed Air Supply System, if necessary	Set	1
N.1.8	Maintenance Tools Machine Shop Equipment	Lot	1
N.1.9	Spare Parts	Lot	1
N.1.10	Instruction Employer s Personnel and Attendance of Employer at Shop Tests	Lot	1
N.1.11	Flow Meter System	Set	1
N.2	Furnishing and Installing Generators and Excitation System :		
N.2.1	Generator (Horizontal 2MVA 750rpm 6.6kV pf.0.8)	Set	1
N.2.2	Excitation System (Brushless exciter & AVR two indoor cubicles)	Set	1
N.2.3	Neutral Grounding Cubicle	Set	1
N.2.4	Spare parts	Lot	1
N.3	Furnishing and Installing Main Transformer (2000kVA 6.6/20kV)	Set	1
N.4	Furnishing and Installing Outdoor Cubicle :		
N.4.1	20kV DS Cubicle (one outdoor cubicle 20 kV MOF, DS, LA, DS, CH)	Lot	1
N.4.2	20kV CB Cubicle (one outdoor cubicle 24kV CB, PT, CT, CH)	Set	1
N.4.3	6.6kV Cubicle (one outdoor cubicle 6.6 kV DS, PT, CT, CH)	Lot	1
N.5	Furnishing and Installing Indoor Cubicle :		
N.5.1	6.6kV CB cubicle (one indoor cubicle VCB 7.2kV 1kA, DS, PT, CT, Ar, CH)	Lot	1
N.5.2	Station Tr. Cubicle (one indoor cubicle SLTr: 6.6/.4,.2 150kVA, PF, PT, CT)	Lot	1
N.5.3	DC Supply System (one indoor cubicle, Charger, Inverter, Battery, MCCB)	Lot	1
N.5.4	Switchgear for Krapyak s/s one indoor cubicle, 24kV CB, PT, CT, CH	Lot	1
N.6	Furnishing and Installing Control and Protection Equipment (six panels)	Lot	1
N.7	Furnishing and Installing Cables and Fittings :		
N.7.1	20kV Power Cables (CVT 3c 35m)	Lot	1
N.7.2	6.6kV Power Cables (CVT 3c 100m)	Lot	1
N.7.3	Low Voltage Cables (PVC-CVV, CVV-S)	Lot	1
N.8	Furnishing and Installing Ancillary Equipment :		
N.8.1	Telephone System (PABX 20 telephone sets)	Lot	1
N.8.2	Lighting Auxiliary (Lighting fixture Distribution panels conduit wires)	Lot	1
N.9	Furnishing and Installing Grounding System	Lot	1
N.10	Furnishing and Installing Overhead Travelling Crane (15ton, span= 9.5m, lift=20m, Hoist=1 tonne)	Set	1
N.11	Furnishing and Installing Transmission Lines :		
N.11.1	Steel Towers (20kV 1cct h=20m)	Set	2
N.11.2	Concrete Poles (20kV 1cct h=13m)	No.	280
N.11.3	Insulators and Fittings (Suspension : 254mm)	Lot	1
N.11.4	Power Conductors (AAAC 120 sq. 14km)	km	14
N.11.5	Telecommunication Lines (CCCP-AP-SS-0.65mm-20P)	km	14

PACKAGE 1: JATIBARANG MULTIPURPOSE DAM INCLUDING APPURTENANT STRUCTURES

Item No.	Description	Unit	Quantity
O.	**RELOCATION OF POWER TRANSMISSION LINE**		
O.1	Relocation of Power Transmission Line	L.S.	
P.	**MISCELLANEOUS WORKS**		
P.1	Bridge Bearings :		
P.1.1	for Spillway Bridge including Elastomeric Bearing Pad (350 x 280 x 73) and Rubber Sheet (400 x 100 x 30)	No.	6
P.1.2	for Access Road Bridge including Elastometric Bearing Pad (350 x 280 x 59) and Rubber Sheet (400 x 100 x 200)	No.	10
P.2	Bridge Expansion Joints :		
P.2.1	in Spillway Bridge	L.S.	
P.2.2	in Access Road Bridge	L.S.	
P.3	Permanent Electrical Installation :		
	Gallery and General Lighting Installation	L.S.	
	Power Supply Facilities	L.S.	
P.4	Supplying and Installing Submergible Drainage Pumps :		
P.4.1	Drainage for Gallery; 0.2 m³/min with Automatic Pump Operation System	No.	2
P.4.2	Drainage for Hydropower Station; 0.5 m³/min	No.	2
P.5	Reconstruction Wet Stone Masonry Steps to Goa Kreo	L.S.	
P.6	Furnishing and Installing Trash Boom in Reservoir Including Concrete Anchor	L.S.	
P.7	Supplying and Installing Reservoir Water Level Sensor with Recorder	L.S.	
P.8	Supplying and Installing Water Level Staff Gauge :	No.	
P.8.1	for Reservoir Water Level Installed on Inclined Intake Structure	No.	
P.8.2	for Downstream River Water Level Installed on Concrete Wall	No.	
P.9	Provision of Maintenance Equipment :		
P.9.1	Patrol Boat with Trailer	No.	1
P.9.2	Patrol Vehicles (4-WD)	No.	2
P.9.3	Station Wagon	No.	2
P.9.4	Dump Truck (6 tonne)	No.	1
P.9.5	Grass Cutters	No.	3
O.	**BUILDING WORKS**		
O.1	Hydropower Station (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & Windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	
O.2	Garage (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	
O.3	Guard House (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	
O.4	External Works (including excavation, filling, grading, foundation, fence, drain cover, flag stone, retaining wall, tree planting, concrete block, plastering, concrete paving, tile, sanitary, electrical and painting works)	L.S.	

PACKAGE 2 : OPERATION AND MAINTENANCE BUILDINGS AND GOA KREO BRIDGE

Item No.	Description	Unit	Original Quantity	Quantity with Allowance
A.	GENERAL			
B.	DAM MANGEMENT COMPLEX			
B.1	Buildings			
B.1.1	Administration Building (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & Windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.		
B.1.2	Staff House 1 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.		
B.1.3	Staff House 2-1 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.		
B.1.4	Staff House 2-2 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.		
B.1.5	Staff House 2-3 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.		
B.1.6	Staff House 2-4 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.		
B.1.7	Mushola (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.		
B.2.	External Works (including excavation, filling, grading, foundation, fence, drain cover, flag stone, retaining wall, tree planting, concrete block, plastering, concrete paving, tile, sanitary, electrical and painting works)	L.S.		
B.3.	Power Supply Facilities (including PLN connection to all buildings)	L.S.		

PACKAGE 2 : OPERATION AND MAINTENANCE BUILDINGS AND GOA KREO BRIDGE

Item No.	Description	Unit	Original Quantity	Quantity with Allowance
C.	CONSTRUCTION OF APPROACH BRIDGE TO GOA KREO			
C.1.	Bridge and Approach Road			
	(Superstructure)			
C.1.1	Concrete, Type B including Formwork	m^3	99	104
C.1.2	Deformed Reinforcing Bars	kg	17,616	18,660
C.1.3	Asphaltic Concrete	tonne	23	25
C.1.4	Expansion Joint	m	10	11
C.1.5	Hand Rail	kg	476	500
C.1.6	Drain Pipe, PVC Pipe Dia. 100 mm	m	48	51
C.1.7	Elastometric Bearing Pad (316 x 316 x 41)	No.	16	16
	(Substructure and Approach Road)			
C.1.8	Clearing and Grubbing	m^2		10
C.1.9	Stripping of Topsoil	m^3	47	50
C.1.10	Excavation	m^3	1,023	1,130
C.1.11	Backfilling	m^3	879	967
C.1.12	Embankment	m^3	103	114
C.1.13	Concrete, Type C-1 including Scaffolding and Formwork	m^3	155	163
	Formwork	m^2	410	
	Scaffolding	m^2	43	
C.1.14	Deformed Reinforcing Bars	kg	11,473	12,170
C.1.15	Levelling Concrete, Type E	m^3	8	9
C.1.16	Wet Stone Masonry	m^3	136	150
C.1.17	Weep Hole, Dia. 50 mm	No.	70	70
C.1.18	Asphaltic Concrete	tonne	18	19
C.1.19	Gravel	m^3	31	35
C.2.	Gate Relocation			
C.2.1	Demolition of Existing Gate	L.S.		
C.2.2	Excavation	m^3	14	20
C.2.3	Concrete, Type C-1 including Formwork	m^3	6	7
C.2.4	Deformed Reinforcing Bars	kg	210	230
C.2.5	Wet Stone Masonry Reconstruction	m^3	7	10
C.2.6	Stone Block Reconstruction	m^3	21	30
C.3	Existing Buildings			
C.3.1	Demolition and Reconstruction of Guard House, Mushola and Toilet	L.S.		

Chapter 2
DAM

2.1 Dam Excavation

[m^3]

DAM		Excavation Volume						Total Vol. in each Height
		D	CL	CM-L	CM-H	td	rd	
higher than EL. 157.0 m	Upstream Pervious Zone Foundation	0	0	0	0	0	0	0
	Impervious and Semi-pervious Zone Trench	347	879	0	0	0	0	1,226
	Downstream Pervious Zone Foundation	0	0	0	0	0	0	0
	Total	347	879	0	0	0	0	1,226
EL. 140.0 m - EL. 157.0 m	Upstream Pervious Zone Foundation	0	1,206	0	0	0	0	1,206
	Impervious and Semi-pervious Zone Trench	0	15,921	0	0	0	0	15,921
	Downstream Pervious Zone Foundation	204	3,159	0	0	0	0	3,363
	Total	204	20,286	0	0	0	0	20,490
EL. 125.0 m - EL. 140.0 m	Upstream Pervious Zone Foundation	0	2,756	0	0	0	0	2,756
	Impervious and Semi-pervious Zone Trench	0	19,181	10,515	0	0	0	29,696
	Downstream Pervious Zone Foundation	0	1,306	268	0	0	0	1,574
	Total	0	23,243	10,783	0	0	0	34,026
EL. 110.0 m - EL. 125.0 m	Upstream Pervious Zone Foundation	0	3,053	0	0	0	0	3,053
	Impervious and Semi-pervious Zone Trench	0	9,206	13,961	5,880	0	0	29,047
	Downstream Pervious Zone Foundation	0	1,496	0	0	0	0	1,496
	Total	0	13,755	13,961	5,880	0	0	33,596
EL. 95.0 m - EL. 110.0 m	Upstream Pervious Zone Foundation	0	2,174	0	0	0	18	2,192
	Impervious and Semi-pervious Zone Trench	0	3,186	6,355	6,487	1,174	0	17,202
	Downstream Pervious Zone Foundation	0	1,618	0	0	2,631	0	4,249
	Total	0	6,978	6,355	6,487	3,805	18	23,643
EL. 80.0 m - EL. 95.0 m	Upstream Pervious Zone Foundation	0	1,041	1,681	0	2,635	8,484	13,841
	Impervious and Semi-pervious Zone Trench	0	1,414	5,879	2,526	2,306	3,097	15,222
	Downstream Pervious Zone Foundation	0	1,417	1,648	0	7,175	5,661	15,901
	Total	0	3,872	9,208	2,526	12,116	17,242	44,964
Grand Total	Upstream Pervious Zone Foundation	0	10,230	1,681	0	2,635	8,502	23,048
	Impervious and Semi-pervious Zone Trench	347	49,787	36,710	14,893	3,480	3,097	108,314
	Downstream Pervious Zone Foundation	204	8,996	1,916	0	9,806	5,661	26,583
	Total	551	69,013	40,307	14,893	15,921	17,260	157,945
	Total x 1.1	600	75,900	44,300	16,400	17,500	19,000	173,700

1. EXCAVATION FOR UPSTREAM PERVIOUS ZONE FOUNDATION

higher than EL. 157.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110												
120												
130												
140												
150												
160												
170												
180												
190												
200												
210												
220												
230												
240												
250												
TOTAL												

EL. 140.0 m - EL. 157.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80		0.0										
90		36.5						182.5				
100		0.0						182.5				
110												
120												
130												
140												
150												
160												
170												
180												
190		0.0										
200		0.5						2.5				
210		37.1						188.0				
220		33.3						352.0				
230		13.2						232.5				
240		0.0						66.0				
250												
TOTAL								1,206.0				

EL. 125.0 m - EL. 140.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90		0.0										
100		70.2						351.0				
110		46.2						582.0				
120		0.0						231.0				
130												
140												
150												
160												
170		0.0										
180		64.5						322.5				
190		51.4						579.5				
200		43.3						473.5				
210		0.0						216.5				
220												
230												
240												
250												
TOTAL								2,756.0				

EL. 110.0 m - EL. 125.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100		0.0										
110		43.9						219.5				
120		140.1						920.0				
130		0.0						700.5				
140												
150		0.0										
160		10.5						52.5				
170		100.7						556.0				
180		10.1						554.0				
190		0.0						50.5				
200												
210												
220												
230												
240												
250												
TOTAL								3,053.0				

EL. 95.0 m ~ EL. 110.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110												
120		0.0				0.0						
130		128.6				1.8		643.0				9.0
140		0.0				0.0		643.0				9.0
150		19.6						98.0				
160		69.2						444.0				
170		0.0						346.0				
180												
190												
200												
210												
220												
230												
240												
250												
TOTAL								2,174.0				18.0

EL. 80.0 m ~ EL. 95.0 m (m2) (m3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110												
120		0.0	0.0		0.0							
130		4.3	31.0		263.5	0.0		21.5	155.0		1,317.5	
140		0.0	79.0		0.0	622.5		21.5	550.0		1,317.5	3,112.5
150		10.1	58.1			225.9		50.5	685.5			4,242.0
160		89.7	0.0			0.0		499.0	290.5			1,129.5
170		0.0						448.5				
180												
190												
200												
210												
220												
230												
240												
250												
TOTAL								1,041.0	1,681.0		2,635.0	8,484.0

2. EXCAVATION IMPERVIOUS ZONE FOUNDATION

higher than EL. 157.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110												
120												
130												
140												
150												
160												
170												
180												
190												
200												
210												
220												
230		0.0										
240	0.0	34.5						172.5				
250	34.7	53.4					173.5	439.5				
260	0.0	0.0					173.5	267.0				
TOTAL							347.0	879.0				

EL. 140.0 m - EL. 157.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60		0.0										
70		414.8						2,074.0				
80		246.7						3,307.5				
90		41.1						1,439.0				
100		0.0						205.5				
110												
120												
130												
140												
150												
160												
170												
180												
190		0.0										
200		53.5						267.5				
210		215.9						1,347.0				
220		275.5						2,457.0				
230		210.2						2,428.5				
240		130.8						1,705.0				
250		3.6						672.0				
260		0.0						18.0				
TOTAL								15,921.0				

EL. 125.0 m – EL. 140.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60		0.0	0.0									
70		101.8	15.7					509.0	78.5			
80		235.6	25.5					1,687.0	206.0			
90		428.0	43.1					3,318.0	343.0			
100		450.6	24.3					4,393.0	337.0			
110		163.6	0.0					3,071.0	121.5			
120		0.0						818.0				
130												
140												
150												
160												
170		0.0										
180		26.5	0.0					132.5				
190		217.8	294.2					1,221.5	1,471.0			
200		175.7	480.4					1,967.5	3,873.0			
210		83.2	162.6					1,294.5	3,215.0			
220		35.3	5.7					592.5	841.5			
230		0.0	0.0					176.5	28.5			
240												
250												
TOTAL								19,181.0	10,515.0			

EL. 110.0 m – EL. 125.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90		0.0	0.0									
100		36.5	257.2	0.0				182.5	1,286.0			
110		309.5	153.9	247.1				1,730.0	2,055.5	1,235.5		
120		290.8	0.0	148.3				3,001.5	769.5	1,977.0		
130		0.0		0.0				1,454.0		741.5		
140												
150												
160		0.0		0.0								
170		99.3	0.0	19.4				496.5		97.0		
180		184.5	408.4	137.6				1,419.0	2,042.0	785.0		
190		0.0	485.7	35.6				922.5	4,470.5	866.0		
200			90.9	0.0					2,883.0	178.0		
210			0.0						454.5			
220												
230												
240												
250												
TOTAL								9,206.0	13,961.0	5,880.0		

EL. 95.0 m - EL. 110.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100				0.0								
110		0.0	0.0	39.4						197.0		
120		70.0	251.2	190.9	0.0			350.0	1,256.0	1,151.5		
130		135.1	42.3	32.0	117.4			1,025.5	1,467.5	1,114.5	587.0	
140		0.0	0.0	0.0	0.0			675.5	211.5	160.0	587.0	
150												
160		0.0	0.0	0.0								
170		113.5	295.8	191.6				567.5	1,479.0	958.0		
180		0.0	46.2	194.8				567.5	1,710.0	1,932.0		
190			0.0	0.0					231.0	974.0		
200												
210												
220												
230												
240												
250												
TOTAL								3,186.0	6,355.0	6,487.0	1,174.0	

EL. 80.0 m - EL. 95.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110												
120		0.0	0.0	0.0	0.0							
130		13.5	98.0	29.9	135.5	0.0		67.5	490.0	149.5	677.5	
140		0.0	168.2	95.9	0.0	265.3		67.5	1,331.0	629.0	677.5	1,326.5
150		0.0	150.4	87.1	95.1	0.0		0.0	1,593.0	915.0	475.5	1,326.5
160		127.9	171.3	0.0	0.0	44.4		639.5	1,608.5	435.5	475.5	222.0
170		0.0	0.0	39.7		0.0		639.5	856.5	198.5		222.0
180				0.0						198.5		
190												
200												
210												
220												
230												
240												
250												
TOTAL								1,414.0	5,879.0	2,526.0	2,306.0	3,097.0

3. EXCAVATION FOR DOWNSTREAM PERVIOUS ZONE FOUNDATION

higher than EL. 157.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110												
120												
130												
140												
150												
160												
170												
180												
190												
200												
210												
220												
230												
240												
250												
TOTAL												

EL. 140.0 m - EL. 157.0 m (m^2) (m^3)

Sta.	Area						Volume					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60	0.0	0.0										
70	2.1	172.4					10.5	862.0				
80	18.3	86.4					102.0	1,294.0				
90	0.0	0.0					91.5	432.0				
100												
110												
120												
130												
140												
150												
160												
170												
180												
190												
200		0.0										
210		18.7						93.5				
220		22.5						206.0				
230		15.9						192.0				
240		0.0						79.5				
250												
TOTAL							204.0	3,159.0				

EL. 125.0 m - EL. 140.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80		0.0										
90		28.9						144.5				
100		44.5						367.0				
110		0.0						222.5				
120												
130												
140												
150												
160												
170		0.0										
180		17.0						85.0				
190		34.5	0.0					257.5				
200		0.0	26.8					172.5	134.0			
210		5.7	0.0					28.5	134.0			
220		0.0						28.5				
230												
240												
250												
TOTAL								1,306.0	268.0			

EL. 110.0 m - EL. 125.0 m

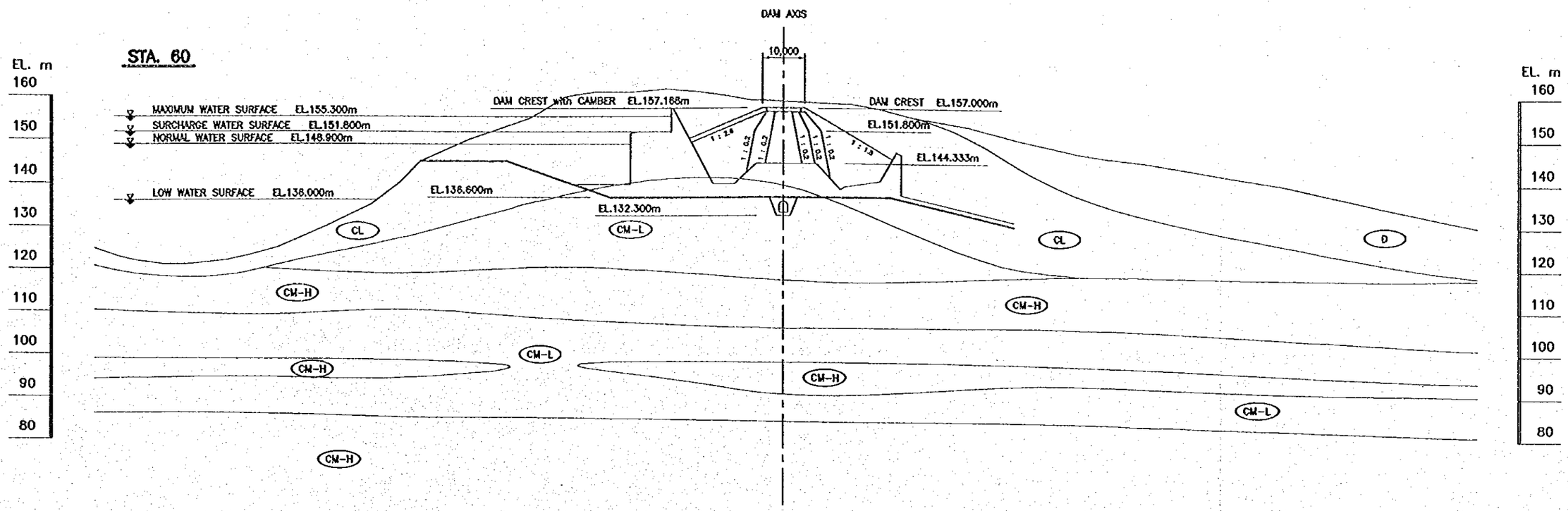
Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100		0.0										
110		66.0						330.0				
120		0.0						330.0				
130												
140												
150												
160		0.0										
170		53.7						268.5				
180		29.9						418.0				
190		0.0						149.5				
200												
210												
220												
230												
240												
250												
TOTAL								1,496.0				

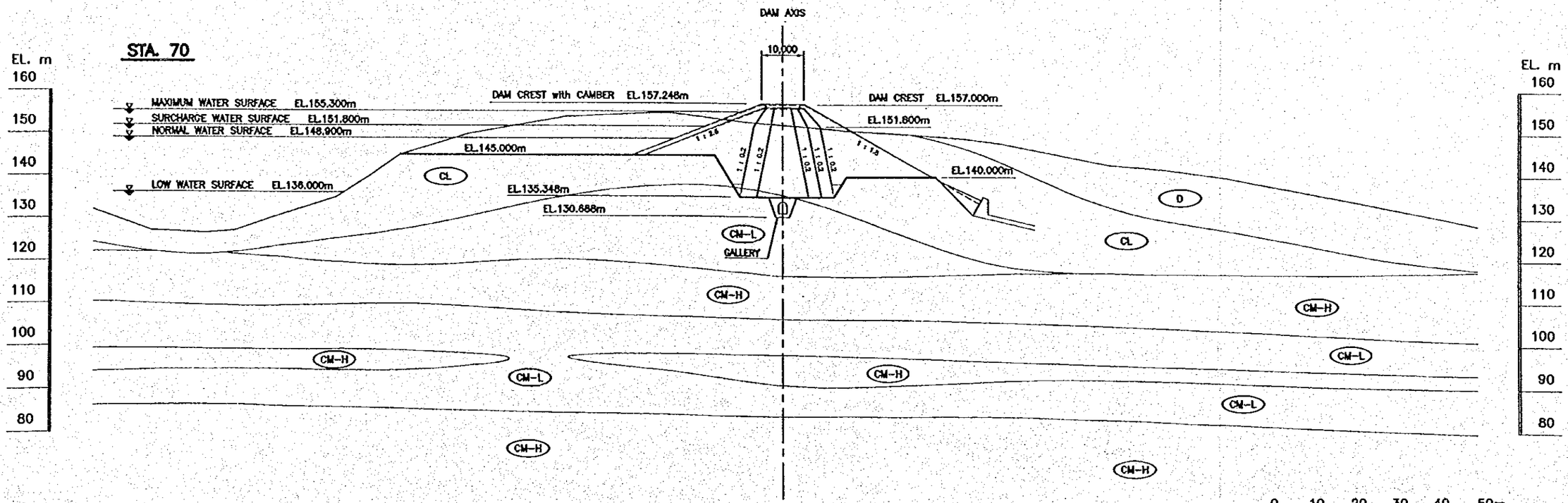
EL. 95.0 m – EL. 110.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110		0.0			0.0							
120		102.6			42.7			513.0			213.5	
130		0.0			0.0			513.0			213.5	
140												
150		0.0			0.0							
160		29.6			220.4			148.0			1,102.0	
170		29.6			0.0			296.0			1,102.0	
180		0.0						148.0				
190												
200												
210												
220												
230												
240												
250												
TOTAL								1,618.0			2,631.0	

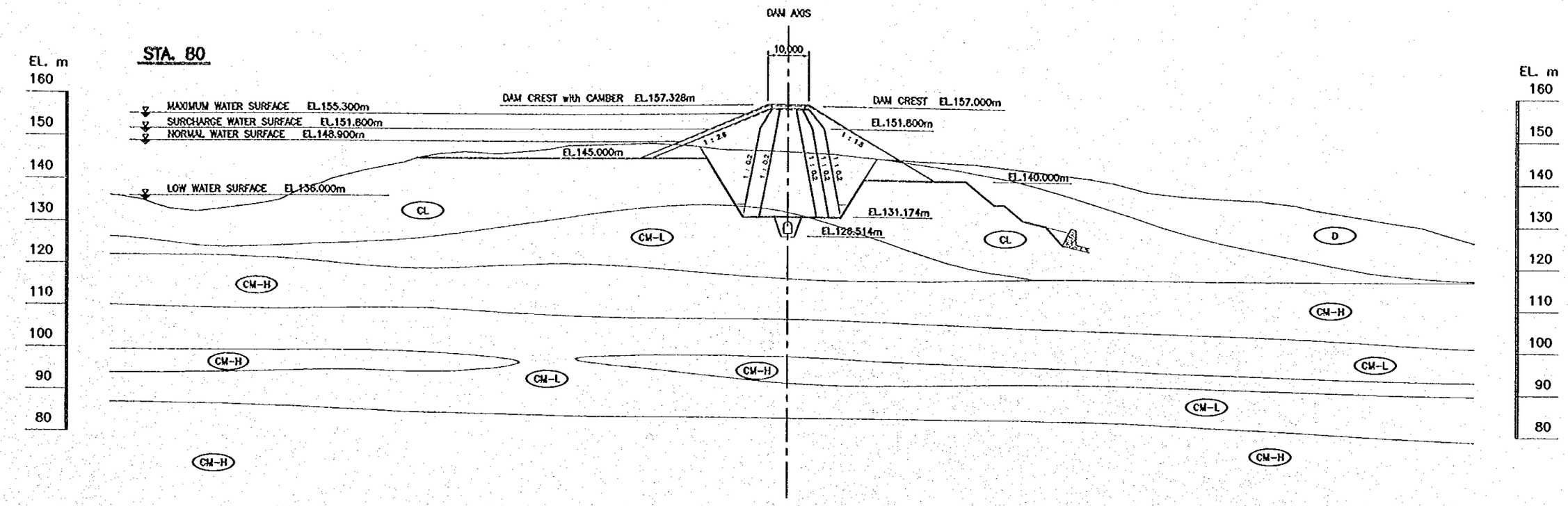
EL. 80.0 m – EL. 95.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
60												
70												
80												
90												
100												
110		0.0			0.0							
120		48.9	0.0		77.6	0.0		244.5			388.0	
130		8.1	49.4		75.9	134.6		285.0	247.0		767.5	673.0
140		0.0	58.1		0.0	336.0		40.5	537.5		379.5	2,353.0
150		0.0	57.3		413.6	76.2		0.0	577.0		2,068.0	2,061.0
160		84.7	0.0		150.4	19.3		423.5	286.5		2,820.0	477.5
170		0.0			0.0	0.0		423.5			752.0	96.5
180												
190												
200												
210												
220												
230												
240												
250												
TOTAL								1,417.0	1,648.0		7,175.0	5,661.0

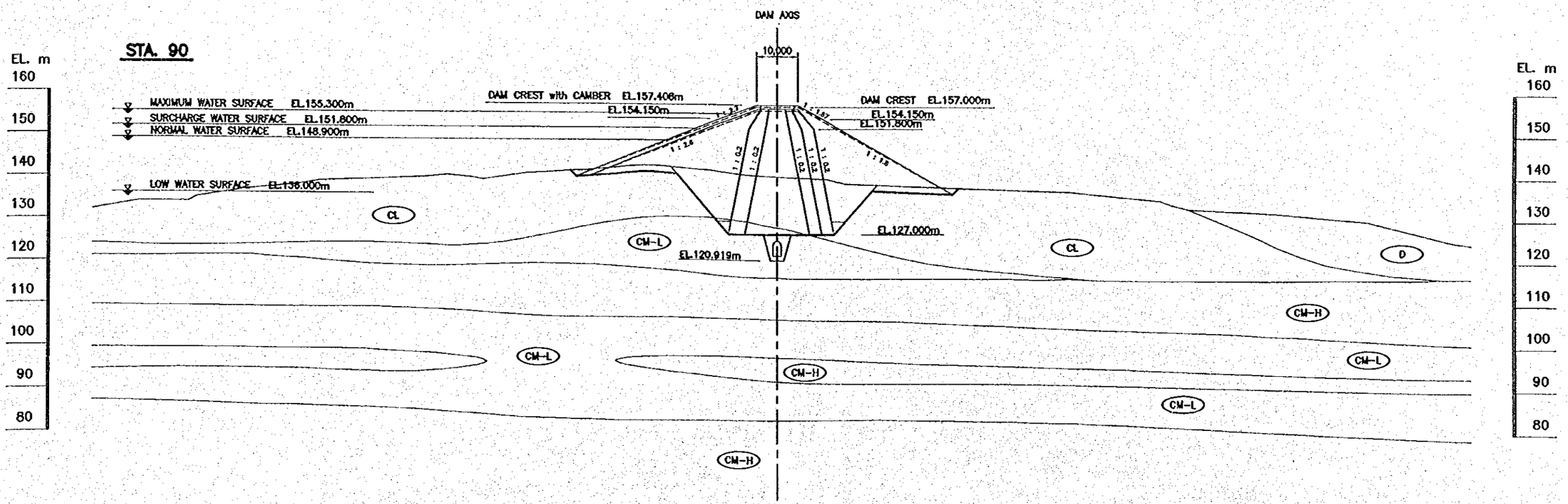

STA. 60
EL. m
160
150
140
130
120
110
100
90
80
DAM AXIS
10,000
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
DAM CREST with CAMBER EL.157.168m
DAM CREST EL.157.000m
EL.151.800m
EL.144.333m
EL.136.600m
EL.132.300m
CL
CM-L
CM-H
D
1 : 2.8
1 : 0.2
1 : 0.2
1 : 0.2
1 : 0.2
1 : 1.3


STA. 70
EL. m
160
150
140
130
120
110
100
90
80
DAM AXIS
10,000
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
DAM CREST with CAMBER EL.157.248m
DAM CREST EL.157.000m
EL.151.800m
EL.145.000m
EL.140.000m
EL.135.348m
EL.130.688m
CL
CM-L
CM-H
D
GALLERY
1 : 2.8
1 : 0.2
1 : 0.2
1 : 0.2
1 : 0.2
1 : 1.3
SCALE 0 10 20 30 40 50m

STA. 80

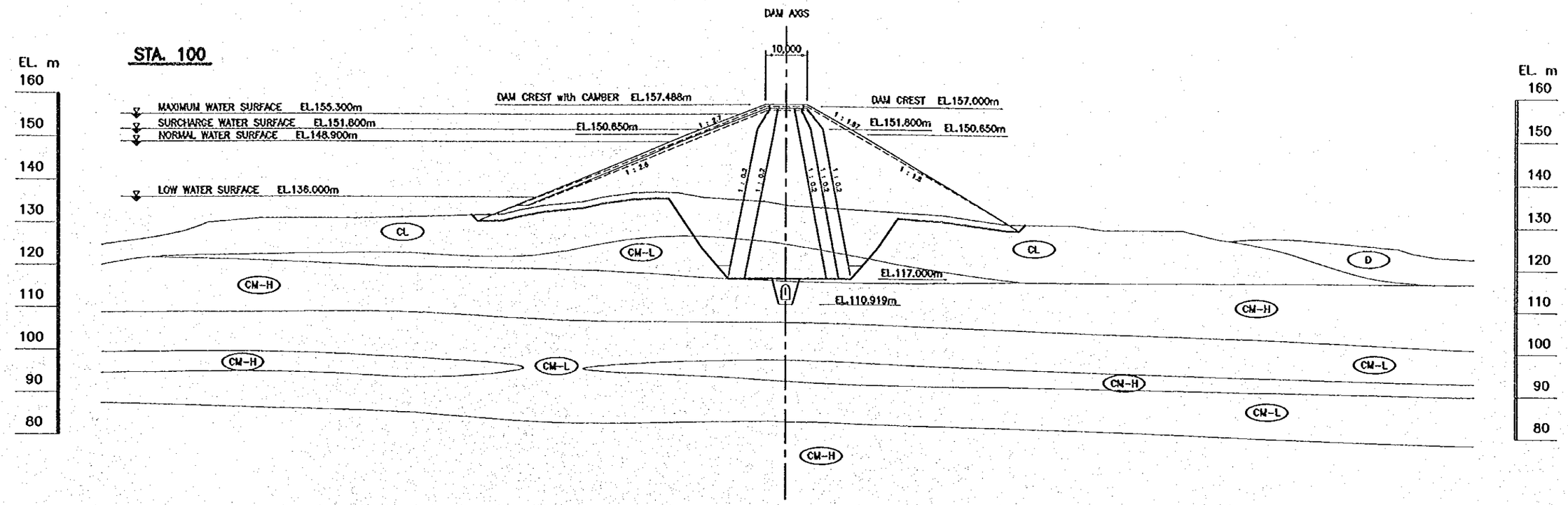


STA. 90

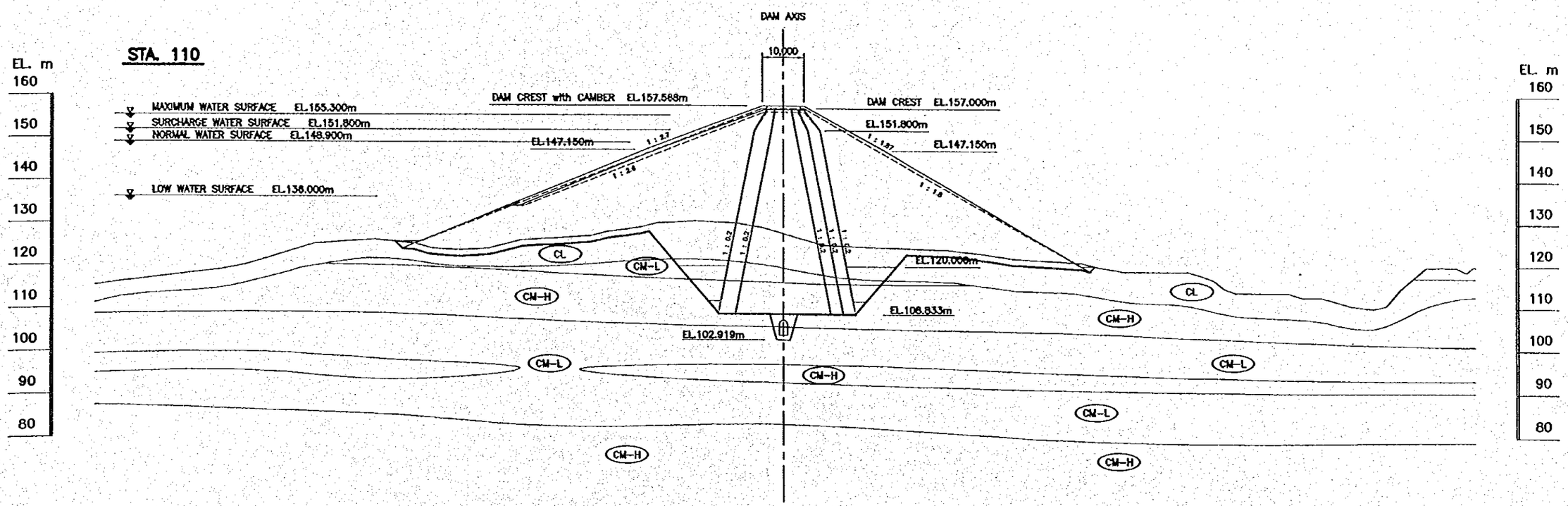


SCALE 0 10 20 30 40 50m

STA. 100

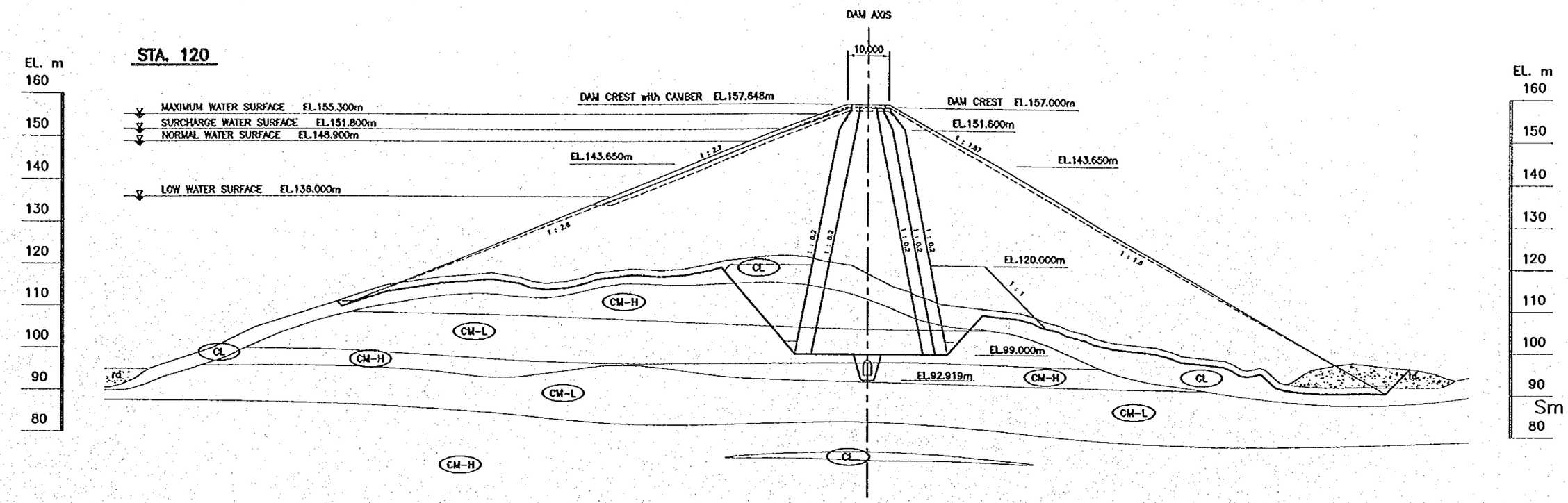


STA. 110

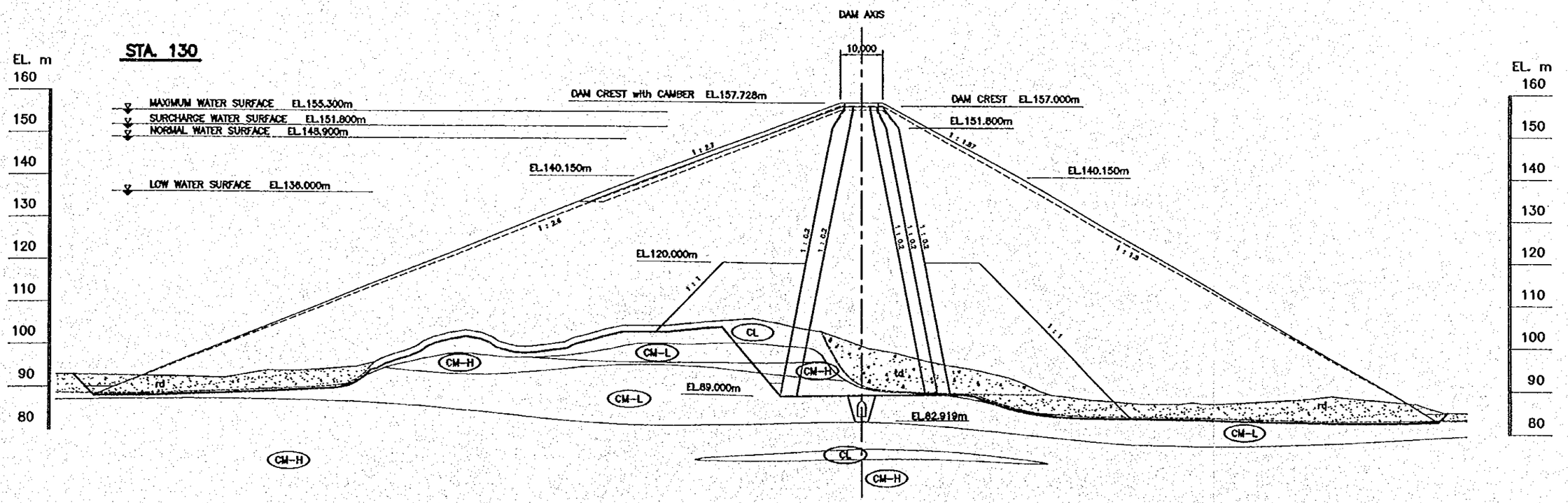


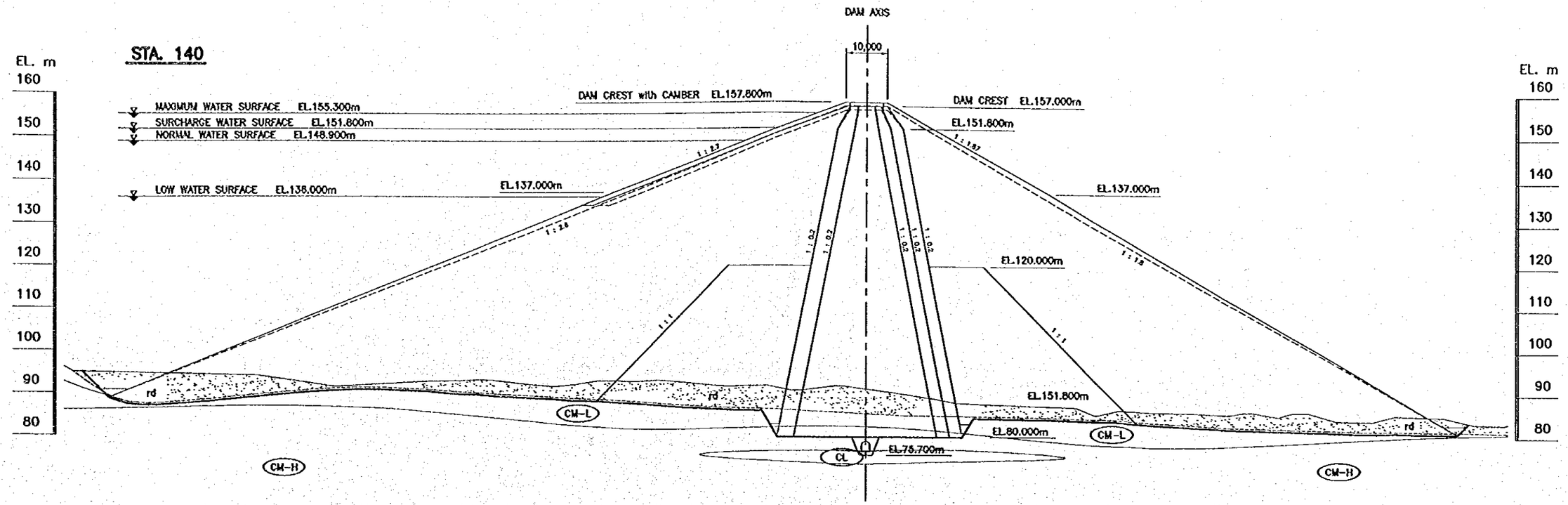
SCALE 0 10 20 30 40 50m

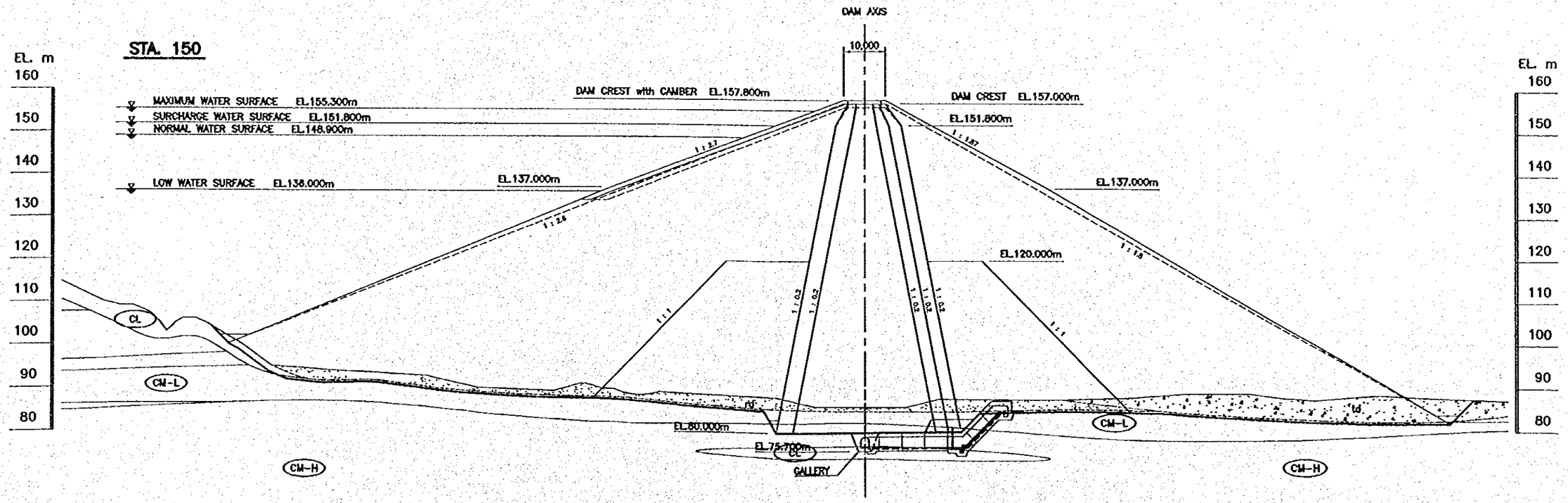
STA. 120



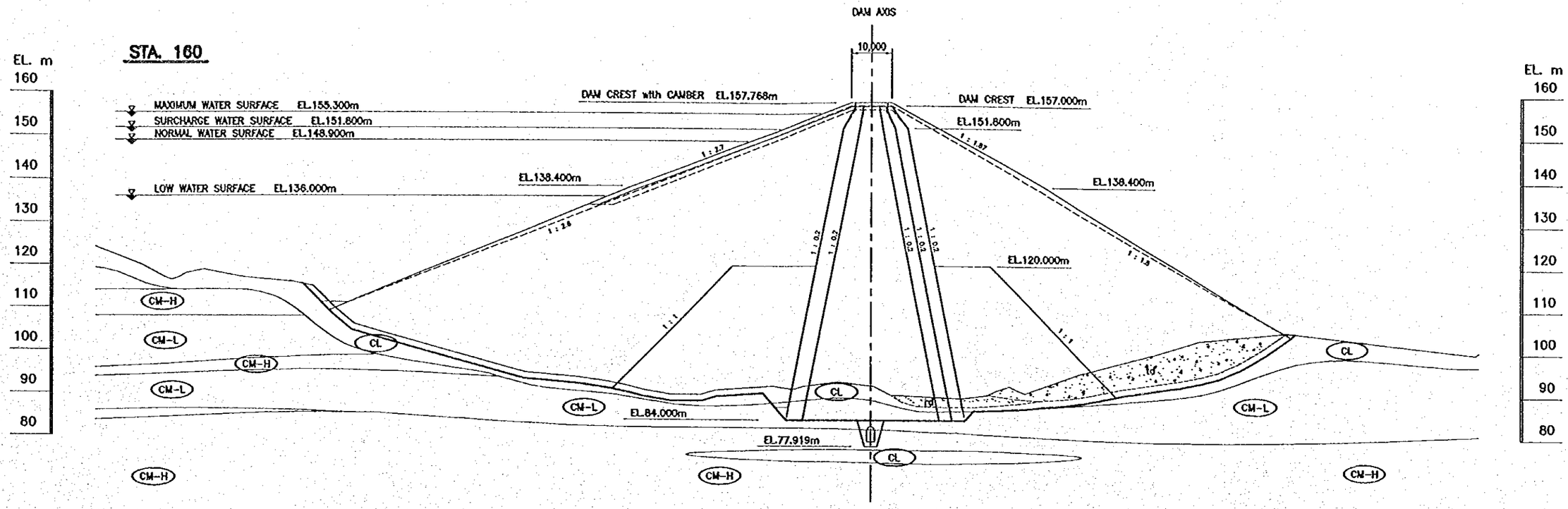
STA. 130



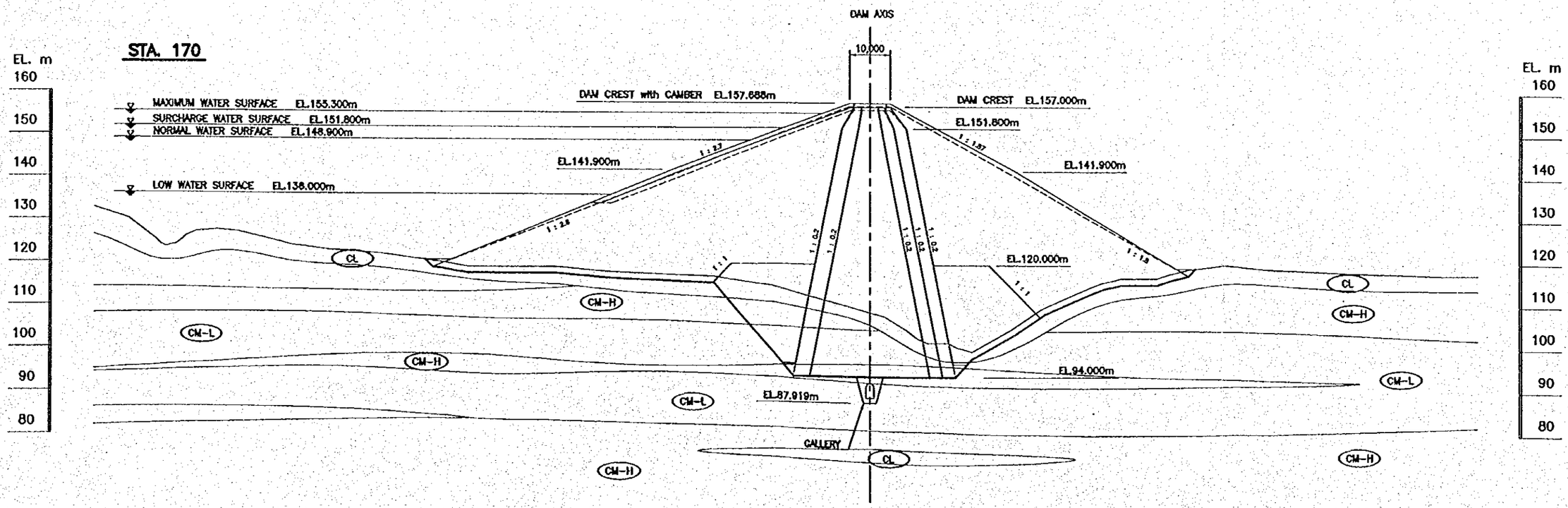

STA. 140
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.138.000m
DAM AXIS
10,000
DAM CREST with CAMBER EL.157.800m
DAM CREST EL.157.000m
EL.151.800m
EL.137.000m
EL.137.000m
EL.120.000m
EL.151.800m
EL.80.000m
EL.75.700m
CL
CM-L
CM-H
rd
1:2.7
1:2.6
1:0.2
1:1
1:1.87
1:1.8


STA. 150
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.138.000m
DAM AXIS
10,000
DAM CREST with CAMBER EL.157.800m
DAM CREST EL.157.000m
EL.151.800m
EL.137.000m
EL.137.000m
EL.120.000m
EL.80.000m
EL.75.700m
CL
GALLERY
CM-L
CM-H
rd
1:2.7
1:2.6
1:0.2
1:1
1:1.87
1:1.8
SCALE 0 10 20 30 40 50m

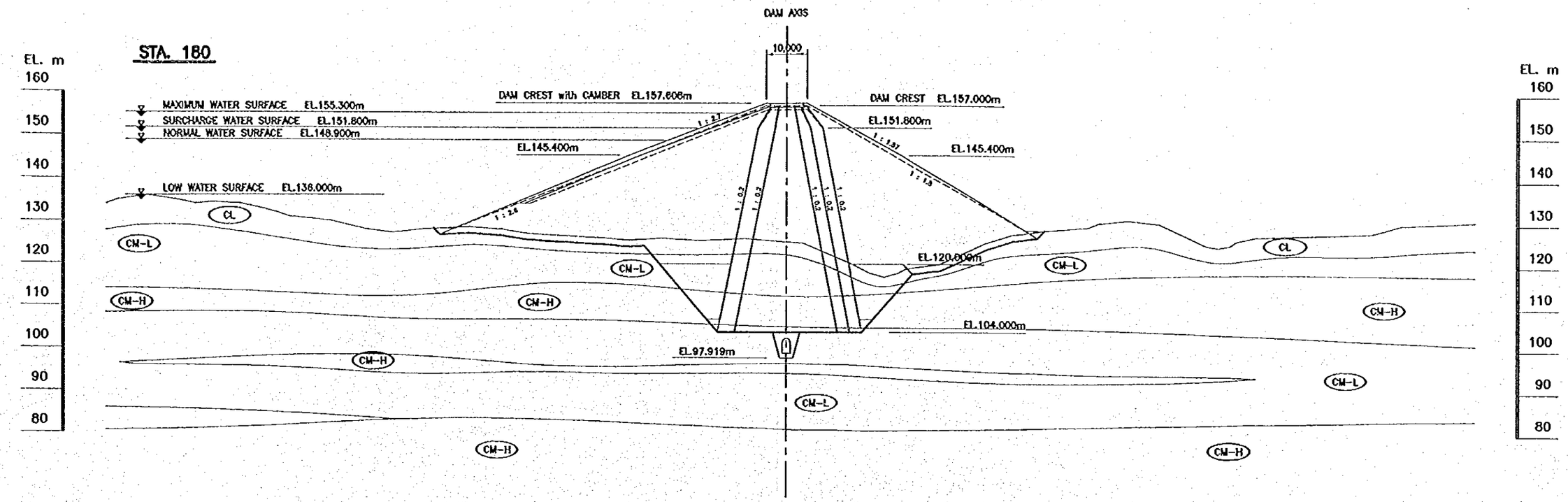
STA. 160



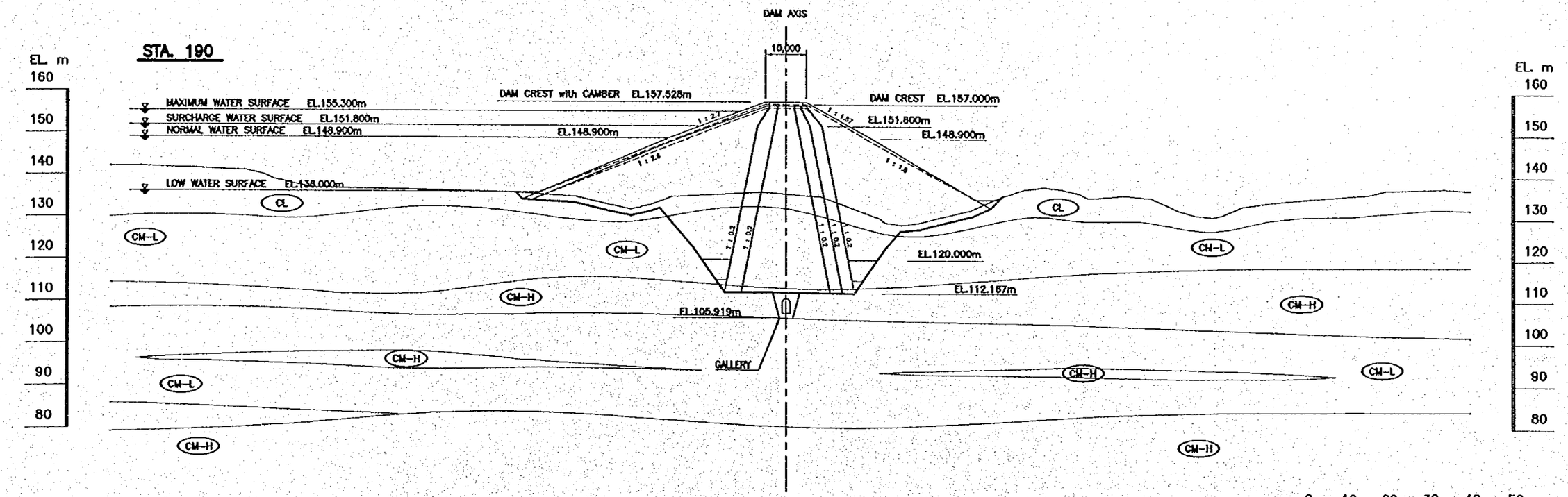
STA. 170



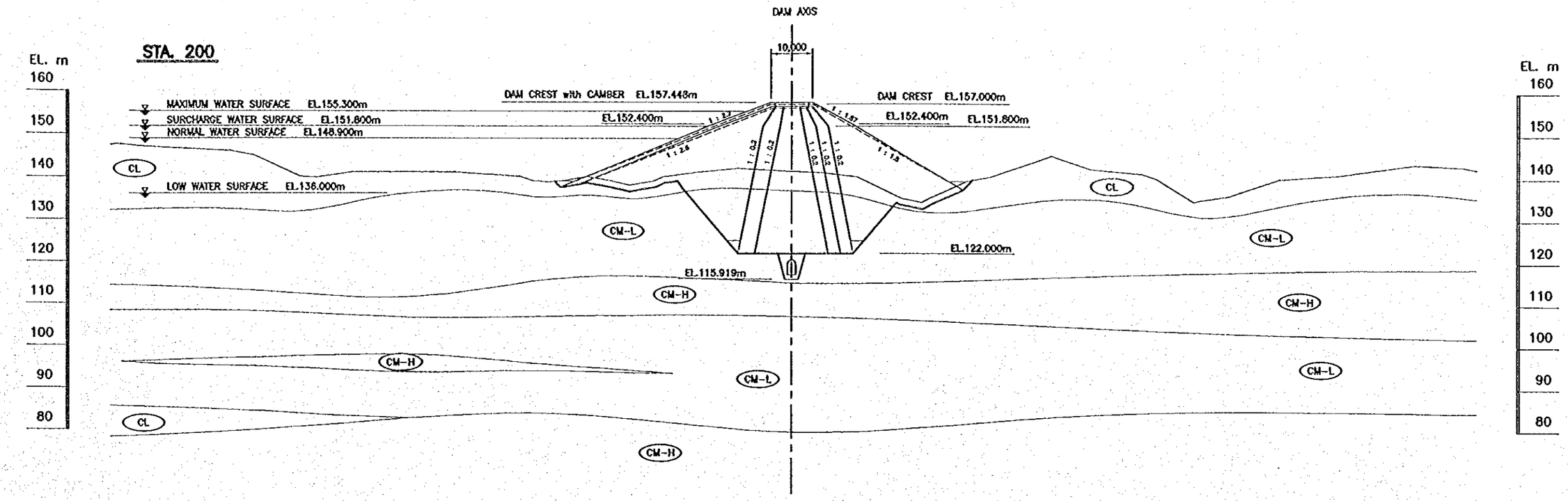
STA. 180

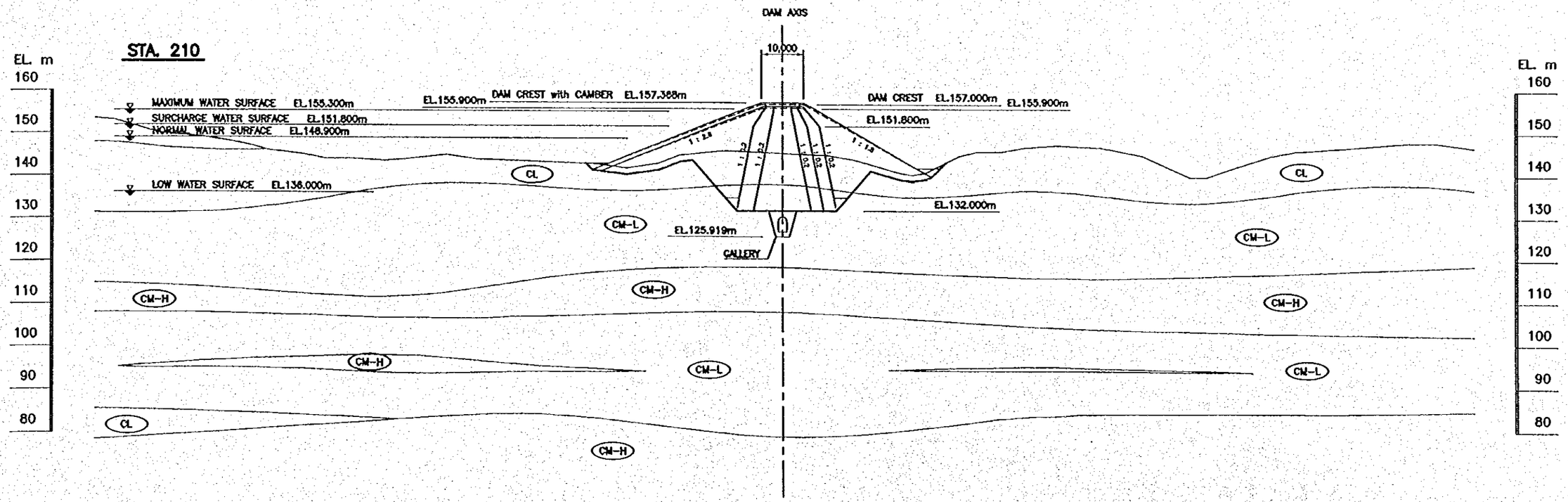


STA. 190

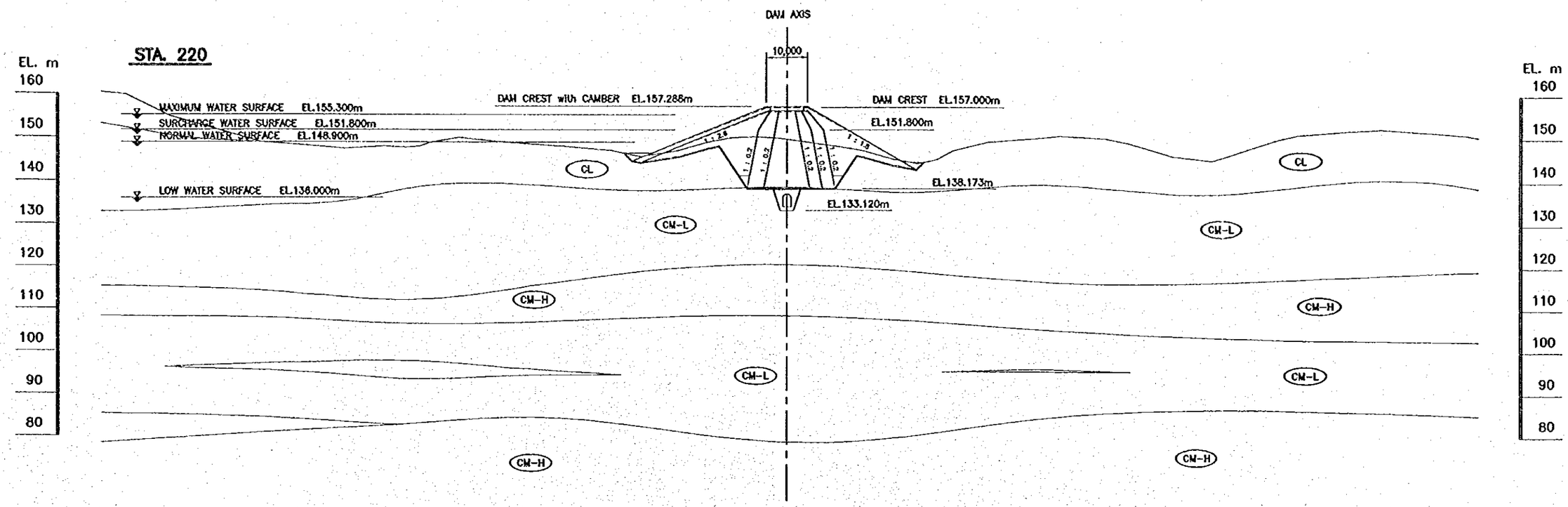


SCALE 0 10 20 30 40 50m

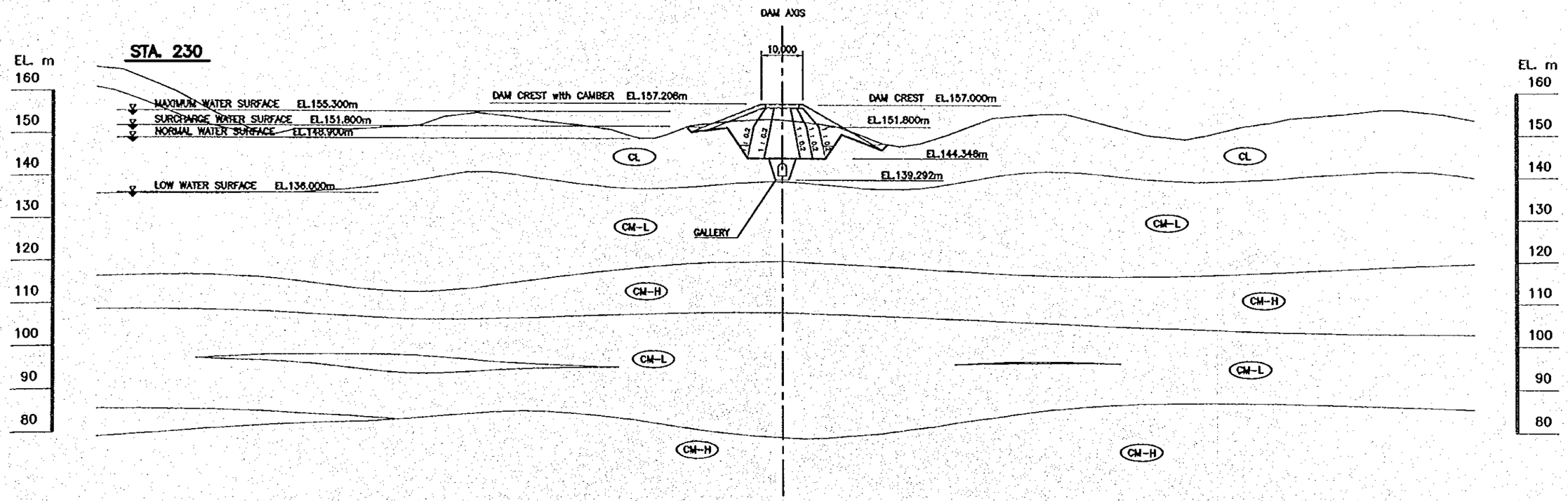

STA. 200
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
DAM AXIS
10,000
DAM CREST with CAMBER EL.157.448m
EL.152.400m
DAM CREST EL.157.000m
EL.152.400m
EL.151.800m
EL.122.000m
EL.115.919m
CL
CM-L
CM-H
EL. m
160
150
140
130
120
110
100
90
80


STA. 210
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
EL.155.900m
DAM CREST with CAMBER EL.157.368m
DAM CREST EL.157.000m
EL.155.900m
EL.151.800m
EL.132.000m
EL.125.919m
GALLERY
CL
CM-L
CM-H
EL. m
160
150
140
130
120
110
100
90
80
SCALE 0 10 20 30 40 50m

STA. 220

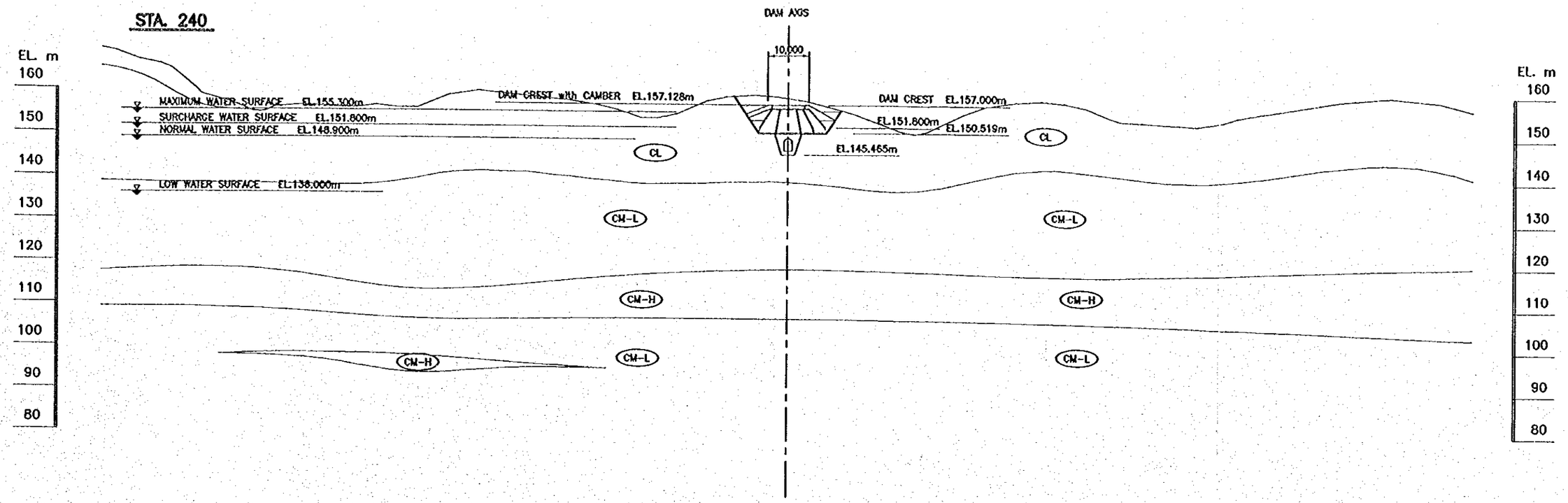


STA. 230

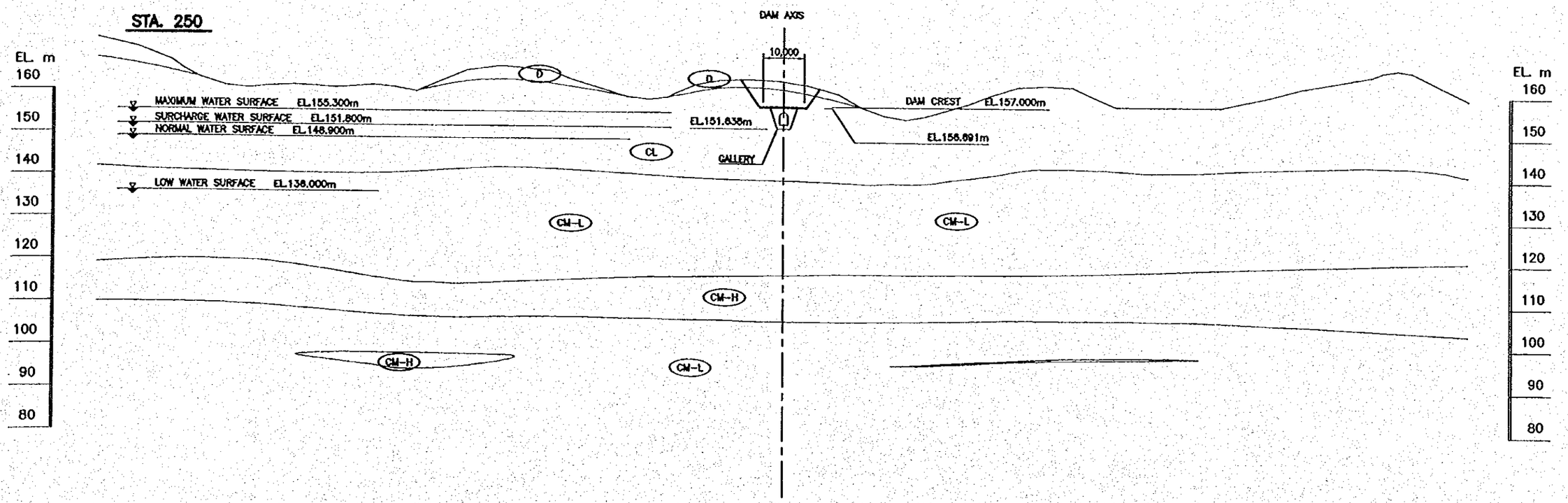


SCALE 0 10 20 30 40 50m

STA. 240



STA. 250



SCALE 0 10 20 30 40 50m

2.2 Dam Embankment

SUMMARY OF EMBANKMENT CALCULATION (1/2)

Item	Unit	Quantity Original (m^3)	Quantity x 1.05 (m^3)
Dam Embankment Impervious Zone including Contact Slurry and Contact Material	m^3	113,513	119,000
Dam Embankment Semi-pervious Zone :			
in Upstream Semi-pervious Zone	m^3	31,192	33,000
in Downstream Fine Semi-pervious Zone	m^3	22,781	24,000
in Downstream Coarse Semi-pervious Zone	m^3	23,559	25,000
Dam Embankment Pervious Zone :			
in Inner Pervious Zone	m^3	91,487	96,000
in Outer Pervious Zone including Surface Treatment	m^3	471,465	495,000
in Riprap Zone	m^3	9,752	10,000
Total (excluding Road Material)	m^3	763,751	802,000
Special Compaction for Dam Embankment :			
in Impervious Zone Embankment	m^3	1,470	1,540
in Upstream and Downstream Semi-pervious Zone	m^3	2,800	2,940

SUMMARY OF EMBANKMENT CALCULATION (2/2)

Sta.	1			2			3			4			5			6		
	Impervious	Ave. Area [m²]	Volume [m³]	Upstream Semi-pervious	Ave. Area [m²]	Volume [m³]	Downstream Semi-pervious Fine	Ave. Area [m²]	Volume [m³]	Downstream Semi-pervious Coarse	Ave. Area [m²]	Volume [m³]	Upstream Inner Pervious	Ave. Area [m²]	Volume [m³]	Downstream Inner Pervious	Ave. Area [m²]	Volume [m³]
50.5	0.0			0.0			0.0			0.0								
60	75.6	37.8	359.1	45.2	22.6	214.7	32.5	16.3	154.4	37.1	18.6	176.2						
70	170.3	123.0	1,229.5	83.2	64.2	642.0	59.6	46.1	460.5	63.4	50.3	502.5						
80	225.6	198.0	1,979.5	100.2	91.7	917.0	72.3	66.0	659.5	76.1	69.8	697.5						
90	287.7	256.7	2,566.5	118.2	109.2	1,092.0	85.0	78.7	786.5	89.9	83.0	830.0						
100	464.5	376.1	3,761.0	158.5	138.4	1,383.5	115.2	100.1	1,001.0	120.1	105.0	1,050.0	0.0			0.0		
110	638.7	551.6	5,516.0	190.9	174.7	1,747.0	139.9	127.6	1,275.5	144.3	132.2	1,322.0	61.3	30.7	306.5	61.3	30.7	306.5
120	883.6	761.2	7,611.5	230.9	210.9	2,109.0	169.5	154.7	1,547.0	174.4	159.4	1,593.5	232.4	146.9	1,468.5	259.4	160.4	1,603.5
130	1,172.4	1,028.0	10,280.0	271.2	251.1	2,510.5	199.7	184.6	1,846.0	199.7	187.1	1,870.5	537.4	384.9	3,849.0	936.6	598.0	5,980.0
140	1,466.5	1,319.5	13,194.5	306.1	288.7	2,886.5	226.9	213.3	2,133.0	230.5	215.1	2,151.0	1,112.9	825.2	8,251.5	991.1	963.9	9,638.5
150	1,466.5	1,466.5	14,665.0	306.1	306.1	3,061.0	226.9	226.9	2,269.0	230.5	230.5	2,305.0	1,138.7	1,125.8	11,258.0	966.5	978.8	9,788.0
160	1,331.8	1,399.2	13,991.5	291.3	298.7	2,987.0	214.8	220.9	2,208.5	217.5	224.0	2,240.0	993.1	1,065.9	10,659.0	848.2	907.4	9,073.5
170	1,023.0	1,177.4	11,774.0	251.1	271.2	2,712.0	184.6	199.7	1,997.0	189.5	203.5	2,035.0	344.1	668.6	6,686.0	355.4	601.8	6,018.0
180	754.2	888.6	8,886.0	210.8	231.0	2,309.5	154.4	169.5	1,695.0	159.3	174.4	1,744.0	134.1	239.1	2,391.0	129.0	242.2	2,422.0
190	564.3	659.3	6,592.5	177.1	194.0	1,939.5	129.8	142.1	1,421.0	133.8	146.6	1,465.5	23.6	78.9	788.5	23.6	76.3	763.0
200	371.1	467.7	4,677.0	138.3	157.7	1,577.0	100.1	115.0	1,149.5	105.0	119.4	1,194.0	0.0	11.8	118.0	0.0	11.8	118.0
210	214.4	292.8	2,927.5	98.1	118.2	1,182.0	69.9	85.0	850.0	74.8	89.9	899.0						
220	137.4	175.9	1,759.0	72.3	85.2	852.0	51.2	60.6	605.5	55.2	65.0	650.0						
230	75.7	106.6	1,065.5	47.3	59.8	598.0	32.5	41.9	418.5	36.5	45.9	458.5						
240	29.2	52.5	524.5	23.0	35.2	351.5	13.8	23.2	231.5	18.8	27.7	276.5						
250.5	0.0	14.6	153.3	0.0	11.5	120.8	0.0	6.9	72.5	0.0	9.4	98.7						
TOTAL			113,513.4			31,192.5			22,781.3			23,559.4			45,776.0			45,711.0

Sta.	7			8			9			10			Total
	Upstream Outer Pervious	Ave. Area [m²]	Volume [m³]	Downstream Outer Pervious	Ave. Area [m²]	Volume [m³]	Riprap	Ave. Area [m²]	Volume [m³]	Road Material	Ave. Area [m²]	Volume [m³]	[m³]
50.5	0.0			0.0			0.0			0.0			
60	155.9	78.0	740.5	165.7	82.9	787.1	19.7	9.9	93.6	7.2	3.6	34.2	2,559.8
70	174.9	165.4	1,654.0	201.8	183.8	1,837.5	33.0	26.4	263.5	7.2	7.2	72.0	6,661.5
80	217.0	196.0	1,959.5	226.4	214.1	2,141.0	33.0	33.0	330.0	7.2	7.2	72.0	8,756.0
90	367.5	292.3	2,922.5	339.3	282.9	2,828.5	49.6	41.3	413.0	7.2	7.2	72.0	11,511.0
100	750.2	558.9	5,588.5	627.2	483.3	4,832.5	64.1	56.9	568.5	7.2	7.2	72.0	18,257.0
110	1,302.6	1,026.4	10,264.0	987.9	807.6	8,075.5	64.8	64.5	644.5	7.2	7.2	72.0	29,529.5
120	1,919.1	1,610.9	16,108.5	2,353.9	1,670.9	16,709.0	65.9	65.4	653.5	7.2	7.2	72.0	49,476.0
130	3,924.6	2,921.9	29,218.5	3,275.7	2,814.8	28,148.0	66.8	66.4	663.5	7.2	7.2	72.0	84,438.0
140	4,586.8	4,255.7	42,557.0	3,380.7	3,328.2	33,282.0	67.5	67.2	671.5	7.2	7.2	72.0	114,837.5
150	4,291.3	4,439.1	44,390.5	3,294.0	3,337.4	33,373.5	67.4	67.5	674.5	7.2	7.2	72.0	121,856.5
160	3,433.5	3,862.4	38,624.0	2,385.7	2,839.9	28,398.5	67.0	67.2	672.0	7.2	7.2	72.0	108,926.0
170	1,849.1	2,641.3	26,413.0	1,345.1	1,865.4	18,654.0	65.9	66.5	664.5	7.2	7.2	72.0	77,025.5
180	1,270.7	1,559.9	15,599.0	943.7	1,144.4	11,444.0	64.8	65.4	653.5	7.2	7.2	72.0	47,216.0
190	836.1	1,053.4	10,534.0	674.0	808.9	8,088.5	67.6	66.2	662.0	7.2	7.2	72.0	32,326.5
200	532.3	684.2	6,842.0	451.0	562.5	5,625.0	56.9	62.3	622.5	7.2	7.2	72.0	21,996.0
210	285.6	409.0	4,089.5	236.4	343.7	3,437.0	47.4	52.2	521.5	7.2	7.2	72.0	13,978.5
220	136.8	211.2	2,112.0	123.7	180.1	1,800.5	41.4	44.4	444.0	7.2	7.2	72.0	8,295.0
230	44.1	90.5	904.5	49.7	86.7	867.0	19.3	30.4	303.5	7.2	7.2	72.0	4,687.5
240	7.5	25.8	258.0	13.8	31.8	317.5	13.3	16.3	163.0	7.2	7.2	72.0	2,194.5
250.5	0.0	3.8	39.4	0.0	6.9	72.5	0.0	6.7	60.8	0.0	3.6	37.8	664.7
TOTAL			260,818.9			210,646.6			9,752.4			1,368.0	765,191.9

EMBANKMENT VOLUME CALCULATION (1/10)

Sta.60

(m^2)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	5.4	2.9	2.2	2.2			2.2	4.4	5.4	7.2	31.9
15	150-155	27.3	17.7	13.3	13.3			39.2	26.2	13.6		150.6
14	145-150	37.2	20.0	15.0	15.0			66.8	62.1	0.8		216.9
13	140-145	5.7	4.6	2.0	6.6			46.2	67.7			132.8
12	135-140							1.5	5.4			6.9
11	130-135											0.0
10	125-130											0.0
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		75.6	45.2	32.5	37.1	0.0	0.0	155.9	165.8	19.8	7.2	539.1

Sta.70

(m^2)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	5.7	3.1	2.3	2.3			2.5	4.6	5.6	7.2	33.3
15	150-155	27.3	17.8	13.3	13.3			40.4	26.8	13.7		152.6
14	145-150	37.2	20.0	15.0	15.0			96.9	62.9	13.7		260.7
13	140-145	47.2	20.0	15.0	15.0			29.9	102.2			229.3
12	135-140	52.9	22.4	14.0	17.7			5.3	5.3			117.6
11	130-135											0.0
10	125-130											0.0
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		170.3	83.3	59.6	63.3	0.0	0.0	175.0	201.8	33.0	7.2	793.5

EMBANKMENT VOLUME CALCULATION (2/10)

Sta.80 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	6.1	3.3	2.5	2.5			2.6	4.8	5.8	7.2	34.8
15	150-155	27.4	17.8	13.3	13.3			41.0	27.3	13.6		153.7
14	145-150	37.2	20.0	15.0	15.0			97.2	63.2	13.6		261.2
13	140-145	47.2	20.0	15.0	15.0			47.3	102.3			246.8
12	135-140	57.2	20.0	15.0	15.0			26.4	26.4			160.0
11	130-135	50.5	19.1	11.5	15.2			2.4	2.4			101.1
10	125-130											0.0
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		225.6	100.2	72.3	76.0	0.0	0.0	216.9	226.4	33.0	7.2	957.6

Sta.90 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	6.5	3.5	2.6	2.6			3.2	5.4	6.3	7.2	37.3
15	150-155	27.4	17.8	13.4	13.4			44.3	29.4	13.7		159.4
14	145-150	37.2	20.0	15.0	15.0			100.1	64.9	13.5		265.7
13	140-145	47.2	20.0	15.0	15.0			133.1	103.6	16.1		350.0
12	135-140	57.2	20.0	15.0	15.0			57.0	106.2			270.4
11	130-135	67.2	20.0	15.0	15.0			29.9	29.9			177.0
10	125-130	45.1	16.9	9.0	13.9							84.9
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		287.8	118.2	85.0	89.9	0.0	0.0	367.6	339.4	49.6	7.2	1,344.7

EMBANKMENT VOLUME CALCULATION (3/10)

Sta.100 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	6.8	3.7	2.8	2.8			3.5	5.7	6.6	7.2	39.1
15	150-155	27.4	17.9	13.4	13.4			46.4	31.1	14.4		164.0
14	145-150	37.2	20.0	15.0	15.0			104.7	67.7	13.5		273.1
13	140-145	47.2	20.0	15.0	15.0			162.3	106.2	13.5		379.2
12	135-140	57.2	20.0	15.0	15.0			213.3	141.7	13.5		478.7
11	130-135	67.2	20.0	15.0	15.0			136.3	173.5	2.7		429.7
10	125-130	77.2	20.0	15.0	15.0			54.0	68.6			249.8
9	120-125	87.2	20.0	15.0	15.0			29.8	29.8			196.8
8	115-120	57.1	16.9	9.0	13.9							96.9
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		464.5	158.5	115.2	120.1	0.0	0.0	750.3	627.3	64.2	7.2	2,307.3

Sta.110 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	7.2	3.9	2.9	2.9			3.9	6.0	6.8	7.2	40.8
15	150-155	27.4	17.9	13.4	13.4			47.4	31.8	14.4		165.7
14	145-150	37.2	20.0	15.0	15.0			107.8	70.2	14.1		279.3
13	140-145	47.2	20.0	15.0	15.0			166.6	109.2	13.4		386.4
12	135-140	57.2	20.0	15.0	15.0			223.9	147.7	13.4		492.2
11	130-135	67.2	20.0	15.0	15.0			291.9	186.1	2.7		597.9
10	125-130	77.2	20.0	15.0	15.0			323.0	224.6			674.8
9	120-125	87.2	20.0	15.0	15.0			138.3	208.2			483.7
8	115-120	97.2	20.0	15.0	15.0	46.1	46.1		4.2			243.6
7	110-115	107.2	23.8	15.0	18.8	15.2	15.2					195.2
6	105-110	26.5	5.3	3.5	4.1							39.4
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		638.7	190.9	139.8	144.2	61.3	61.3	1,302.8	988.0	64.8	7.2	3,599.0

EMBANKMENT VOLUME CALCULATION (4/10)

Sta.120 (m³)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	7.5	4.1	3.1	3.1			4.2	6.3	7.0	7.2	42.5
15	150-155	27.5	17.9	13.5	13.5			48.4	32.5	14.4		167.7
14	145-150	37.2	20.0	15.0	15.0			109.0	71.3	14.4		281.9
13	140-145	47.2	20.0	15.0	15.0			170.8	112.3	13.8		394.1
12	135-140	57.2	20.0	15.0	15.0			229.0	151.4	13.5		501.1
11	130-135	67.2	20.0	15.0	15.0			297.5	190.4	2.7		607.8
10	125-130	77.2	20.0	15.0	15.0			357.9	229.4			714.5
9	120-125	87.2	20.0	15.0	15.0			415.6	268.4			821.2
8	115-120	97.2	20.0	15.0	15.0	98.3	75.0	265.7	232.4			818.6
7	110-115	107.2	20.0	15.0	15.0	73.3	95.0	20.9	251.4			597.8
6	105-110	117.2	20.0	15.0	15.0	46.1	74.8		270.2			558.3
5	100-105	127.2	24.3	15.0	19.3	14.7	14.7		254.4			469.6
4	95-100	26.6	4.5	3.0	3.5				169.7			207.3
3	90-95								114.0			114.0
2	85-90											0.0
1	80-85											0.0
Total		883.6	230.8	169.6	174.4	232.4	259.5	1,919.0	2,354.1	65.8	7.2	6,296.4

Sta.130 (m³)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	7.9	4.3	3.2	3.2			4.6	6.6	7.3	7.2	36.4
15	150-155	27.5	18.0	13.5	13.5			49.5	33.2	14.4		142.1
14	145-150	37.2	20.0	15.0	15.0			110.1	72.0	14.4		246.5
13	140-145	47.2	20.0	15.0	15.0			172.6	113.8	14.4		350.8
12	135-140	57.2	20.0	15.0	15.0			233.6	154.2	13.7		451.5
11	130-135	67.2	20.0	15.0	15.0			302.8	192.9	2.7		548.4
10	125-130	77.2	20.0	15.0	15.0			363.7	231.8			645.5
9	120-125	87.2	20.0	15.0	15.0			422.0	270.7			742.7
8	115-120	97.2	20.0	15.0	15.0	110.0	75.0	370.2	234.6			839.8
7	110-115	107.2	20.0	15.0	15.0	130.0	95.0	408.5	253.5			1,044.2
6	105-110	117.2	20.0	15.0	15.0	150.0	115.0	446.8	272.4			1,151.4
5	100-105	127.2	20.0	15.0	15.0	86.6	135.0	420.4	291.3			1,110.5
4	95-100	137.2	20.0	15.0	15.0	46.1	155.0	275.1	310.2			973.6
3	90-95	147.2	24.3	15.0	15.0	14.7	175.0	265.6	329.1			985.9
2	85-90	30.6	4.5	3.0	3.0		156.2	79.4	348.0			624.7
1	80-85						30.3		161.8			192.1
Total		1,172.4	271.1	199.7	199.7	537.4	936.5	3,924.9	3,276.1	66.9	7.2	10,591.9

EMBANKMENT VOLUME CALCULATION (5/10)

Sta. 140 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	8.2	4.5	3.4	3.4			4.9	6.9	7.5	7.2	46.0
15	150-155	27.5	18.0	13.5	13.5			50.4	33.8	14.4		171.1
14	145-150	37.2	20.0	15.0	15.0			111.1	72.7	14.4		285.4
13	140-145	47.2	20.0	15.0	15.0			173.6	114.5	14.4		399.7
12	135-140	57.2	20.0	15.0	15.0			236.0	156.0	14.1		513.3
11	130-135	67.2	20.0	15.0	15.0			306.1	195.2	2.7		621.2
10	125-130	77.2	20.0	15.0	15.0			366.6	233.9			727.7
9	120-125	87.2	20.0	15.0	15.0			424.5	272.6			834.3
8	115-120	97.2	20.0	15.0	15.0	110.0	75.0	372.3	236.3			940.8
7	110-115	107.2	20.0	15.0	15.0	130.0	95.0	410.2	255.1			1,047.5
6	105-110	117.2	20.0	15.0	15.0	150.0	115.0	448.0	273.8			1,154.0
5	100-105	127.2	20.0	15.0	15.0	170.0	135.0	485.8	292.5			1,260.5
4	95-100	137.2	20.0	15.0	15.0	190.0	155.0	523.7	311.2			1,367.1
3	90-95	147.2	20.0	15.0	15.0	210.0	175.0	548.4	329.9			1,460.5
2	85-90	157.2	20.0	15.0	15.0	146.5	195.0	125.5	348.6			1,022.8
1	80-85	167.2	23.6	15.0	18.6	6.4	46.1		247.9			524.8
Total		1,466.5	306.1	226.9	230.5	1,112.9	991.1	4,587.1	3,380.9	67.5	7.2	12,376.7

Sta. 150 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	8.2	4.5	3.4	3.4			4.9	6.9	7.5	7.2	46.0
15	150-155	27.5	18.0	13.5	13.5			50.4	33.8	14.4		171.1
14	145-150	37.2	20.0	15.0	15.0			111.1	72.7	14.4		285.4
13	140-145	47.2	20.0	15.0	15.0			173.6	114.5	14.4		399.7
12	135-140	57.2	20.0	15.0	15.0			236.0	156.0	14.1		513.3
11	130-135	67.2	20.0	15.0	15.0			305.5	195.2	2.6		620.5
10	125-130	77.2	20.0	15.0	15.0			365.4	233.9			726.5
9	120-125	87.2	20.0	15.0	15.0			422.5	272.6			832.3
8	115-120	97.2	20.0	15.0	15.0	110.0	75.0	369.7	236.3			938.2
7	110-115	107.2	20.0	15.0	15.0	130.0	95.0	406.9	254.9			1,044.0
6	105-110	117.2	20.0	15.0	15.0	150.0	115.0	444.1	273.6			1,149.9
5	100-105	127.2	20.0	15.0	15.0	170.0	135.0	488.2	292.3			1,262.7
4	95-100	137.2	20.0	15.0	15.0	190.0	155.0	466.1	311.0			1,309.3
3	90-95	147.2	20.0	15.0	15.0	210.0	175.0	372.9	329.7			1,284.8
2	85-90	157.2	20.0	15.0	15.0	172.3	195.0	74.0	348.4			996.9
1	80-85	167.2	23.6	15.0	18.6	6.4	21.5		162.3			414.6
Total		1,466.5	306.1	226.9	230.5	1,138.7	966.5	4,291.3	3,294.1	67.4	7.2	11,995.2

EMBANKMENT VOLUME CALCULATION (6/10)

Sta.160 (m³)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	8.1	4.4	3.3	3.3			4.8	6.7	7.4	7.2	45.2
15	150-155	27.5	18.0	13.5	13.5			50.0	33.5	14.4		170.4
14	145-150	37.2	20.0	15.0	15.0			110.6	72.4	14.4		284.6
13	140-145	47.2	20.0	15.0	15.0			173.1	114.2	14.4		398.9
12	135-140	57.2	20.0	15.0	15.0			234.9	155.0	13.8		510.9
11	130-135	67.2	20.0	15.0	15.0			302.9	193.3	2.7		616.1
10	125-130	77.2	20.0	15.0	15.0			362.2	231.3			720.7
9	120-125	87.2	20.0	15.0	15.0			418.8	269.3			825.3
8	115-120	97.2	20.0	15.0	15.0	110.0	75.0	365.5	232.3			930.0
7	110-115	107.2	20.0	15.0	15.0	130.0	95.0	408.0	250.3			1,040.5
6	105-110	117.2	20.0	15.0	15.0	150.0	115.0	406.5	268.3			1,107.0
5	100-105	127.2	20.0	15.0	15.0	170.0	135.0	323.7	263.0			1,068.9
4	95-100	137.2	20.0	15.0	15.0	190.0	155.0	209.1	199.5			940.8
3	90-95	147.2	20.0	15.0	15.0	205.1	175.0	63.5	96.4			737.2
2	85-90	157.2	24.3	15.0	17.1	38.0	98.2		0.3			350.1
1	80-85	32.6	4.5	3.0	3.5							43.6
Total		1,331.8	291.2	214.8	217.4	993.1	848.2	3,433.6	2,385.8	67.1	7.2	9,790.2

Sta.170 (m³)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	7.7	4.2	3.2	3.2			4.4	6.4	7.1	7.2	43.4
15	150-155	27.5	18.0	13.5	13.5			49.0	32.9	14.4		168.8
14	145-150	37.2	20.0	15.0	15.0			109.5	71.7	14.4		282.8
13	140-145	47.2	20.0	15.0	15.0			171.9	113.1	14.1		396.3
12	135-140	57.2	20.0	15.0	15.0			230.3	151.5	13.3		502.3
11	130-135	67.2	20.0	15.0	15.0			297.2	189.1	2.7		606.2
10	125-130	77.2	20.0	15.0	15.0			356.2	226.7			710.1
9	120-125	87.2	20.0	15.0	15.0			415.6	264.3			817.1
8	115-120	97.2	20.0	15.0	15.0	109.6	75.0	215.0	208.9			755.7
7	110-115	107.2	20.0	15.0	15.0	100.4	95.0		74.4			427.0
6	105-110	117.2	20.0	15.0	15.0	73.3	104.3		6.1			350.9
5	100-105	127.2	20.0	15.0	15.0	46.1	65.1					288.4
4	95-100	137.2	24.3	15.0	19.3	14.7	16.0					226.5
3	90-95	28.6	4.5	3.0	3.5							39.6
2	85-90											0.0
1	80-85											0.0
Total		1,023.0	251.0	184.7	189.5	344.1	355.4	1,849.1	1,345.1	66.0	7.2	5,615.1

EMBANKMENT VOLUME CALCULATION (7/10)

Sta.180 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	7.3	4.0	3.0	3.0			4.0	6.1	6.9	7.2	41.5
15	150-155	27.5	17.9	13.4	13.4			47.9	32.2	14.4		166.7
14	145-150	37.2	20.0	15.0	15.0			108.5	70.9	14.4		281.0
13	140-145	47.2	20.0	15.0	15.0			168.5	110.2	13.3		389.2
12	135-140	57.2	20.0	15.0	15.0			224.8	147.6	13.2		492.8
11	130-135	67.2	20.0	15.0	15.0			291.6	185.0	2.7		596.5
10	125-130	77.2	20.0	15.0	15.0			315.0	218.7			660.9
9	120-125	87.2	20.0	15.0	15.0			110.5	155.5			403.2
8	115-120	97.2	20.0	15.0	15.0	73.3	68.2		17.5			306.2
7	110-115	107.2	20.0	15.0	15.0	46.1	46.1					249.4
6	105-110	117.2	24.3	15.0	19.3	14.7	14.7					205.2
5	100-105	24.6	4.5	3.0	3.5							35.6
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		754.2	210.7	154.1	159.2	134.1	129.0	1,270.8	943.7	64.9	7.2	3,828.2

Sta.190 (m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	7.0	3.8	2.9	2.9			3.7	5.8	6.7	7.2	40.0
15	150-155	27.4	17.9	13.4	13.4			46.9	31.5	14.4		164.9
14	145-150	37.2	20.0	15.0	15.0			106.3	68.9	13.6		276.0
13	140-145	47.2	20.0	15.0	15.0			163.0	106.7	13.2		380.1
12	135-140	57.2	20.0	15.0	15.0			219.1	144.3	16.8		487.4
11	130-135	67.2	20.0	15.0	15.0			177.0	175.1	2.9		472.2
10	125-130	77.2	20.0	15.0	15.0			73.3	94.9			295.4
9	120-125	87.2	20.0	15.0	15.0			46.9	46.9			231.0
8	115-120	97.2	20.4	15.0	15.4	23.6	23.6					195.2
7	110-115	59.5	14.9	8.5	12.1							95.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		564.3	177.0	129.8	133.8	23.6	23.6	836.2	674.1	67.6	7.2	2,637.2

EMBANKMENT VOLUME CALCULATION (8/10)

Sta.200 (m^2)

No.	Elevation (El.. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	6.6	3.6	2.7	2.7			3.4	5.5	6.5	7.2	38.2
15	150-155	27.4	17.8	13.4	13.4			45.6	30.4	14.0		162.0
14	145-150	37.2	20.0	15.0	15.0			102.1	65.9	13.4		268.6
13	140-145	47.2	20.0	15.0	15.0			159.3	104.0	13.4		373.9
12	135-140	57.2	20.0	15.0	15.0			135.0	140.4	9.6		392.2
11	130-135	67.2	20.0	15.0	15.0			57.0	75.0			249.2
10	125-130	77.2	20.0	15.0	15.0			29.9	29.9			187.0
9	120-125	51.1	16.9	9.0	13.9							90.9
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		371.1	138.3	100.1	105.0	0.0	0.0	532.3	451.1	56.9	7.2	1,762.0

Sta.210 (m^2)

No.	Elevation (El.. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	6.3	3.4	2.6	2.6			3.1	5.2	6.2	7.2	36.6
15	150-155	27.4	17.8	13.4	13.4			42.7	28.1	13.6		156.4
14	145-150	37.2	20.0	15.0	15.0			98.6	63.7	13.6		263.1
13	140-145	47.2	20.0	15.0	15.0			111.4	103.9	14.1		326.6
12	135-140	57.2	20.0	15.0	15.0			29.9	35.5			172.6
11	130-135	39.1	16.9	9.0	13.9							78.9
10	125-130											0.0
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		214.4	98.1	70.0	74.9	0.0	0.0	285.7	236.4	47.5	7.2	1,034.2

EMBANKMENT VOLUME CALCULATION (9/10)

Sta.220

(m²)

No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	5.9	3.2	2.4	2.4			2.6	4.7	5.7	7.2	34.1
15	150-155	27.3	17.8	13.3	13.3			40.8	26.9	13.7		153.1
14	145-150	37.2	20.0	15.0	15.0			75.1	61.3	19.8		243.4
13	140-145	47.2	22.5	15.0	17.5			18.3	30.7	2.3		153.5
12	135-140	19.7	8.8	5.5	7.0							41.0
11	130-135											0.0
10	125-130											0.0
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		137.3	72.3	51.2	55.2	0.0	0.0	136.8	123.6	41.5	7.2	625.1

Sta.230

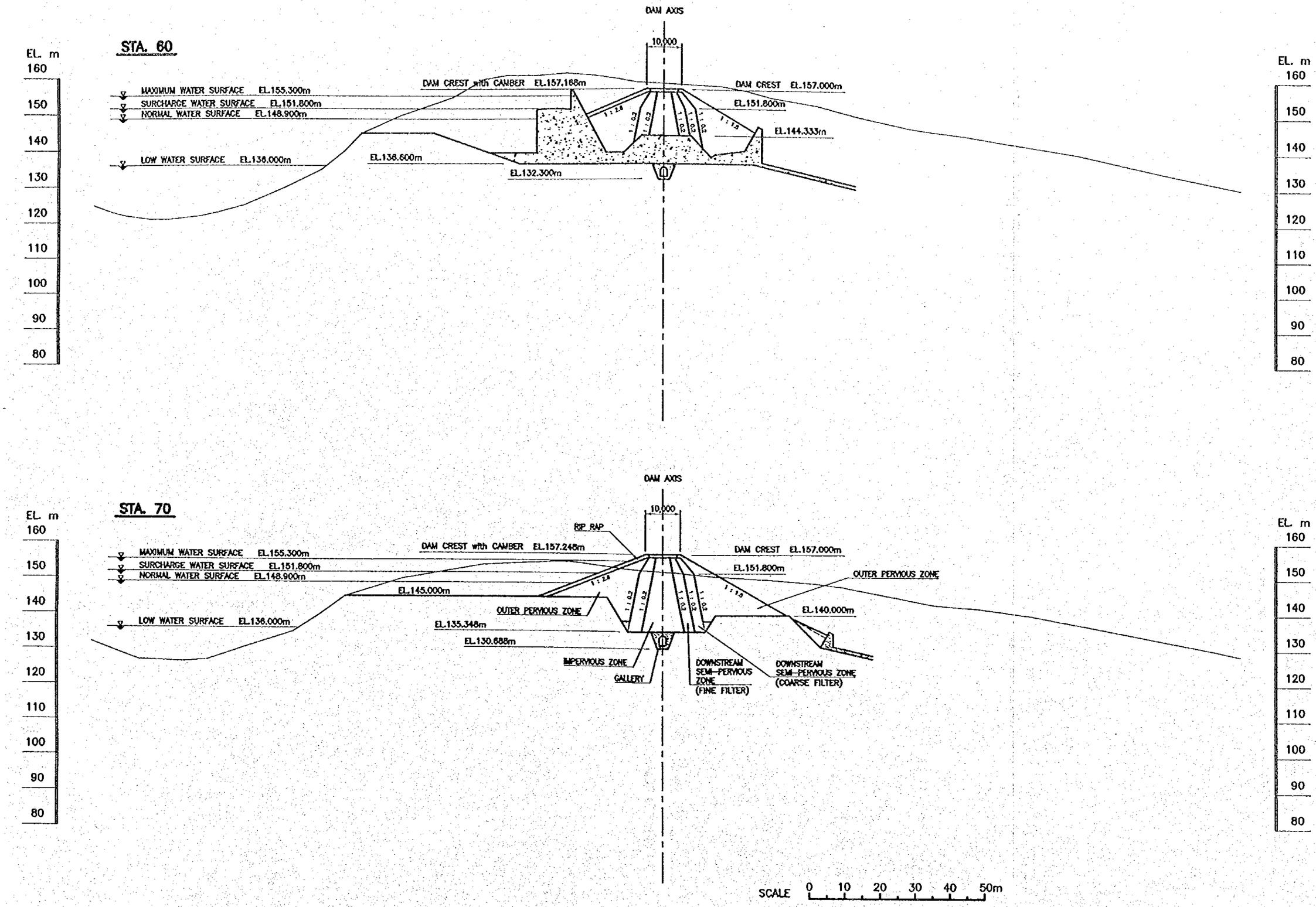
(m²)

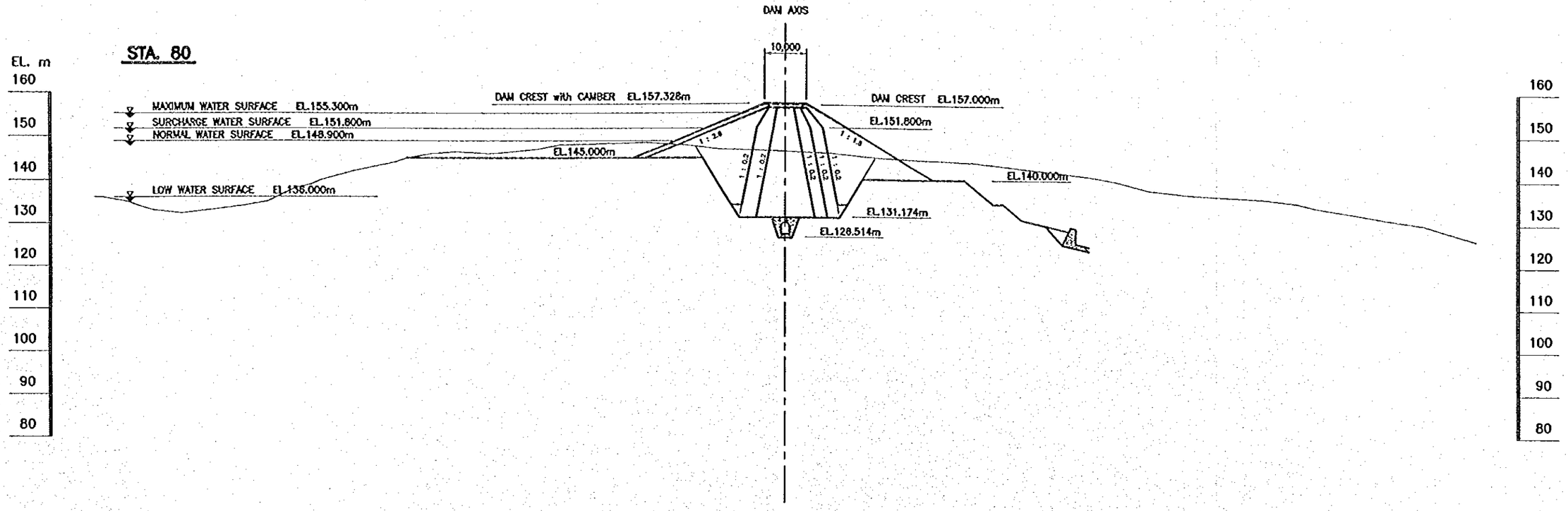
No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	5.6	3.0	2.3	2.3			2.3	4.5	5.5	7.2	32.7
15	150-155	27.3	17.7	13.3	13.3			31.6	26.3	13.9		143.4
14	145-150	37.2	23.8	15.0	18.8			10.2	18.9			123.9
13	140-145	5.6	2.8	2.0	2.2							12.6
12	135-140											0.0
11	130-135											0.0
10	125-130											0.0
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		75.7	47.3	32.6	36.6	0.0	0.0	44.1	49.7	19.4	7.2	312.6

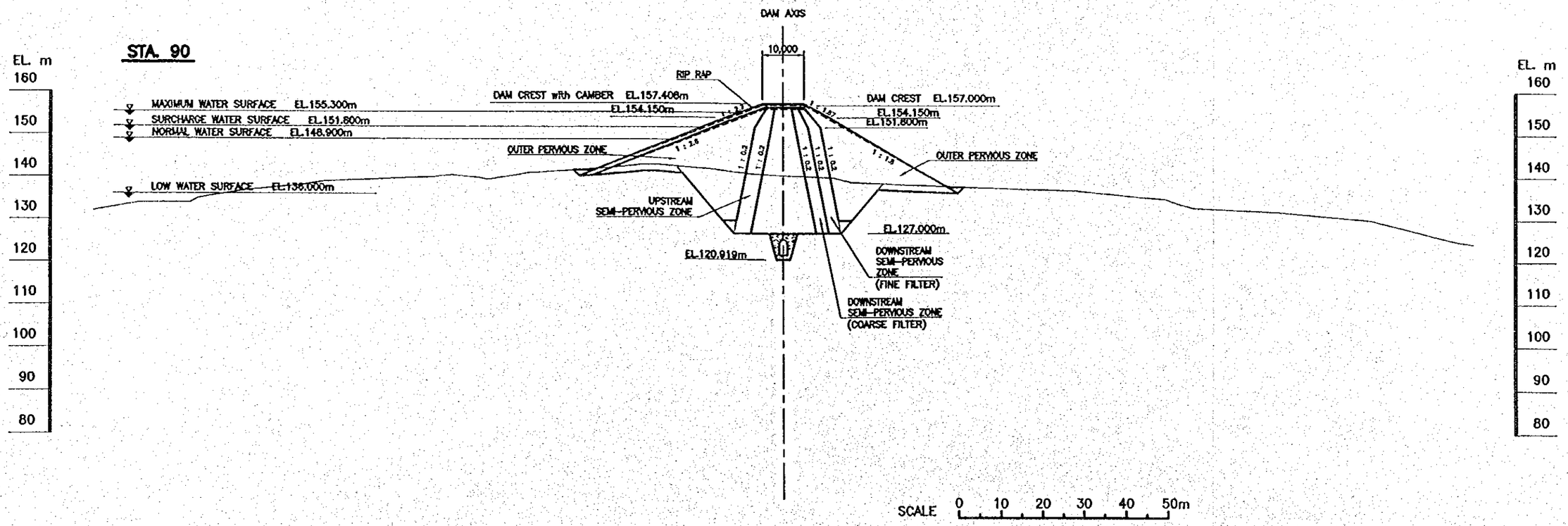
EMBANKMENT VOLUME CALCULATION (10/10)

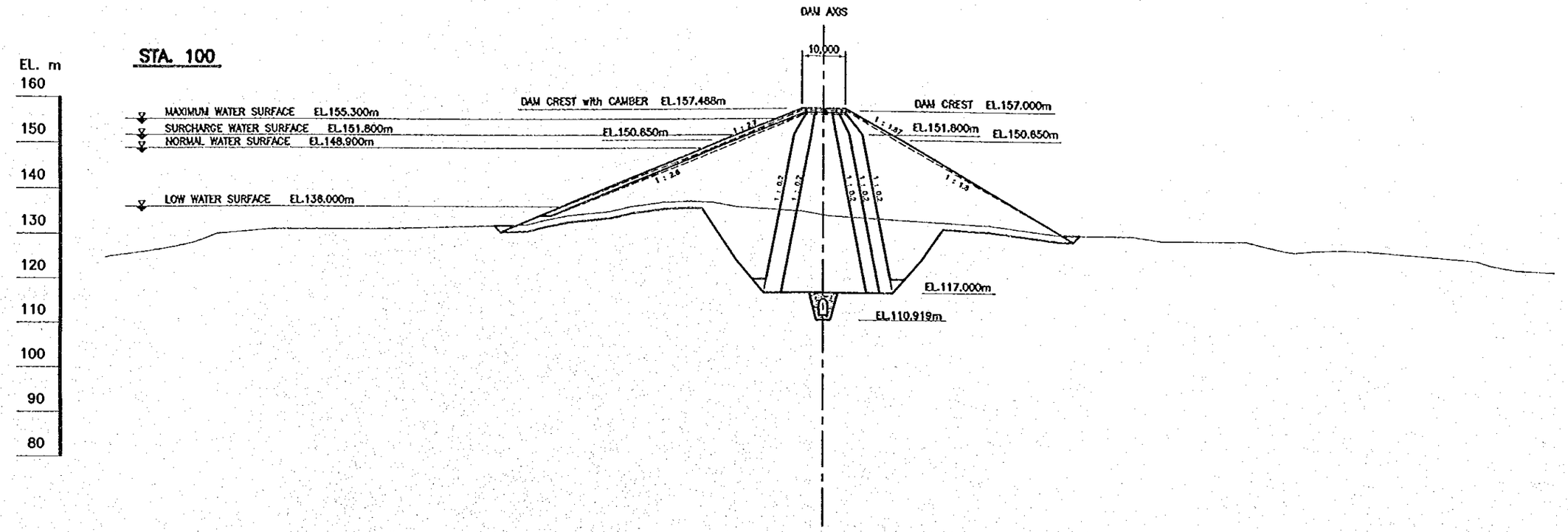
Sta.240 (m^2)

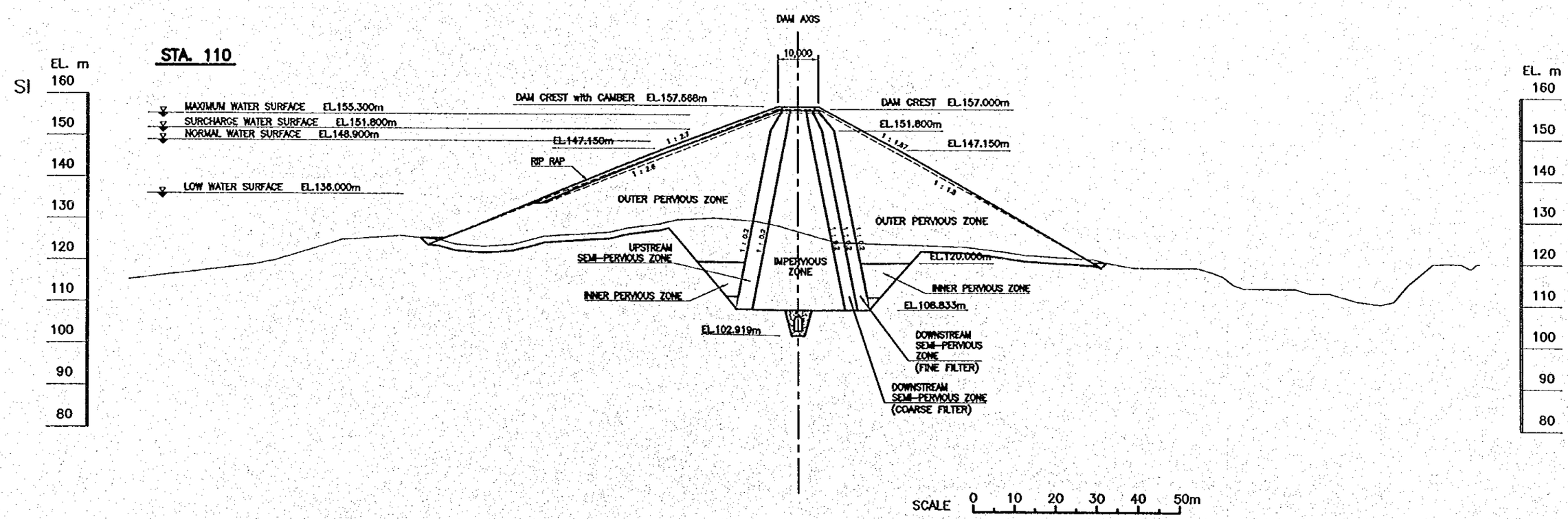
No.	Elevation (EL. m)	1 Impervious	2 Upstream Semi-pervious	3 Downstream Semi-pervious Fine	4 Downstream Semi-pervious Coarse	5 Upstream Inner Pervious	6 Downstream Inner Pervious	7 Upstream Outer Pervious	8 Downstream Outer Pervious	9 Riprap	10 Road Material	Total
16	155-157	5.2	2.8	2.1	2.1			2.0	6.5	12.2	7.2	40.1
15	150-155	24.0	20.3	11.7	16.7			5.4	7.3	1.1		86.5
14	145-150											0.0
13	140-145											0.0
12	135-140											0.0
11	130-135											0.0
10	125-130											0.0
9	120-125											0.0
8	115-120											0.0
7	110-115											0.0
6	105-110											0.0
5	100-105											0.0
4	95-100											0.0
3	90-95											0.0
2	85-90											0.0
1	80-85											0.0
Total		29.2	23.1	13.8	18.8	0.0	0.0	7.4	13.8	13.3	7.2	126.6


STA. 60
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
DAM AXIS
10.000
DAM CREST with CAMBER EL.157.168m
DAM CREST EL.157.000m
EL.151.800m
EL.144.333m
EL.136.600m
EL.132.300m
1:2.5
1:0.2
1:0.3
STA. 70
RIP RAP
EL.145.000m
OUTER PERVIOUS ZONE
EL.140.000m
EL.135.348m
EL.130.688m
IMPERVIOUS ZONE
GALLERY
DOWNSTREAM SEMI-PERVIOUS ZONE (FINE FILTER)
DOWNSTREAM SEMI-PERVIOUS ZONE (COARSE FILTER)
SCALE 0 10 20 30 40 50m

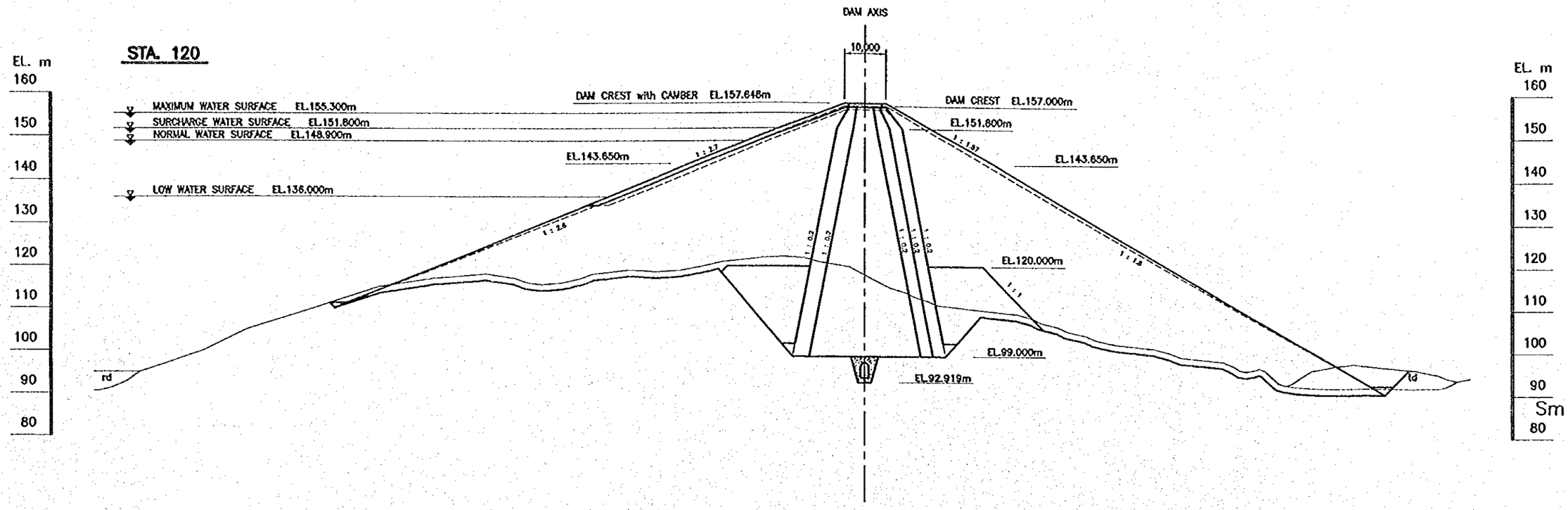

STA. 80
EL. m
160
150
140
130
120
110
100
90
80
DAM AXIS
10,000
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
DAM CREST with CAMBER EL.157.328m
DAM CREST EL.157.000m
EL.151.800m
EL.145.000m
EL.140.000m
EL.131.174m
EL.128.514m
1 : 2.8
1 : 1.8
1 : 0.2
1 : 0.3


STA. 90
EL. m
160
150
140
130
120
110
100
90
80
DAM AXIS
10,000
RIP RAP
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
DAM CREST with CAMBER EL.157.408m
EL.154.150m
DAM CREST EL.157.000m
EL.154.150m
EL.151.800m
OUTER PERVIOUS ZONE
OUTER PERVIOUS ZONE
UPSTREAM SEMI-PERVIOUS ZONE
EL.127.000m
EL.120.919m
DOWNSTREAM SEMI-PERVIOUS ZONE (FINE FILTER)
DOWNSTREAM SEMI-PERVIOUS ZONE (COARSE FILTER)
1 : 2.8
1 : 1.8
1 : 0.2
1 : 0.3
SCALE 0 10 20 30 40 50m

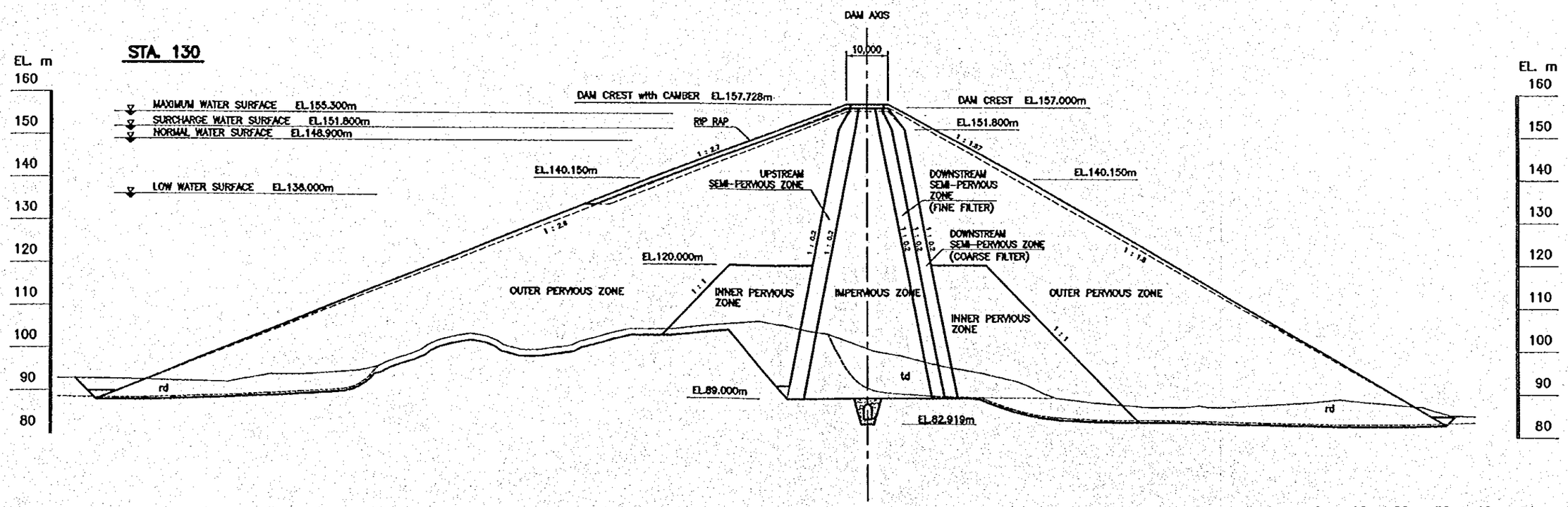

STA. 100
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.138.000m
DAM AXIS
10.000
DAM CREST with CAMBER EL.157.488m
EL.150.650m
DAM CREST EL.157.000m
EL.151.800m
EL.150.650m
EL.117.000m
EL.110.919m
1:2.6
1:0.2
1:0.2
1:0.2
1:0.2
1:1.8
1:2.7
1:1.87


STA. 110
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.138.000m
DAM AXIS
10.000
DAM CREST with CAMBER EL.157.568m
EL.147.150m
DAM CREST EL.157.000m
EL.151.800m
EL.147.150m
RIP RAP
OUTER PERVIOUS ZONE
OUTER PERVIOUS ZONE
UPSTREAM SEMI-PERVIOUS ZONE
IMPERVIOUS ZONE
EL.120.000m
INNER PERVIOUS ZONE
INNER PERVIOUS ZONE
EL.108.833m
EL.102.919m
DOWNSTREAM SEMI-PERVIOUS ZONE (FINE FILTER)
DOWNSTREAM SEMI-PERVIOUS ZONE (COARSE FILTER)
SCALE 0 10 20 30 40 50m
1:2.7
1:2.6
1:0.2
1:0.2
1:0.2
1:0.2
1:1.8
1:1.87

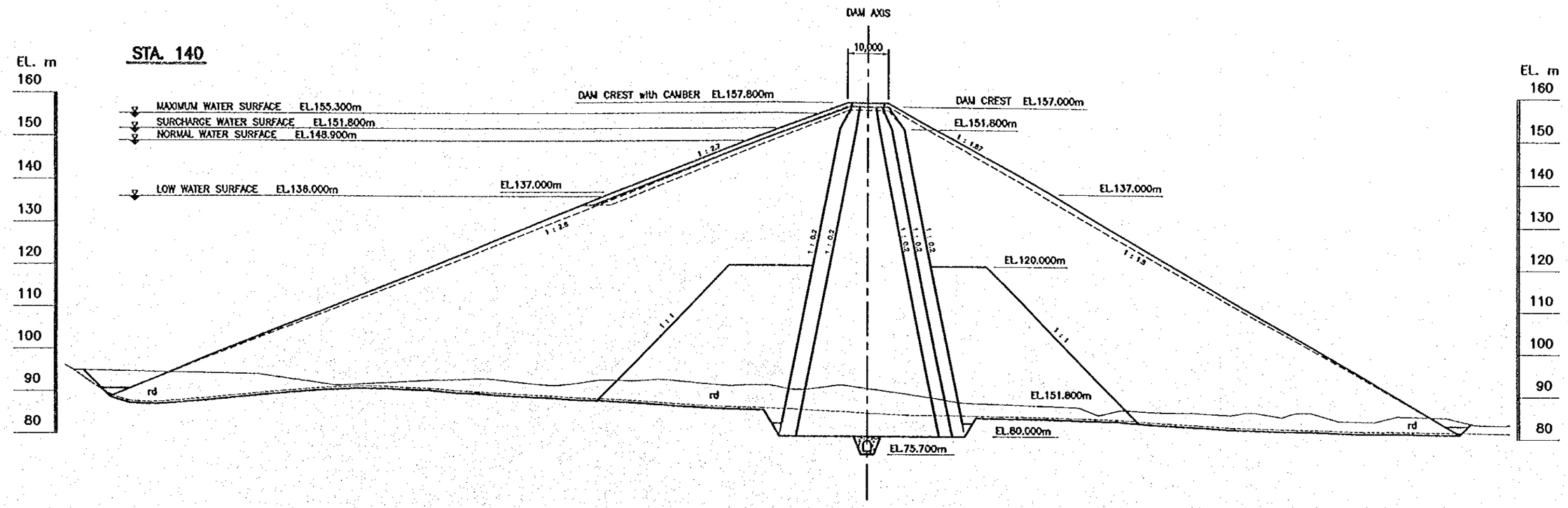
STA. 120

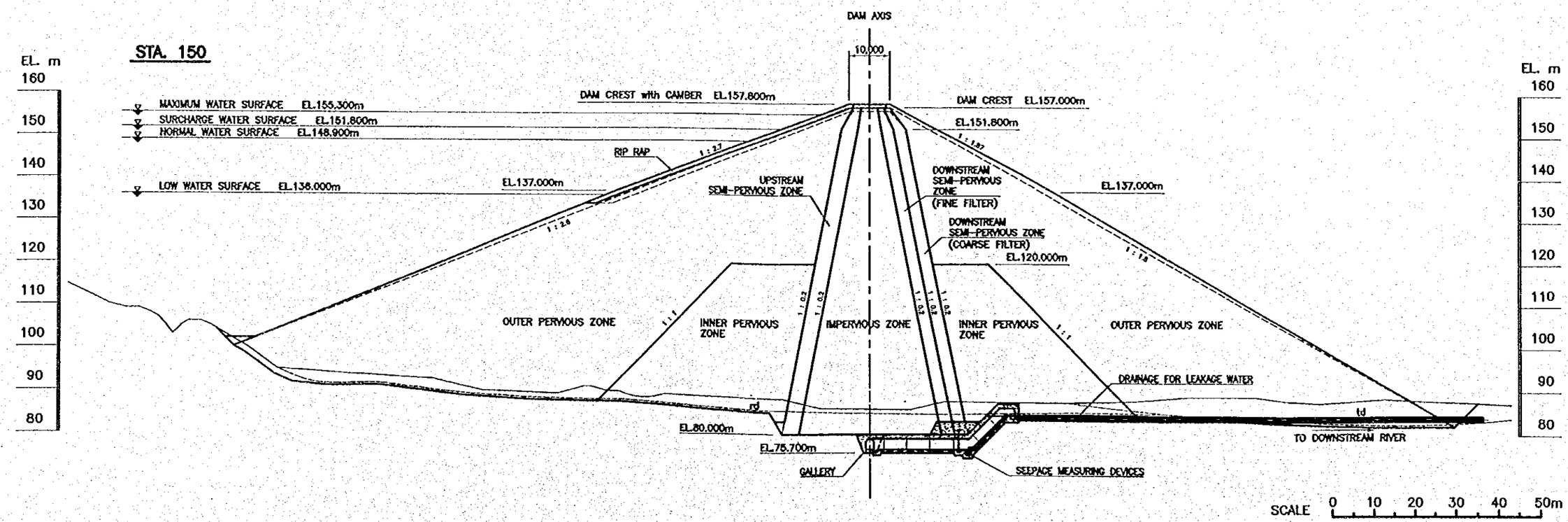


STA. 130

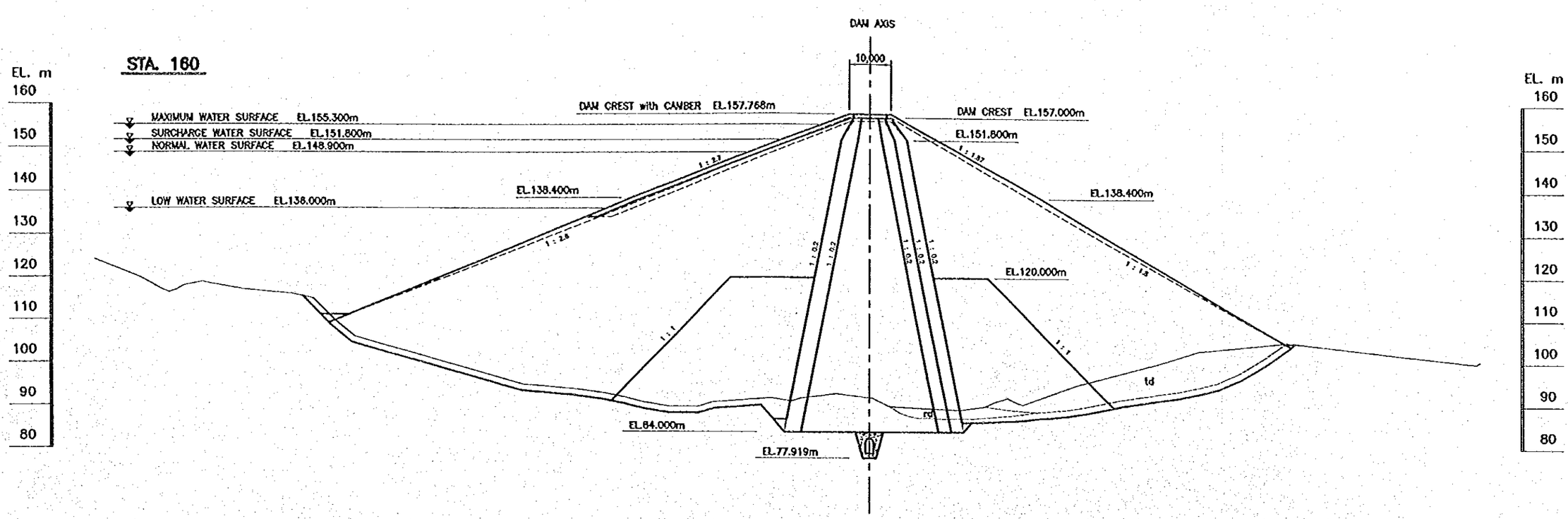


SCALE 0 10 20 30 40 50m

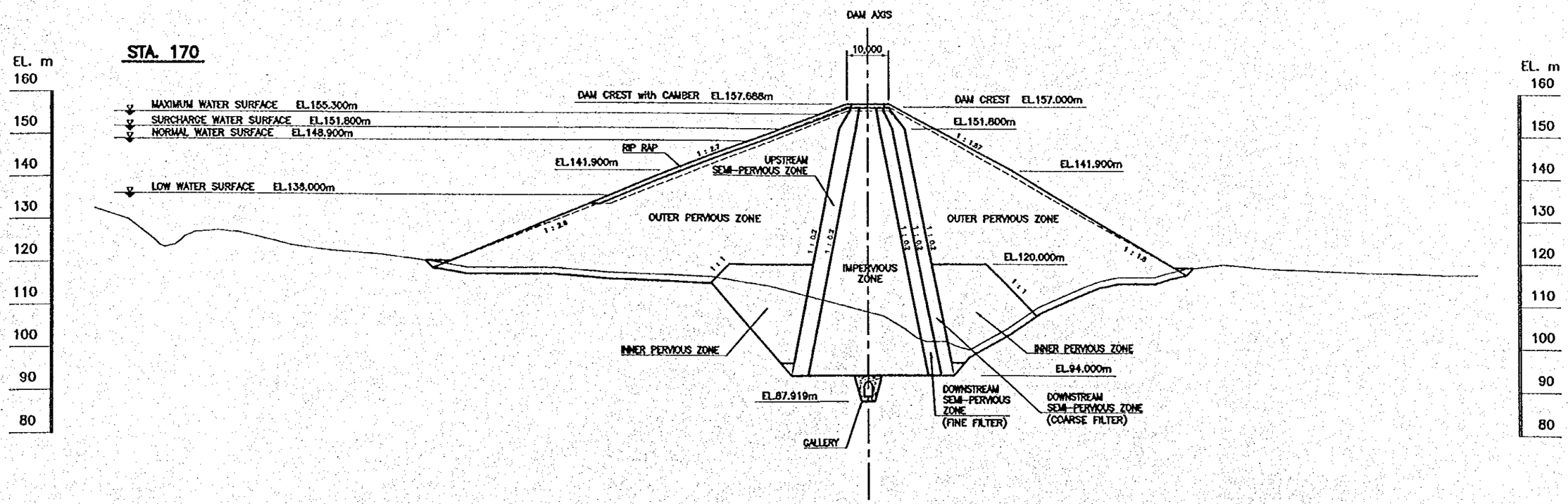

STA. 140
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.138.000m
EL.137.000m
DAM AXIS
10,000
DAM CREST with CAMBER EL.157.800m
DAM CREST EL.157.000m
EL.151.800m
EL.137.000m
EL.120.000m
EL.151.800m
EL.60.000m
EL.75.700m
rd
1 : 2.7
1 : 2.6
1 : 1.87
1 : 1.9
1 : 0.2
1 : 0.3
1 : 0.5
1 : 1


STA. 150
EL. m
160
150
140
130
120
110
100
90
80
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.138.000m
EL.137.000m
RIP RAP
DAM AXIS
10,000
DAM CREST with CAMBER EL.157.800m
DAM CREST EL.157.000m
EL.151.800m
EL.137.000m
UPSTREAM SEMI-PERVIOUS ZONE
DOWNSTREAM SEMI-PERVIOUS ZONE (FINE FILTER)
DOWNSTREAM SEMI-PERVIOUS ZONE (COARSE FILTER)
EL.120.000m
OUTER PERVIOUS ZONE
INNER PERVIOUS ZONE
IMPERVIOUS ZONE
INNER PERVIOUS ZONE
OUTER PERVIOUS ZONE
DRAINAGE FOR LEAKAGE WATER
EL.80.000m
EL.75.700m
GALLERY
SEEPAGE MEASURING DEVICES
TO DOWNSTREAM RIVER
td
1 : 2.7
1 : 2.6
1 : 1.87
1 : 1.9
1 : 0.2
1 : 0.3
1 : 0.5
1 : 1
SCALE 0 10 20 30 40 50m

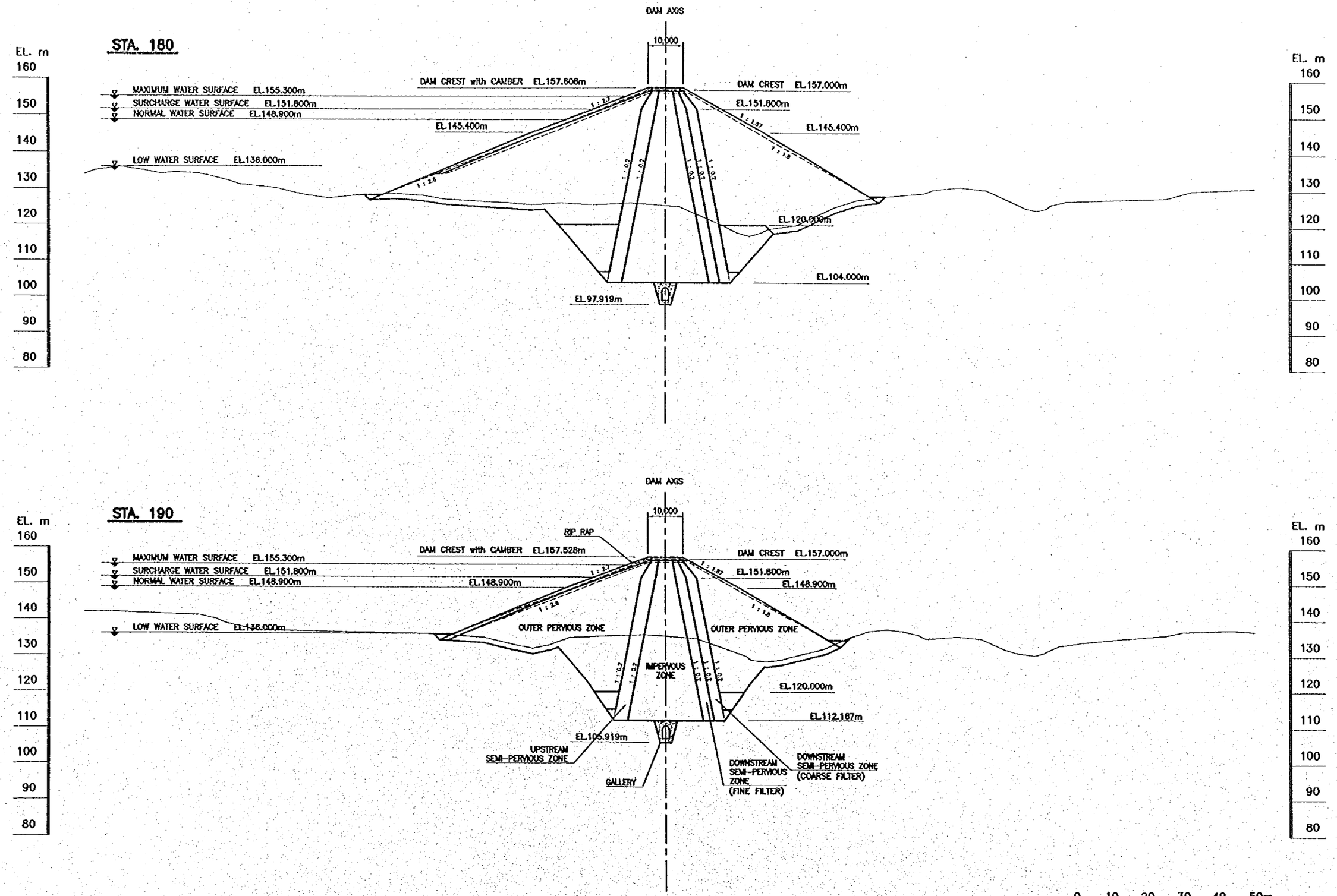
STA. 160



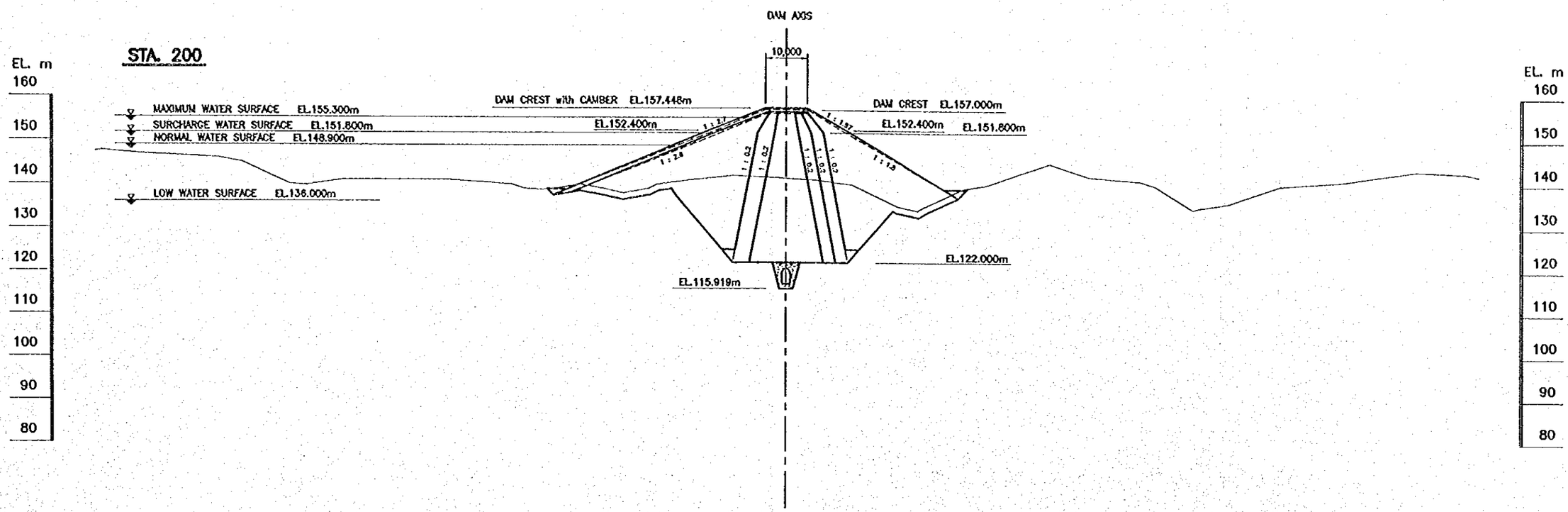
STA. 170



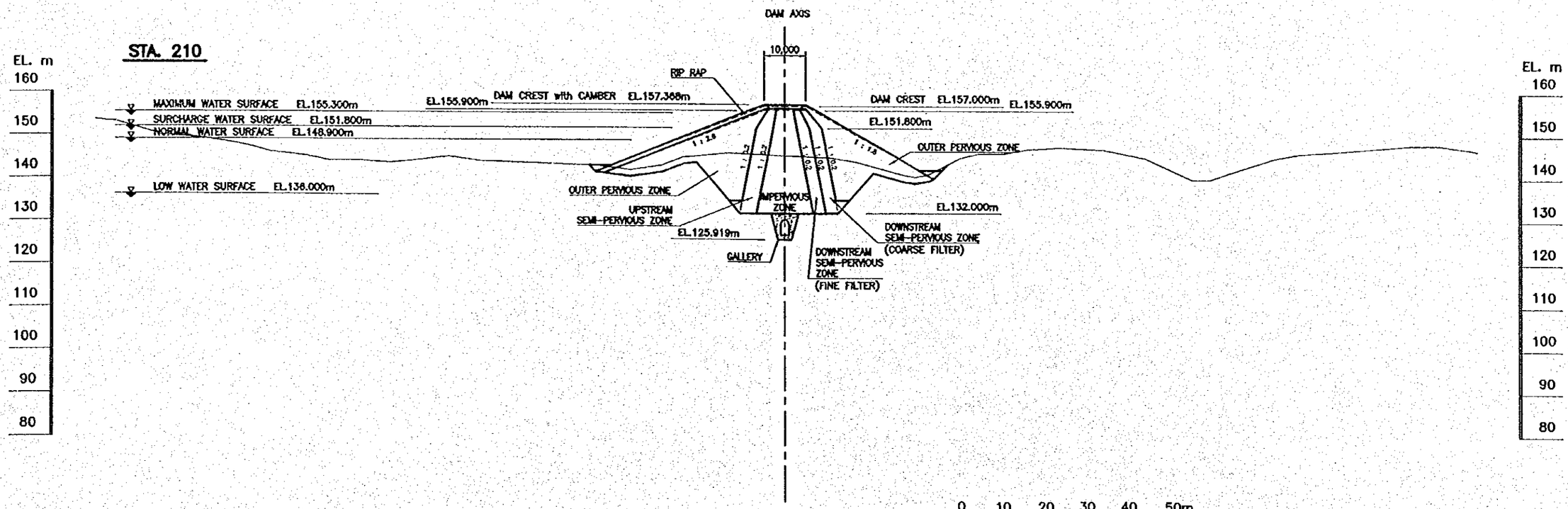
SCALE 0 10 20 30 40 50m


STA. 180
EL. m
160
150
140
130
120
110
100
90
80
DAM AXIS
10,000
DAM CREST with CAMBER EL.157.608m
DAM CREST EL.157.000m
MAXIMUM WATER SURFACE EL.155.300m
SURCHARGE WATER SURFACE EL.151.800m
NORMAL WATER SURFACE EL.148.900m
LOW WATER SURFACE EL.136.000m
EL.151.800m
EL.145.400m
EL.120.000m
EL.104.000m
EL.97.919m
1 : 2.7
1 : 2.5
1 : 0.2
1 : 0.3
1 : 1.87
1 : 1.8
STA. 190
RIP RAP
DAM CREST with CAMBER EL.157.528m
DAM CREST EL.157.000m
EL.148.900m
OUTER PERVIOUS ZONE
IMPERVIOUS ZONE
EL.112.187m
EL.105.919m
UPSTREAM SEMI-PERVIOUS ZONE
GALLERY
DOWNSTREAM SEMI-PERVIOUS ZONE (FINE FILTER)
DOWNSTREAM SEMI-PERVIOUS ZONE (COARSE FILTER)
1 : 2.4
SCALE 0 10 20 30 40 50m

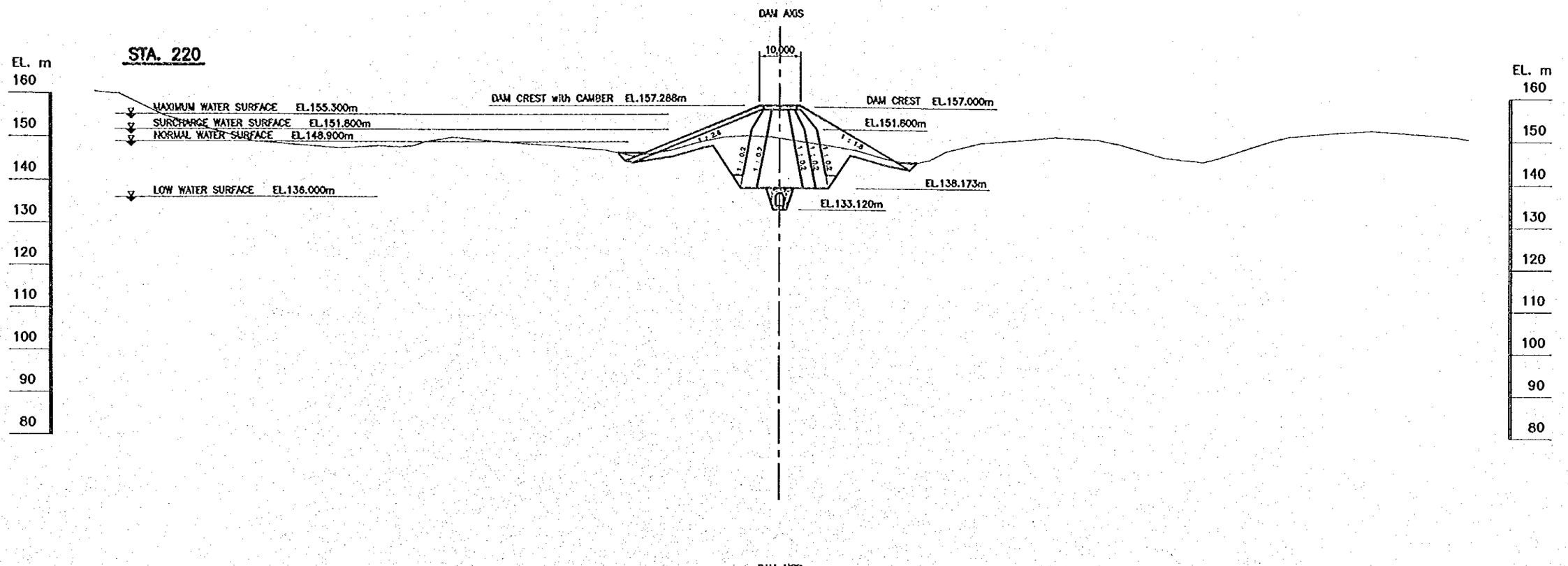
STA. 200



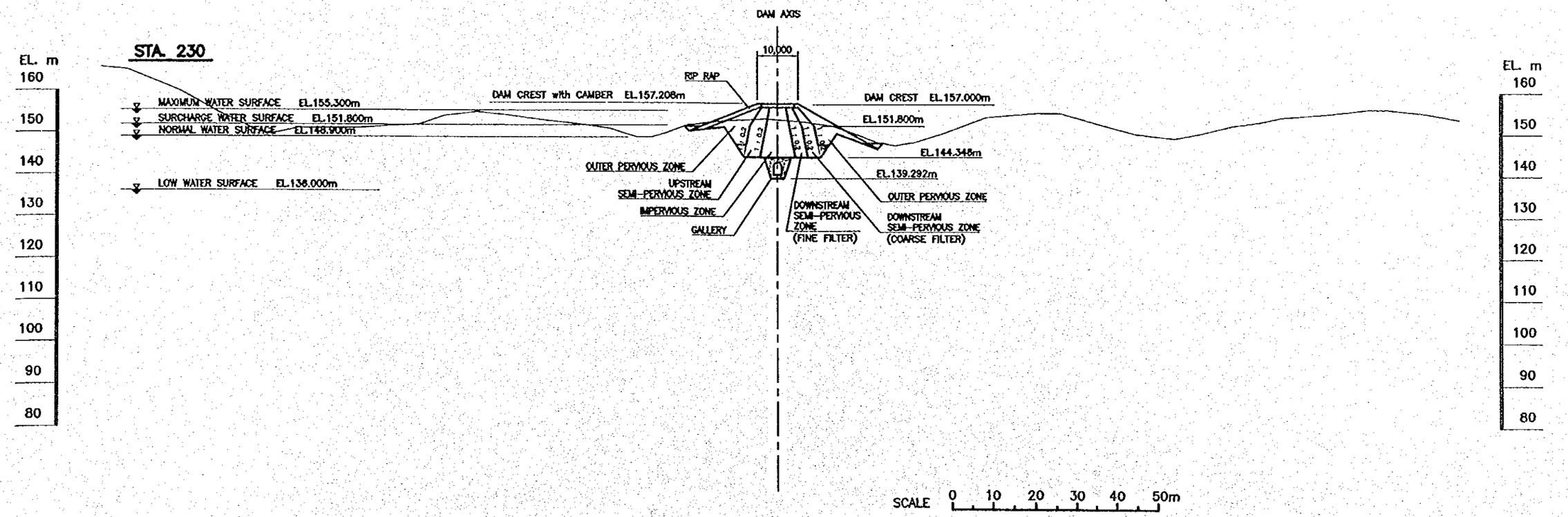
STA. 210



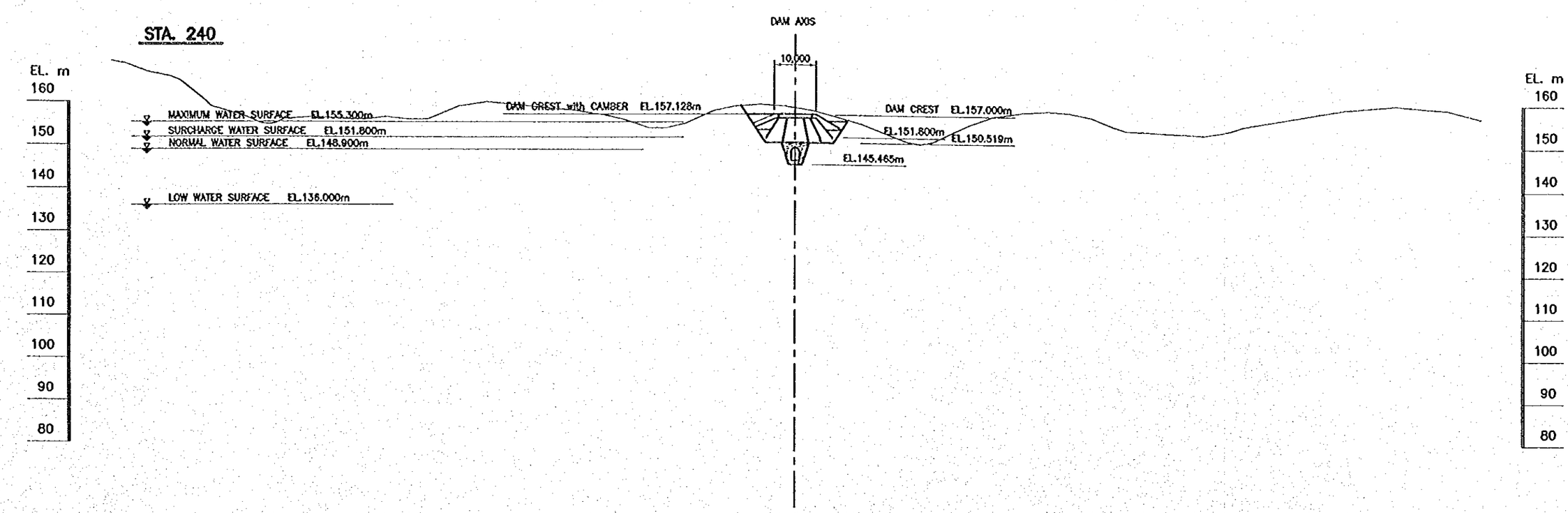
STA. 220



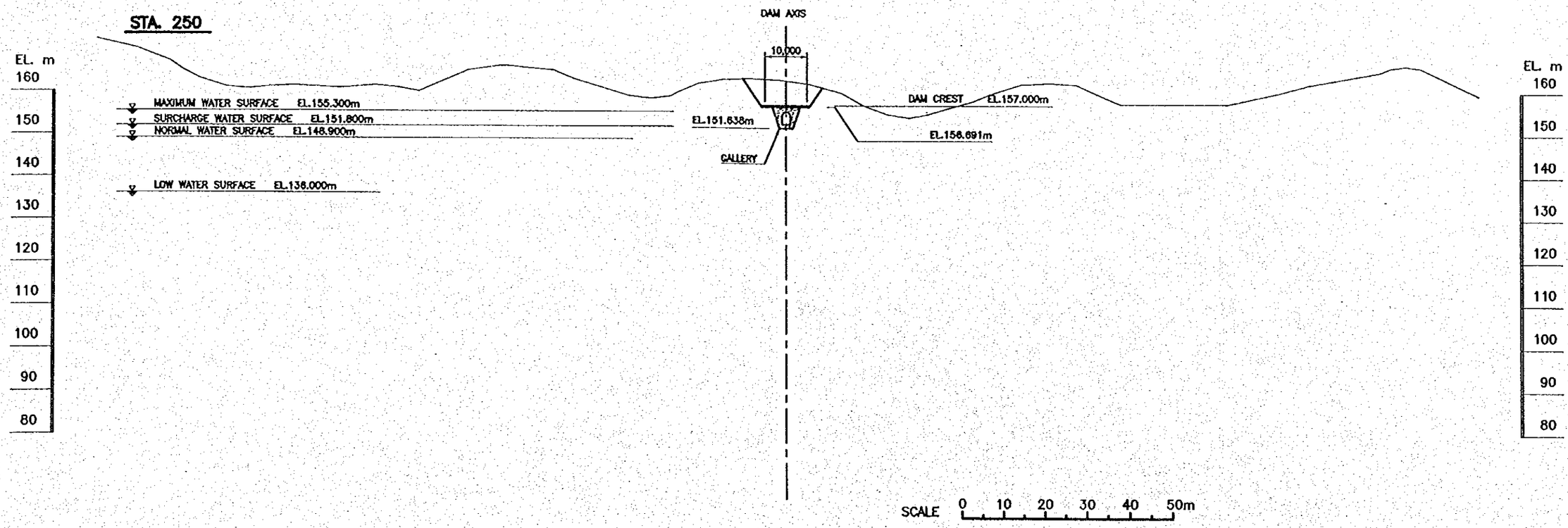
STA. 230



STA. 240



STA. 250



2.3 Gallery

GALLERY - CONCRETE AND EXCAVATION

Block No.	Concrete			Excavation		
	Distance (m)	Area (m^2)	Volume (m^3)	Distance (m)	Area (m^2)	Volume (m^3)
Left Entrance			12.158			0.000
1	9.000	16.495	148.455	9.000	21.156	190.404
2	9.000	16.495	148.455	9.000	21.156	190.404
3	9.000	16.495	148.455	9.000	21.156	190.404
4	9.000	16.495	148.455	9.000	21.156	190.404
5	6.034		100.182	6.034	21.156	127.655
6	6.000	16.495	98.970	6.000	21.156	126.936
7	6.000	16.495	98.970	6.000	21.156	126.936
8	6.000	16.495	98.970	6.000	21.156	126.936
9	5.905		96.240	5.905	21.156	124.926
10	5.000	16.495	82.475	5.000	21.156	105.780
11	6.000	16.495	98.970	6.000	21.156	126.936
12	6.000	16.495	98.970	6.000	21.156	126.936
13	6.000		112.752	6.000	21.156	126.936
14	6.305		109.274	6.305	21.156	133.389
15	6.000	16.495	98.970	6.000	21.156	126.936
16	6.000	16.495	98.970	6.000	21.156	126.936
17	6.000	16.495	98.970	6.000	21.156	126.936
18	6.000	16.495	98.970	6.000	21.156	126.936
19	6.000	16.495	98.970	6.000	21.156	126.936
20	6.000	16.495	98.970	6.000	21.156	126.936
21	5.583		90.723	5.583	21.156	118.114
22	6.000	16.495	98.970	6.000	21.156	126.936
23	6.000		120.459	6.000	21.156	126.936
24	5.583		90.723	5.583	21.156	118.114
25	6.000	16.495	98.970	6.000	21.156	126.936
26	6.000	16.495	98.970	6.000	21.156	126.936
27	6.000	16.495	98.970	6.000	21.156	126.936
28	6.000	16.495	98.970	6.000	21.156	126.936
29	6.000	16.495	98.970	6.000	21.156	126.936
30	6.000	16.495	98.970	6.000	21.156	126.936
31	6.305		109.274	6.305	21.156	133.389
32	6.000		112.752	6.000	21.156	126.936
33	6.000	16.495	98.970	6.000	21.156	126.936
34	6.000	16.495	98.970	6.000	21.156	126.936
35	6.000	16.495	98.970	6.000	21.156	126.936
36	6.000	16.495	98.970	6.000	21.156	126.936
37	6.492		107.465	6.492	21.156	137.345
38	6.000	16.495	98.970	6.000	21.156	126.936
39	6.000	16.495	98.970	6.000	21.156	126.936
40	6.000	16.495	98.970	6.000	21.156	126.936
41	6.000	16.495	98.970	6.000	21.156	126.936
42	6.000	16.495	98.970	6.000	21.156	126.936
43	5.000	16.495	82.475	5.000	21.156	105.780
44	5.000	16.495	82.475	5.000	21.156	105.780
45			156.611			200.865
46			87.131			111.752
47	5.500	14.646	80.553	5.500	19.307	106.189
48	5.500	14.646	80.553	5.500	19.307	106.189
49	5.500	14.646	80.553	5.500	19.307	106.189
50	5.928		96.314	5.928	19.307	114.452
51	5.500	14.646	80.553	5.500	19.307	106.189
52	6.784		94.826		19.307	0.000
			5,332.531			6,631.789
Total		x 1.05 =	5,600		x 1.05 =	7,000

TYPE OF WORK : Production and Construction of concrete (Type B)
LOCATION : Gallery

CALCULATION	RESULT
(B 5)	
$A_1 = 1/2 \times (6.640 + 3.200) \times 4.300 - \{(\pi/4 \times 2.00^2 \times 1/2 + (1.50 \times 2.00) + (0.30 \times 0.30)\}$ = 16.495 m²	
$V = A_1 \times (6.895 + 5.252) \times 1/2$ =	100.182 m³
(B 9)	
A_1 = 16.495 m² (refer to "B 5")	
$V = A_1 \times (6.754 + 4.915) \times 1/2$ =	96.240 m³
(B 13)	
A_1 = 16.495 m² (refer to "B 5")	
$A_2 = 1/2 \times (7.350 + 3.200) \times 5.188 - \{\pi/4 \times 2.00^2 \times 1/2 + (1.50 \times 2.00) + (0.30 \times 0.30)\}$ = 22.706 m²	
$V_1 = A_1 \times 1.562$ = 25.765 m³	
$V_2 = 1/2 \times (A_1 + A_2) \times 4.438$ = 86.987 m³	
$\Sigma V = V_1 + V_2$ =	112.752 m³
(B 14)	
A_1 = 16.495 m² (refer to "B 5")	
$V_1 = A_1 \times (3.076 + 1.347) \times 1/2$ = 36.479 m³	
A_2 = 22.706 m² (refer to "B 13")	
$V_2 = (A_1 + A_2) \times 1/2 \times 2.00$ = 39.201 m³	
$V_3 = A_2 \times 1/2 \times 2.959$ = 33.594 m³	
$\Sigma V = V_1 + V_2 + V_3$ =	109.274 m³
(B 21)	
A_1 = 16.495 m² (refer to "B 5")	
$V = A_1 \times (3.719 + 7.281) \times 1/2$ =	90.723 m³
(B 37)	
A_1 = 16.495 m² (refer to "B 5")	
$V = A_1 \times (6.993 + 6.037) \times 1/2$ =	107.465 m³

TYPE OF WORK : Production and Construction of concrete (Type B)
LOCATION : Gallery

CALCULATION		RESULT
(B 24)		
(refer to "B 21")	V =	90.723 m³
(B 31)		
(refer to "B 14")	V =	109.274 m³
(B 32)		
(refer to "B 13")	V =	112.752 m³

TYPE OF WORK : Production and Construction of concrete (Type B)
LOCATION : Galley

CALCULATION	RESULT
(B 23)	
$A_1 = 6.00 \times 6.64 + 5.78 \times 0.18 = 40.880\ m^2$ /	
$A_2 = 6.00 \times 4.92 + 5.78 \times 0.18 = 30.560\ m^2$ /	
$V_1 = 1/2 \times (A_1 + A_2) \times 4.30 = 153.596\ m^3$ /	
$V_2 = 1/2 \times (1.840 + 2.200) \times 0.60 \times 6.00 = 7.272\ m^3$ /	
$V_3 = -(\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) \times 6.00 = -27.425\ m^3$ /	
$V_4 = -0.30 \times 0.30 \times 6.00 = -0.540\ m^3$ /	
$V_5 = -(\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) \times 2.50 = -11.427\ m^3$ /	
$V_6 = -0.30 \times 0.30 \times 2.50 = -0.225\ m^3$ /	
$V_7 = -0.30 \times 0.30 \times 2.00 = -0.180\ m^3$ /	
$V_8 = -0.60 \times 0.60 \times 1.70 = -0.612\ m^3$ /	
$\Sigma V = V_1 + V_2 + V_3 + V_4 + V_5 + V_6 + V_7 + V_8 =$	$120.459\ m^3$
(B45)	
$A_1 = 1/2 \times (6.640 + 3.200) \times 4.300 - \{(\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) + (0.30 \times 0.30)\} = 16.495\ m^2$ /	
$V_1 = A_1 \times (2.212 + 0.992) \times 1/2 = 26.425\ m^3$ /	
$V_2 = A_1 \times (4.824 + 3.604) \times 1/2 + (0.30 \times 0.30 \times 1.70) = 69.663\ m^3$ /	
$A_2 = 1/2 \times (6.640 + 3.200) \times 4.300 = 21.156\ m^2$ /	
$V_3 = A_2 \times (2.320 + 0.60) \times 1/2 = 30.888\ m^3$ /	
$A_3 = 1/2 \times (6.640 + 3.200) \times 4.300 - \{(2.50 \times 2.00 - 1/2 \times 0.20^2 \times 2) + (0.30 \times 0.30)\} = 16.106\ m^2$	
$V_4 = A_3 \times (0.68 + 3.00) \times 1/2 = 29.635\ m^3$ /	
$\Sigma V = V_1 + V_2 + V_3 + V_4 =$	$156.611\ m^3$

TYPE OF WORK : Production and Construction of concrete (Type B)
LOCATION : Gallery

CALCULATION	RESULT
(B46)	
$A_1 = 1/2 \times (6.640 + 3.200) \times 4.300 - \{(2.50 \times 2.00 - 1/2 \times 0.20^2 \times 2) + (0.30 \times 0.30)\} = 16.106\ m^2$	
$V_1 = A_1 \times (1.840 + 2.631) \times 1/2 = 36.005\ m^3$	
$A_2 = (2.60 \times 3.60) - \{(2.50 \times 2.00 - 1/2 \times 0.20^2 \times 2) + (0.30 \times 0.30)\} = 4.310\ m^2$	
$V_2 = A_2 \times (4.384 + 5.657) \times 1/2 = 21.638\ m^3$	
$A_3 = (0.30 + 1.82) \times 1/2 \times 3.80 = 4.028\ m^2$	
$A_4 = (0.45 + 0.60) \times 1/2 \times 0.50 = 0.263\ m^2$	
$V_3 = 1/2 \times (A_3 + A_4) \times 4.396 \times 2 = 18.863\ m^3$	
$A_5 = (2.60 \times 3.40) - \{(2.50 \times 2.00 - 1/2 \times 0.20^2 \times 2) + (0.30 \times 0.30)\} = 3.790\ m^2$	
$V_4 = A_5 \times (3.560 + 1.869) \times 1/2 = 10.288\ m^3$	
$V_5 = 1/2 \times 0.50 \times 0.15 \times (3.500 + 3.800) \times 1/2 = 0.137\ m^3$	
$\Sigma V = V_1 + V_2 + V_3 + V_4 + V_5 + 0.50 \times 0.20 \times 2.00 =$	$87.131\ m^3$
(B50)	
$A_1 = 1/2 \times (5.780 + 2.840) \times 4.900 - \{(\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) + (0.30 \times 0.30)\} = 16.458\ m^2$	
$V_1 = A_1 \times (3.220 + 4.685) \times 1/2 - \{(0.30 \times 0.60 \times 2.00 \times 2) + (1.200 \times 1.300 \times 1.00)\} = 62.770\ m^3$	
$A_2 = 1/2 \times (2.420 + 2.840) \times 0.70 = 1.841\ m^2$	
$V_2 = A_2 \times (2.180 + 2.685) \times 1/2 = 4.478\ m^3$	
$A_3 = 1/2 \times (5.780 + 3.200) \times 4.300 - \{(\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) + (0.30 \times 0.30)\} = 14.646\ m^2$	
$V_3 = A_3 \times (0.90 + 3.10) \times 1/2 = 29.292\ m^3$	
$V_4 = -\pi/4 \times 0.20^2 \times (3.30 + 0.30) \times 2 = -0.226\ m^3$	
$\Sigma V = V_1 + V_2 + V_3 + V_4 =$	$96.314\ m^3$

TYPE OF WORK : Production and Construction of concrete (Type B)
LOCATION : Gallery

CALCULATION	RESULT
(B52)	
$V_1 = (3.404 + 3.818) \times 1/2 \times 1.00 \times 3.800 = 13.722\ m^3$	
$V_2 = (4.436 + 4.850) \times 1/2 \times 1.00 \times 3.800 = 17.643\ m^3$	
$V_3 = 0.90 \times 3.30 \times 3.800 - \pi/4 \times 0.60^2 \times 0.90 = 11.032\ m^3$	
$V_4 = 1/2 \times (3.404 + 2.037) \times 3.300 \times 0.90 \times 2 = 16.160\ m^3$	
$V_5 = 1/2 \times (3.536 + 2.169) \times 3.300 \times 0.90 \times 2 = 16.944\ m^3$	
$V_6 = 1/2 \times (2.037 + 3.500) \times 2.000 \times 0.80 - (0.30 \times 0.30 \times 3.500) = 4.115\ m^3$	
$V_7 = 1.60 \times 2.00 \times 2.169 - \{(1.00 \times 0.80 \times 1.00) + 1/2 \times 0.469^2 \times 1.00\} = 6.031\ m^3$	6.941
$V_8 = \{1/2 \times 0.99 \times 3.285 + 1/2 \times 0.18 \times 0.600\} \times 1/2 \times 4.48) \times 2 = 7.528\ m^3$	
$V_9 = 1/2 \times 0.18 \times 0.600 \times 3.069 \times 2 = 0.331\ m^3$	
$V_{10} = 1/2 \times 1.60 \times 0.48 \times (4.16 + 3.20) \times 1/2 - \pi/4 \times 0.60^2 \times 0.330 = 1.320\ m^3$	
$\Sigma V = V_1 + \sim + V_{10} =$	94.826 m³
(Entrance) ; EL + 156.100 m above	
$V_1 = 1/2 \times (0.990 + 5.734) \times 3.100 \times 0.30 = 3.587\ m^3$	
$V_2 = 1/2 \times (1.414 + 5.734) \times 2.800 \times 0.30 = 3.002\ m^3$	
$V_3 = 1/2 \times (3.560 + 2.400) \times 2.800 \times 0.30 \times 2 = 5.006\ m^3$	
$V_4 = 0.50 \times 0.20 \times 2.00 = 0.200\ m^3$	
$V_5 = 1/2 \times 0.20 \times 0.20 \times (3.360 + 5.734) \times 2 = 0.363\ m^3$	
$\Sigma V = V_1 + \sim + V_5 =$	12.158 m³

TYPE OF WORK : Formwork
LOCATION : Gallery

CALCULATION	RESULT
(B 5)	
$A_1 = 1/2 \times (6.640 + 3.200) \times 4.300 - \{(\pi/4 \times 2.00^2 \times 1/2 + (1.50 \times 2.00) + (0.30 \times 0.30)\}$ $= 16.50\ m^2$	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2 + 0.30 \times 2\} \times (6.895 + 5.252) \times 1/2$ $= 40.95\ m^2$	
$\Sigma A = A_1 \times 2 + A_2 + (2.054 \times 6.640) + (1.373 \times 2.00)$ =	$90.33\ m^2$
(B 9)	
$A_1 = 16.50\ m^2$ (refer to "B 5")	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2 + 0.30 \times 2\} \times (6.754 + 4.915) \times 1/2$ $= 39.33\ m^2$	
$\Sigma A = A_1 \times 2 + A_2 + (1.924 \times 6.640) + (1.252 \times 2.00)$ =	$87.61\ m^2$
(B 13)	
$A_1 = 16.50\ m^2$ (refer to "B 5")	
$A_2 = 1/2 \times (7.350 + 3.200) \times 5.188 - \{\pi/4 \times 2.00^2 \times 1/2 + (1.50 \times 2.00) + (0.30 \times 0.30)\}$ $= 22.71\ m^2$	
$A_3 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2 + 0.30 \times 2\} \times 6.00$ =	$40.50\ m^2$
$A_4 = 4.526 \times (7.350 + 6.640) \times 1/2$ =	$31.66\ m^2$
$A_5 = 6.640 \times 1.562$ =	$10.37\ m^2$
$A_6 = 2.00 \times 6.00$ =	$12.00\ m^2$
$\Sigma A = A_1 + \sim + A_6$ =	$133.74\ m^2$
(B 14)	
$A_1 = 16.50\ m^2$ (refer to "B 5")	
$A_2 = 22.71\ m^2$ (refer to "B 13")	
$A_3 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2 + 0.30 \times 2\} \times 6.305$ =	$42.51\ m^2$
$A_4 = 2.00 \times 6.305$ =	$12.61\ m^2$
$A_5 = 6.640 \times 3.076$ =	$20.42\ m^2$
$A_6 = 1/2 \times (7.350 + 6.640) \times 2.695$ =	$18.85\ m^2$
$\Sigma A = A_1 + \sim + A_6$ =	$133.60\ m^2$

TYPE OF WORK : Formwork
LOCATION : Gallery

CALCULATION	RESULT
(B 21)	
A_1 = 16.50 m² (refer to "B5")	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2 + 0.30 \times 2\} \times (4.547 + 6.619) \times 1/2$ = 37.64 m²	
A_3 = 6.640 × 1.219 = 8.09 m²	
A_4 = 2.00 × 2.669 = 5.34 m²	
$\Sigma A = A_1 + \sim + A_4$ =	67.57 m²
(B 37)	
A_1 = 16.50 m² (refer to "B5")	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2 + 0.30 \times 2\} \times 6.491$ = 43.76 m²	
A_3 = 6.640 × (2.003 + 4.990) = 46.43 m²	
A_4 = 2.00 × (1.607 + 4.593) = 12.40 m²	
$\Sigma A = A_1 + \sim + A_4$ =	119.09 m²

TYPE OF WORK : Formwork
LOCATION : Gallery

CALCULATION	RESULT
(B23)	
$A_1 = \frac{1}{2} \times (6.820 + 5.100) \times 4.300 + \frac{1}{2} \times (1.840 + 2.200) \times 0.60 - \{(\frac{\pi}{4} \times 2.00^2 \times \frac{1}{2} + 1.50 \times 2.00) + (0.30 \times 0.30)\}$	
$= 22.18\ m^2$	
$A_2 = 1.50 \times 6.00 = 9.00\ m^2$	
$A_3 = 1.50 \times (2.00 \times 2 + 2.50 \times 2) = 13.50\ m^2$	
$A_4 = \frac{\pi}{2} \times 2.00 \times (6.00 + 2.50) = 26.70\ m^2$	
$A_5 = 0.30 \times (6.00 + 5.70 + 2.50 \times 2) = 5.01\ m^2$	
$A_6 = 0.30 \times (1.70 + 0.60 \times 2 + 1.70) = 1.38\ m^2$	
$A_7 = 6.00 \times 4.30 - \{(\frac{\pi}{4} \times 2.00^2 \times \frac{1}{2} + 1.50 \times 2.00) + (0.30 \times 0.30)\}$	
$= 21.14\ m^2$	
$\Sigma A = A_1 \times 2 + A_2 + \sim + A_7 =$	$131.09\ m^2$
(B45)	
$A_1 = \frac{1}{2} \times (6.640 + 3.200) \times 4.30 - \{(\frac{\pi}{4} \times 2.00^2 \times \frac{1}{2} + 1.50 \times 2.00) + (0.30 \times 0.30)\}$	
$= 16.50\ m^2$	
$A_2 = (\frac{\pi}{2} \times 2.00 + 1.50 \times 2) \times (1.574 + 4.186) \times \frac{1}{2} - (2.50 \times 2.00) = 12.69\ m^2$	
$A_3 = (2.30 \times 2 + 0.283 \times 2 + 1.80) \times 2.50 = 14.92\ m^2$	
$A_4 = 0.30 \times (3.35 + 2.50 \times 2 + 0.30) = 2.595\ m^2$	
$A_5 = \frac{1}{2} \times (6.640 + 3.200) \times 4.200 - (2.50 \times 2.00) = 16.16\ m^2$	
$\Sigma A = A_1 + \sim + A_5 =$	$62.87\ m^2$
(B46)	
$A_1 = \frac{1}{2} \times (6.080 + 3.200) \times 3.600 - (2.50 \times 2.00) = 11.70\ m^2$	
$A_2 = \frac{1}{2} \times (1.264 + 2.300) \times 2.50 \times 2 = 8.91\ m^2$	
$A_3 = \frac{1}{2} \times (5.374 + 5.388) \times 2.50 \times 2 = 26.91\ m^2$	
$A_4 = \frac{1}{2} \times (3.436 + 2.400) \times 2.50 \times 2 = 14.59\ m^2$	
$A_5 = (1.264 + 5.374 + 3.436) \times 2.00 = 20.15\ m^2$	
$A_6 = 5.388 \times 2.00 = 10.78\ m^2$	
$A_7 = 0.30 \times (2.30 + 5.388 + 0.900 + 0.300) = 2.67\ m^2$	
$A_8 = 0.50 \times 2.00 \times 2 = 2.00\ m^2$	
$A_9 = \frac{1}{2} \times (6.460 + 3.560) \times 2.90 \times 2 = 29.06\ m^2$	
$A_{10} = 2.60 \times 2.90 - (2.50 \times 2.00) = 2.54\ m^2$	
$\Sigma A = A_1 + \sim + A_{10} =$	$129.31\ m^2$

TYPE OF WORK : Formwork
LOCATION : Gallery

CALCULATION	RESULT
(B.50)	
$A_1 = 1/2 \times (4.745 + 4.048) \times 1.50 \times 2 = 13.19\ m^2$	
$A_2 = 1/2 \times (2.314 + 1.692) \times 1.50 \times 2 = 6.01\ m^2$	
$A_3 = 1/2 \times (3.634 + 4.048) \times \pi/2 \times 2.00 = 12.07\ m^2$	
$A_4 = 1/2 \times (1.692 + 1.278) \times \pi/2 \times 2.00 = 4.67\ m^2$	
$A_4 = 1/2 \times (5.780 + 2.840) \times 4.90 - \{\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00 + (0.30 \times 0.30)\} = 16.46\ m^2$	
$A_5 = 1/2 \times (5.780 + 3.200) \times 4.30 - \{\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00 + (0.30 \times 0.30)\} = 14.65\ m^2$	
$A_6 = 1.30 \times 1.20 \times 2 = 3.12\ m^2$	21.119
$A_7 = 1.30 \times 1.00 \times 2 = 2.60\ m^2$	
$A_8 = 0.60 \times 2.00 \times 4 = 4.80\ m^2$	19.367
$A_9 = 2.30 \times 2.00 = 4.60\ m^2$	
$\Sigma A = A_1 + \sim + A_9 =$	82.17 m²
(B.52)	
$A_1 = 1/2 \times (5.780 + 3.200) \times 4.300 - \{\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00 + (0.30 \times 0.30)\} = 14.65\ m^2$	17.307
$A_2 = (\pi/2 \times 2.00 \times 1/2 + 1.50 \times 2) \times (2.837 + 3.404) \times 1/2 = 14.26\ m^2$	
$A_3 = (\pi/2 \times 2.00 \times 1/2 + 0.50 \times 2) \times (3.536 + 2.169) \times 1/2 = 7.33\ m^2$	
$A_4 = (\pi/4 \times 2.00^2 \times 1/2 + 0.50 \times 2.00) + (1.00 \times 0.80) = 3.37\ m^2$	
$A_5 = 1.00 \times 0.80 \times 2 + 0.80 \times 1.00 = 2.40\ m^2$	
$A_6 = 3.50 \times 2.00 = 7.00\ m^2$	
$A_7 = 1/2 \times (7.550 + 4.850) \times 2.700 \times 2 = 33.48\ m^2$	
$A_8 = 3.80 \times 2.70 = 10.26\ m^2$	
$A_9 = 3.818 \times 3.80 = 14.51\ m^2$	
$\Sigma A = A_1 + \sim + A_9 =$	107.26 m²

TYPE OF WORK : Scaffolding

LOCATION : Gallery

CALCULATION	RESULT
(B 5)	
$A_1 = 6.640 \times 4.300 \times 2 = 57.10\ m^2$	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2\} \times (6.895 + 5.252) \times 1/2 = 37.30\ m^2$	
$\Sigma A = A_1 + A_2 =$	94.40 m²
(B 9)	
$A_1 = 57.10\ m^2$ (refer to "B 5")	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2\} \times (6.754 + 4.915) \times 1/2 = 35.83\ m^2$	
$\Sigma A = A_1 + A_2 =$	92.93 m²
(B 13)	
$A_1 = 6.640 \times 4.300 = 28.55\ m^2$	
$A_2 = 7.350 \times 5.188 = 38.13\ m^2$	
$A_3 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2\} \times 6.00 = 36.85\ m^2$	
$\Sigma A = A_1 + A_2 + A_3 =$	103.53 m²
(B 14)	
$A_1 = 6.640 \times 4.300 = 28.55\ m^2$	
$A_2 = 7.350 \times 5.188 = 38.13\ m^2$	
$A_3 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2\} \times 6.305 = 38.72\ m^2$	
$\Sigma A = A_1 + A_2 + A_3 =$	105.40 m²
(B 21)	
$A_1 = 6.640 \times 4.300 = 28.55\ m^2$	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2\} \times (2.151 + 3.431) = 34.28\ m^2$	
$\Sigma A = A_1 + A_2 =$	62.83 m²
(B 37)	
$A_1 = 6.640 \times 4.300 = 28.55\ m^2$	
$A_2 = \{\pi \times 2.00 \times 1/2 + 1.50 \times 2\} \times 6.491 = 39.87\ m^2$	
$\Sigma A = A_1 + A_2 =$	68.42 m²

TYPE OF WORK : Scaffolding
LOCATION : Gallery

CALCULATION		RESULT
(B23)		
$A_1 = 1/2 \times (6.820 + 5.100) \times 4.30 \times 2$	$= 51.26\ m^2$	
$A_2 = 6.00 \times 4.30$	$= 25.80\ m^2$	
$A_3 = 2.50 \times (6.00 + 2.00 \times 2 + 2.50 \times 2)$	$= 37.50\ m^2$	
$\Sigma A = A_1 + A_2 + A_3$	$=$	$114.56\ m^2$
(B45)		
$A_1 = 1/2 \times (6.640 + 3.200) \times 4.30 \times 2$	$= 42.31\ m^2$	
$A_2 = 2.50 \times (1.574 \times 2 + 4.185 + 3.00 + 5.00)$	$= 38.33\ m^2$	
$\Sigma A = A_1 + A_2$	$=$	$80.64\ m^2$
(B46)		
$A_1 = 1/2 \times (6.080 + 3.200) \times 4.30$	$= 19.95\ m^2$	
$A_2 = 1/2 \times (1.264 + 2.300) \times 2.50 \times 2$	$= 8.91\ m^2$	
$A_3 = 1/2 \times (5.374 + 5.388) \times 2.50 \times 2$	$= 26.91\ m^2$	
$A_3 = 1/2 \times (3.436 + 2.400) \times 2.50 \times 2$	$= 14.59\ m^2$	
$A_4 = 1/2 \times (6.460 + 3.560) \times 2.90 \times 2$	$= 29.06\ m^2$	
$A_5 = 2.60 \times 2.90$	$= 7.54\ m^2$	
$\Sigma A = A_1 + \sim + A_5$	$=$	$106.96\ m^2$
(B50)		
$A_1 = 1/2 \times (5.780 + 2.840) \times 4.900$	$= 21.12\ m^2$	
$A_2 = 1/2 \times (5.780 + 3.200) \times 4.300$	$= 19.31\ m^2$	
$A_3 = 1/2 \times (4.745 + 3.634) \times 2.50 \times 2$	$= 20.95\ m^2$	
$A_4 = 1/2 \times (2.314 + 1.278) \times 2.50 \times 2$	$= 8.98\ m^2$	
$\Sigma A = A_1 + \sim + A_4$	$=$	$70.36\ m^2$
(B52)		
$A_1 = 1/2 \times (5.780 + 3.200) \times 4.30$	$= 19.31\ m^2$	
$A_2 = 1/2 \times (2.837 + 3.404) \times 2.50 \times 2$	$= 15.60\ m^2$	
$A_3 = 1/2 \times (7.550 + 4.850) \times 2.70 \times 2$	$= 33.48\ m^2$	
$A_4 = 3.80 \times 2.70$	$= 10.26\ m^2$	
$\Sigma A = A_1 + \sim A_4$	$=$	$78.65\ m^2$

TYPE OF WORK : Supporting
LOCATION : Gallery

CALCULATION		RESULT
(B 5)		
$A = \{\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00 + 0.30 \times 0.30\}$	$= 4.66\ m^2$	
$V_1 = A \times (6.895 + 5.252) \times 1/2$	$= 28.30\ m^3$	
$V_2 = 1/2 \times 4.300 \times 1.795 \times 6.640$	$= 25.63\ m^3$	
$\Sigma V = V_1 + V_2$	$=$	$50.93\ m^3$
(B 9)		
$A = 4.66\ m^2$ (refer to "B 5")		
$V_1 = A \times (6.754 + 4.915) \times 1/2$	$= 27.19\ m^3$	
$V_2 = 1/2 \times 4.300 \times 1.784 \times 6.640$	$= 25.47\ m^3$	
$\Sigma V = V_1 + V_2$	$=$	$52.66\ m^3$
(B 13)		
$A = 4.66\ m^2$ (refer to "B 5")		
$V_1 = A \times 6.00$	$= 27.96\ m^3$	
$V_2 = 1/2 \times 5.188 \times 5.188 \times 7.350$	$= 98.91\ m^3$	
$\Sigma V = V_1 + V_2$	$=$	$126.87\ m^3$
(B 14)		
$A = 4.66\ m^2$ (refer to "B 5")		
$V_1 = A \times 6.305$	$= 29.38\ m^3$	
$V_2 = 1/2 \times 4.30 \times 4.30 \times 6.640$	$= 61.39\ m^3$	
$\Sigma V = V_1 + V_2$	$=$	$90.77\ m^3$
(B 21)		
$A = 4.66\ m^2$ (refer to "B 5")		
$V = A \times (2.151 + 3.431)$	$=$	$26.01\ m^3$
(B 37)		
$A_1 = 4.66\ m^2$ (refer to "B 5")		
$V_1 = A_1 \times 6.491$	$= 30.25\ m^3$	
$V_2 = 1/2 \times 4.30 \times 4.30 \times 6.640$	$= 61.39\ m^3$	
$\Sigma V = V_1 + V_2$	$=$	$91.64\ m^3$

TYPE OF WORK : Supporting

LOCATION : Gallery

CALCULATION	RESULT
(B23)	
$V = (\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) \times (6.00 + 2.50)$ =	38.85 m³
(B45)	
$V_1 = (\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) \times (1.574 + 4.185)$ = 26.32 m³	
$V_2 = 2.50 \times 3.00 \times 2.00$ = 15.00 m³	
$V_3 = 1/2 \times 4.30 \times 2.071 \times (6.640 + 3.200) \times 1/2$ = 21.91 m³	
$\Sigma V = V_1 + V_2 + V_3$ =	63.23 m³
(B46)	
$V_1 = 1/2 \times (1.264 + 2.300) \times 2.50 \times 2.00$ = 8.91 m³	
$V_2 = 1/2 \times (5.374 + 5.388) \times 2.50 \times 2.00$ = 26.91 m³	
$V_3 = 1/2 \times (3.436 + 2.400) \times 2.50 \times 2.00$ = 14.59 m³	
$\Sigma V = V_1 + V_2 + V_3$ =	50.41 m³
(B50)	
$V_1 = (\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) \times (4.190 + 1.796)$ =	27.36 m³
(B52)	
$V_1 = (\pi/4 \times 2.00^2 \times 1/2 + 1.50 \times 2.00) \times (3.500 + 3.404) \times 1/2$ = 15.78 m³	
$V_2 = (\pi/4 \times 2.00^2 \times 1/2 + 0.50 \times 2.00) \times (3.536 + 1.700) \times 1/2$ = 6.73 m³	
$\Sigma V = V_1 + V_2$ =	22.51 m³

TYPE OF WORK :
LOCATION : Gallery

CALCULATION	RESULT
(Entrance) : EL+156.100m above	
(Formwork)	
$A_1 = 1/2 \times (0.990 + 5.734) \times 3.100 \times 2 = 20.84\ m^2$	
$A_2 = 1/2 \times (1.414 + 5.734) \times 2.800 \times 2 = 20.01\ m^2$	
$A_3 = 1/2 \times (3.560 + 2.400) \times 2.800 \times 2 \times 2 = 33.38\ m^2$	
$A_4 = 0.50 \times 2.00 \times 2 = 2.00\ m^2$	
$A_5 = 0.20 \times 2.00 = 0.40\ m^2$	
$A_6 = 0.283 \times (3.360 + 5.734) \times 2 = 5.15\ m^2$	
$\Sigma A = A_1 + \sim + A_6 =$	$81.78\ m^2$
(Scaffolding)	
$A_1 = 20.84\ m^2$	
$A_2 = 20.01\ m^2$	
$A_3 = 33.38\ m^2$	
$A_4 = 2.60 \times 2.80 = 7.28\ m^2$	
$\Sigma A = A_1 + \sim + A_4 =$	$81.51\ m^2$
(Supporting)	
$V_1 = 1/2 \times (1.414 + 5.734) \times 2.800 \times 2.00 = 20.01\ m^3$	
$V_2 = 1/2 \times (3.560 + 2.400) \times 2.800 \times 2.00 = 16.69\ m^3$	
$\Sigma V = V_1 + V_2 =$	$36.70\ m^3$

GALLERY - STEEL REINFORCEMENT BAR

Block No.	Distance (m)	Volume (kg)
Left Entrance		7,088
1	9.000	5,230
2	9.000	5,230
3	9.000	5,230
4	9.000	5,230
5	6.034	3,559
6	6.000	3,477
7	6.000	3,477
8	6.000	3,477
9	5.905	3,518
10	5.000	2,892
11	6.000	4,069
12	6.000	4,069
13	6.000	4,380
14	6.305	4,344
15	6.000	4,996
16	6.000	4,996
17	6.000	4,996
18	6.000	4,996
19	6.000	4,996
20	6.000	4,996
21	5.583	4,821
22	6.000	4,996
23	6.000	6,915
24	5.583	4,821
25	6.000	4,996
26	6.000	4,996
27	6.000	4,996
28	6.000	4,996
29	6.000	4,996
30	6.000	4,996
31	6.305	4,344
32	6.000	4,380
33	6.000	4,069
34	6.000	4,069
35	6.000	3,477
36	6.000	3,477
37	6.492	3,799
38	6.000	3,477
39	6.000	3,477
40	6.000	3,477
41	6.000	3,477
42	6.000	3,477
43	5.000	2,892
44	5.000	2,892
45		4,913
46		3,673
47	5.500	4,521
48	5.500	4,521
49	5.500	4,521
50	5.928	5,202
51	5.500	4,521
52	6.784	8,114
Total		237,545
	x 1.06 =	252,000

TYPE OF WORK : Furnishing and Installing Deformed Reinforcing bar
LOCATION : Gallery

CALCULATION		RESULT
(B 5)		
(Refer to drawing)	W = 3559 kg	3.56 ton
(B 9)		
(Refer to drawing)	W = 3518 kg	3.52 ton
(B 13)		
(Refer to drawing)	W = 4380 kg	4.38 ton
(B 14)		
(Refer to drawing)	W = 4344 kg	4.34 ton
(B 21)		
(Refer to drawing)	W = 4821 kg	4.82 ton
(B 31)		
(Refer to drawing)	W = 4344 kg	4.34 ton
(B 32)		
(Refer to drawing)	W = 4380 kg	4.38 ton
(B 37)		
(Refer to drawing)	W = 3799 kg	3.80 ton
(B 24)		
(Refer to drawing)	W = 4821 kg	4.82 ton

TYPE OF WORK : Furnishing and Installing Deformed Reinforcing Bars
LOCATION :

CALCULATION	RESULT
(B 23)	
W = 6,915 kg (refer to drawing)	6.92 ton
(B 45)	
W = 4,913 kg (refer to drawing)	4.91 ton
(B 46)	
W = 3,673 kg (refer to drawing)	3.67 ton
(B 50)	
W = 5,202 kg (refer to drawing)	5.20 ton
(B 52)	
W = 8,114 kg (refer to drawing)	8.11 ton
(Entrance at Left side)	
W = 7,088 kg	7.09 ton
(Upstream Portal of Diversion Facility)	
W = 30,636 kg	30.64 ton
(Inclined Intake Structure)	
W_1 = 344 kg	
W_2 = 3311 kg/5.0m × (23.397 - 0.10) = 15414 kg	
W_3 = (0.56 × 1.58 kgf/m × 90) × 3 = 239 kg	
W_4 = 1847 kg/5.0m × 37.85 = 13982 kg	
W_5 = 1847 kg/5.0m × 1/2 × (1.376 + 4.690) = 1120 kg	
W_6 = (0.56 × 1.58 kgf/m × 74) × 4 = 262 kg	
W_7 = 9250 kg	
$\Sigma W = W_1 + \sim + W_7$ =	40.61 ton

GALLERY STAIRS - CONCRETE

Block No.	Gradient	Distance (m)	1 Step (m)	Number of Steps (No.)	Volume per Step (m3)	Volume (m3)
Spillway L3	1 : 1	23.094	0.353	65.4	0.067	4.36
Spillway L4-1	1 : 1	23.094	0.353	65.4	0.067	4.36
1						0.00
2						0.00
3						0.00
4						0.00
5	1 : 2.396	1.373	0.400	3.4	0.061	0.21
6	1 : 2.396	6.000	0.400	15.0	0.061	0.91
7	1 : 2.396	6.000	0.400	15.0	0.061	0.91
8	1 : 2.396	6.000	0.400	15.0	0.061	0.91
9	1 : 2.396	4.158	0.400	10.4	0.061	0.63
	1 : 1	1.253	0.353	3.5	0.067	0.24
10	1 : 1	5.000	0.353	14.2	0.067	0.94
11	1 : 1	6.000	0.353	17.0	0.067	1.13
12	1 : 1	6.000	0.353	17.0	0.067	1.13
13	1 : 1	6.000	0.353	17.0	0.067	1.13
14	1 : 1	4.305	0.353	12.2	0.067	0.81
15	1 : 1	6.000	0.353	17.0	0.067	1.13
16	1 : 1	6.000	0.353	17.0	0.067	1.13
17	1 : 1	6.000	0.353	17.0	0.067	1.13
18	1 : 1	6.000	0.353	17.0	0.067	1.13
19	1 : 1	6.000	0.353	17.0	0.067	1.13
20	1 : 1	6.000	0.353	17.0	0.067	1.13
21	1 : 1	2.669	0.353	7.6	0.067	0.50
22						0.00
23						0.00
24	1 : 1	2.669	0.353	7.6	0.067	0.50
25	1 : 1	6.000	0.353	17.0	0.067	1.13
26	1 : 1	6.000	0.353	17.0	0.067	1.13
27	1 : 1	6.000	0.353	17.0	0.067	1.13
28	1 : 1	6.000	0.353	17.0	0.067	1.13
29	1 : 1	6.000	0.353	17.0	0.067	1.13
30	1 : 1	6.000	0.353	17.0	0.067	1.13
31	1 : 1	4.305	0.353	12.2	0.067	0.81
32	1 : 1	6.000	0.353	17.0	0.067	1.13
33	1 : 1	6.000	0.353	17.0	0.067	1.13
34	1 : 1	6.000	0.353	17.0	0.067	1.13
35	1 : 1	6.000	0.353	17.0	0.067	1.13
36	1 : 1	6.000	0.353	17.0	0.067	1.13
37	1 : 1	1.607	0.353	4.6	0.067	0.30
	1 : 1.62	4.593	0.400	11.5	0.084	0.96
38	1 : 1.62	6.000	0.400	15.0	0.084	1.26
39	1 : 1.62	6.000	0.400	15.0	0.084	1.26
40	1 : 1.62	6.000	0.400	15.0	0.084	1.26
41	1 : 1.62	6.000	0.400	15.0	0.084	1.26
42	1 : 1.62	6.000	0.400	15.0	0.084	1.26
43	1 : 1.62	5.000	0.400	12.5	0.084	1.05
44	1 : 1.62	5.000	0.400	12.5	0.084	1.05
45	1 : 1.62	1.219	0.400	3.0	0.084	0.26
46	1 : 1	5.374	0.353	15.2	0.067	1.01
47						0.00
48						0.00
49						0.00
50	1 : 1	2.314	0.353	6.6	0.067	0.44
51	1 : 1	5.500	0.353	15.6	0.067	1.04
52	1 : 1	3.500	0.353	9.9	0.067	0.66
Total					x 1.02 =	51.817 50.0

GALLERY STAIRS - STEEL REINFORCEMENT BAR

Block No.	Gradient	Distance (m)	1 Step (m)	Number of Steps (No.)	Weight per Step (kg)	Volume (kg)
Spillway L3	1 : 1	23.094	0.353	65.4	9.776	639.57
Spillway L4-1	1 : 1	23.094	0.353	65.4	9.776	639.57
1						0.00
2						0.00
3						0.00
4						0.00
5	1 : 2.396	1.373	0.400	3.4	9.776	33.56
6	1 : 2.396	6.000	0.400	15.0	9.776	146.64
7	1 : 2.396	6.000	0.400	15.0	9.776	146.64
8	1 : 2.396	6.000	0.400	15.0	9.776	146.64
9	1 : 2.396	4.158	0.400	10.4	9.776	101.62
	1 : 1	1.253	0.353	3.5	9.776	34.70
10	1 : 1	5.000	0.353	14.2	9.776	138.47
11	1 : 1	6.000	0.353	17.0	9.776	166.16
12	1 : 1	6.000	0.353	17.0	9.776	166.16
13	1 : 1	6.000	0.353	17.0	9.776	166.16
14	1 : 1	4.305	0.353	12.2	9.776	119.22
15	1 : 1	6.000	0.353	17.0	9.776	166.16
16	1 : 1	6.000	0.353	17.0	9.776	166.16
17	1 : 1	6.000	0.353	17.0	9.776	166.16
18	1 : 1	6.000	0.353	17.0	9.776	166.16
19	1 : 1	6.000	0.353	17.0	9.776	166.16
20	1 : 1	6.000	0.353	17.0	9.776	166.16
21	1 : 1	2.669	0.353	7.6	9.776	73.92
22						0.000
23						0.000
24	1 : 1	2.669	0.353	7.6	9.776	73.92
25	1 : 1	6.000	0.353	17.0	9.776	166.16
26	1 : 1	6.000	0.353	17.0	9.776	166.16
27	1 : 1	6.000	0.353	17.0	9.776	166.16
28	1 : 1	6.000	0.353	17.0	9.776	166.16
29	1 : 1	6.000	0.353	17.0	9.776	166.16
30	1 : 1	6.000	0.353	17.0	9.776	166.16
31	1 : 1	4.305	0.353	12.2	9.776	119.22
32	1 : 1	6.000	0.353	17.0	9.776	166.16
33	1 : 1	6.000	0.353	17.0	9.776	166.16
34	1 : 1	6.000	0.353	17.0	9.776	166.16
35	1 : 1	6.000	0.353	17.0	9.776	166.16
36	1 : 1	6.000	0.353	17.0	9.776	166.16
37	1 : 1	1.607	0.353	4.6	9.776	44.50
	1 : 1.62	4.593	0.400	11.5	9.776	112.25
38	1 : 1.62	6.000	0.400	15.0	9.776	146.64
39	1 : 1.62	6.000	0.400	15.0	9.776	146.64
40	1 : 1.62	6.000	0.400	15.0	9.776	146.64
41	1 : 1.62	6.000	0.400	15.0	9.776	146.64
42	1 : 1.62	6.000	0.400	15.0	9.776	146.64
43	1 : 1.62	5.000	0.400	12.5	9.776	122.20
44	1 : 1.62	5.000	0.400	12.5	9.776	122.20
45	1 : 1.62	1.219	0.400	3.0	9.776	29.79
46	1 : 1	5.374	0.353	15.2	9.776	148.83
47						0.00
48						0.00
49						0.00
50	1 : 1	2.314	0.353	6.6	9.776	64.08
51	1 : 1	5.500	0.353	15.6	9.776	152.32
52	1 : 1	3.500	0.353	9.9	9.776	96.93
Total						7,363.272
					x 1.06 =	7,800.0

GALLERY - WATER STOP 300 mm IN WIDTH

Joint No.	1 (m)	2 (m)	3 (m)	4 (m)	5 (m)	Total (m)
Spillway 1	9.694	5.754	4.084	4.000	2.794	26.326
0	9.694	5.754	4.084	4.000	2.794	26.326
1	9.694	5.754	4.084	4.000	2.794	26.326
2	9.694	5.754	4.084	4.000	2.794	26.326
3	9.694	5.754	4.084	4.000	2.794	26.326
4	9.694	5.754	4.084	4.000	2.794	26.326
5	9.694	5.754	4.084	4.000	2.794	26.326
6	9.694	5.754	4.084	4.000	2.794	26.326
7	9.694	5.754	4.084	4.000	2.794	26.326
8	9.694	5.754	4.084	4.000	2.794	26.326
9	9.694	5.754	4.084	4.000	2.794	26.326
10	9.694	5.754	4.084	4.000	2.794	26.326
11	9.694	5.754	4.084	4.000	2.794	26.326
12	9.694	5.754	4.084	4.000	2.794	26.326
13	9.694	5.754	4.084	4.000	2.794	26.326
14	9.694	5.754	4.084	4.000	2.794	26.326
15	9.694	5.754	4.084	4.000	2.794	26.326
16	9.694	5.754	4.084	4.000	2.794	26.326
17	9.694	5.754	4.084	4.000	2.794	26.326
18	9.694	5.754	4.084	4.000	2.794	26.326
19	9.694	5.754	4.084	4.000	2.794	26.326
20	9.694	5.754	4.084	4.000	2.794	26.326
21	9.694	5.754	4.084	4.000	2.794	26.326
22	9.694	5.754	4.084	4.000	2.794	26.326
23	9.694	5.754	4.084	4.000	2.794	26.326
24	9.694	5.754	4.084	4.000	2.794	26.326
25	9.694	5.754	4.084	4.000	2.794	26.326
26	9.694	5.754	4.084	4.000	2.794	26.326
27	9.694	5.754	4.084	4.000	2.794	26.326
28	9.694	5.754	4.084	4.000	2.794	26.326
29	9.694	5.754	4.084	4.000	2.794	26.326
30	9.694	5.754	4.084	4.000	2.794	26.326
31	9.694	5.754	4.084	4.000	2.794	26.326
32	9.694	5.754	4.084	4.000	2.794	26.326
33	9.694	5.754	4.084	4.000	2.794	26.326
34	9.694	5.754	4.084	4.000	2.794	26.326
35	9.694	5.754	4.084	4.000	2.794	26.326
36	9.694	5.754	4.084	4.000	2.794	26.326
37	9.694	5.754	4.084	4.000	2.794	26.326
38	9.694	5.754	4.084	4.000	2.794	26.326
39	9.694	5.754	4.084	4.000	2.794	26.326
40	9.694	5.754	4.084	4.000	2.794	26.326
41	9.694	5.754	4.084	4.000	2.794	26.326
42	9.694	5.754	4.084	4.000	2.794	26.326
43	9.694	5.754	4.084	4.000	2.794	26.326
44	9.694	5.754	4.084	4.000	2.794	26.326
45	9.694	5.754	4.084	4.000	2.794	26.326
46	9.694	5.754	4.084	4.000	2.794	26.326
47	9.396	4.974	4.084	4.000	2.754	25.208
48	9.396	4.974	4.084	4.000	2.754	25.208
49	9.396	4.974	4.084	4.000	2.754	25.208
50	9.396	4.974	4.084	4.000	2.754	25.208
51	9.396	4.974	4.084	4.000	2.754	25.208
52	9.396	4.974	4.084	4.000	2.754	25.208
						1,388.570
Total					x 1.05 =	1,500

GALLERY - IGAS

Joint No.	Area (cm^2)	Distance (cm)	Total (cm^3)	Total (litter)
0				
1				
2				
3				
4				
5	200.0	664.0	132,800	132.8
6	200.0	664.0	132,800	132.8
7	200.0	664.0	132,800	132.8
8	200.0	664.0	132,800	132.8
9	200.0	664.0	132,800	132.8
10	200.0	664.0	132,800	132.8
11	200.0	664.0	132,800	132.8
12	200.0	664.0	132,800	132.8
13	200.0	664.0	132,800	132.8
14	200.0	664.0	132,800	132.8
15	200.0	664.0	132,800	132.8
16	200.0	664.0	132,800	132.8
17	200.0	664.0	132,800	132.8
18	200.0	664.0	132,800	132.8
19	200.0	664.0	132,800	132.8
20	200.0	664.0	132,800	132.8
21	200.0	664.0	132,800	132.8
22	200.0	664.0	132,800	132.8
23	200.0	664.0	132,800	132.8
24	200.0	664.0	132,800	132.8
25	200.0	664.0	132,800	132.8
26	200.0	664.0	132,800	132.8
27	200.0	664.0	132,800	132.8
28	200.0	664.0	132,800	132.8
29	200.0	664.0	132,800	132.8
30	200.0	664.0	132,800	132.8
31	200.0	664.0	132,800	132.8
32	200.0	664.0	132,800	132.8
33	200.0	664.0	132,800	132.8
34	200.0	664.0	132,800	132.8
35	200.0	664.0	132,800	132.8
36	200.0	664.0	132,800	132.8
37	200.0	664.0	132,800	132.8
38	200.0	664.0	132,800	132.8
39	200.0	664.0	132,800	132.8
40	200.0	664.0	132,800	132.8
41	200.0	664.0	132,800	132.8
42	200.0	664.0	132,800	132.8
43	200.0	664.0	132,800	132.8
44	200.0	664.0	132,800	132.8
45	200.0	664.0	132,800	132.8
46	200.0	664.0	132,800	132.8
47	200.0	578.0	115,600	115.6
48	200.0	578.0	115,600	115.6
49	200.0	578.0	115,600	115.6
50	200.0	578.0	115,600	115.6
51	200.0	578.0	115,600	115.6
52	200.0	578.0	115,600	115.6
Total				6,271.2
			x 1.02 =	6,400

2.4 Spillway

2.4.1 Excavation, Backfill and Stripping Top Soil

Excavation Volume of Spillway

Unit : [m^3]

Elevation	Excavation Volume [m^3]						Total
	D	CL	CM-L	CM-H	td	rd	
higher than EL. 157.0 m	4,047.0	61,471.5	7.0	0.0	0.0	0.0	65,525.5
EL. 136.6 m - EL. 157.0 m	26,173.0	102,664.0	32,945.0	0.0	0.0	0.0	161,782.0
EL. 125.0 m - EL. 136.6 m	27,817.0	19,148.0	0.0	0.0	0.0	0.0	46,965.0
EL. 110.0 m - EL. 125.0 m	19,075.3	21,942.3	0.0	20,528.4	344.0	0.0	61,890.0
EL. 95.0 m - EL. 110.0 m	0.0	6,286.3	11,737.4	22,844.5	104.0	0.0	40,972.2
EL. 80.0 m - EL. 95.0 m	0.0	4,510.1	23,751.5	994.0	1,248.5	3,632.4	34,136.5
Lower than EL. 80.0 m	0.0	0.0	0.2	1,029.0	0.0	0.0	1,029.2
Total	77,112.3	216,022.2	68,441.1	45,395.9	1,696.5	3,632.4	412,300.4
Total x 1.1	84,800.0	237,600.0	75,300.0	49,900.0	1,900.0	4,000.0	453,500.0

Backfill Volume of Spillway

Unit : [m^3]

	Left Side	Right Side	Total
Backfill Volume	17,154.0	2,108.0	19,262.0
Backfill Volume x 1.1	18,900.0	2,300.0	21,200.0

Unit : [m^2]

	Total
Stripping Top Soil	33,962.1
Stripping Top Soil x 1.1	37,400.0

Excavation Volume Classified by Elevation

(1) Higher than EL. 157.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
-20												
-10												
0												
10		0										
20		87					0	433	0	0		
30		333					0	2,098	0	0		
40		612					0	4,727	0	0		
50		845					0	7,286	0	0		
60		991	0				0	9,180	0	0		
70		1,030	1				0	10,104	4	0		
80-1		964	0				0	9,966	4	0		
80-1 (Left)	0	766					---	---	---	---	---	---
80-2 (Left)	42	623					209	6,947	0	0		
90	83	532					625	5,774	0	0		
100	106	230					947	3,808	0	0		
110	147	0					1,266	1,150	0	0		
120	27						868	0	0	0		
130	0						134	0	0	0		
140							0	0	0	0		
150												
160												
170												
180												
190												
200												
210												
220												
230												
240												
250												
260												
270												
280												
290												
300												
310												
320												
330												
Total							4,047	61,472	7	0	0	0

(2) EL. 136.6 m - EL. 157.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
-20		0										
-10		86					0	428	0	0		
0		228					0	1,567	0	0		
10		597	0				0	4,122	0	0		
20		1,221	42				0	9,089	210	0		
30		1,162	192				0	11,917	1,170	0		
40		997	364				0	10,798	2,782	0		
50		771	548				0	8,839	4,564	0		
60		525	591				0	6,477	5,698	0		
70		498	607				0	5,115	5,993	0		
80-1		630	482				0	5,640	5,446	0		
80-1 (Left)		143	386				---	---	---	---	---	---
80-2 (Left)		212	318				0	1,775	3,522	0		
90		873	187				0	5,421	2,525	0		
100	0	835	10				0	8,536	986	0		
110	48	772	0				239	8,032	51	0		
120	257	572					1,523	6,720	0	0		
130	407	357					3,320	4,649	0	0		
140	496	156					4,517	2,566	0	0		
150	489	17					4,926	866	0	0		
160	369	2					4,288	99	0	0		
170	261	0					3,148	12	0	0		
180	184						2,227	0	0	0		
190	92						1,383	0	0	0		
200	14						532	0	0	0		
210	0						72	0	0	0		
220							0	0	0	0		
230												
240												
250												
260												
270												
280												
290												
300												
310												
320												
330												
Total							26,173	102,664	32,945	0	0	0

(3) EL. 125.0 m - EL. 136.6 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
-20												
-10												
0												
10												
20												
30												
40												
50												
60												
70												
80-1												
80-2												
90												
100		0					0	0	0	0	0	0
110		48					0	241	0	0	0	0
120		122					0	851	0	0	0	0
130		216					0	1,691	0	0	0	0
140	0	330					0	2,732	0	0	0	0
150	37	418					187	3,744	0	0	0	0
160	161	350					994	3,840	0	0	0	0
170	287	250					2,243	2,996	0	0	0	0
180	391	154					3,389	2,019	0	0	0	0
190	497	22					4,437	881	0	0	0	0
200	479	5					4,881	133	0	0	0	0
210	380	0					4,296	23	0	0	0	0
220	272						3,261	0	0	0	0	0
230	147						2,096	0	0	0	0	0
240	33						900	0	0	0	0	0
250	0						165	0	0	0	0	0
260							0	0	0	0	0	0
270							0	0	0	0	0	0
280							0	0	0	0	0	0
290	0						0	0	0	0	0	0
300	4						18	0	0	0	0	0
310	27						151	0	0	0	0	0
320	35						308	0	0	0	0	0
330	23						291	0	0	0	0	0
340	9						159	0	0	0	0	0
350	0						43	0	0	0	0	0
360	0						0	0	0	0	0	0
Total							27,817	19,148	0	0	0	0

(4) EL. 110.0 m - EL. 125.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
-20												
-10												
0												
10												
20												
30												
40												
50												
60												
70												
80-1												
80-2												
90												
100												
110												
120												
130												
140												
150		0					0	0	0	0	0	0
160		70					0	351	0	0	0	0
170		156					0	1,128	0	0	0	0
180	0	269		0			0	2,124	0	0	0	0
190	3	373		83			16	3,213	0	415	0	0
200	39	366		236			212	3,698	0	1,594	0	0
210	193	210		249			1,161	2,883	0	2,424	0	0
220	274	116		220			2,333	1,632	0	2,342	0	0
230	300	54		215			2,867	849	0	2,173	0	0
240	320	37		224			3,097	452	0	2,197	0	0
250	273	30		228			2,965	330	0	2,261	0	0
260	196	35		198			2,345	323	0	2,127	0	0
270	87	31		154	0		1,412	333	0	1,759	0	0
280	36	31		94	24		613	311	0	1,241	120	0
290	18	24		61	10		268	274	0	773	172	0
300	40	69		21	0		290	466	0	406	52	0
310	40	81		47			400	753	0	339	0	0
320	39	94		15			392	874	0	310	0	0
330	27	70		10			330	820	0	123	0	0
340	17	53		0			221	615	0	49	0	0
350	7	24					120	382	0	0	0	0
360	0	2					37	127	0	0	0	0
370		0					0	8	0	0	0	0
Total							19,075	21,942	0	20,528	344	0

(5) EL. 95.0 m - EL. 110.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
-20												
-10												
0												
10												
20												
30												
40												
50												
60												
70												
80-1												
80-2												
90												
100												
110												
120												
130												
140												
150												
160												
170												
180												
190				0			0	0	0	0	0	0
200		0		27			0	0	0	135	0	0
210		7	0	197	0		0	36	0	1,122	0	0
220		0	93	262	1		0	36	464	2,299	6	0
230		37	192	260	9		0	185	1,426	2,612	52	0
240		51	190	287	0		0	442	1,912	2,736	46	0
250		45	177	301			0	483	1,833	2,943	0	0
260		45	156	273			0	453	1,661	2,870	0	0
270		49	124	222			0	471	1,399	2,471	0	0
280		55	106	177			0	518	1,151	1,994	0	0
290		58	78	124			0	564	920	1,504	0	0
300		54	18	52			0	563	483	879	0	0
310		58	29	74			0	562	236	632	0	0
320		65	5	23			0	613	168	488	0	0
330		69	3	5			0	667	40	140	0	0
340		35	3	0			0	520	32	23	0	0
350		0	0				0	176	16	0	0	0
360												
Total							0	6,286	11,737	22,845	104	0

(6) EL. 80.0 m - EL. 95.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
-20												
-10												
0												
10												
20												
30												
40												
50												
60												
70												
80-1												
80-2												
90												
100												
110												
120												
130												
140												
150												
160												
170												
180												
190												
200												
210												
220			0				0	0	0	0	0	0
230		0	27		0		0	0	136	0	0	0
240		20	228		4	0	0	102	1,274	0	20	0
250		41	388	0	8	14	0	308	3,077	0	60	70
260		38	456	8	10	26	0	393	4,219	39	89	202
270		31	404	10	0	42	0	344	4,302	90	49	341
280		42	328	22		52	0	367	3,660	164	0	469
290		38	296	11	0	30	0	401	3,119	166	0	411
300		35	90	20	27	59	0	365	1,932	153	137	447
310		59	108	24	7	43	0	469	990	220	171	510
320		63	31	4	15	28	0	610	691	142	108	353
330		52	20	0	27	27	0	573	252	22	208	277
340		32	0		27	42	0	420	101	0	271	346
350		0	0		0	0	0	161	1	0	137	209
360												
Total							0	4,510	23,752	994	1,249	3,632

(7) Lower than EL. 80.0 m

Sta.	Area (m^2)						Volume (m^3)					
	D	CL	CM-L	CM-H	td	rd	D	CL	CM-L	CM-H	td	rd
-20												
-10												
0												
10												
20												
30												
40												
50												
60												
70												
80-1												
80-2												
90												
100												
110												
120												
130												
140												
150												
160												
170												
180												
190												
200												
210												
220												
230												
240												
250												
260												
270												
280												
290			0	0			0	0	0	0	0	0
300			0	36			0	0	0	178	0	0
310			0	67			0	0	0	515	0	0
320				0			0	0	0	337	0	0
330							0	0	0	0	0	0
Total							0	0	0	1,029	0	0

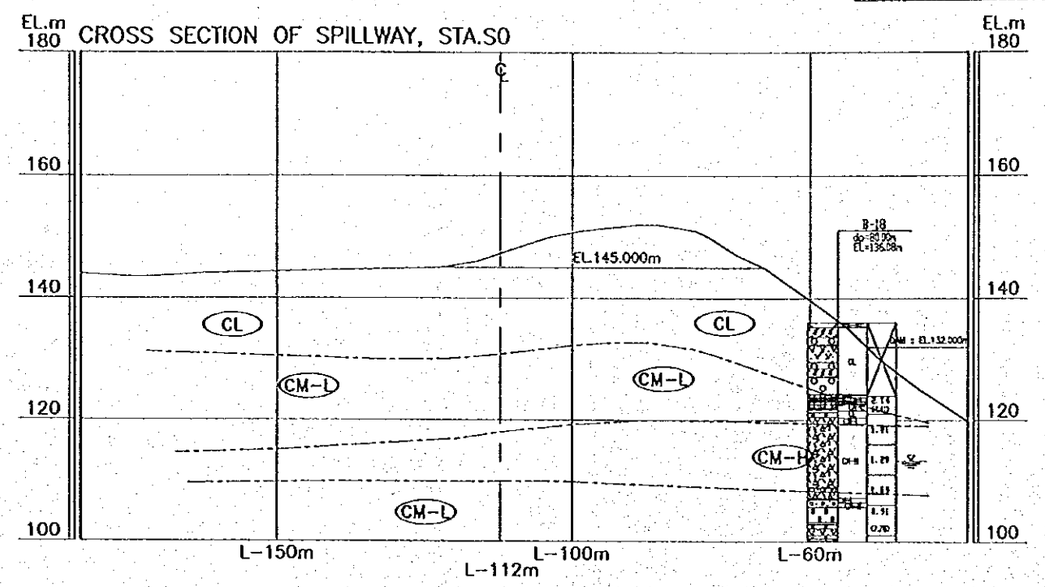
Backfill Volume of Spillway

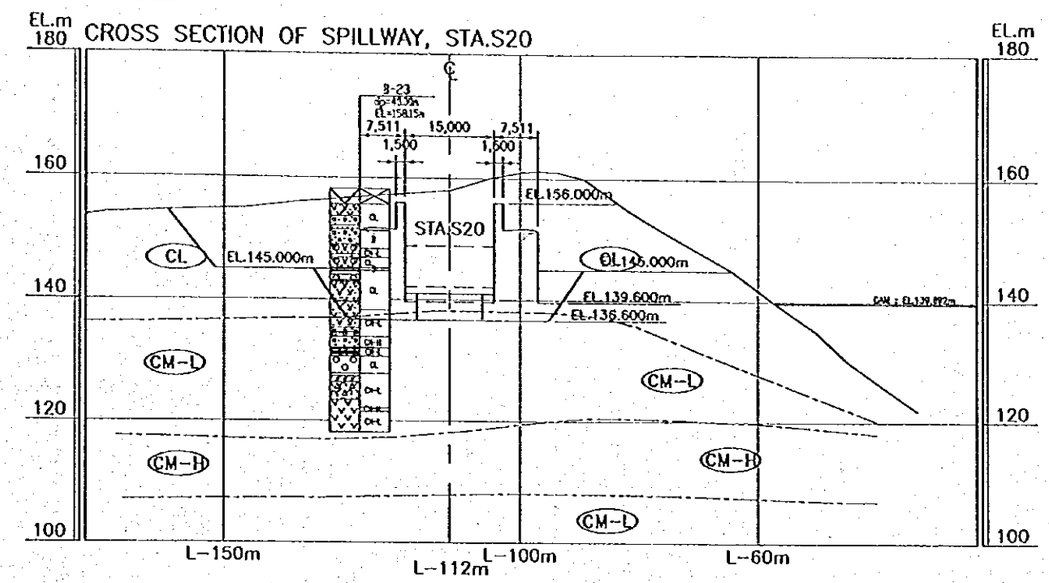
Sta.S	Left Side of Spillway			Right Side of Spillway		
	Area [m^2]	Ave. Area [m^2]	Volume [m^3]	Area [m^2]	Ave. Area [m^2]	Volume [m^3]
-20						
-10						
0						
10	0.0			0.0		
20	32.4	16.2	162.0	32.4	16.2	162.0
30	21.2	26.8	268.0	21.2	26.8	268.0
40	15.0	18.1	181.0	21.2	21.2	212.0
50	151.3	83.2	831.5	22.6	21.9	219.0
60	137.9	144.6	1,446.0	0.0	11.3	113.0
70	177.7	157.8	1,578.0			
80-1	177.7	177.7	1,777.0			
80-2	177.7	177.7	1,777.0			
90	111.4	144.6	1,445.5	0.0		
100	52.0	81.7	817.0	1.2	0.6	6.0
110	26.3	39.2	391.5	8.0	4.6	46.0
120	11.0	18.7	186.5	8.8	8.4	84.0
130	3.5	7.3	72.5	1.4	5.1	51.0
140	3.5	3.5	35.0	3.5	2.5	24.5
150	3.5	3.5	35.0	3.5	3.5	35.0
160	3.5	3.5	35.0	3.5	3.5	35.0
170	3.5	3.5	35.0	3.5	3.5	35.0
180	4.1	3.8	38.0	4.1	3.8	38.0
190	2.1	3.1	31.0	2.1	3.1	31.0
200	1.4	1.8	17.5	1.4	1.8	17.5
210	1.4	1.4	14.0	1.4	1.4	14.0
220	1.4	1.4	14.0	1.4	1.4	14.0
230	1.8	1.6	16.0	1.8	1.6	16.0
240	18.4	10.1	101.0	0.0	0.9	9.0
250	65.6	42.0	420.0	19.0	9.5	95.0
260	93.9	79.8	797.5	5.0	12.0	120.0
270	93.9	93.9	939.0	3.2	4.1	41.0
280	93.9	93.9	939.0	3.8	3.5	35.0
290	93.9	93.9	939.0	0.0	1.9	19.0
300	88.6	91.3	912.5			
310	45.5	67.1	670.5	0.0		
320	0.4	23.0	229.5	36.8	18.4	184.0
330	0.0	0.2	2.0	0.0	18.4	184.0
Total			17,154.0			2,108.0
				Grand Total :		19,262.0

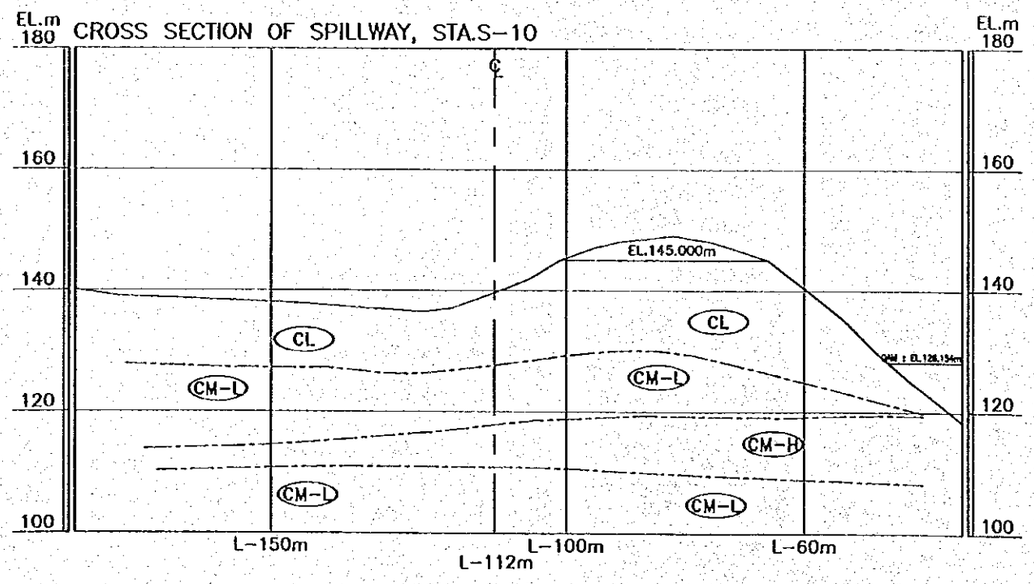
Stripping Top Soil Area of Spillway

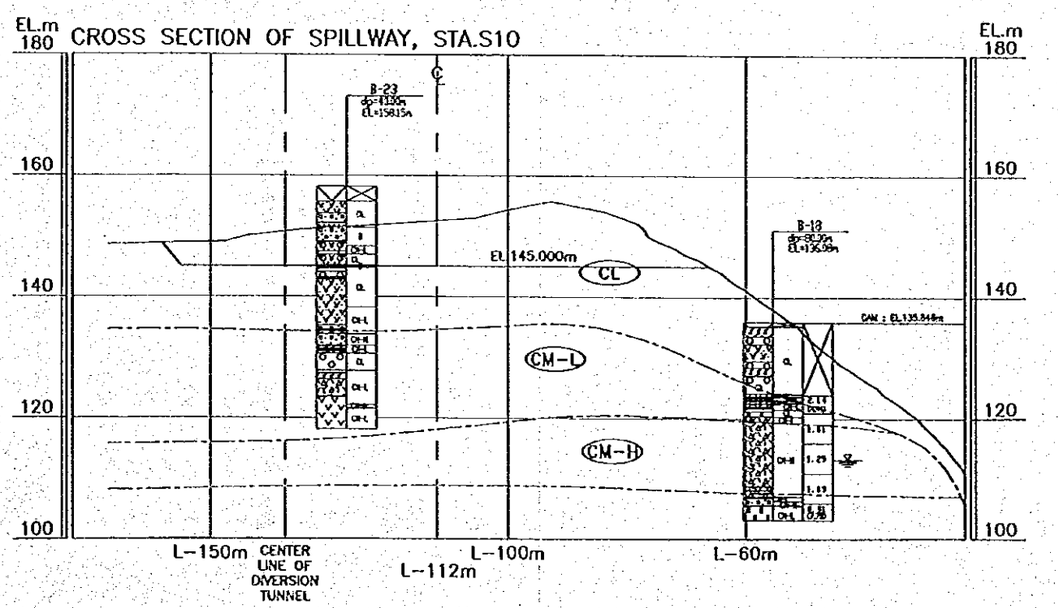
Sta.S	Length [m]	Ave. Length [m]	Area [m^2]
-20	0.00	-	-
-10	36.05	18.03	180.25
0	56.98	46.51	465.13
10	95.23	76.10	761.04
20	100.11	97.67	976.74
30	102.91	101.51	1,015.10
40	105.51	104.21	1,042.07
50	101.34	103.42	1,034.23
60	85.19	93.27	932.66
70	88.19	86.69	866.92
80-1	85.12	86.66	866.57
80-2	85.57	85.34	853.45
90	76.29	80.93	809.28
100	64.48	70.39	703.85
110	62.38	63.43	634.32
120	63.73	63.05	630.55
130	68.78	66.25	662.54
140	71.82	70.30	703.01
150	72.94	72.38	723.79
160	70.26	71.60	716.00
170	73.34	71.80	717.99
180	74.81	74.07	740.74
190	76.69	75.75	757.52
200	78.98	77.84	778.35
210	81.23	80.11	801.06
220	80.76	81.00	809.99
230	82.44	81.60	816.01
240	92.56	87.50	875.00
250	97.51	95.04	950.38
260	95.24	96.38	963.77
270	89.85	92.54	925.44
280	85.78	87.81	878.14
290	82.54	84.16	841.60
300	95.08	88.81	888.08
310	103.26	99.17	991.71
320	118.79	111.03	1,110.26
330	122.05	120.42	1,204.17
340	97.92	109.98	1,099.85
350	25.48	61.70	617.04
360	4.35	14.92	149.18
370	0.00	2.18	21.76
Total			31,515.47

CROSS SECTIONS OF SPILLWAY (1/10)



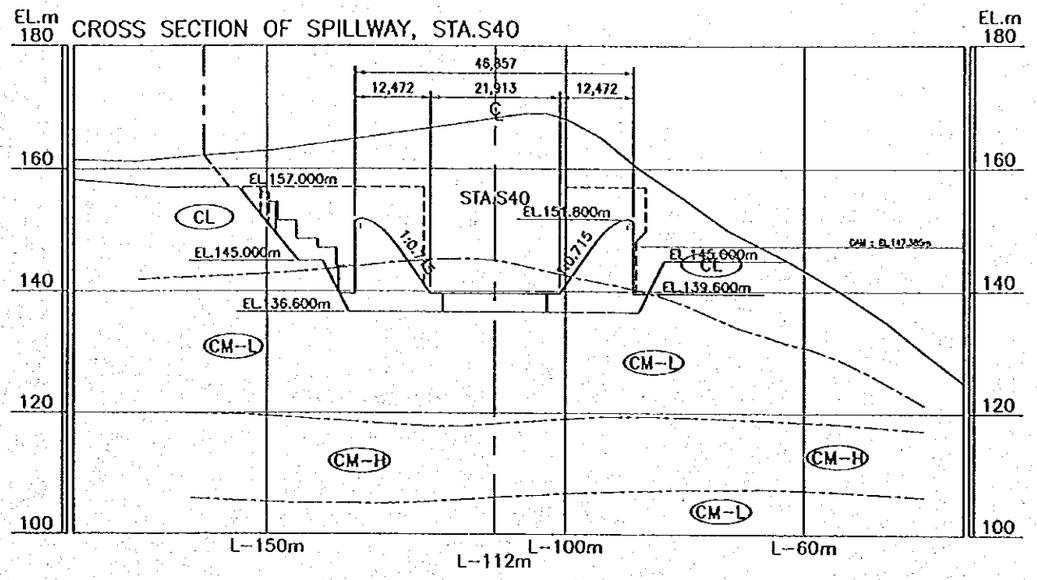


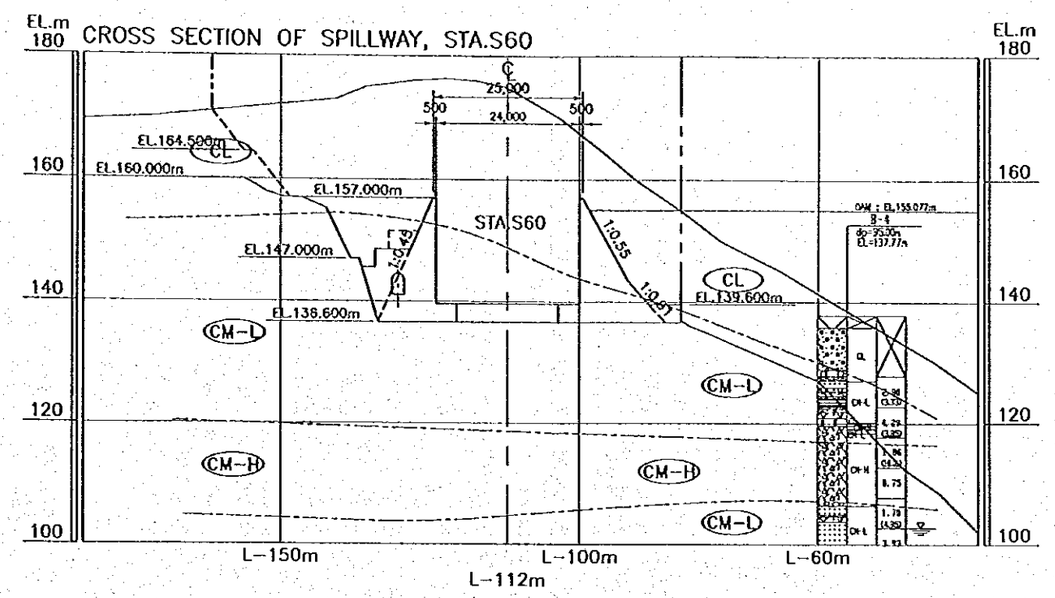


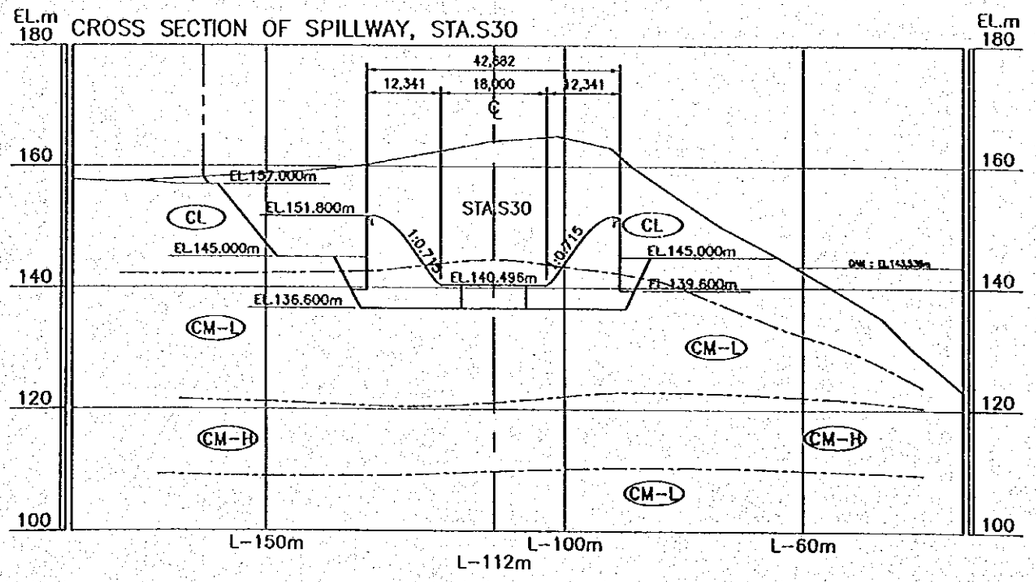


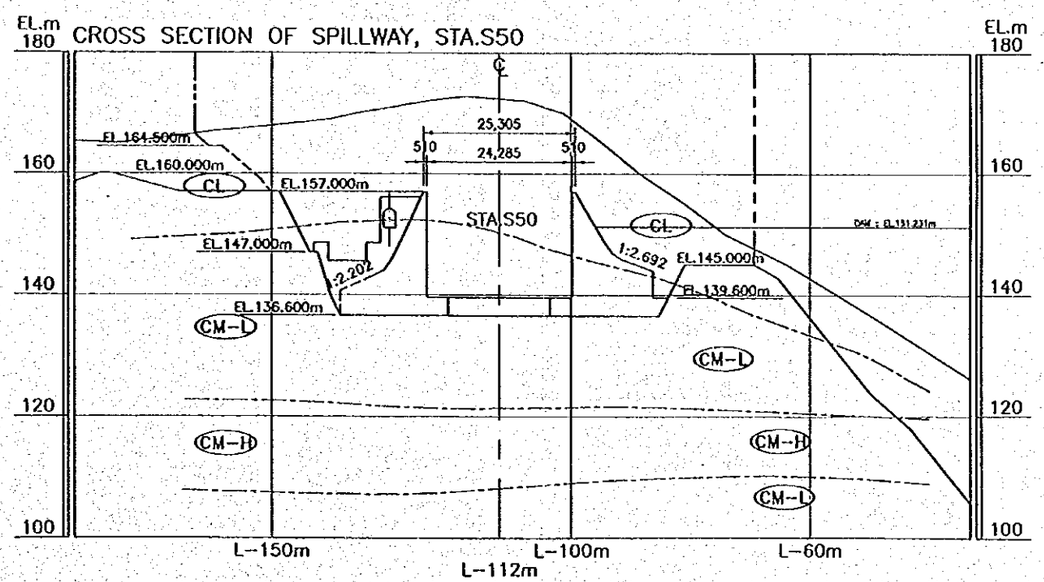
SCALE 0 25 50m

CROSS SECTIONS OF SPILLWAY (2/10)









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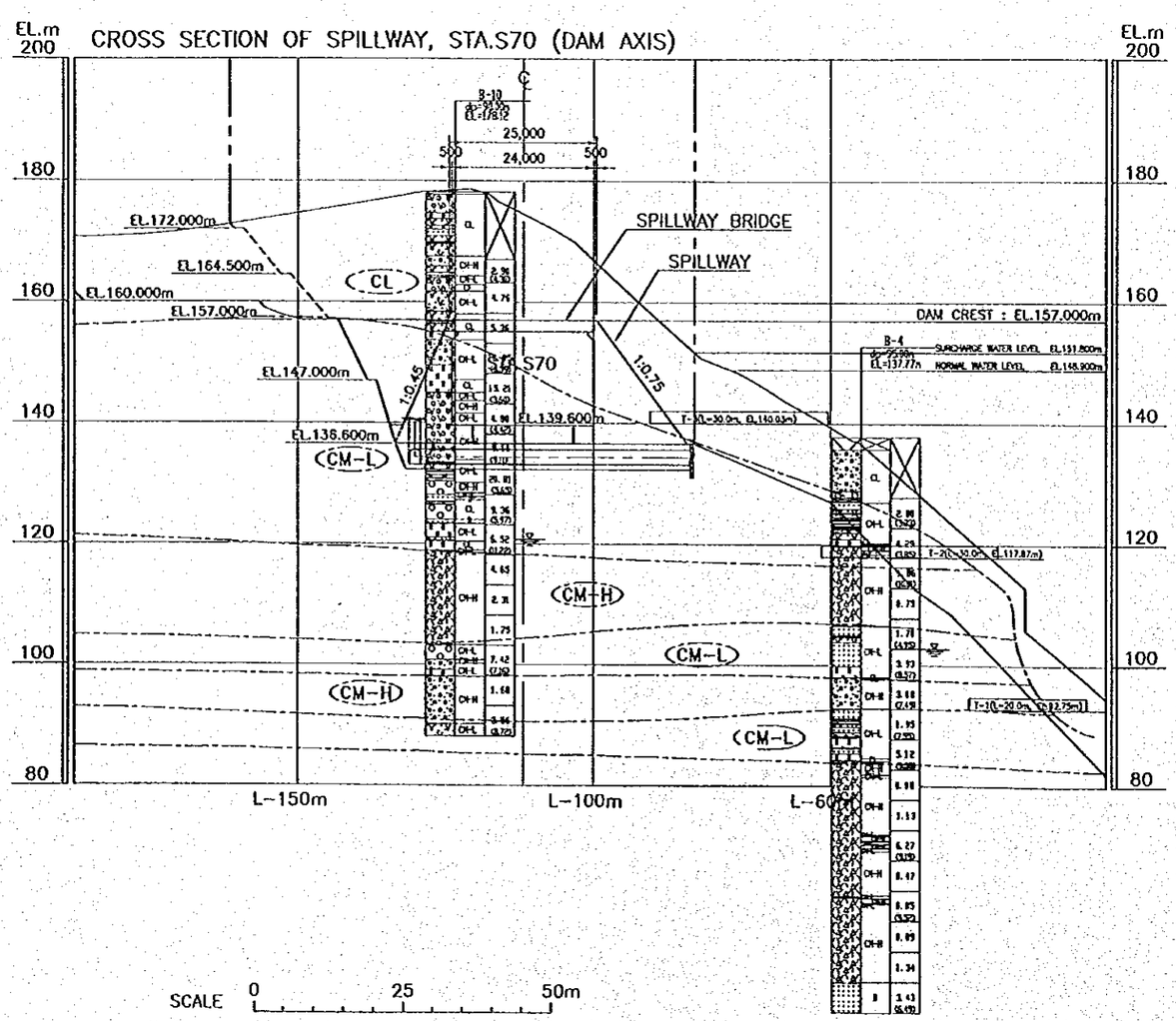
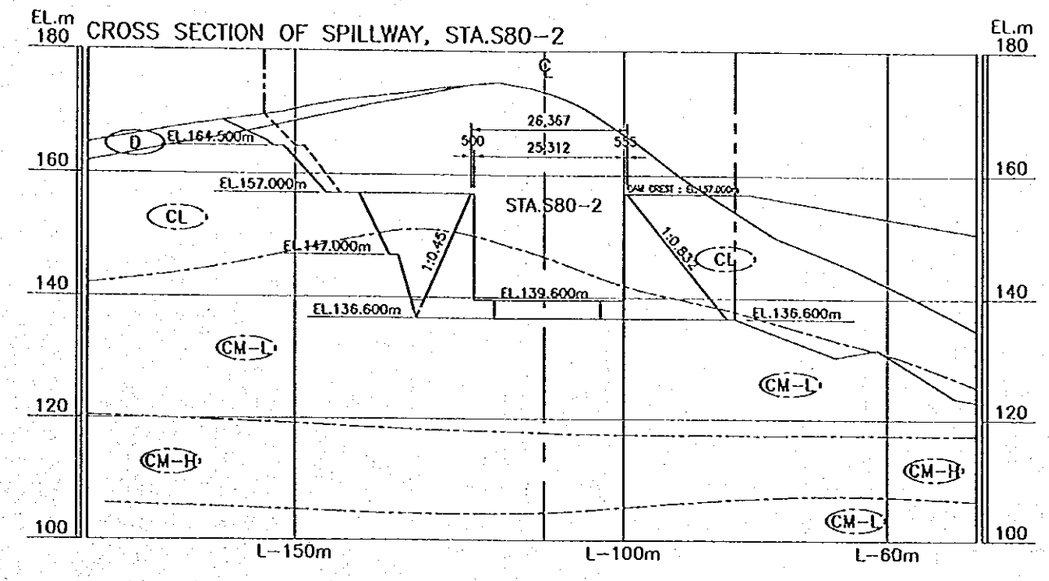
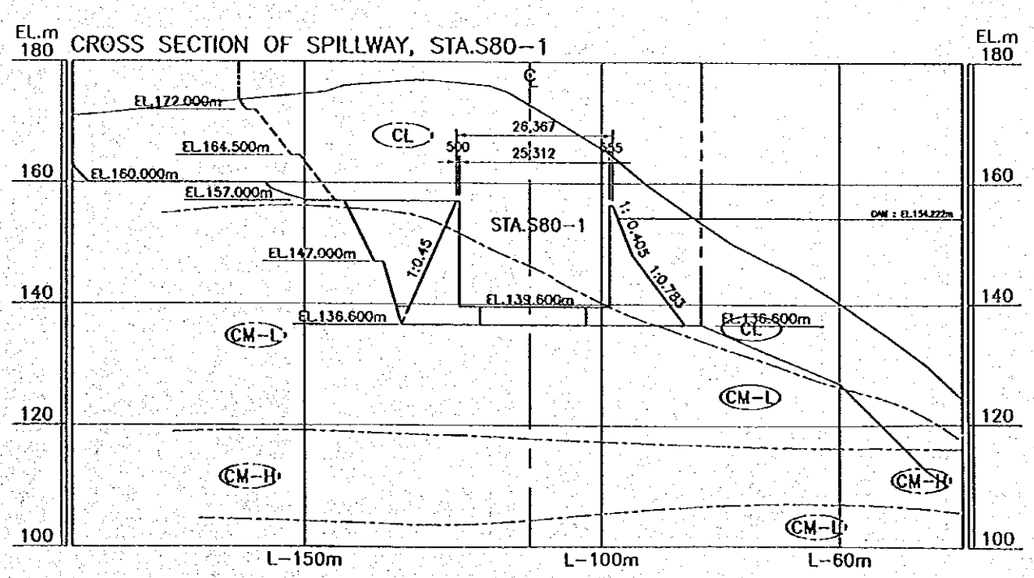
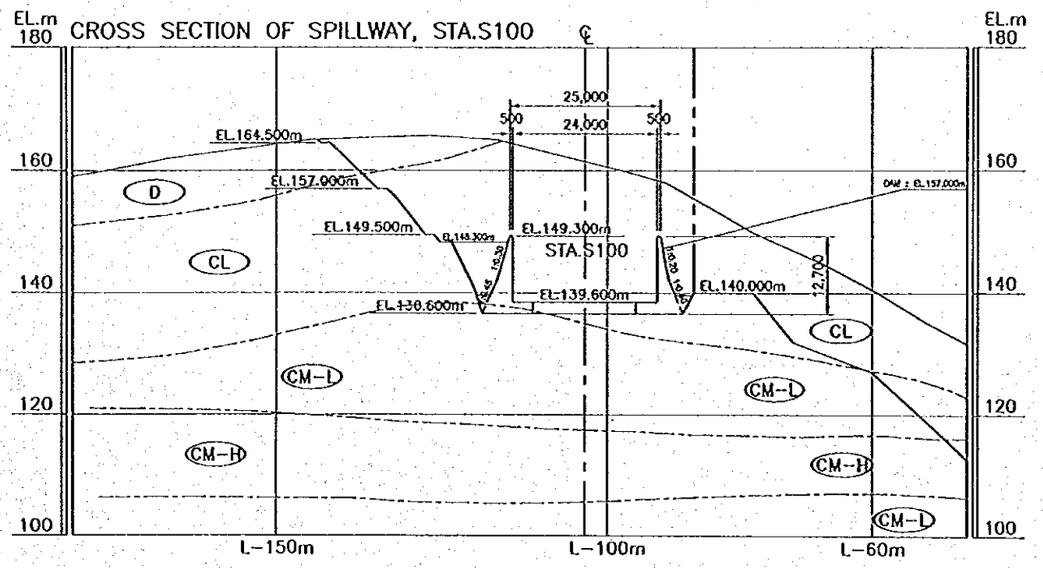
CROSS SECTIONS OF SPILLWAY (3/10)

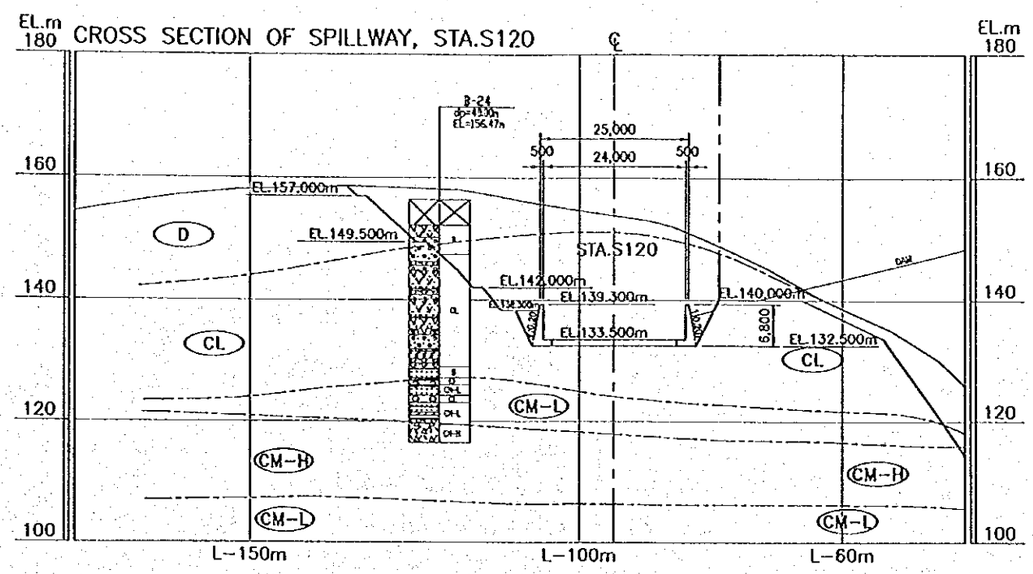


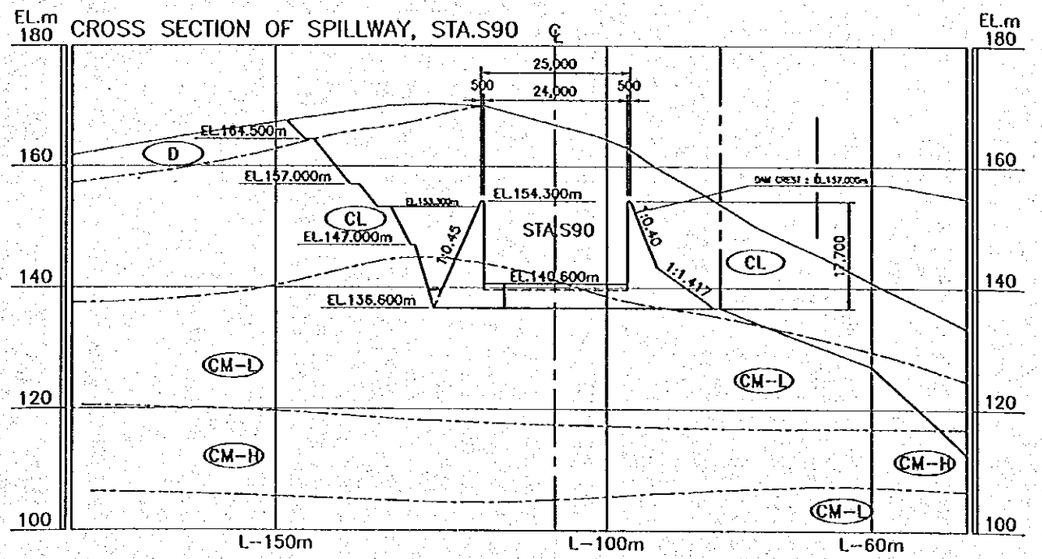


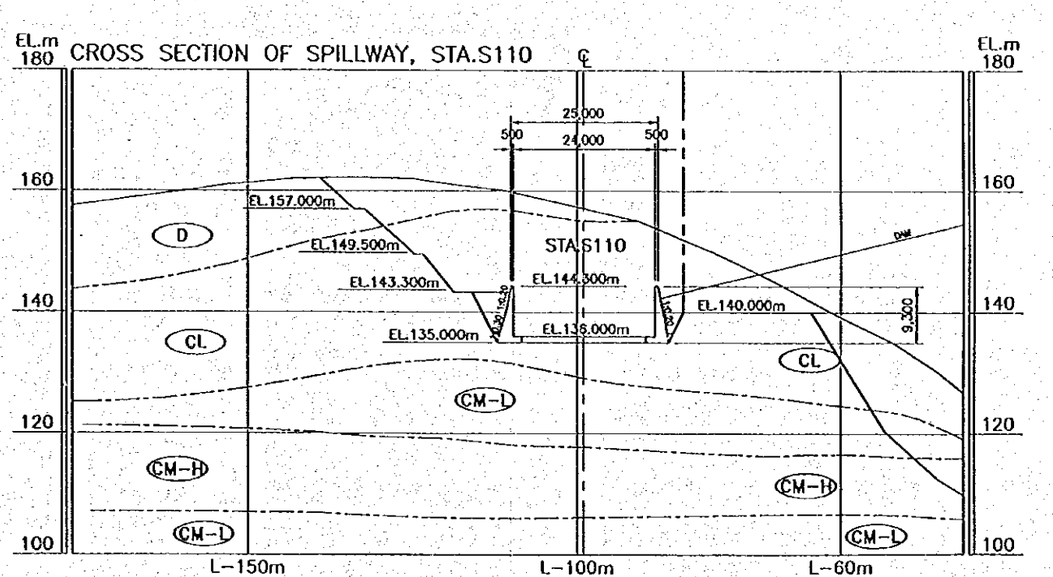


CROSS SECTIONS OF SPILLWAY (4/10)



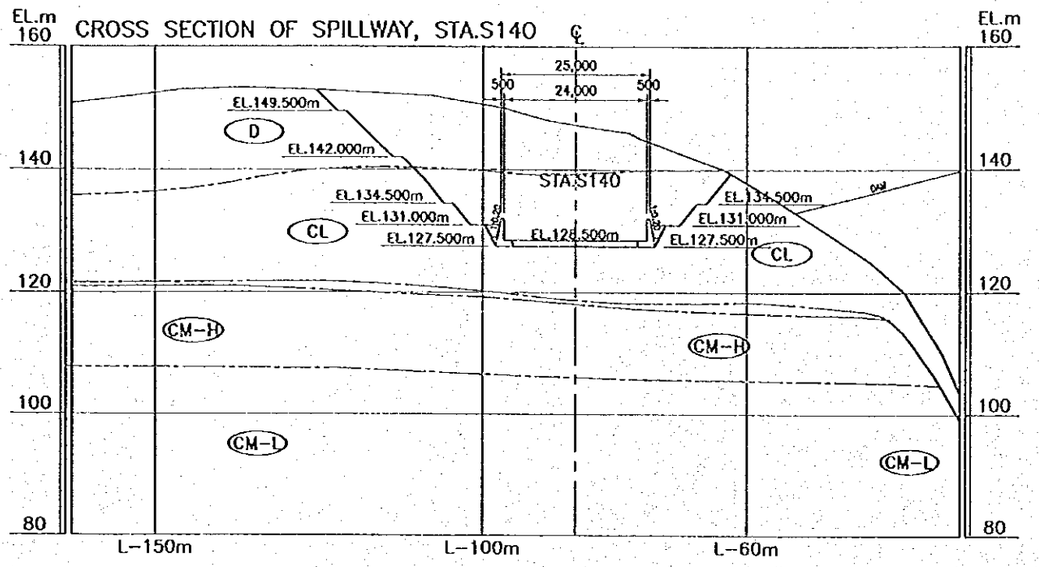


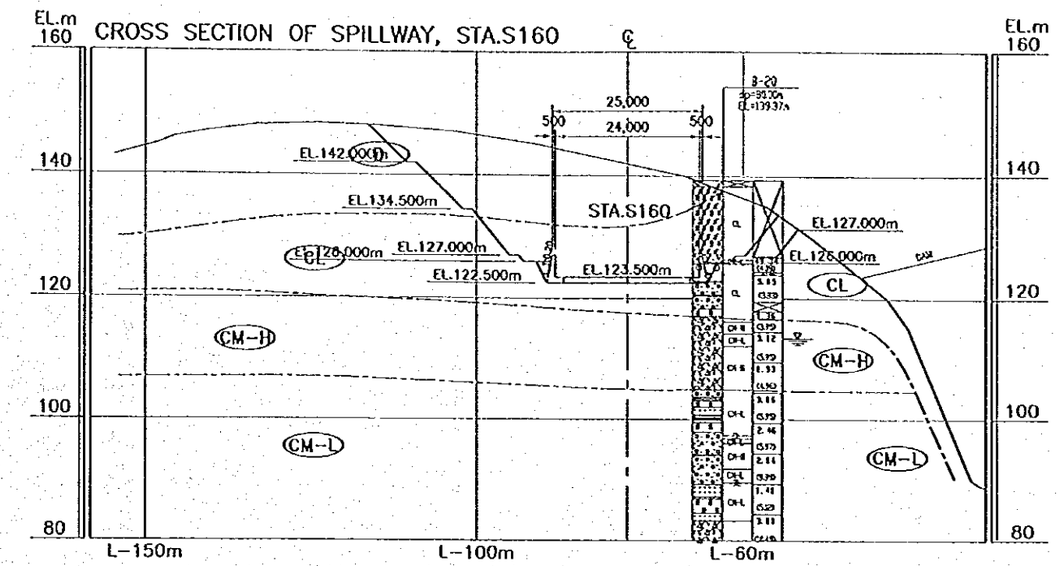


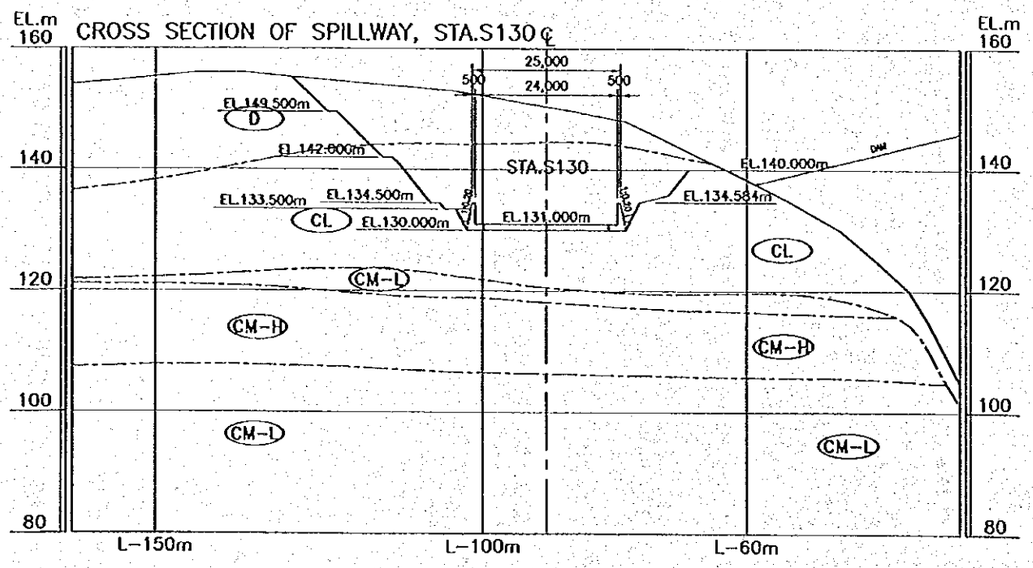


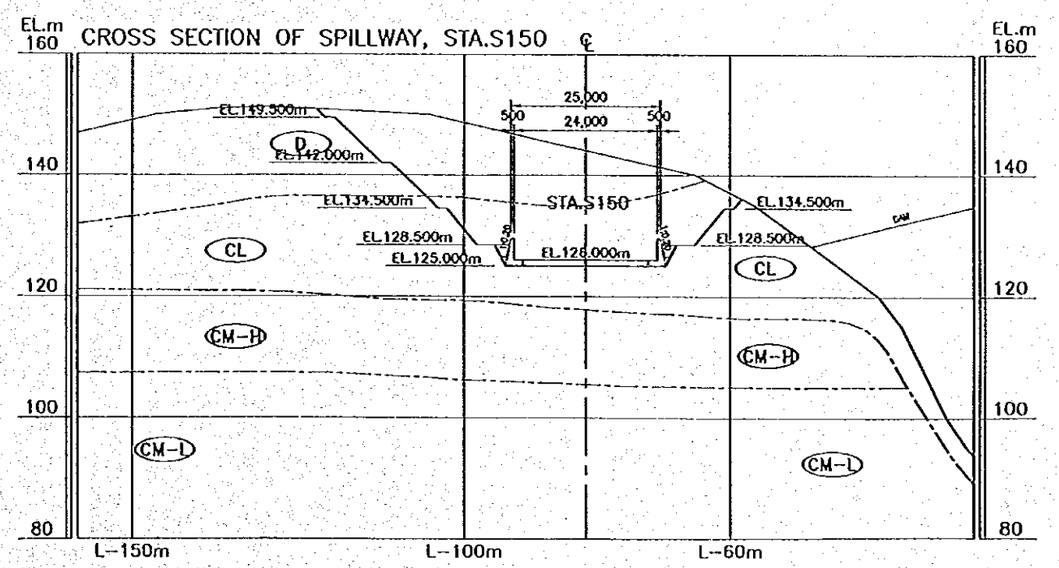
SCALE 0 25 50m

CROSS SECTIONS OF SPILLWAY (5/10)



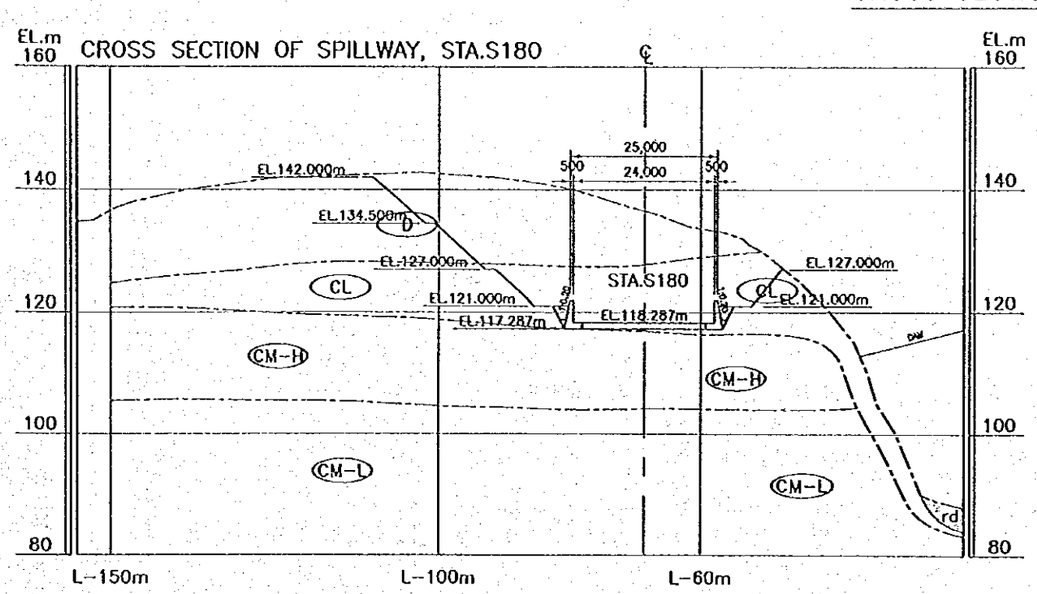


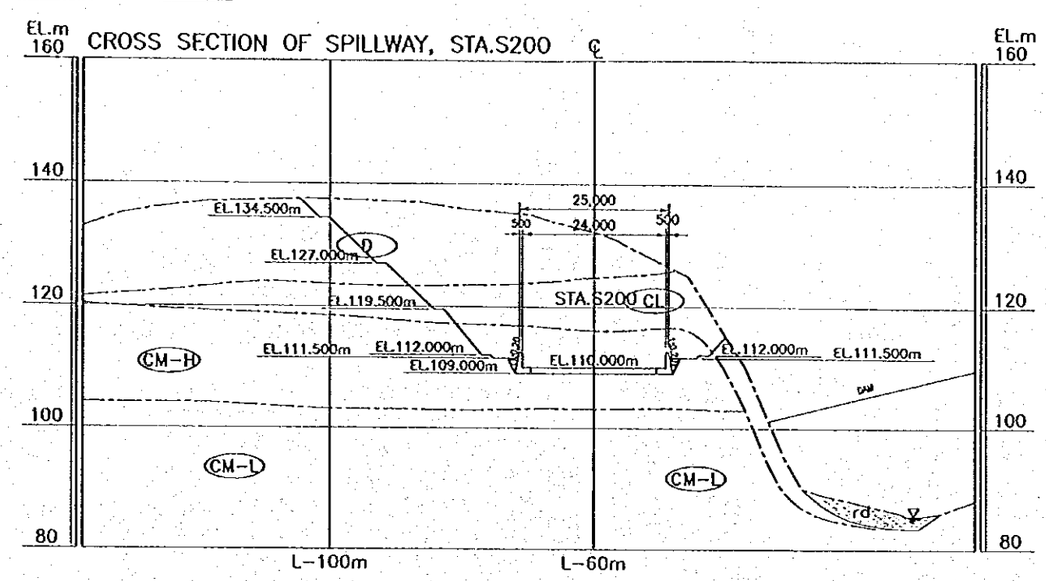


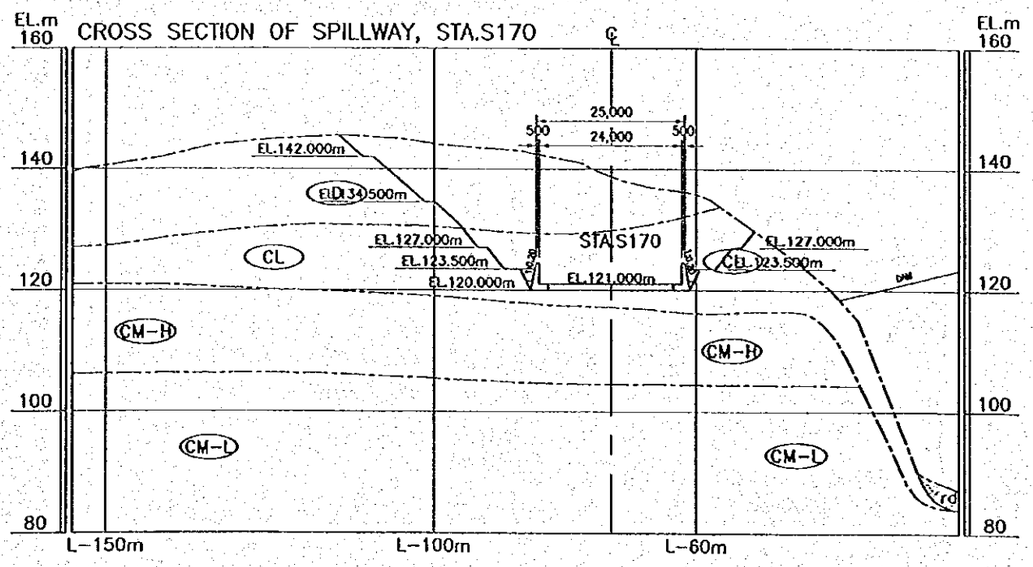


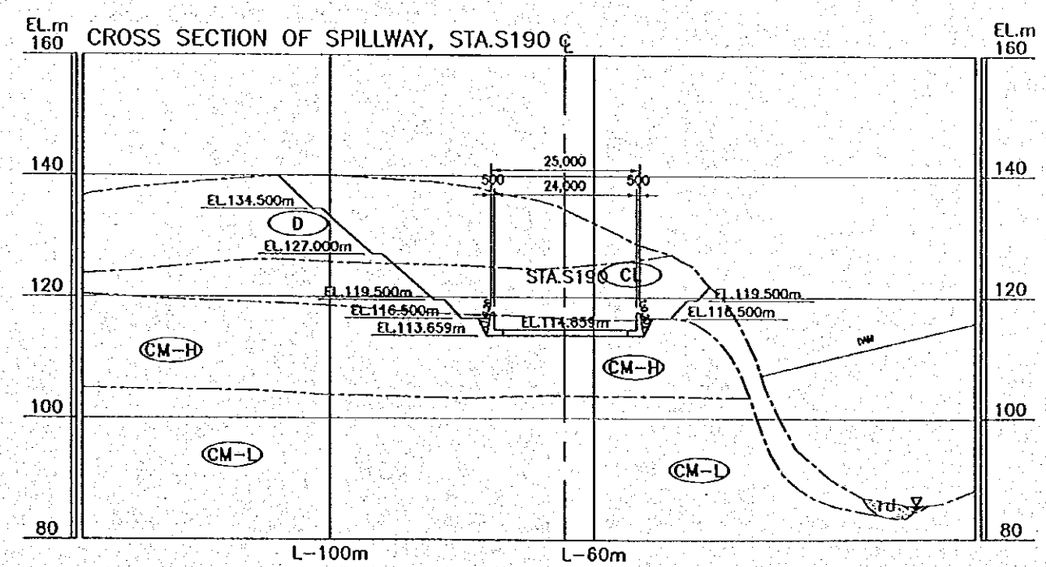
SCALE 0 25 50m

CROSS SECTIONS OF SPILLWAY (6/10)



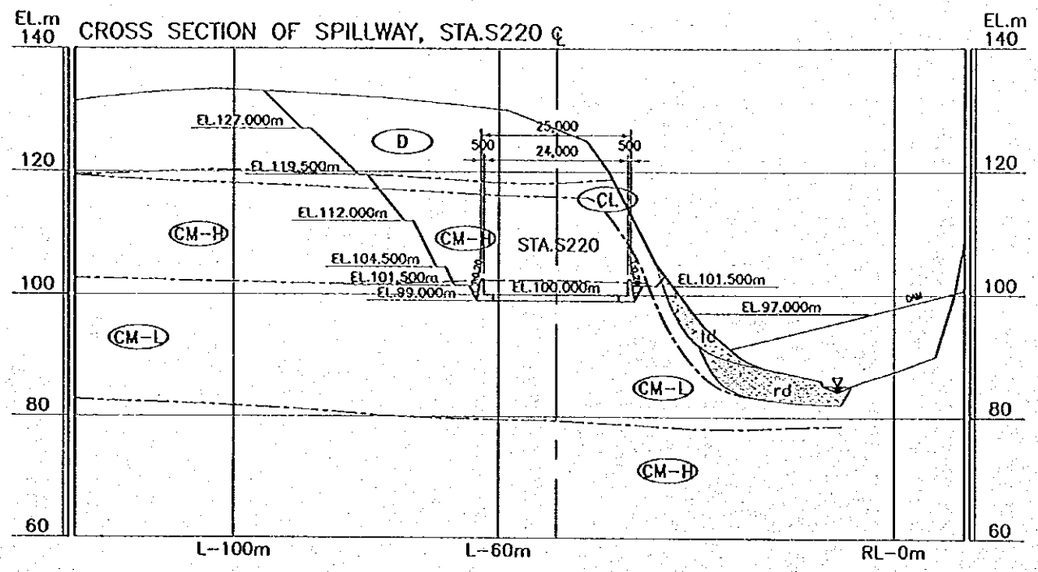


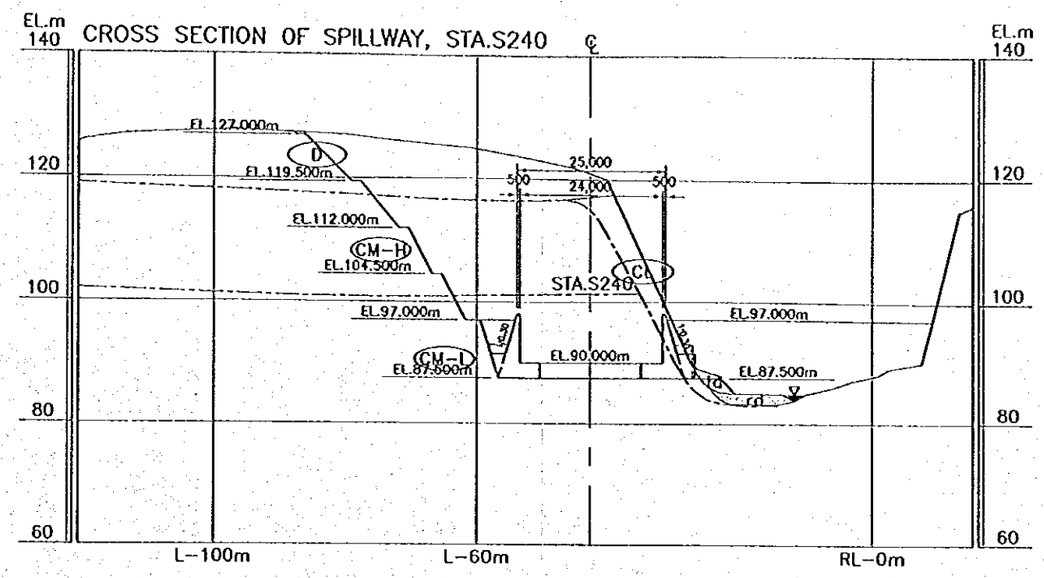


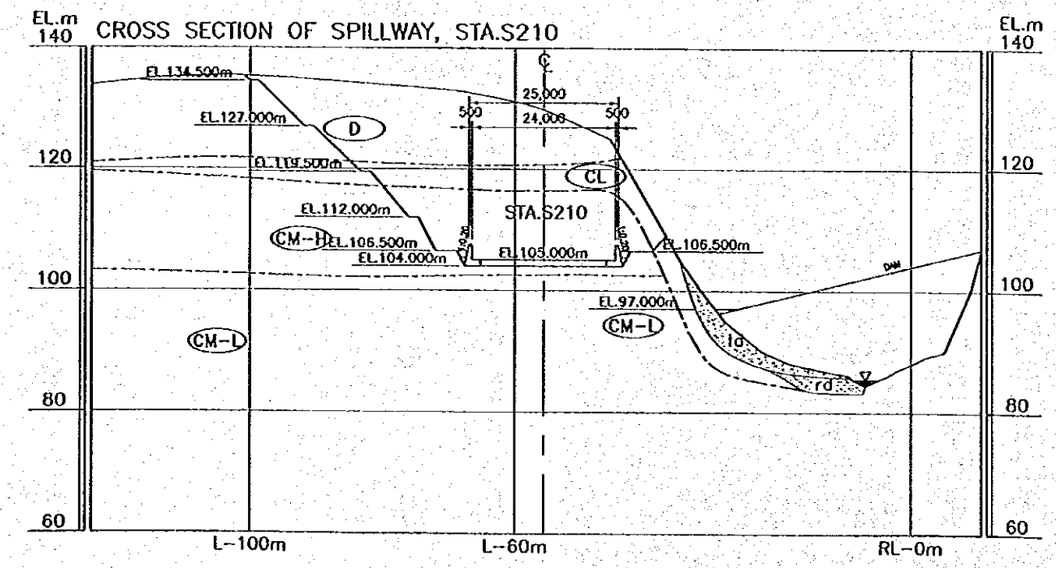


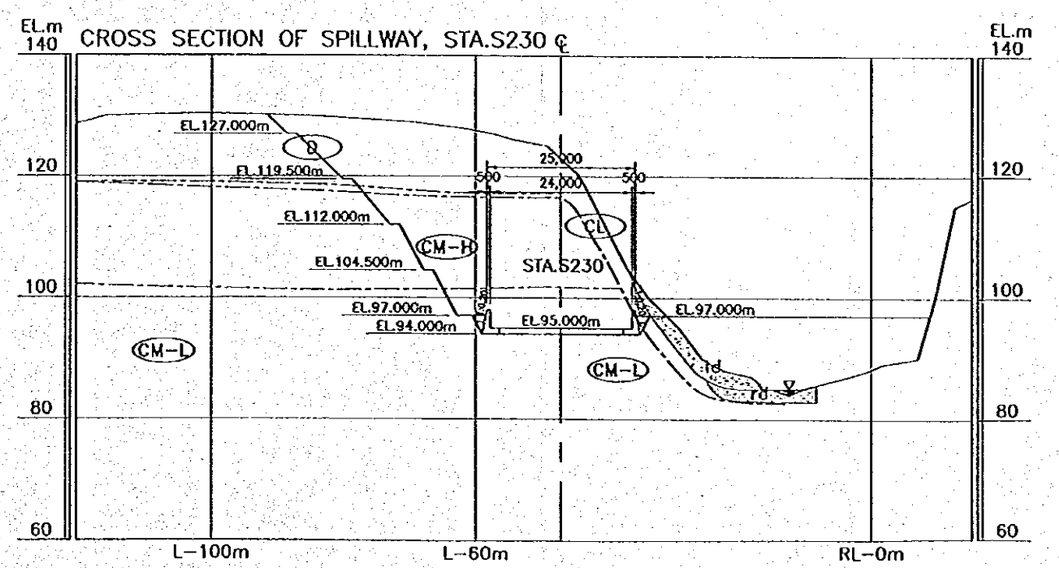
SCALE 0 25 50m

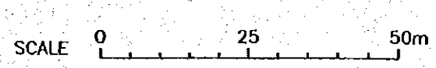
CROSS SECTIONS OF SPILLWAY (7/10)



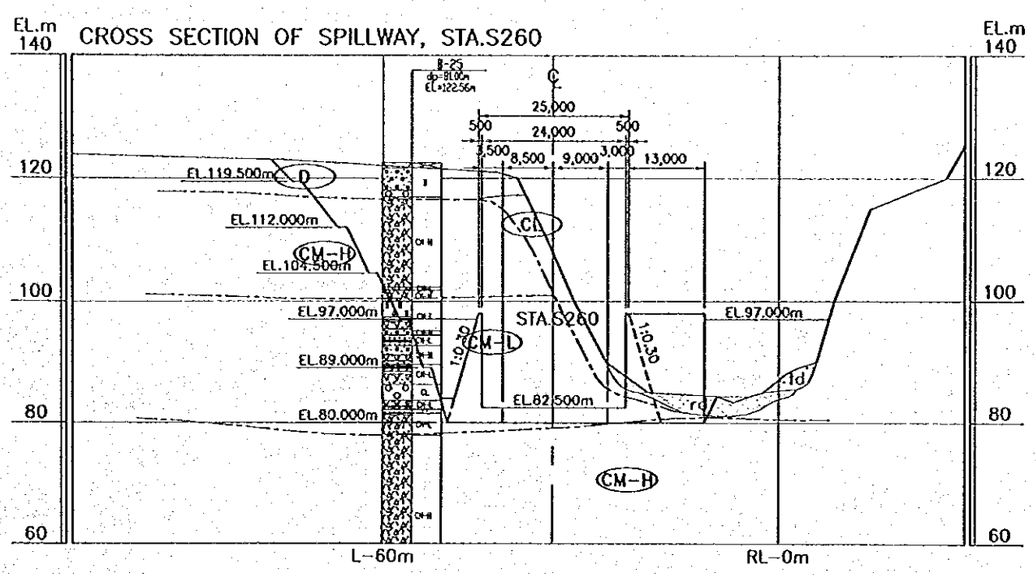


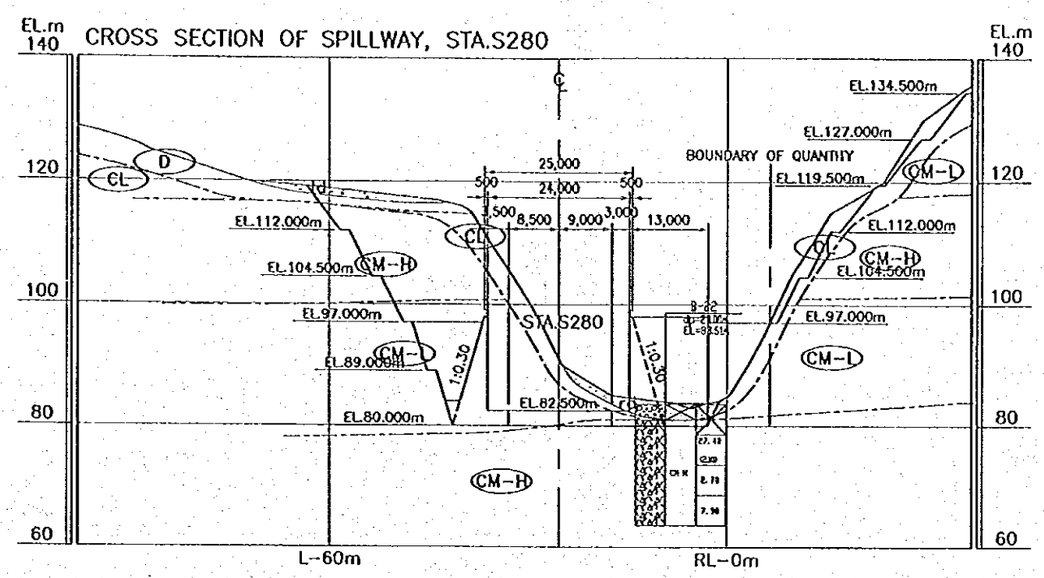


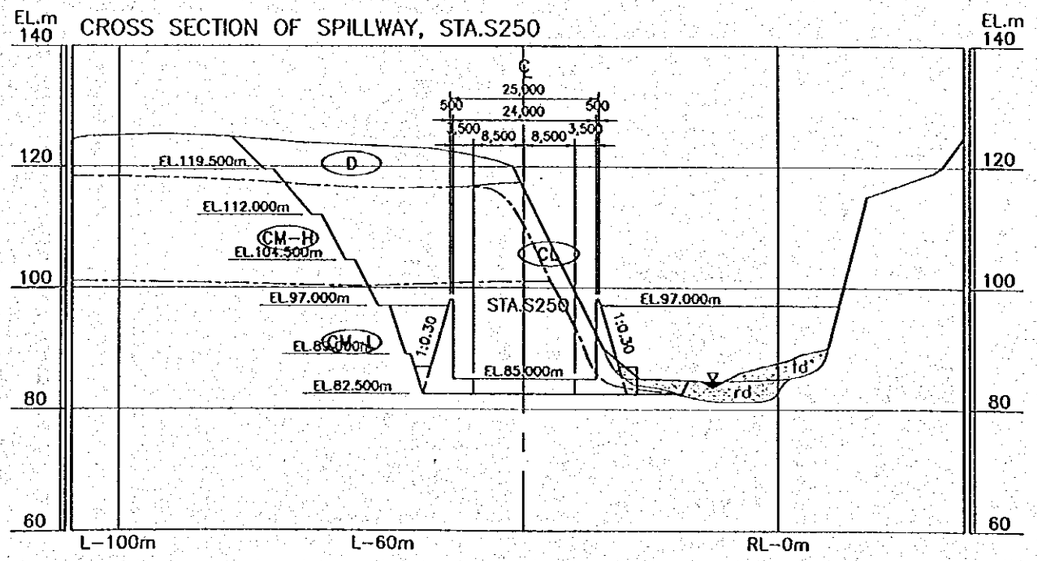


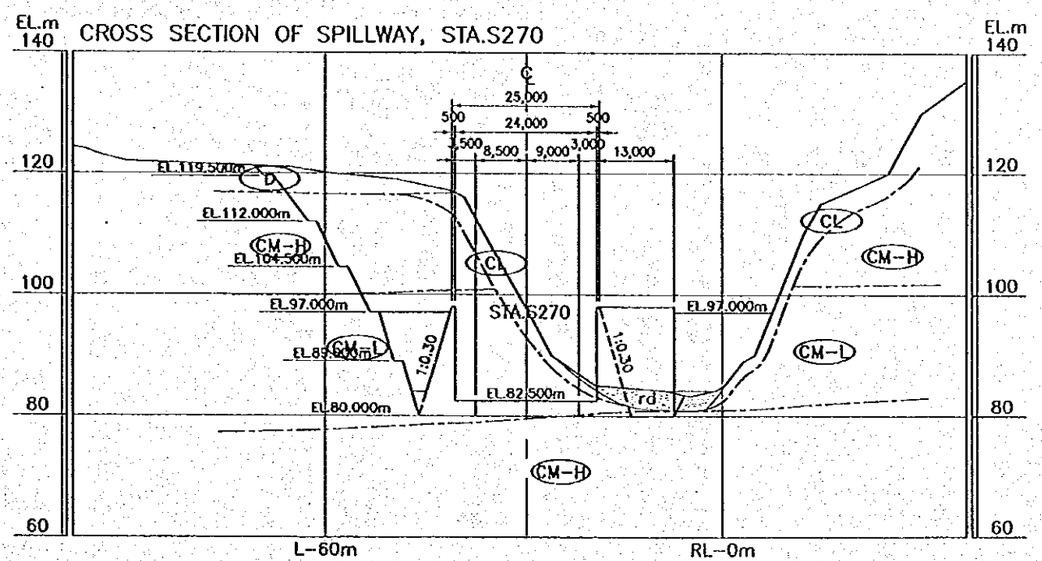


CROSS SECTIONS OF SPILLWAY (8/10)



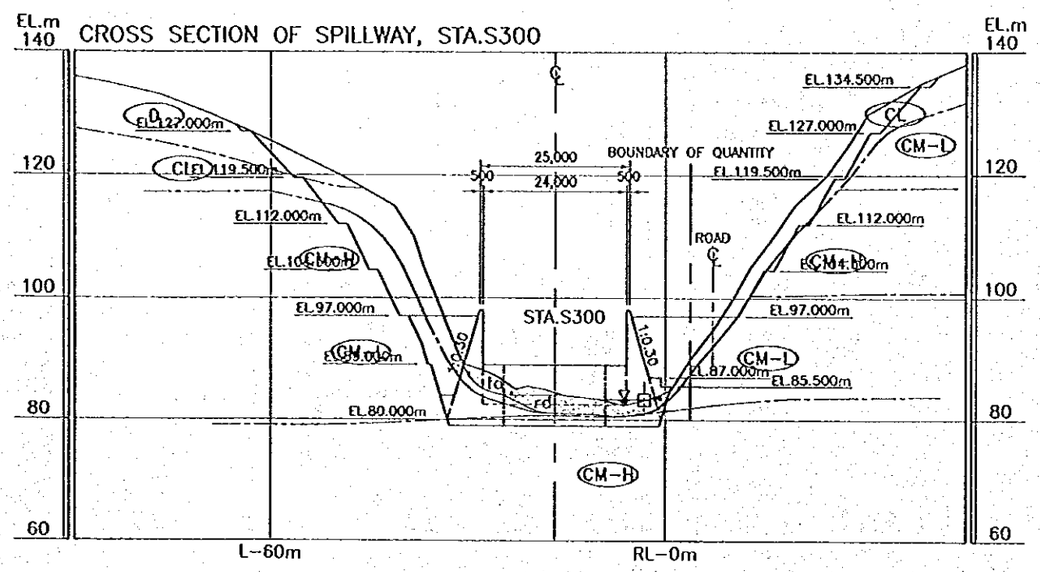


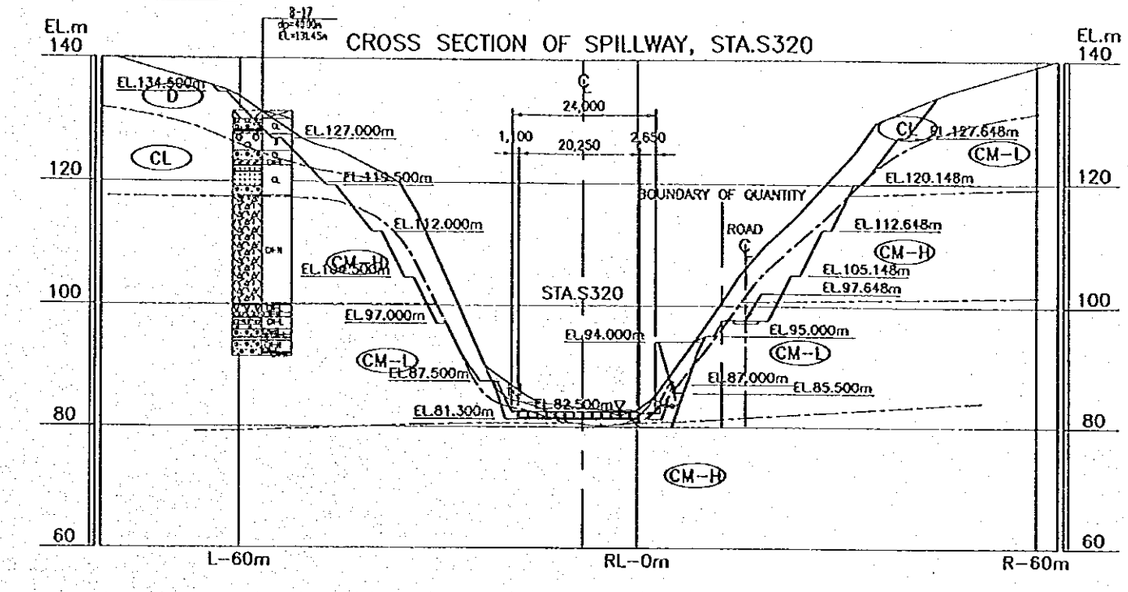


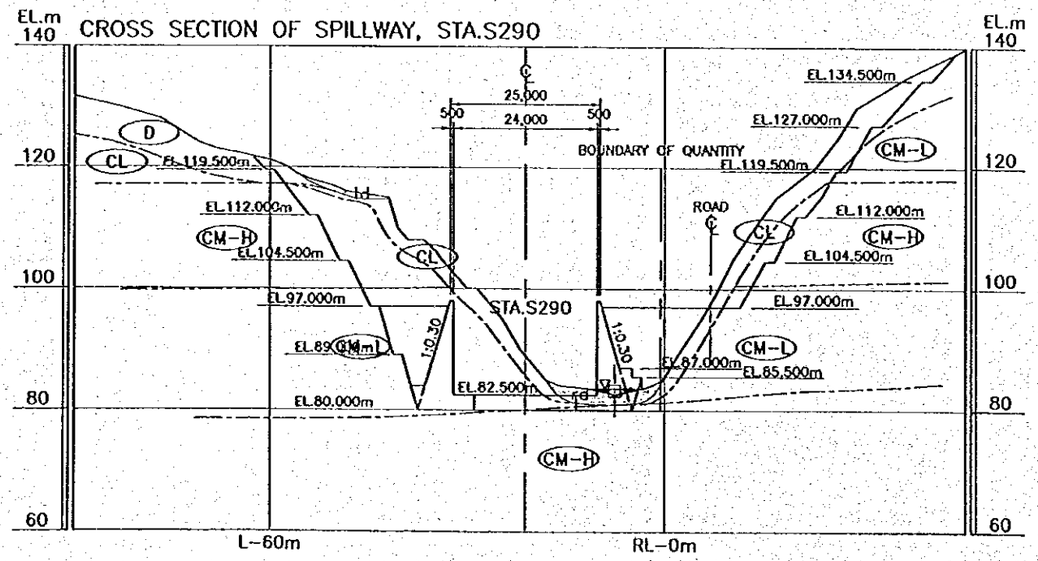


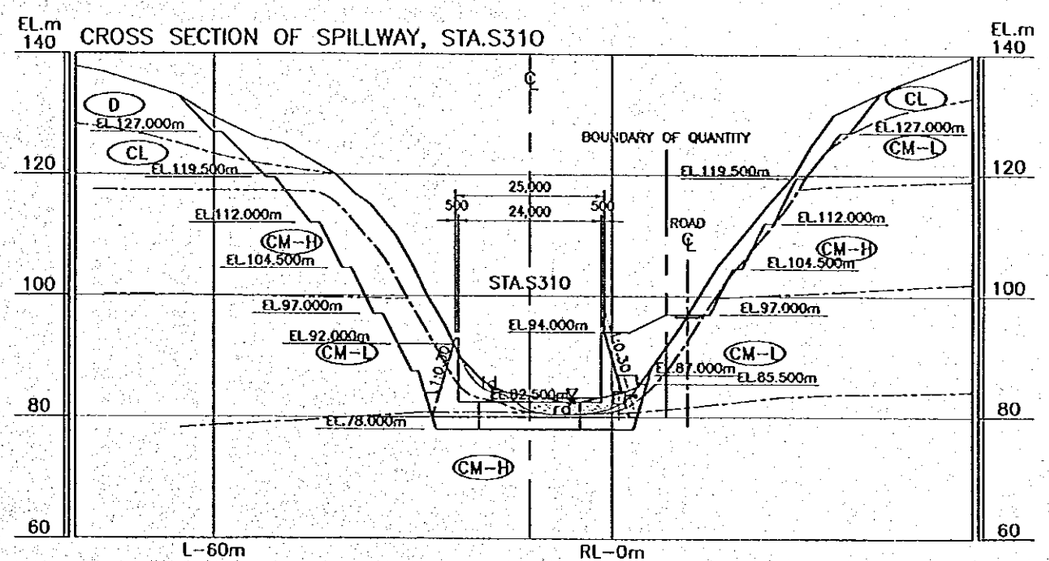
SCALE 0 25 50m

CROSS SECTIONS OF SPILLWAY (9/10)



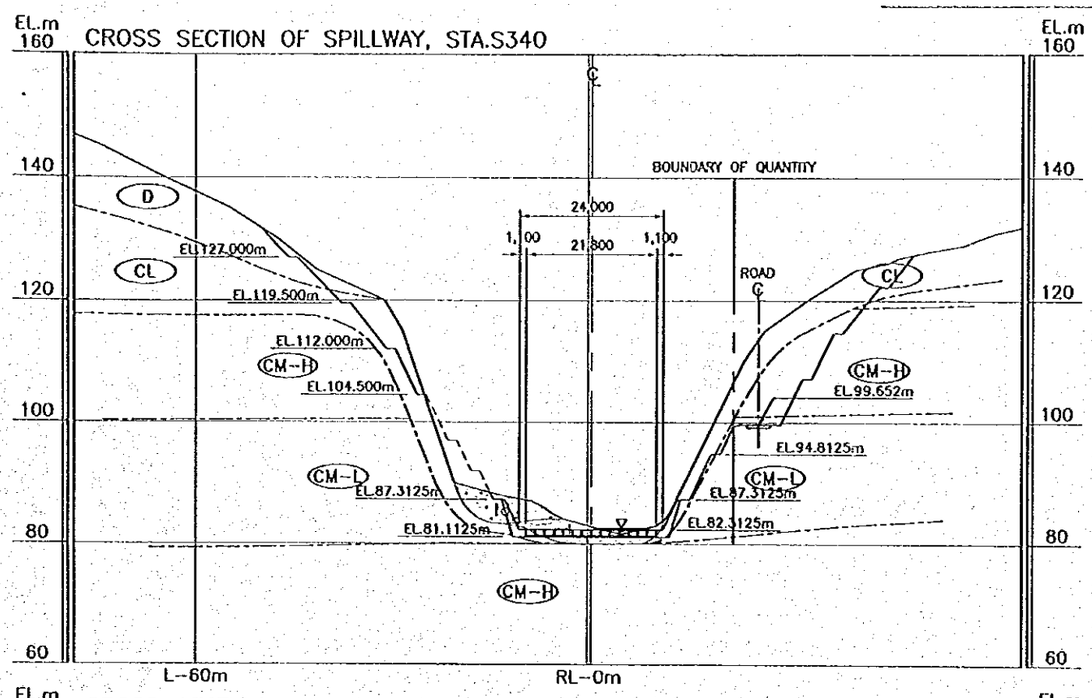


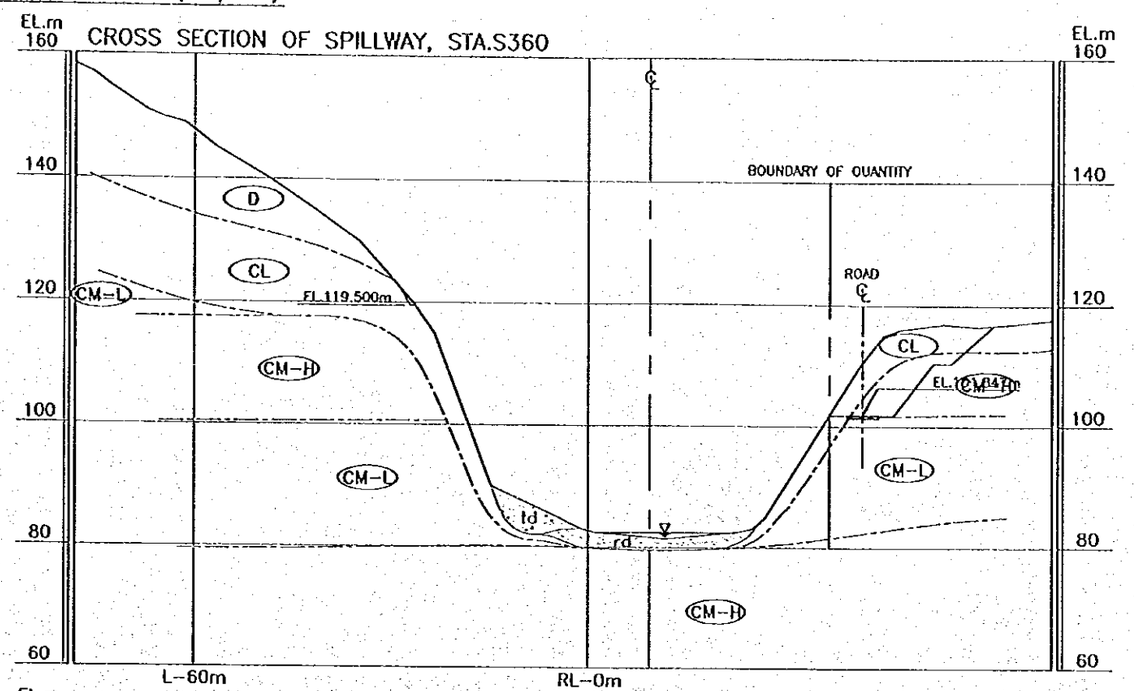


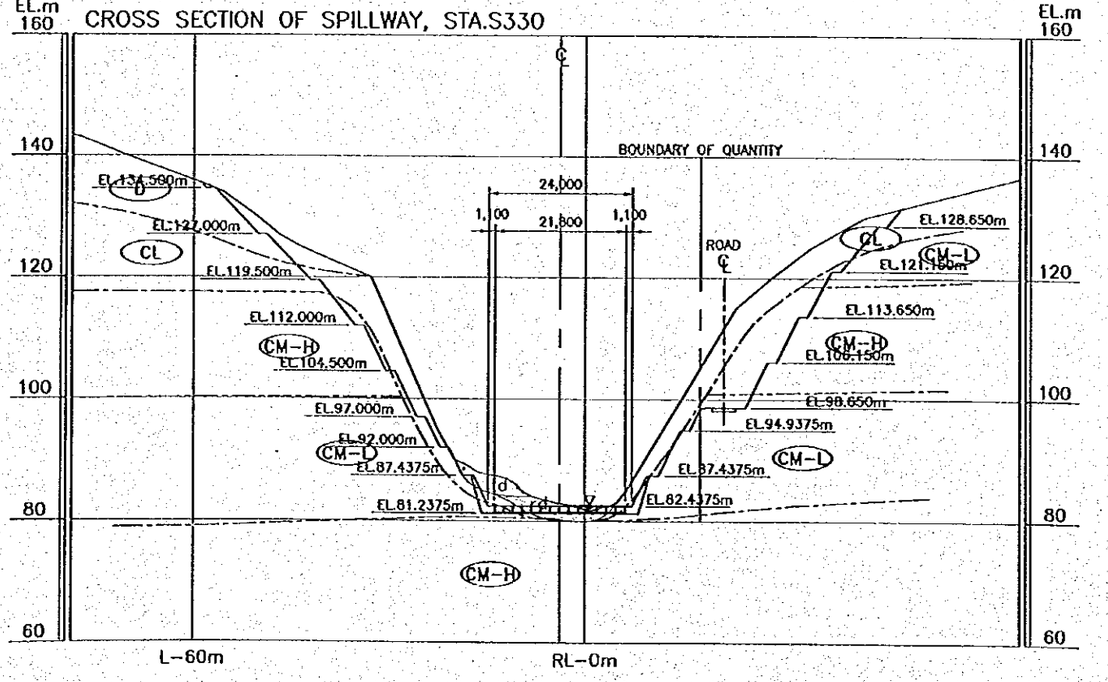


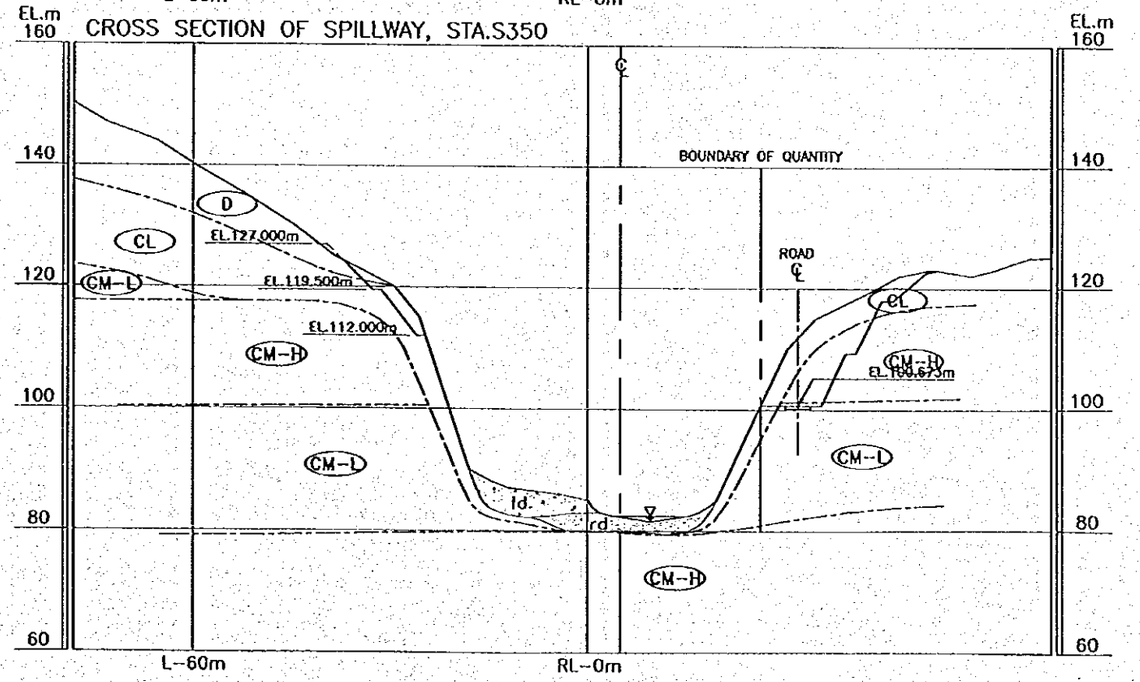
SCALE 0 25 50m

CROSS SECTIONS OF SPILLWAY (10/10)









SCALE 0 25 50m

2.4.2 Cocrete (Type D)

Concrete Volume of Spillway by Each Block

Unit : (m^3)

Block	Left Wall		Center Slab				Right Wall	
	Name	Volume (m^3)	Name	Volume (m^3)	Name	Volume (m^3)	Name	Volume (m^3)
1	L-1	2,387.64	C-1	1,191.11	---	---	R-1	2,387.64
2	L-2	1,382.29	C-2	621.08	---	---	R-2	1,382.29
---	L-W	685.21	---	---	---	---	---	---
3	L-3	3,710.33	C-3	765.00	---	---	R-3	2,937.61
4-1	L-4-1	2,036.12	C-4-1	765.00	---	---	R-4	4,458.87
4-2	L-4-2	2,270.63	C-4-2	642.60	---	---	---	---
5	L-5	1,107.15	C-5	714.00	---	---	R-5	474.66
6	L-6	250.82	C-6L	140.70	C-6R	140.70	R-6	210.28
7	L-7	137.48	C-7L	157.50	C-7R	157.50	R-7	137.48
8	L-8	98.50	C-8L	157.50	C-8R	157.50	R-8	98.50
9	L-9	98.50	C-9L	157.50	C-9R	157.50	R-9	98.50
10	L-10	98.51	C-10L	157.50	C-10R	157.50	R-10	98.51
11	L-11	96.95	C-11L	157.50	C-11R	157.50	R-11	96.95
12	L-12	80.95	C-12L	157.50	C-12R	157.50	R-12	80.95
13	L-13	79.21	C-13L	157.50	C-13R	157.50	R-13	79.21
14	L-14	186.13	C-14L	212.63	C-14R	212.63	R-14	196.84
15	L-15	730.74	C-15	637.50	---	---	R-15	786.00
16	L-16	1,061.06	C-16	656.25	---	---	R-16	Hydro PS
17	L-17	1,067.25	C-17	656.25	---	---	R-17	Hydro PS
18	L-18	1,067.25	C-18	637.50	---	---	R-18	1,113.56
19	L-19	1,517.30	C-19	2,155.31	---	---	R-19	1,492.47
20	---	---	---	---	---	---	R-20	616.89
Total		20,150.03		10,897.41		1,455.83		16,747.22
							G-Total	49,250.49
						G-Total x 1.05		51,700.00

(1) Concrete Volume of Overflow Weir (Overflow Weir ~ J3 and JR3)

G-Total	16,764.98 (m^3)

Left Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
L-1	JCL	108.28	2.00	216.56	
	Pier+J1	190.01	1.50	285.02	
	J1	142.75	10.21	1,457.80	
	J1	142.75	3.00	428.26	2,387.64
L-2	J1	142.75	9.68	1,382.29	1,382.29
L-3	J2	142.75	2.00	285.51	
	LW	120.25			
			2.00	298.15	
	1-1	177.90			
			3.15	536.08	
	2-2	162.90			
			3.56	530.56	
	3-3	135.17			
	Edge	0.00			
			7.82	623.71	
	4-4	159.62			
			3.56	594.62	
	5-5	174.44			
			4.94	841.70	
	J3	166.54			3,710.33
				Total	7,480.27

Center

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
C-1	JCL	108.28			
			11.00	1,191.11	
	JCR	108.28			1,191.11
C-2	A	207.03	3.00	621.08	621.08
C-3	B	255.00	3.00	765.00	765.00
				Total	2,577.18

Right Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
R-1	JCR	108.28	2.00	216.56	
	Pier+J1	190.01	1.50	285.02	
	J1	142.75	10.21	1,457.80	
	J1	142.75	3.00	428.26	2,387.64
R-2	J1	142.75	9.68	1,382.29	1,382.29
R-3	J2	142.75	2.00	285.51	
	JR3	152.75	3.82	582.75	
	JR3	152.75	9.52	1,454.67	
	JR3	152.75	4.02	614.68	2,937.61
				Total	6,707.54

(2) Concrete Volume of Control Portion (J3 and JR3 ~ JR4 and Block L-W)

G-Total	11,742.60 (m^3)

Left Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
L-4-1	J3	153.77			
			15.00	2,036.12	
	J4-1(left)	117.71			2,036.12
L-4-2	J4-1(left)	117.71			
			8.68	1,021.71	
	J4-1(left)	117.71			
			11.28	1,248.91	
	J4-2(left)	103.73			2,270.63
L-5 upper	J4-2(left)	103.73			
			6.00	552.67	
	JR4(left)	80.49			552.67
L-W	Edge	0.00			
			3.30	39.46	
	A1-A1	23.92			
	A2-A2	19.60			
			1.50	41.50	
	B1-B1	35.74			
	B2-B2	26.40			
			1.50	53.52	
	C1-C1	44.96			
	C2-C2	27.48			
			3.30	144.24	
	D-D	59.93			
			2.70	172.01	
	E1-E1	67.48			
	E2-E2	53.00			
			3.00	234.48	
	F-F	103.32			685.21
				Total	5,544.62

Center

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
C-4-1	C-4-1	255.00	3.00	765.00	765.00
C-4-2	C-4-2	214.20	3.00	642.60	642.60
C-5 upper	G-G	19.50	17.00	331.50	331.50
				Total	1,739.10

Right Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
R-4	JR3	152.75			
			18.00	2,965.61	
	J4-1(right)	176.76			
			12.07	1,493.26	
	JR4(right)	70.76			4,458.87
				Total	4,458.87

(3) Concrete Volume of Chute (JR4 ~ J15+3.000)

G-Total	9,040.33 (m^3)

(a) Left Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
L-5 lower	JR4	80.49			
			10.00	554.49	
	J5(1/2)	30.41			554.49
L-6	J5(2/2)	25.67			
			13.40	250.82	
	J6	11.76			250.82
L-7	J6	11.76			
			15.00	137.48	
	J7	6.57			137.48
L-8	J7	6.57			
			15.00	98.50	
	J8	6.57			98.50
L-9	J8	6.57			
			15.00	98.50	
	J9	6.57			98.50
L-10	J9	6.57			
			15.00	98.51	
	J10	6.57			98.51
L-11	J10	6.57			
			5.00	34.08	
	J10+5.0m	7.06			
			10.00	62.87	
	J11	5.51			96.95
L-12	J11	5.51			
			15.00	80.95	
	J12	5.28			80.95
L-13	J12	5.28			
			15.00	79.21	
	J13	5.28			79.21
L-14	J13	5.28			
			10.00	81.12	
	J13+10.0m	10.94			
			3.00	51.76	
	J13+13.0m	23.56			
			2.00	53.25	
	J14(1/2)	29.68			186.13
L-15	J14(2/2)	30.31			
			15.00	730.74	
	J15(1/2)	67.12			730.74
L-16 upper	J15(2/2)	62.75			
			3.00	207.26	
	J15+3.0m	75.43			207.26
				Total	2,619.55

(b) Center

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
C-5 lower	JR4	59.50			
			10.00	382.50	
	J5(1/2)	17.00			382.50
	J5(2/2)~J6				
C-6L		10.50	13.40	140.70	140.70
C-6R		10.50	13.40	140.70	140.70
	J6~J7				
C-7L		10.50	15.00	157.50	157.50
C-7R		10.50	15.00	157.50	157.50
	J7~J8				
C-8L		10.50	15.00	157.50	157.50
C-8R		10.50	15.00	157.50	157.50
	J8~J9				
C-9L		10.50	15.00	157.50	157.50
C-9R		10.50	15.00	157.50	157.50
	J9~J10				
C-10L		10.50	15.00	157.50	157.50
C-10R		10.50	15.00	157.50	157.50
	J10~J11				
C-11L		10.50	15.00	157.50	157.50
C-11R		10.50	15.00	157.50	157.50
	J11~J12				
C-12L		10.50	15.00	157.50	157.50
C-12R		10.50	15.00	157.50	157.50
	J12~J13				
C-13L		10.50	15.00	157.50	157.50
C-13R		10.50	15.00	157.50	157.50
C-14L	J13	10.50			
			10.00	105.00	
	J13+10.0m	10.50			
			3.00	55.13	
	J13+13.0m	26.25			
			2.00	52.50	
	J14(1/2)	26.25			212.63
C-14R	J13	10.50			
			10.00	105.00	
	J13+10.0m	10.50			
			3.00	55.13	
	J13+13.0m	26.25			
			2.00	52.50	
	J14(1/2)	26.25			212.63
C-15	J14(2/2)	42.50			
			15.00	637.50	
	J15(1/2)	42.50			637.50
C-16 upper	J15(2/2)	43.75			
			3.00	131.25	
	J15+3.0m	43.75			131.25
				Total	4,062.90

(4) Concrete Volume of Stilling Basin (J15+3.000 ~ END)

G-Total	11,702.58 (m^3)

(a) Left Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
L-16 lower	J15+3.000~J16	71.15	12.00	853.80	853.80
L-17	J16~J17(1/2)	71.15	15.00	1,067.25	1,067.25
L-18	J17(2/2)~J18	71.15	15.00	1,067.25	1,067.25
L-19	G-G	126.78	3.50	443.74	
	J18	62.40			
			2.00	124.80	
	A-A	62.40			
			2.00	136.00	
	B-B	73.60			
			1.50	110.40	
	B-B	73.60			
			9.00	511.36	
	C-C	40.04			
			3.00	151.43	
	D-D	60.91			
			0.50	30.46	
	D-D	60.91			
	I-I	7.93			
			2.30	9.11	
	Edge	0.00			1,517.30
				Total	4,505.60

(b) Center

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
C-16 lower	J15+3.000~J16	43.75	12.00	525.00	525.00
C-17	J16~J17(1/2)	43.75	15.00	656.25	656.25
C-18	J17(2/2)~J18	42.50	15.00	637.50	637.50
C-19	G-G	126.78	17.00	2,155.31	2,155.31
				Total	3,974.06

(c) Right Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
R-16 lower	Concrete volume should be estimated in Hydropower Station				
R-17	Concrete volume should be estimated in Hydropower Station				
R-18	J17(2/2)~J18	74.24	15.00	1,113.56	1,113.56
R-19	H-H	112.88	3.50	395.07	
	J18	65.49			
			2.00	130.98	
	A-A	65.49			
			2.00	142.18	
	B-B	76.69			
			1.50	115.03	
	B-B	76.69			
			6.00	421.73	
	C-C	63.89			
			4.50	287.49	
	J19(1/2)	63.89			1,492.47
R-20	J19(2/2)	79.64			
			1.00	79.64	
	J19(2/2)	79.64			
			0.50	38.49	
	D-D	74.31			
			5.45	316.06	
	E-E	41.68			
			2.55	142.88	
	F-F	70.39			
			0.50	35.19	
	F-F	70.39			
	J-J	7.14			
			1.30	4.64	
	Edge	0.00			616.89
				Total	3,222.93

(c) Right Side

Name	Section	Area (m^2)	Distance (m)	Volume (m^3)	Block (m^3)
R-5	JR4	70.76			
			10.00	474.66	
	J5(1/2)	24.17			474.66
R-6	J5(2/2)	19.62			
			13.40	210.28	
	J6	11.76			210.28
R-7	J6	11.76			
			15.00	137.48	
	J7	6.57			137.48
R-8	J7	6.57			
			15.00	98.50	
	J8	6.57			98.50
R-9	J8	6.57			
			15.00	98.50	
	J9	6.57			98.50
R-10	J9	6.57			
			15.00	98.51	
	J10	6.57			98.51
R-11	J10	6.57			
			5.00	34.08	
	J10+5.0m	7.06			
			10.00	62.87	
	J11	5.51			96.95
R-12	J11	5.51			
			15.00	80.95	
	J12	5.28			80.95
R-13	J12	5.28			
			15.00	79.21	
	J13	5.28			79.21
R-14	J13	5.28			
			10.00	79.13	
	J13+10.0m	10.54			
			3.00	57.54	
	J13+13.0m	27.81			
			2.00	60.18	
	J14(1/2)	32.36			196.84
R-15	J14(2/2)	35.00			
			15.00	786.00	
	J15(1/2)	69.80			786.00
R-16 upper	Concrete volume should be estimated in Hydropower Station				0.00
				Total	2,357.88

Area (m^2)	L	CL	CR	R	Total
JR4	80.49	59.50		70.76	210.75
J5(1/2)	30.41	17.00		24.17	71.58
J5(2/2)	25.67	10.50	10.50	19.62	66.29
J6	11.76	10.50	10.50	11.76	44.53
J7,J8,J9	6.57	10.50	10.50	6.57	34.13
J10	6.57	10.50	10.50	6.57	34.14
J10+5.0m	7.06	10.50	10.50	7.06	35.12
J11	5.51	10.50	10.50	5.51	32.02
J12,J13	5.28	10.50	10.50	5.28	31.56
J13+10.0m	10.94	10.50	10.50	10.54	42.49
J13+13.0m	23.56	26.25	26.25	27.81	103.88
J14(1/2)	29.68	26.25	26.25	32.36	114.55
J14(2/2)	30.31	42.50		35.00	107.81
J15(1/2)	67.12	42.50		69.80	179.42
J15(2/2)	62.75	43.75		---	106.50
J15+3.0m	75.43	43.75		---	119.18

2.4.3 Form Work of Spillway

Unit : (m^2)

Portion	Location	Outside	Inside	Total
Overflow Weir	Overflow Weir~J3,JR3	2,246.98	1,938.61	4,185.60
Control Portion	J3,JR3 ~ JR4,Block L-W	1,663.69	1,522.42	3,186.11
Chute	JR4 ~ J15+3.000	1,603.18	2,077.24	3,680.42
Stilling Basin	J15+3.000 ~ End	1,539.68	2,712.00	4,251.68
Grand Total		7,053.53	8,250.27	15,303.80

(1) Form Work of Overflow Weir (Overflow Weir~J3 and JR3)

(a) Outside : 2,246.98 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
JCL	10.91	7.50	81.84		JCR	10.91	7.50	81.84	
Pier-in	-	-	81.73		Pier-in	-	-	81.73	
Pier-out	-	-	47.26		Pier-out	-	-	47.26	
Pier	8.32	1.50	12.48		Pier	8.32	1.50	12.48	
J1	12.90	30.00	386.85		J1	12.90	30.00	386.85	
J3	19.08	30.21	576.42		JR3	19.86	14.98	297.50	
				1,186.57	JR3	-	-	152.75	1,060.41

(b) Inside : 1,938.61 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
JCL	16.10	7.50	120.78		JCR	16.10	7.50	120.78	
Pier	12.58	1.50	18.87		Pier	12.58	1.50	18.87	
J1	17.01	30.00	510.21		J1	17.01	30.00	510.21	
J1	3.00	14.68	44.05		J1	3.00	14.68	44.05	
Wall	-	-	261.00		Wall	-	-	208.80	
Toe	-	-	45.00	999.91	Toe	-	-	36.00	938.71

(2) Form Work of Control Portion (J3 and JR3 ~ JR4, and Block L-W)

(a) Outside : 1,663.69 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
J4-1(left)	19.08	34.96	667.07		J4-1(right)	25.50	30.07	766.68	
J4-2	17.44	6.00	104.62						
L-W	-	-	125.32	897.00					766.68

(b) Inside : 1,522.42 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
Wall	-	-	560.89		Wall	-	-	613.09	
Toe	-	-	104.30		Toe	-	-	113.30	
L-W	-	-	130.84	796.03					726.39

(3) Form Work of Chute (JR4 ~ J15+3.000)

(a) Outside : 1,603.18 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
JR4(left)	14.15				JR4(right)	17.13			
		10.00	111.97				10.00	125.91	
J5(1/2)	8.25				J5(1/2)	8.06			
J5(2/2)	9.81				J5(2/2)	9.59			
		13.40	107.09				13.40	105.57	
J6	6.17				J6	6.17			
		15.00	69.22				15.00	69.22	
J7	3.06				J7	3.06			
		50.00	162.13				50.00	162.13	
J10+5.0	3.43				J10+5.0	3.43			
		47.00	128.45				47.00	128.45	
J13+7.0	2.04				J13+7.0	2.04			
		26.00	216.53				26.00	216.53	
J15+3.0	14.62			795.38	J15+3.0	14.62			807.79

(b) Inside : 2,077.24 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
Wall	-	-	827.62		Wall	-	-	827.62	
Toe	-	-	211.00	1,038.62	Toe	-	-	211.00	1,038.62

(4) Form Work of Stilling Basin (J15+3.000 ~ End)

(a) Outside : 1,539.68 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
J15+3.0	14.62				J15+3.0	14.62			
		47.50	694.26				20.50	299.63	
J18+5.5	14.62				J18+5.5	14.62			
		9.00	103.36				9.00	105.41	
C-C	8.35				C-C	8.81			
							8.45	74.43	
					E-E	8.81			
D-D(u/s)			60.92		F-F(u/s)			70.39	
D-D(d/s)			60.92	919.45	F-F(d/s)			70.39	620.23

(b) Inside : 2,712.00 (m^2)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)	Section	Length (m)	Distance (m)	Area (m^2)	Total (m^2)
Wall	-	-	830.88		Wall	-	-	936.88	
Toe	-	-	232.75		Toe	-	-	247.13	
Sub-Dam	19.35	24.00	464.38	1,528.00					1,184.00

Frame Work of Joints

Grand Total :	3,184.32 (m^2)

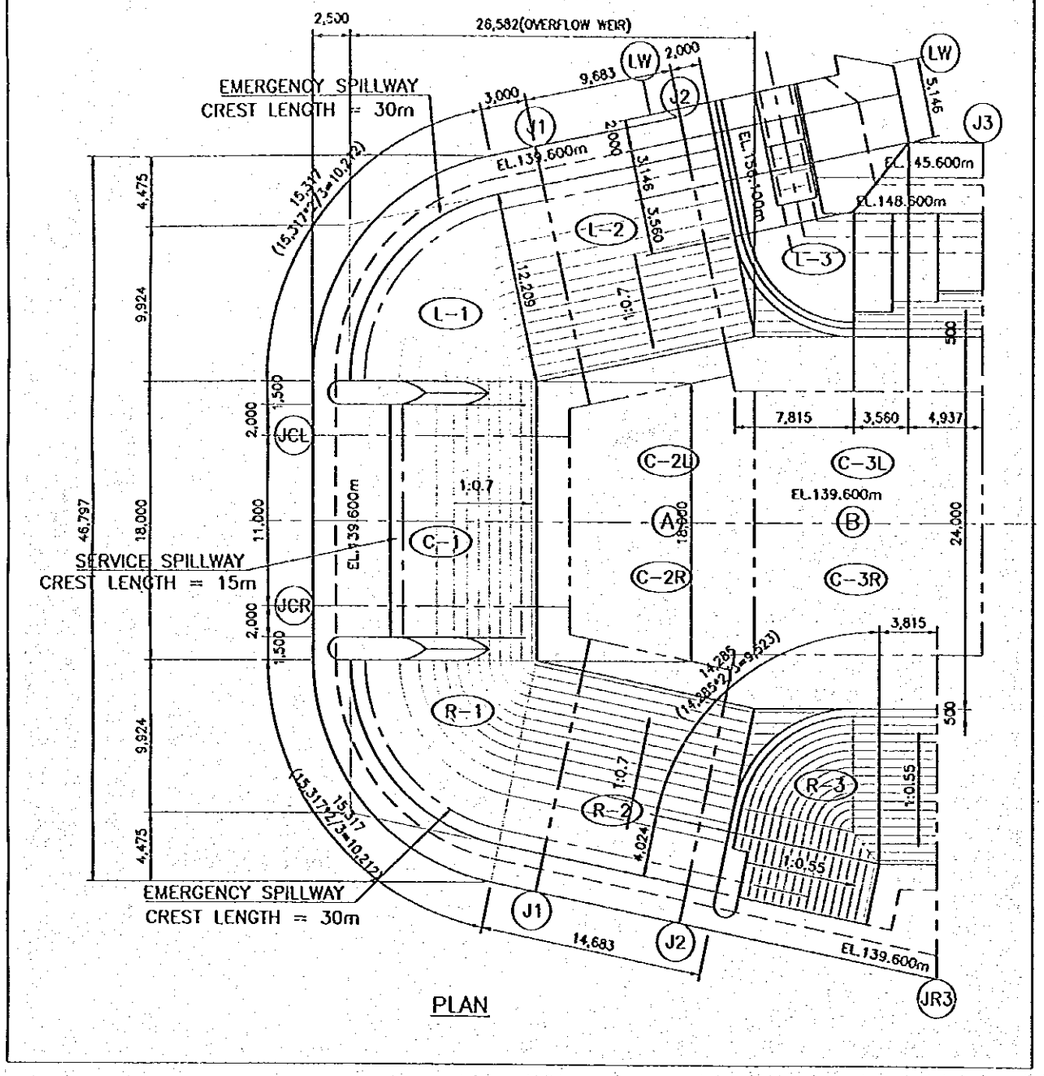
Left		Right		Center	
Section	Area (m^2)	Section	Area (m^2)	Section	Area (m^2)
JCL	108.28	JCR	108.28	-	-
J1	142.75	J1	142.75	-	-
J2	142.75	J2	142.75	J2	72.00
J3	166.54	JR3	152.75	J3	72.00
Jw	120.25	-	-	J4-1	72.00
J4-1	117.71	JR4	70.76	J4-2	72.00
J4-2	103.73	-	-	-	-
J5	30.41	J5	24.17	J5	21.00
J6	11.76	J6	11.76	J6	21.00
J7	6.57	J7	6.57	J7	21.00
J8	6.57	J8	6.57	J8	21.00
J9	6.57	J9	6.57	J9	21.00
J10	6.57	J10	6.57	J10	21.00
J11	5.51	J11	5.51	J11	21.00
J12	5.28	J12	5.28	J12	21.00
J13	5.28	J13	5.28	J13	21.00
J14	30.31	J14	35.00	J14	52.50
J15	67.12	J15	69.80	J15	43.75
J16	71.15	J16	-	J16	43.75
J17	71.15	J17	78.24	J17	43.75
J18	71.15	J18	78.24	J18	42.50
-	-	J19	83.64	Center	143.16
Total	1,297.42	Total	1,040.49	Total	846.41

2.4.4 Weight of Steel Reinforcing Bar by each Block

Unit : (kg)

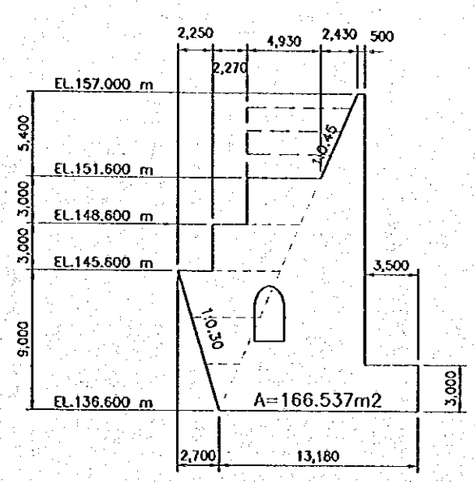
Block	Left Wall		Center Slab				Right Wall	
	Name	Weight (kg)	Name	Weight (kg)	Name	Weight (kg)	Name	Weight (kg)
1	L-1	4,907	C-1	1,702	---	---	R-1	4,907
2	L-2	1,515	C-2	7,090	---	---	R-2	1,515
---	L-W	1,079	---	---	---	---	---	---
3	L-3	13,942	C-3	8,776	---	---	R-3	12,903
4-1	L-4-1	21,051	C-4-1	8,776	---	---	R-4	28,813
4-2	L-4-2	13,565	C-4-2	7,252	---	---	---	---
5	L-5	12,960	C-5	9,513	---	---	R-5	7,780
6	L-6	4,387	C-6L	4,744	C-6R	4,744	R-6	4,183
7	L-7	3,178	C-7L	5,294	C-7R	5,294	R-7	3,178
8	L-8	2,319	C-8L	5,294	C-8R	5,294	R-8	2,319
9	L-9	2,319	C-9L	5,294	C-9R	5,294	R-9	2,319
10	L-10	2,539	C-10L	5,300	C-10R	5,300	R-10	2,539
11	L-11	2,510	C-11L	5,374	C-11R	5,374	R-11	2,510
12	L-12	2,133	C-12L	5,622	C-12R	5,622	R-12	2,133
13	L-13	2,223	C-13L	5,604	C-13R	5,604	R-13	2,223
14	L-14	2,689	C-14L	5,679	C-14R	5,679	R-14	2,689
15	L-15	11,684	C-15	9,250	---	---	R-15	11,724
16	L-16	13,421	C-16	9,226	---	---	R-16	Hydro PS
17	L-17	12,624	C-17	9,050	---	---	R-17	Hydro PS
18	L-18	12,624	C-18	8,776	---	---	R-18	12,624
19	L-19	14,543	C-19	14,852	---	---	R-19	12,191
20	---	---	---	---	---	---	R-20	8,018
Total		158,212		142,468		48,205		124,568
							G-Total :	473,453
						G-Total x 1.06		502,000

DETAIL OF OVERFLOW WEIR (1/2)

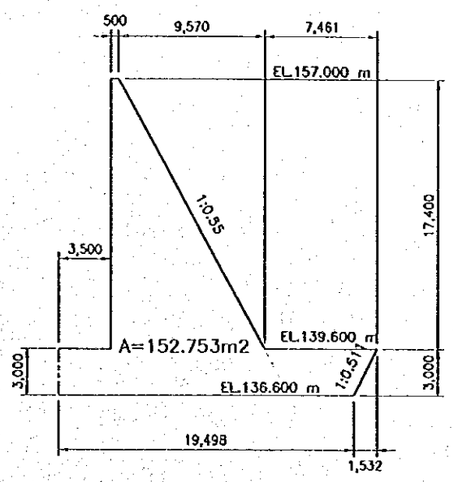


PLAN

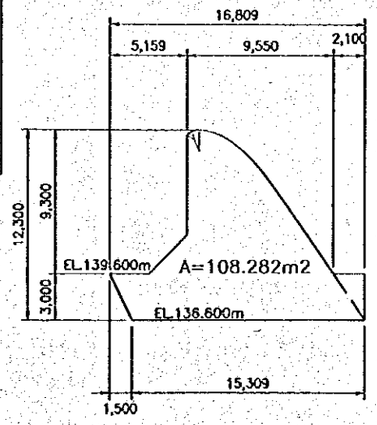
J3



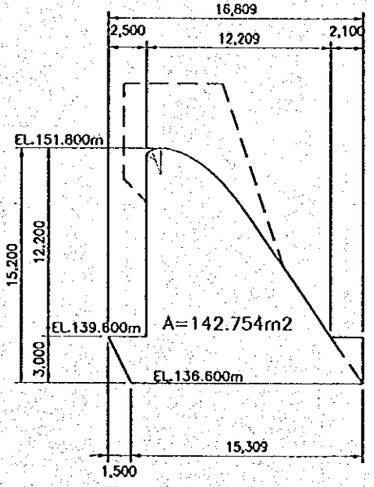
JR3

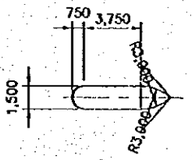


JCL,JCR

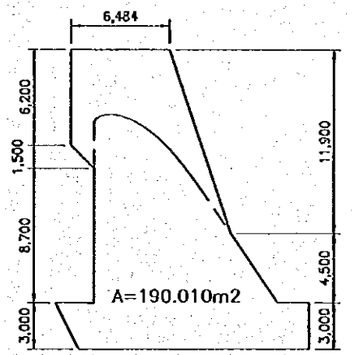


J1,J2





PIER+J1



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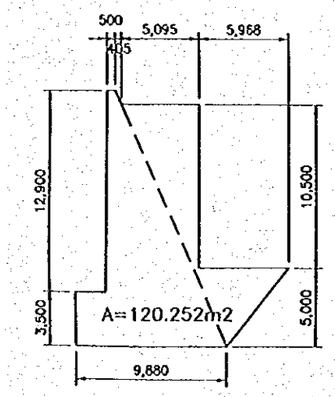

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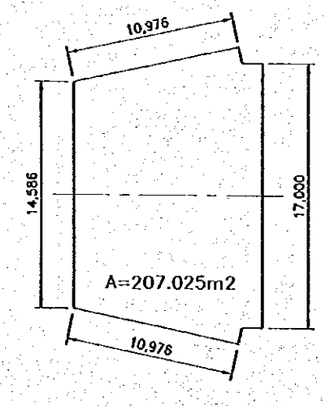

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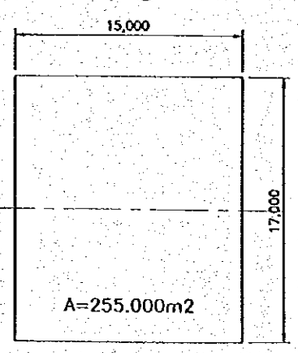
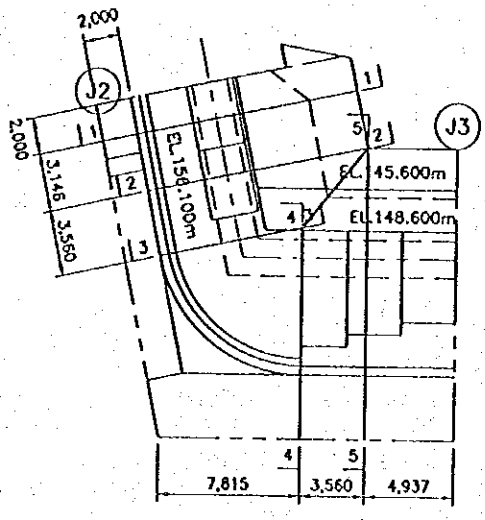
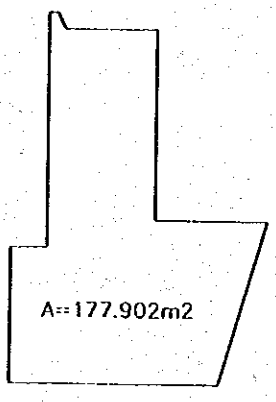


SCALE 0 10 20m

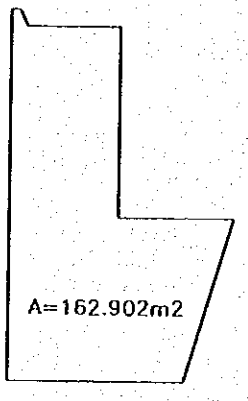
DETAIL OF OVERFLOW WEIR (2/2)



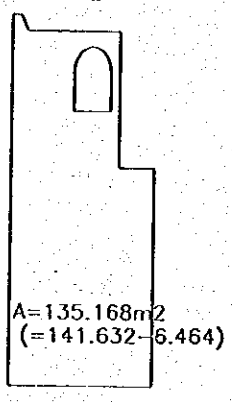
1-1



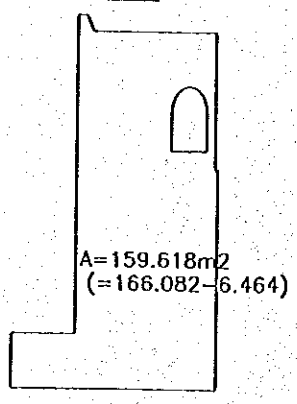
2-2



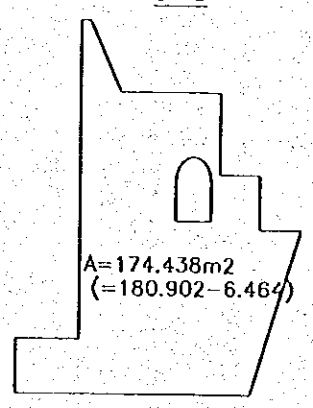
3-3



4-4

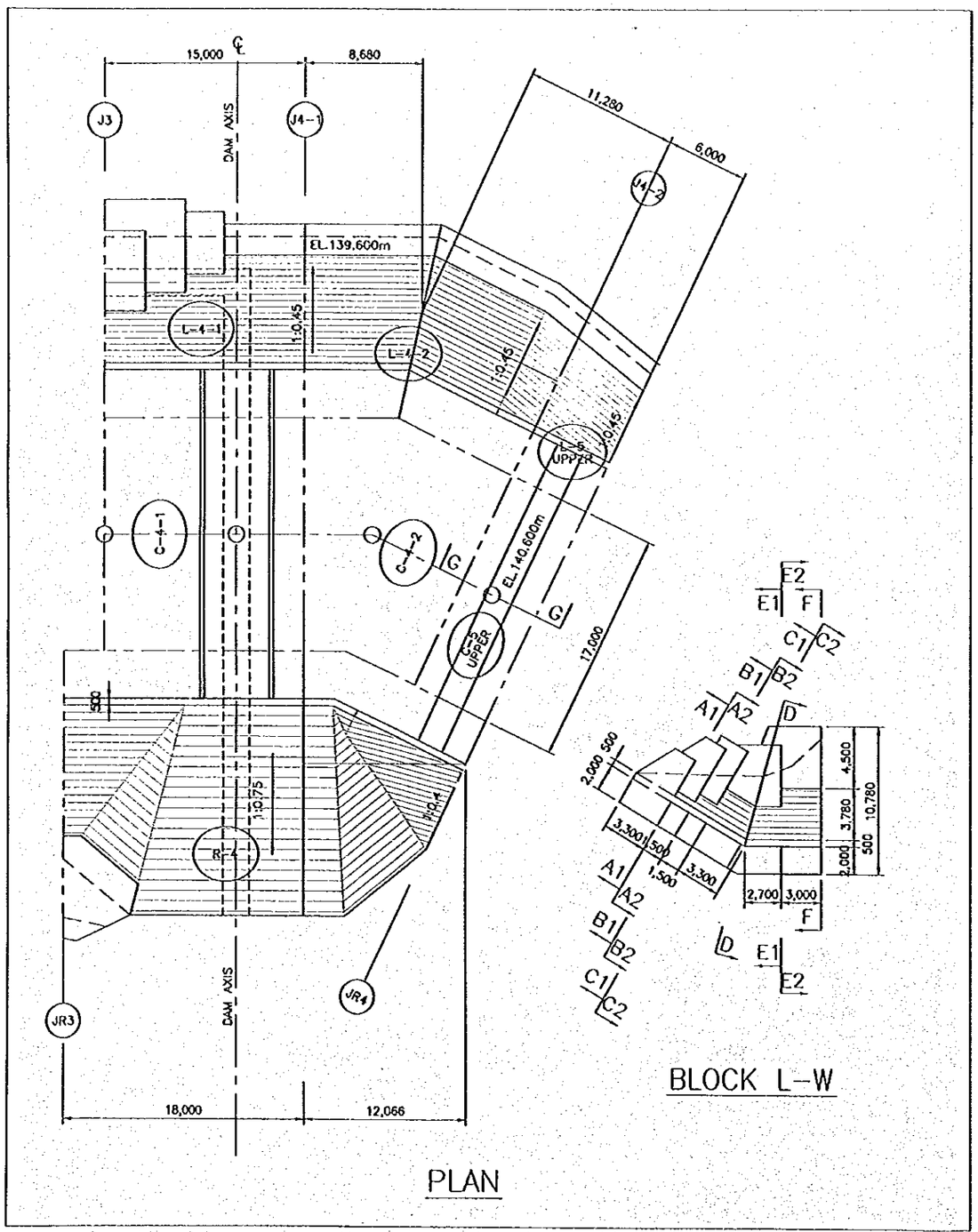


5-5



SCALE 0 10 20m

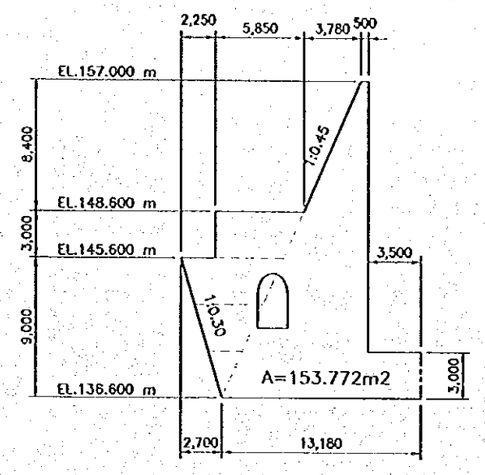
DETAL OF CONTROL PORTION (1/2)



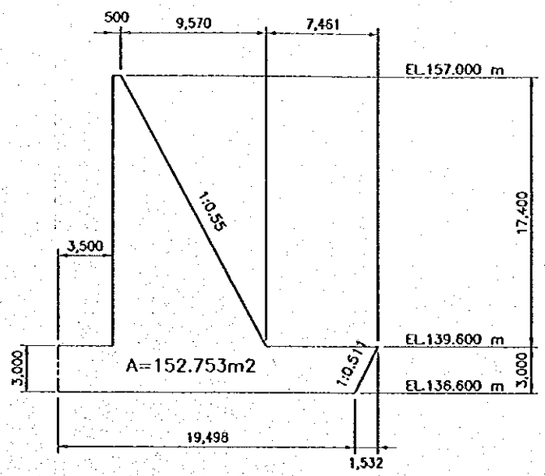
PLAN

BLOCK L-W

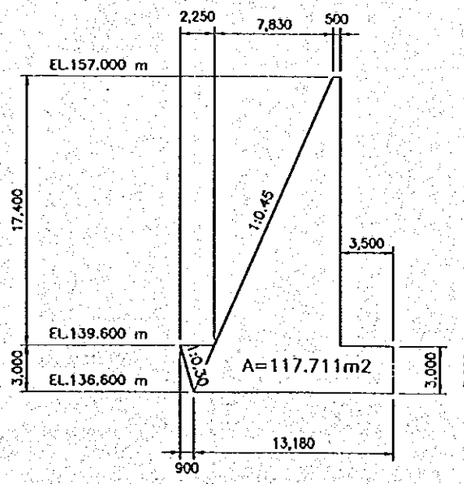
J3



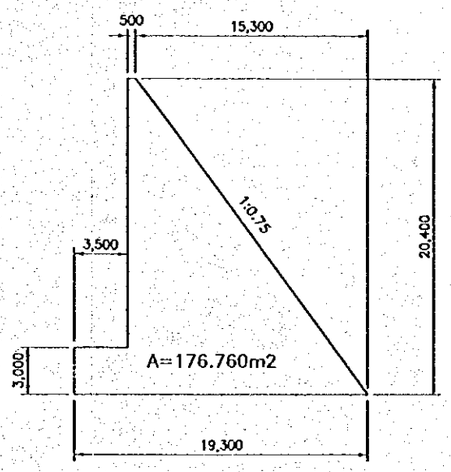
JR3



J4-1(LEFT)



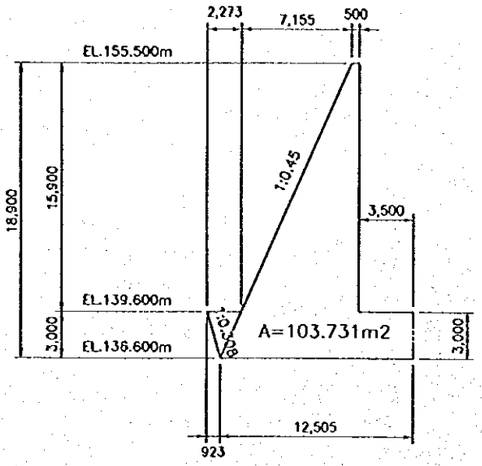
J4-1(RIGHT)



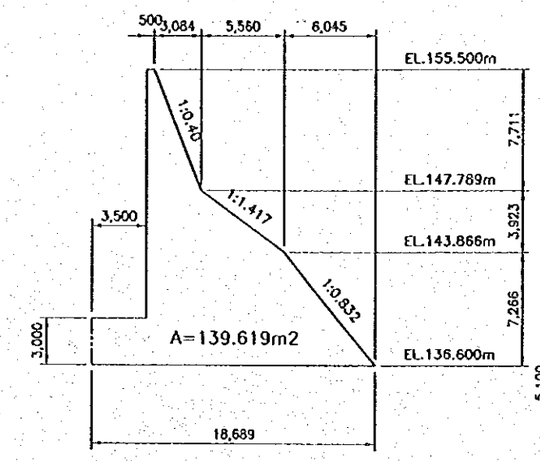
SCALE 0 10 20m

DETAIL OF CONTROL PORTION (2/2)

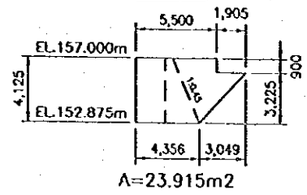
J4--2(LEFT)



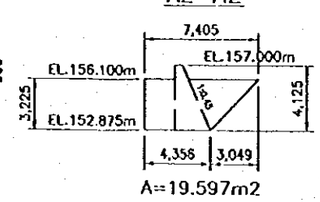
J4--2(RIGHT)



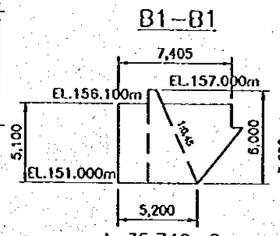
A1--A1



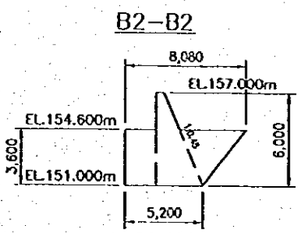
A2--A2



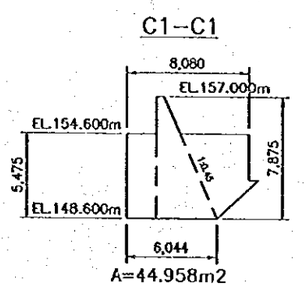
B1--B1



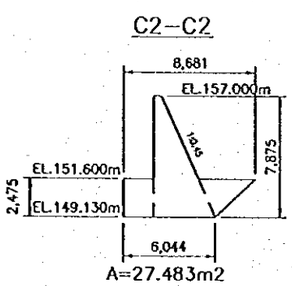
B2--B2



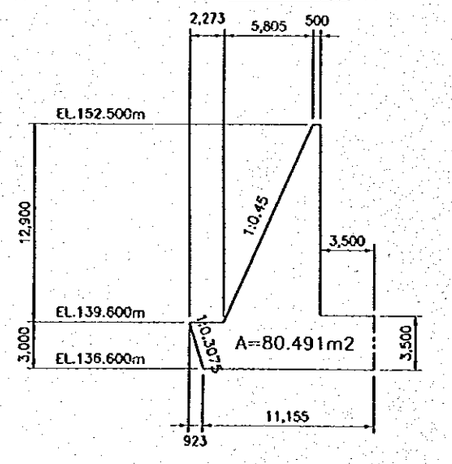
C1--C1



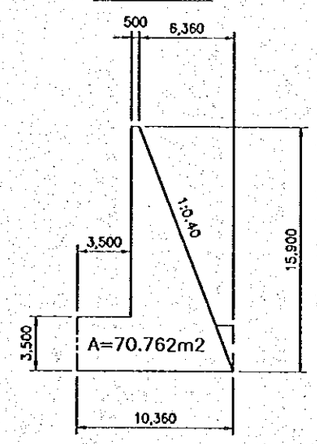
C2--C2



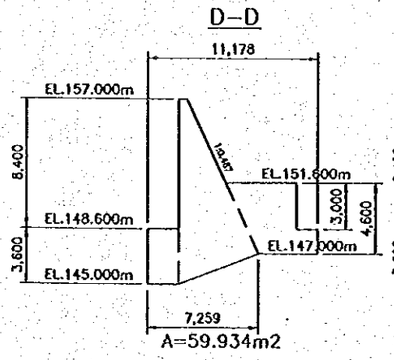
JR4(LEFT)



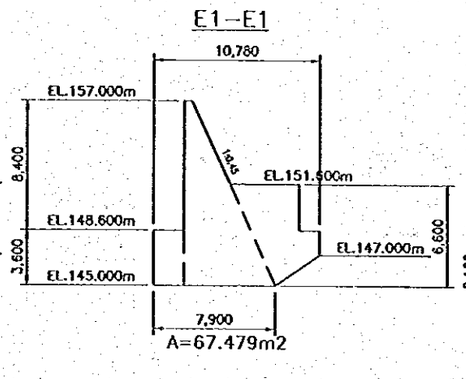
JR4(RIGHT)



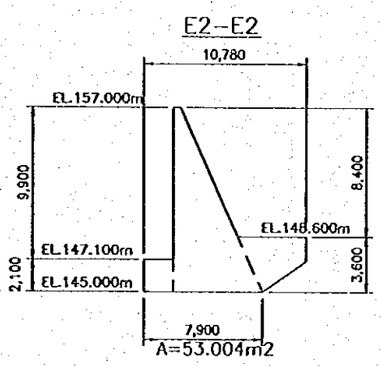
D--D



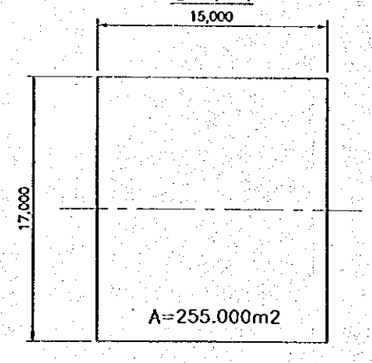
E1--E1



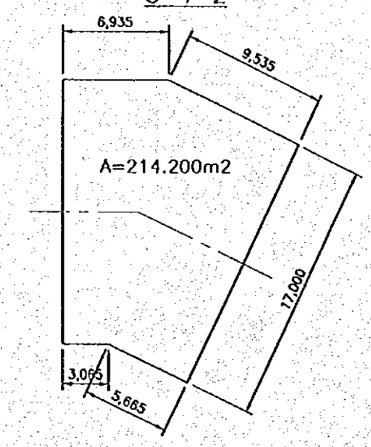
E2--E2



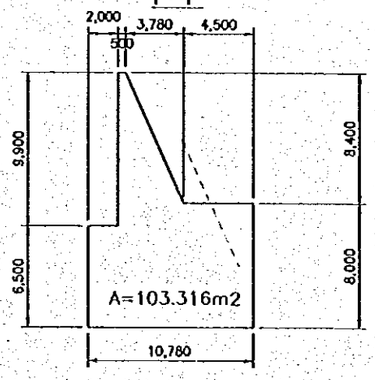
C--4--1



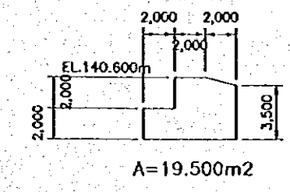
C--4--2



F--F

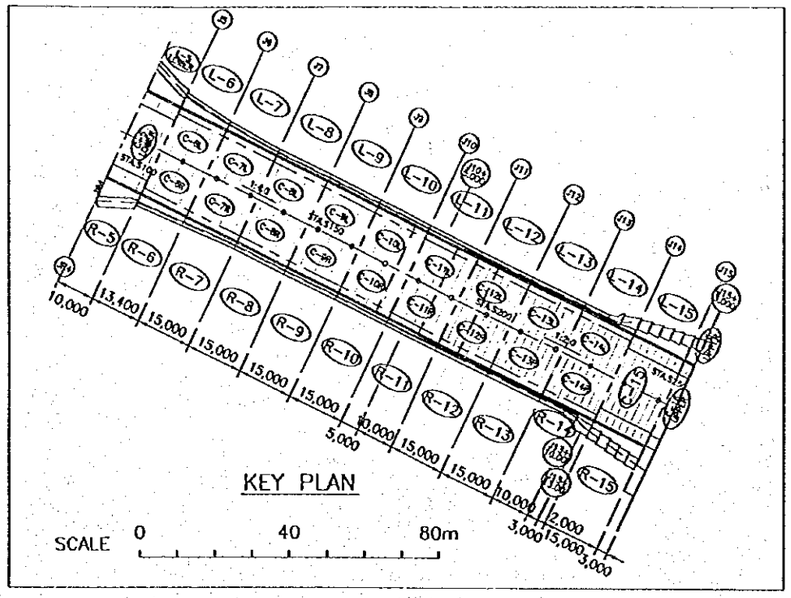


G--G

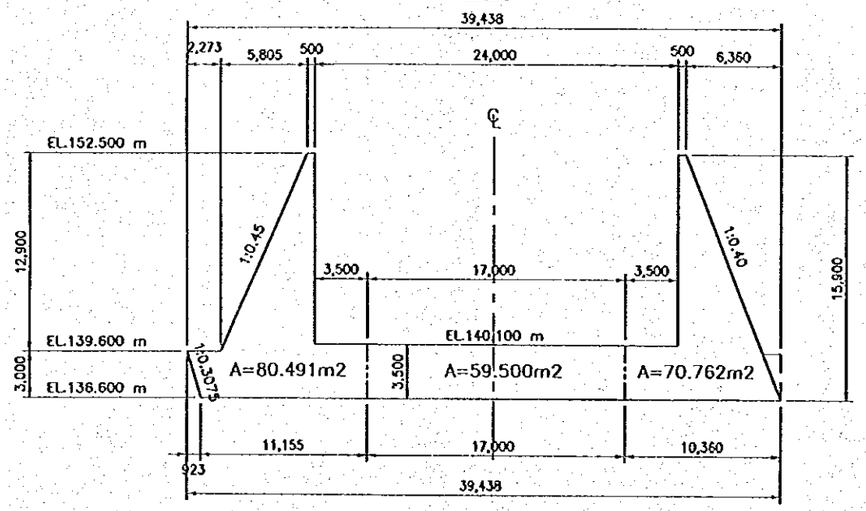


SCALE 0 10 20m

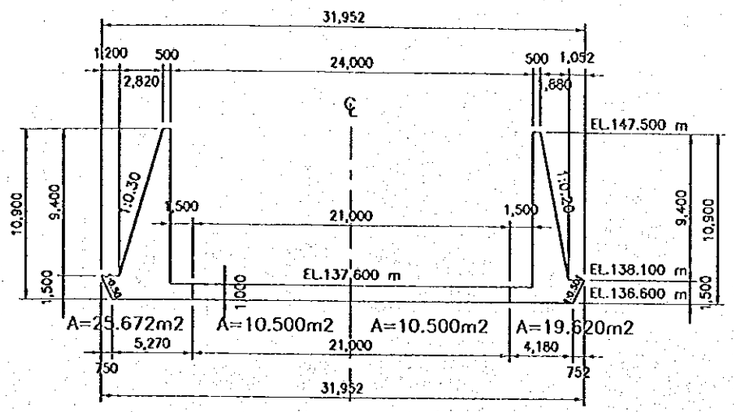
DETAIL OF CHUTE (JR4 – J15+3.000 m) (1/2)



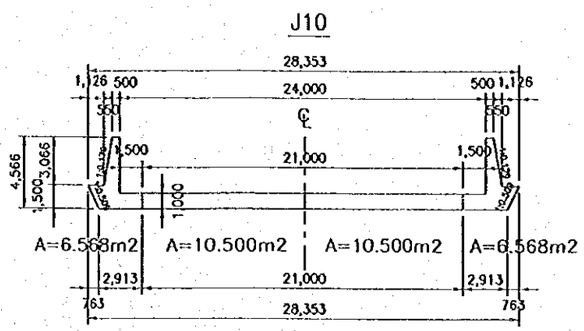
JR4



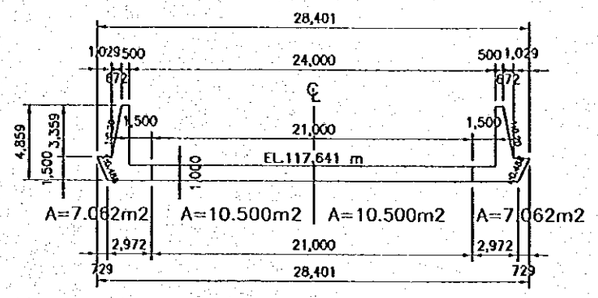
J5(2/2)



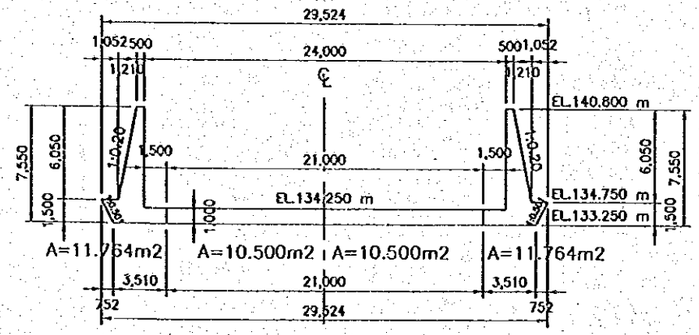
J10



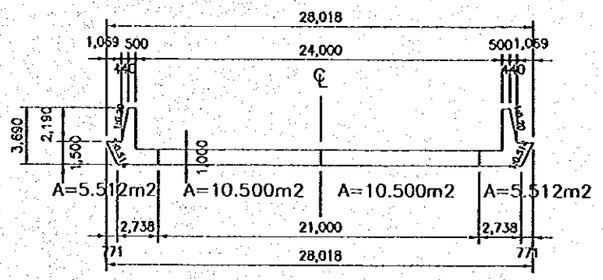
J10+5.000m



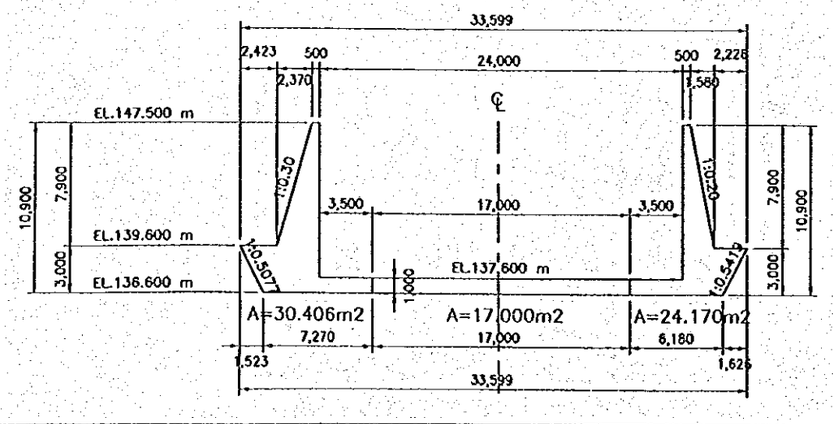
J6



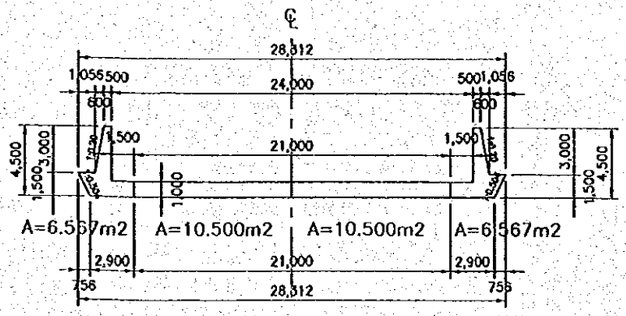
J11



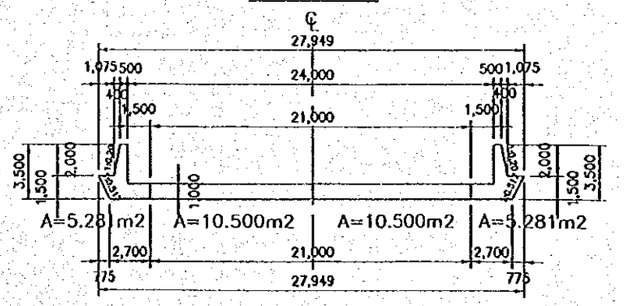
J5(1/2)



J7, J8, J9



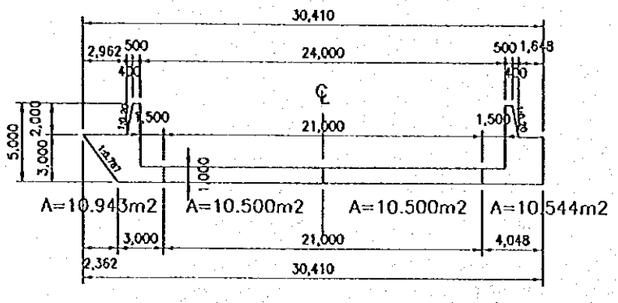
J12, J13



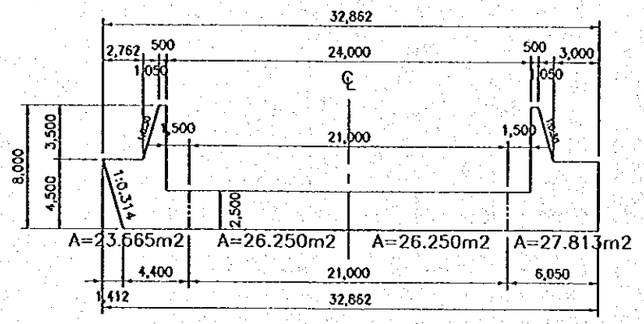
SCALE 0 10 20m

DETAIL OF CHUTE (JR4 – J15+3.000 m) (2/2)

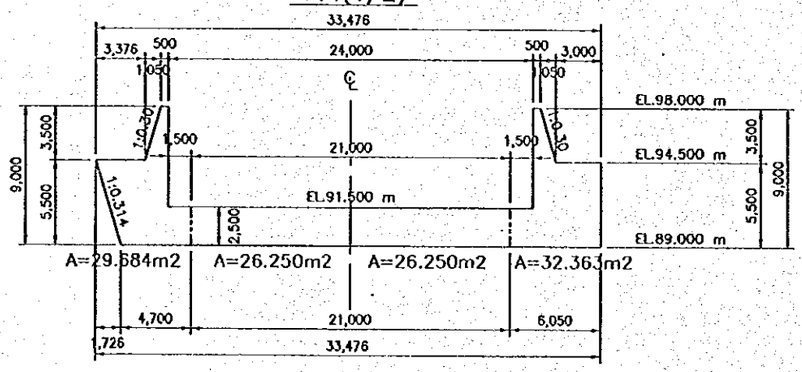
J13+10.000m



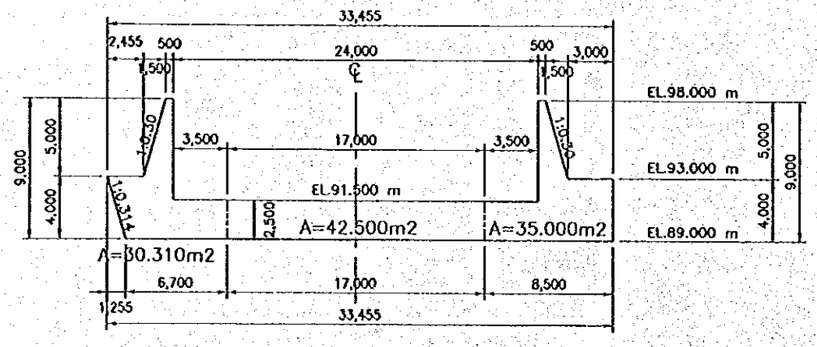
J13+13.000m



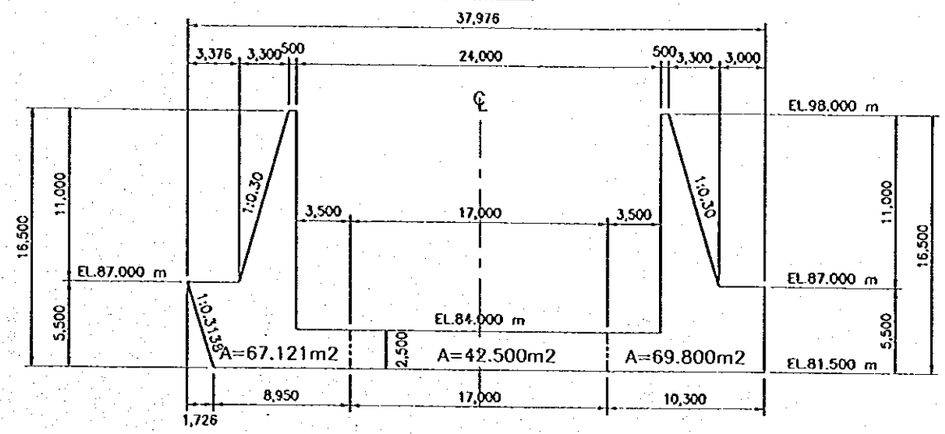
J14(1/2)



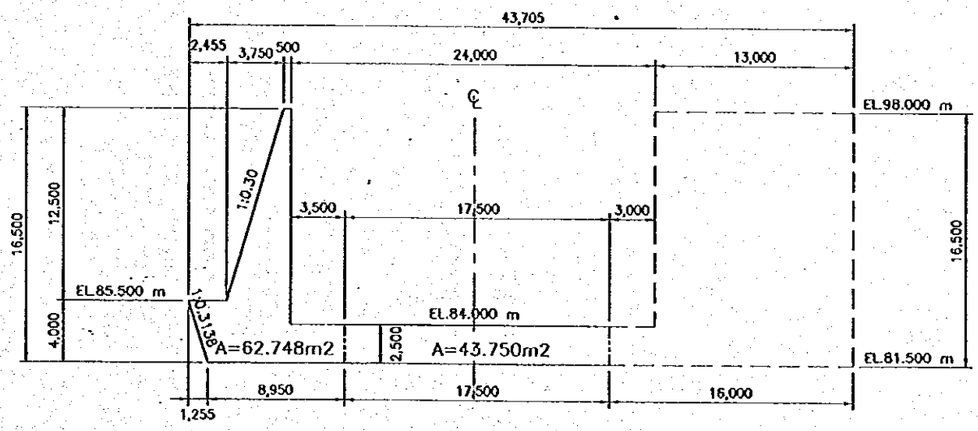
J14(2/2)



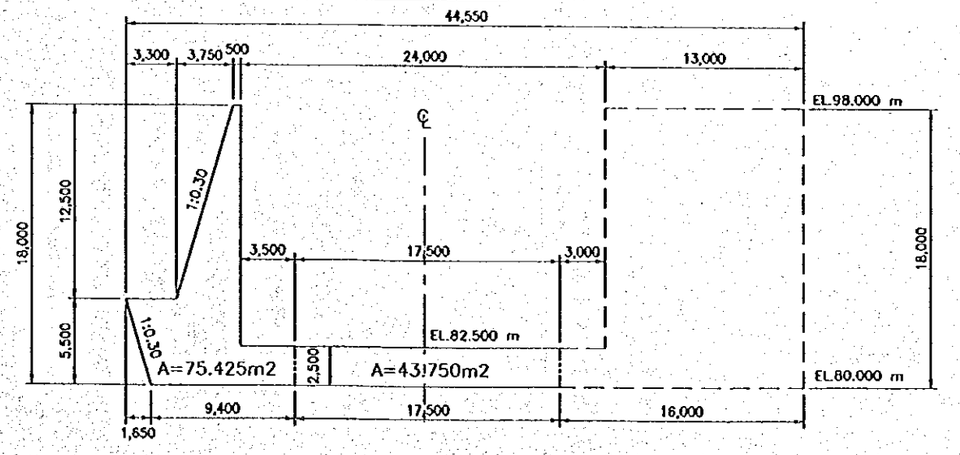
J15(1/2)



J15(2/2)

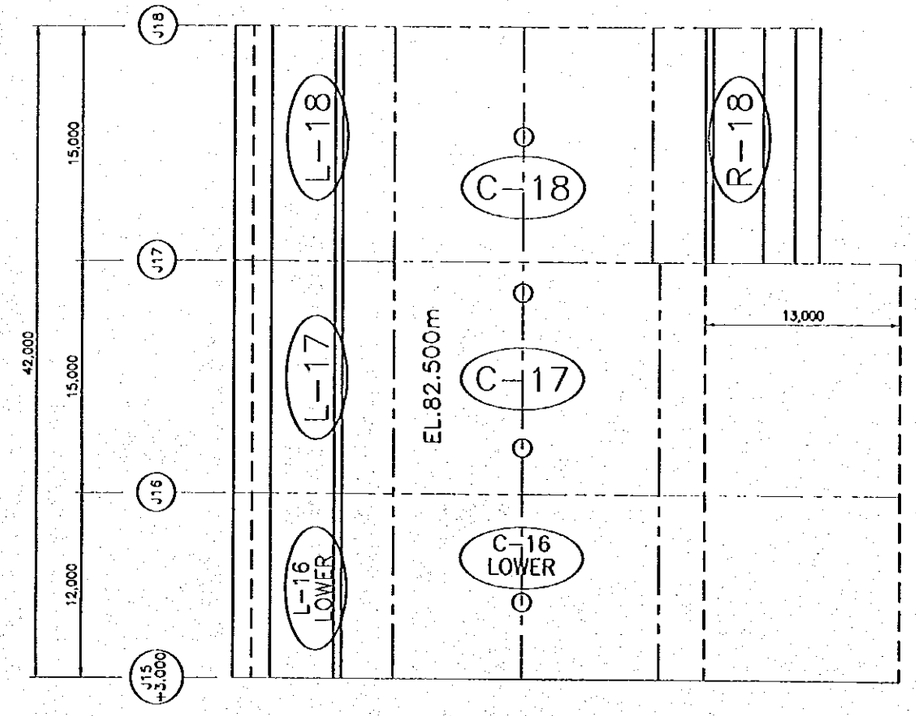


J15+3.000m

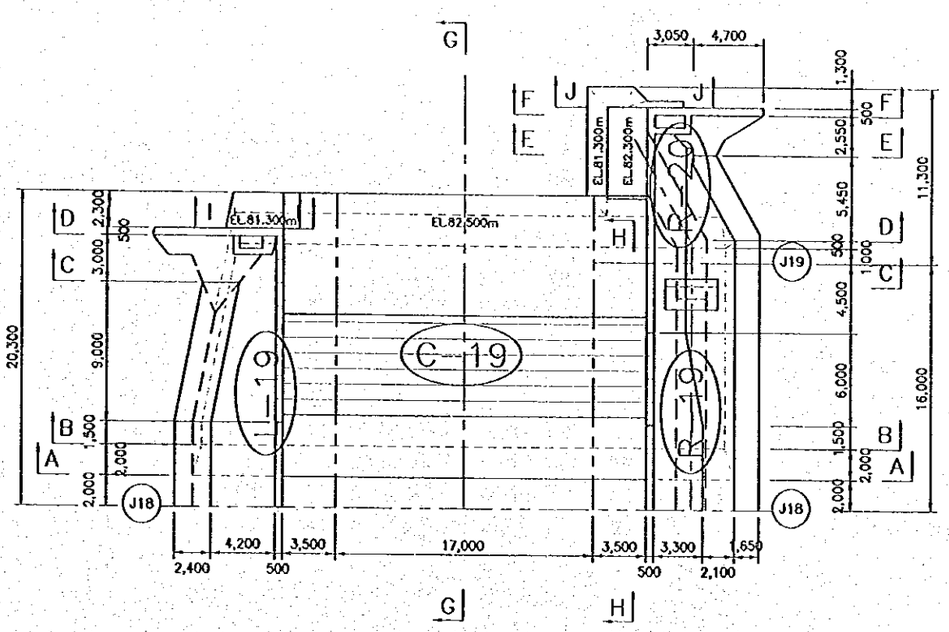


SCALE 0 10 20m

DETAIL OF STILLING BASIN (1/2)



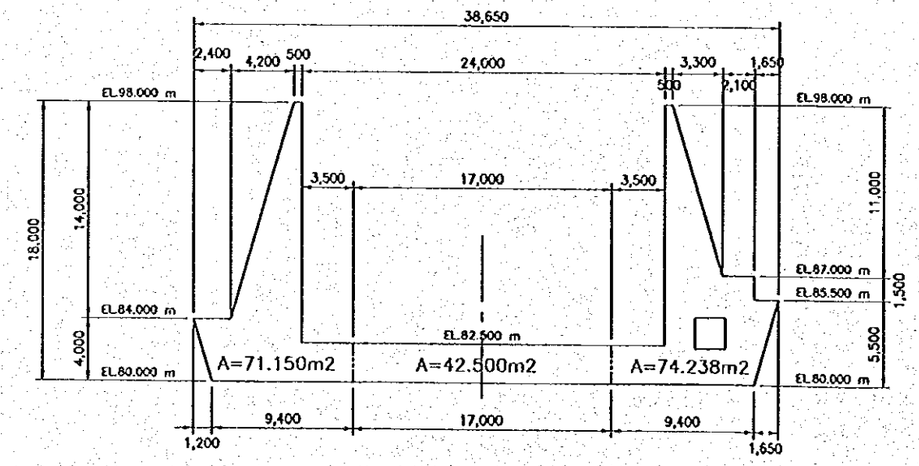
PLAN (J15+3.000m – J18)



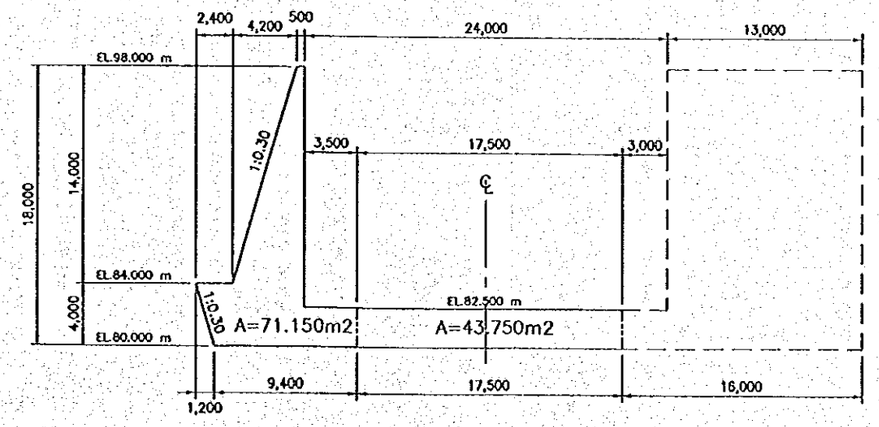
PLAN (BLOCK 19)

L-14

J18



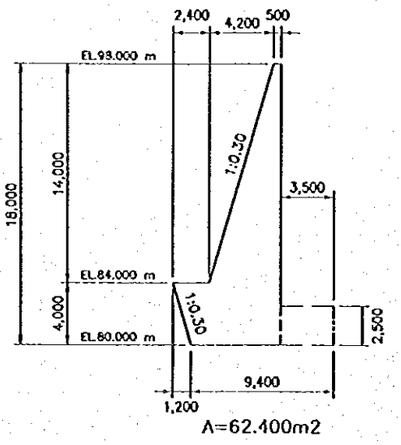
J15+3.000m, J16



SCALE 0 10 20m

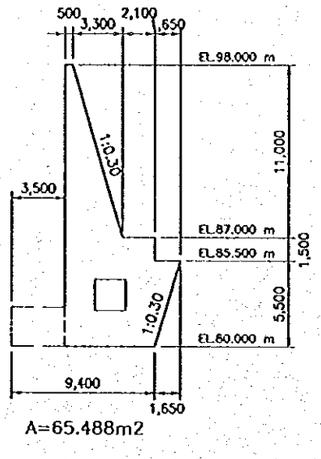
DETAIL OF STILLING BASIN (2/2)

A--A, J18(LEFT)



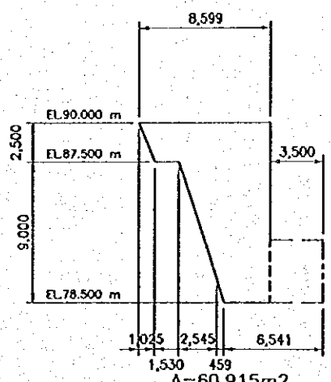
A=62.400m2

A--A, J18(RIGHT)



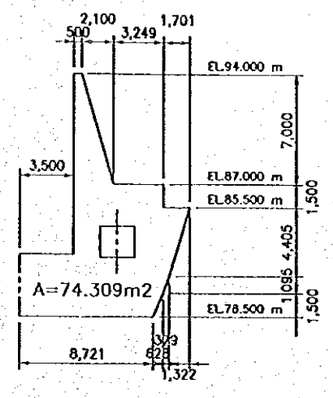
A=65.488m2

D--D(LEFT)

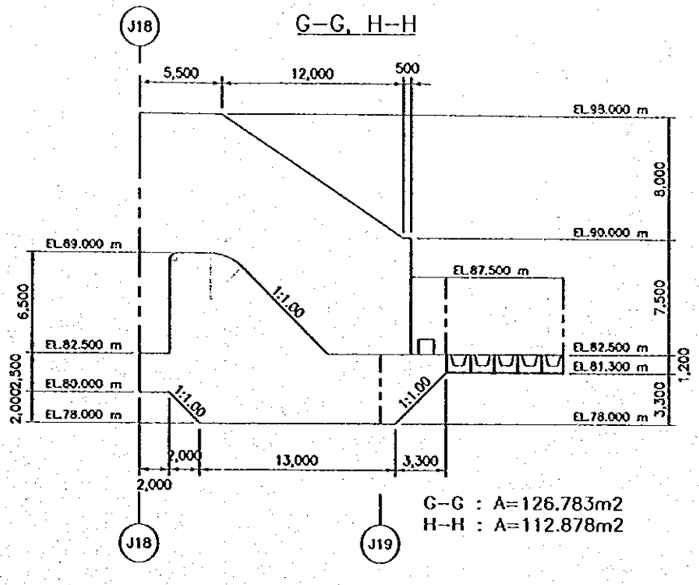


A=60.915m2

D--D(RIGHT)

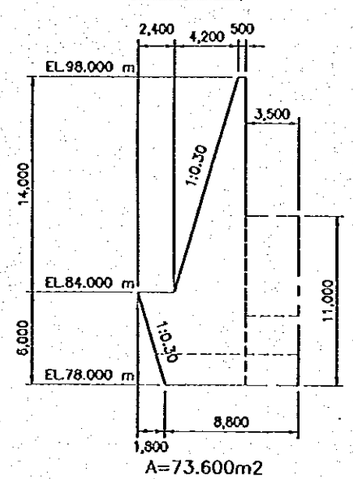


G--G, H--H



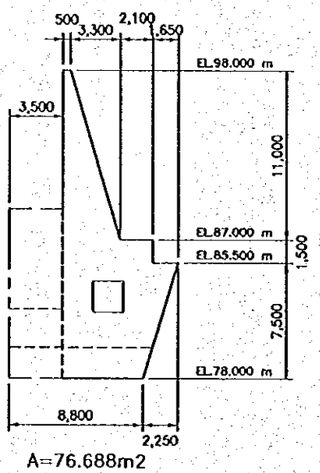
G-G : A=126.783m2
H-H : A=112.878m2

B--B(LEFT)



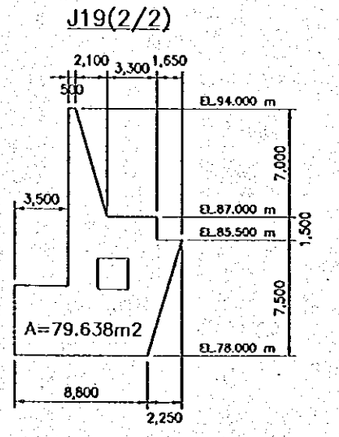
A=73.600m2

B--B(RIGHT)



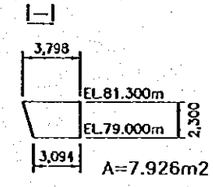
A=76.688m2

J19(2/2)



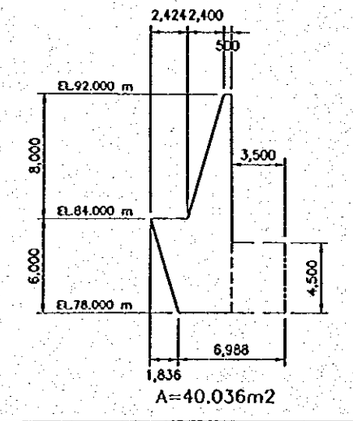
A=79.638m2

I--I



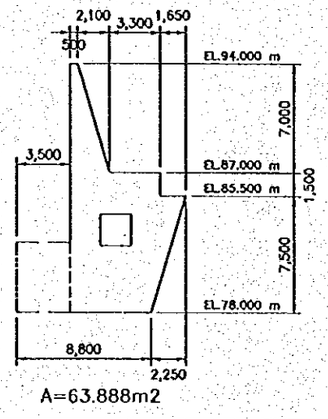
A=7.926m2

C--C(LEFT)



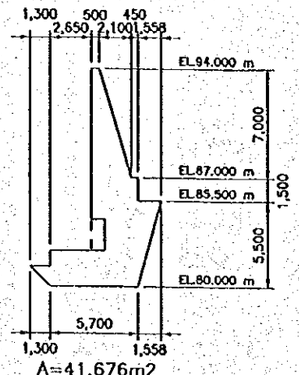
A=40.036m2

C--C(RIGHT), J19(1/2)



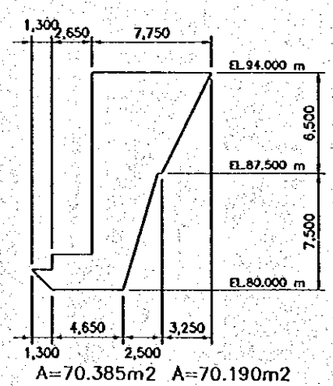
A=63.888m2

E--E(RIGHT)



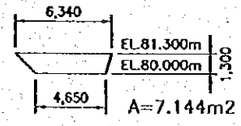
A=41.676m2

F--F(RIGHT)



A=70.385m2 A=70.190m2

J--J



A=7.144m2

SCALE 0 10 20m

2.4.5 Backfill Gravel of Spillway

Unit : (m^3)

		Left	Right	Total
Overflow Weir	Overflow Weir~J3,JR3	273.30	0.00	273.30
Control Portion	J3,JR3 ~ JR4,Block L-W	402.01	0.00	402.01
Chute	JR4 ~ J15+3.000	257.51	153.19	410.70
Stilling Basin	J15+3.000 ~ End	369.32	219.92	589.24
Grand Total		1,302.13	373.12	1,675.25
Grand Total x 1.05		1,370.00	390.00	1,760.00

(1) Overflow Weir (Overflow Weir~J3 and JR3)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)	Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)
J3	18.09	30.21	546.60	273.30					

(2) Control Portion (J3 and JR3 ~ JR4, and Block L-W)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)	Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)
J4-1(left)	17.98	34.96	628.72	314.36					
J4-2	16.34	6.00	98.03	49.02					
L-W	-	-	77.26	38.63					

(3) Chute (JR4 ~ J15+3.000)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)	Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)
JR4(left)	11.95								
		10.00	90.57	45.28					
J5(1/2)	6.16								
J5(2/2)	7.73								
		13.40	79.44	39.72					
J6	4.13								
		15.00	38.63	19.31					
J7	1.02				J7	1.02			
		50.00	60.15	30.08			50.00	60.15	30.08
J10+5.0	1.39				J10+5.0	1.39			
		47.00	56.54	28.27			47.00	56.54	28.27
J13+7.0	1.02				J13+7.0	1.02			
		26.00	189.70	94.85			26.00	189.70	94.85
J15+3.0	13.57				J15+3.0	13.57			

(4) Stilling Basin (J15+3.000 ~ End)

Left					Right				
Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)	Section	Length (m)	Distance (m)	Area (m^2)	Volume (m^3)
J15+3.0	13.57				J15+3.0	13.57			
		47.50	644.67	322.34			20.50	278.23	139.11
J18+5.5	13.57				J18+5.5	13.57			
		9.00	93.96	46.98			9.00	96.01	48.01
C-C	7.31				C-C	7.76			
							8.45	65.61	32.80
					E-E	7.76			

2.4.6 Water Stop

Grand Total of Water Stop :	1,800.87 (m)
Grand Total of Water Stop x 1.05	1,900.00 (m)

Along Cross Section

Unit : (m)

Section	Left	Right	Center
JCL,JCR	37.57	37.57	-
J1	47.54	47.54	-
J2	47.54	47.54	17.00
JR3	-	43.61	-
J3	33.75	-	17.00
Jw	15.90	-	-
J4-1	20.90	-	17.00
J4-2	19.40	-	17.00
JR4	-	15.90	-
J5	13.40	13.40	17.00
J6	8.05	8.05	21.00
J7	5.00	5.00	21.00
J8	5.00	5.00	21.00
J9	5.00	5.00	21.00
J10	5.00	5.00	21.00
J11	5.00	5.00	21.00
J12	4.00	4.00	21.00
J13	4.00	4.00	21.00
J14	10.00	10.00	17.00
J15	17.50	17.50	17.00
J16	19.00	19.00	17.00
J17	19.00	19.00	17.00
J18	19.00	19.00	17.00
J19	-	15.00	-
Total	361.56	346.11	338.00

Along Profile Section

Unit : (m)

Block	Left	Right	Center
C-1	-	-	-
C-2	13.35	13.35	-
C-3	15.00	15.00	-
C-4-1	15.00	15.00	-
C-4-2	16.47	8.73	-
C-5	17.37	17.37	-
C-6	13.81	13.81	13.81
C-7	15.46	15.46	15.46
C-8	15.46	15.46	15.46
C-9	15.46	15.46	15.46
C-10	15.48	15.48	15.48
C-11	15.95	15.95	15.95
C-12	16.69	16.69	16.69
C-13	16.77	16.77	16.77
C-14	16.77	16.77	16.77
C-15	16.77	16.77	-
C-16	15.35	15.35	-
C-17	15.00	15.00	-
C-18	15.00	15.00	-
C-19	29.39	29.39	-
Total	310.55	302.81	141.85

2.4.7 Others

Drainage Ditch

Total Length of Drainage Ditch Type 1-1 :	89.6m
Total Length of Drainage Ditch Type 1-1 x 1.05	94.0m

Type 1-1 (Depth = 500 mm)

Left Side		Right Side	
Location	Length (m)	Location	Length (m)
on EL.97.0m	53.5		
on EL.97.0m	22.2		
Slope of 1:1.5	13.9		
Total	89.6	Total	0.0

Total Length of Drainage Ditch Type 1-2 :	301.1m
Total Length of Drainage Ditch Type 1-2 x 1.05	316.0m

Type 1-2 (Depth = 250 mm)

Left Side		Right Side	
Location	Length (m)	Location	Length (m)
on EL.157.0m	8.1	Slope of 1:4.0	47.5
Slope of 1:2.0	55.3	Slope of 1:2.0	52.9
Slope of 1:4.0	54.5		
Slope of 1:2.0	53.4		
Total	171.3	Total	100.4

From Mountain Stream, Type 1-2 (Depth = 250 mm)

Left Side		Right Side	
Location	Length (m)	Location	Length (m)
Slope of 1:0.5	8.4		
on EL.104.5m	1.5		
Slope of 1:0.5	8.4		
on EL.112.0m	1.5		
Slope of 1:0.8	9.6		
Total	29.4	Total	0.0

Drainage Box

Total Volume of Drainage Box :	7.63 (m3)
Total Volume of Drainage Box :	8.00 (m3)

Drainage Box Type 1-1
2.1m x 2.1m x 0.75m - 1.5m x 1.5m x 0.6m
= 1.958 (m^3/1box)

3 Boxes : 1.958 x 3 = 5.87 (m^3)

Drainage Box Type 1-2
1.25m x 1.25m x 0.50m - 0.75m x 0.75m x 0.35m
= 0.584 (m^3/1box)

3 Boxes : 0.584 x 3 = 1.75 (m^3)

PVC Drain Pipe

(1) ϕ250 mm

Total Length of ϕ250mm :	850.3m

Behind Side Walls

Left Side		Right Side	
Location	Length (m)	Location	Length (m)
J4-1 ~ J5	45.1	J7+9.0 ~ J13+7.0	94.40
J5 ~ J13+7.0	133.0	Step EL.96.0m	3.50
Step EL.96.0m	3.5	Step Concrete	21.50
Step Concrete	28.6	Step ~ Type 1	9.92
on EL.84.25m	58.7	on EL.84.25m	41.90
Total	268.9	Total	171.2

Under the Chute (Type 1)

Left Side		Right Side	
Location	Length (m)	Location	Length (m)
J4-1 ~ J4-2	16.1	J4-1 ~ J4-2	9.20
J4-2 ~ J5	16.0	J4-2 ~ J5	16.0
J5 ~ J13	125.1	J5 ~ J13	125.1
J31 ~ EL.84.25m	27.7	J31 ~ EL.84.25m	27.7
on EL.84.25m	28.7	on EL.84.25m	18.6
Total	213.6	Total	196.6

(2) ϕ200 mm

Total Length of ϕ250mm :	260.5m

Under the Chute (type 2)

Location	Length (m)	Number	Total length (m)
C-5	20.5	1	20.5
C-6 ~ C-15	24.0	10	240.0
Total			260.5

Gravel Bedding for Drain Pipe

Total Volume of Gravel Bedding :	901.4 m3

Under the Chute (Type 1), ϕ250 mm

Type 1 (ϕ250 mm), Left Side

Location	Area (m2)	Length (m)	Number	Volume (m3)
J4-1 ~ J4-2	1.28	16.1	1	20.6
J4-2 ~ J5	1.28	16.0	1	20.4
J5 ~ J13	1.28	125.1	1	159.9
J31 ~ EL.84.25m	1.28	27.7	1	35.4
on EL.84.25m	1.41	28.7	1	40.5
Total		213.6		276.8

Type 1 (ϕ250 mm), Right Side

Location	Area (m2)	Length (m)	Number	Volume (m3)
J4-1 ~ J4-2	1.28	9.20	1	11.8
J4-2 ~ J5	1.28	16.0	1	20.4
J5 ~ J13	1.28	125.1	1	159.9
J31 ~ EL.84.25m	1.28	27.7	1	35.4
on EL.84.25m	1.41	18.6	1	26.2
Total		196.6		253.7

Under the Chute (type 2), ϕ200 mm

Location	Area (m2)	Length (m)	Number	Volume (m3)
C-5	1.36	20.5	1	27.8
C-6 ~ C-11	1.39	24.0	6	200.0
C-12 ~ C-15	1.49	24.0	4	143.0
Total		68.50		370.9

Excavation for Gravel Bedding for Drain Pipe

Total Volume of Excavation :	1,029.7 m3

Under the Chute (Type 1), ϕ250 mm

Type 1 (ϕ250 mm), Left Side

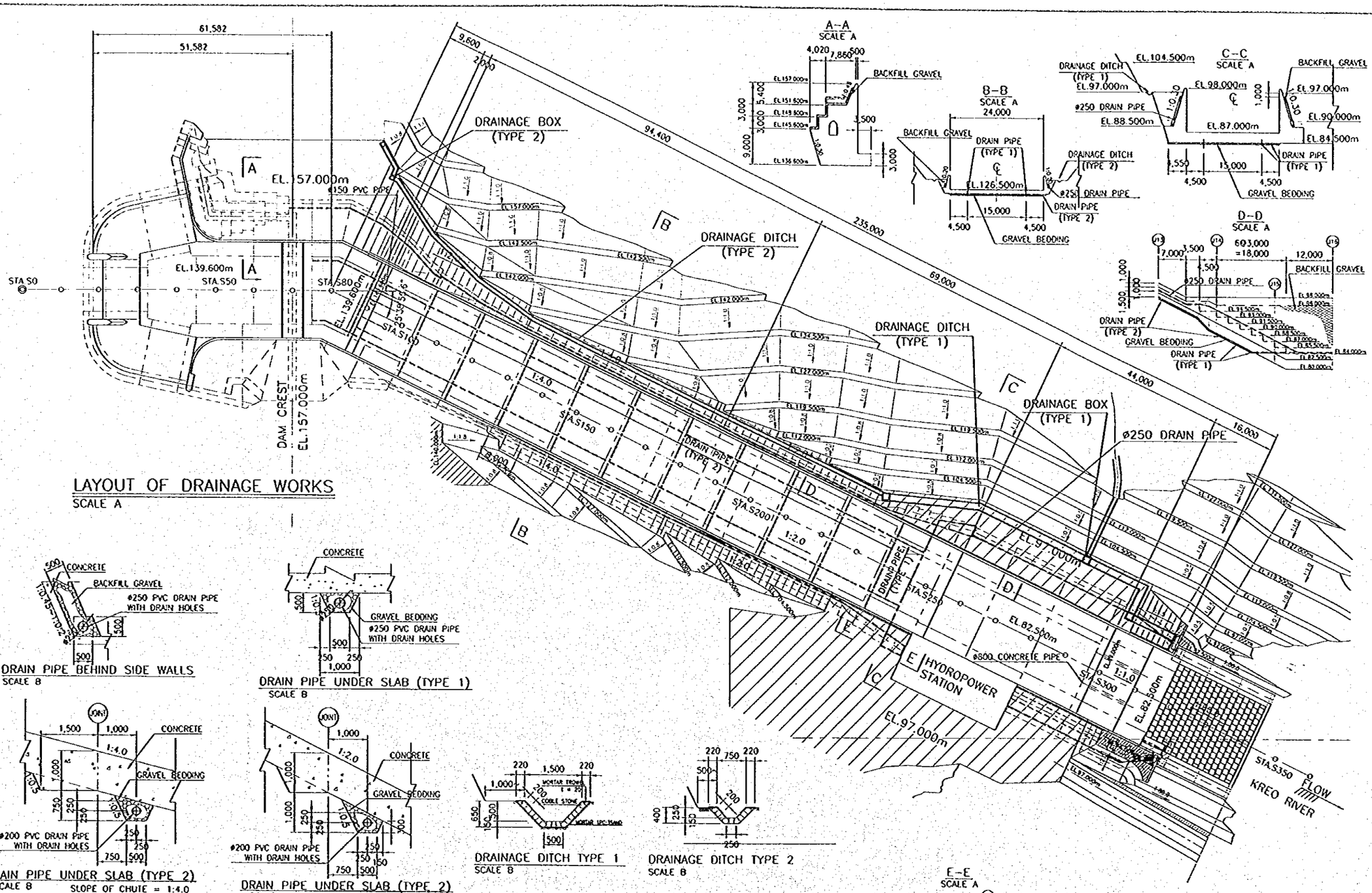
Location	Area (m2)	Length (m)	Number	Volume (m3)
J4-1 ~ J4-2	1.50	16.1	1	24.2
J4-2 ~ J5	1.50	16.0	1	24.0
J5 ~ J13	1.50	125.1	1	187.7
J31 ~ EL.84.25m	1.50	27.7	1	41.6
on EL.84.25m	1.63	28.7	1	46.9
Total		213.6		324.2

Type 1 (ϕ250 mm), Right Side

Location	Area (m2)	Length (m)	Number	Volume (m3)
J4-1 ~ J4-2	1.50	9.20	1	13.8
J4-2 ~ J5	1.50	16.0	1	24.0
J5 ~ J13	1.50	125.1	1	187.7
J31 ~ EL.84.25m	1.50	27.7	1	41.6
on EL.84.25m	1.63	18.6	1	30.4
Total		196.6		297.4

Under the Chute (type 2), ϕ200 mm

Location	Area (m2)	Length (m)	Number	Volume (m3)
C-5	1.50	20.5	1	30.8
C-6 ~ C-11	1.53	24.0	6	220.6
C-12 ~ C-15	1.63	24.0	4	156.8
Total		68.50		408.1



LAYOUT OF DRAINAGE WORKS
SCALE A

DRAIN PIPE BEHIND SIDE WALLS
SCALE B

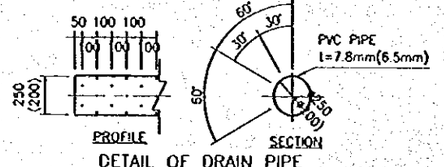
DRAIN PIPE UNDER SLAB (TYPE 1)
SCALE B

DRAIN PIPE UNDER SLAB (TYPE 2)
SCALE B SLOPE OF CHUTE = 1:4.0

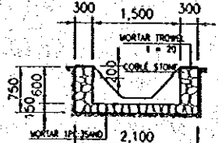
DRAIN PIPE UNDER SLAB (TYPE 2)
SCALE B SLOPE OF CHUTE = 1:2.0

DRAINAGE DITCH TYPE 1
SCALE B

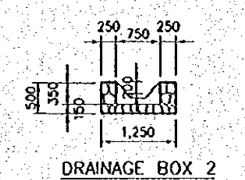
DRAINAGE DITCH TYPE 2
SCALE B



DETAIL OF DRAIN PIPE
SCALE C



DRAINAGE BOX 1
SCALE B



DRAINAGE BOX 2
SCALE B

DETAILS OF DRAINAGE WORKS

SCALE A 1:500 — 0 — 25 — 50m
SCALE B 1:50 — 0 — 2.5 — 5.0m
SCALE C 1:20 — 0 — 1.0 — 2.0m

Shotcrete

Grand Total of Shotcrete :	3,825.26 (m^2)

(1) Shotcrete on Excavation Slope

Left Side of Spillway

Slope of Excavation	1:0.5	
Elevation (EL.m)	Horizontal Area Ah (m^2)	Area of Slope (m^2)
		Ah x 2.2
172~164.5~172	-	-
157~164.5	-	-
149.5~157	-	-
142~149.5	-	-
134.5~142	-	-
127~134.5	-	-
119.5~127	-	-
112~119.5	-	-
104.5~112	538.0	1,202.9
97~104.5	444.0	992.7
92~97	66.9	149.7
87.5~92	47.8	106.9
Total		2,452.3

Right Side of Spillway

Slope of Excavation	1:0.5	
Elevation (EL.m)	Horizontal Area Ah (m^2)	Area of Slope (m^2)
		Ah x 2.2
172~164.5~172	-	-
157~164.5	-	-
149.5~157	-	-
142~149.5	-	-
134.5~142	-	-
127~134.5	-	-
119.5~127	-	-
112~119.5	-	-
104.5~112	-	-
97~104.5	-	-
95~97	59.7	133.5
87.5~95	85.9	192.1
Total		325.6

Left Upstream of Spillway

Slope of Excavation	1:0.8	
Elevation (EL.m)	Horizontal Area Ah (m2)	Area of Slope (m2)
		Ah x 1.6
145~157	270.8	433.4
Total		433.4

(2) Shotcrete on Berm

Left Side

Location	1:0.5 ~ 1:0.8	among 1:0.5
Elevation (EL.m)	Area of Berm (m2)	Area of Berm (m2)
172.0		
164.5	-	-
157.0	-	-
149.5	-	-
142.0	-	-
134.5	-	-
127.0	-	-
119.5	-	-
112.0	232.9	-
104.5	-	197.8
97.0	-	47.0
92.0	-	14.5
87.5	-	49.1
Total	232.9	308.4

Right Side

Location	among 1:0.5
Elevation (EL.m)	Area of Berm (m2)
172.0	
164.5	-
157.0	-
149.5	-
142.0	-
134.5	-
127.0	-
119.5	-
112.0	-
104.5	-
97.0	-
95.0	40.0
87.5	32.7
Total	72.8

Sodding

Grand Total of Sodding :	10,889.5 (m^2)

(1) Sodding on Excavation Slope (1/2)

Sub-Total :	7,173.9 (m^2)

Left Side of Spillway

Slope of Excavation	1:1.0		1:1.0		1:0.8	
Elevation (EL.m)	Horizontal Area Ah (m^2)	Area of Slope (m^2)	Horizontal Area Ah (m^2)	Area of Slope (m^2)	Horizontal Area Ah (m^2)	Area of Slope (m^2)
		Ah x 1.4		Ah x 1.4		Ah x 1.6
172~	-					
164.5~172	34.6	49.0	-	-	-	-
157~164.5	152.6	215.8	-	-	100.1	160.3
149.5~157	283.2	400.6	-	-	83.7	134.0
142~149.5	401.2	567.4	-	-	81.6	130.6
134.5~142	462.3	653.8	28.7	40.6	124.2	198.8
127~134.5	475.7	672.7	284.1	401.8	180.9	289.6
119.5~127	643.7	910.3	465.0	657.6	50.9	81.5
112~119.5	-	-	-	-	1,005.5	1,609.6
104.5~112	-	-	-	-	-	-
97~104.5	-	-	-	-	-	-
92~97	-	-	-	-	-	-
87.5~92	-	-	-	-	-	-
	Total	3,469.5	Total	1,100.0	Total	2,604.4

(2) Sodding on Excavation Slope (2/2)

Sub-Total :	780.5 (m^2)

Right Side of Spillway

Slope of Excavation	1:0.8		1:1.8	
Elevation (EL.m)	Horizontal Area Ah (m^2)	Area of Slope (m^2)	Horizontal Area Ah (m^2)	Area of Slope (m^2)
		Ah x 1.6		Ah x 1.1
172~				
164.5~172	-	-	-	-
157~164.5	-	-	-	-
149.5~157	-	-	-	-
142~149.5	-	-	-	-
134.5~142	89.2	142.8	61.4	70.2
127~134.5	157.9	252.8	-	-
119.5~127	106.0	169.7	-	-
112~119.5	49.7	79.5	-	-
104.5~112	28.9	46.3	-	-
97~104.5	12.1	19.3	-	-
95~97	-	-	-	-
87.5~95	-	-	-	-
	Total	710.3	Total	70.2

(3) Sodding on Berm

Sub-Total :	1,049.3 (m^2)

Left Side of Spillway

Location	1:0.8 ~	1:0.8 ~
Elevation (EL.m)	Area of Berm (m^2)	Area of Berm (m^2)
172.0	-	-
164.5	30.2	-
157.0	66.6	-
149.5	92.4	-
142.0	111.1	-
134.5	136.8	34.3
127.0	137.7	74.2
119.5	148.4	112.9
112.0	-	-
104.5	-	-
97.0	-	-
92.0	-	-
87.5	-	-
Total	723.1	221.4

Right Side of Spillway

Location	1:0.8 ~
Elevation (EL.m)	Area of Berm (m^2)
172.0	-
164.5	-
157.0	-
149.5	-
142.0	-
134.5	38.6
127.0	35.3
119.5	16.5
112.0	9.7
104.5	4.6
97.0	-
92.0	-
87.5	-
Total	104.7

(4) Sodding on Backfill Slope (1/2)

Sub-Total :	1,244.0 (m^2)

Left Side of Spillway

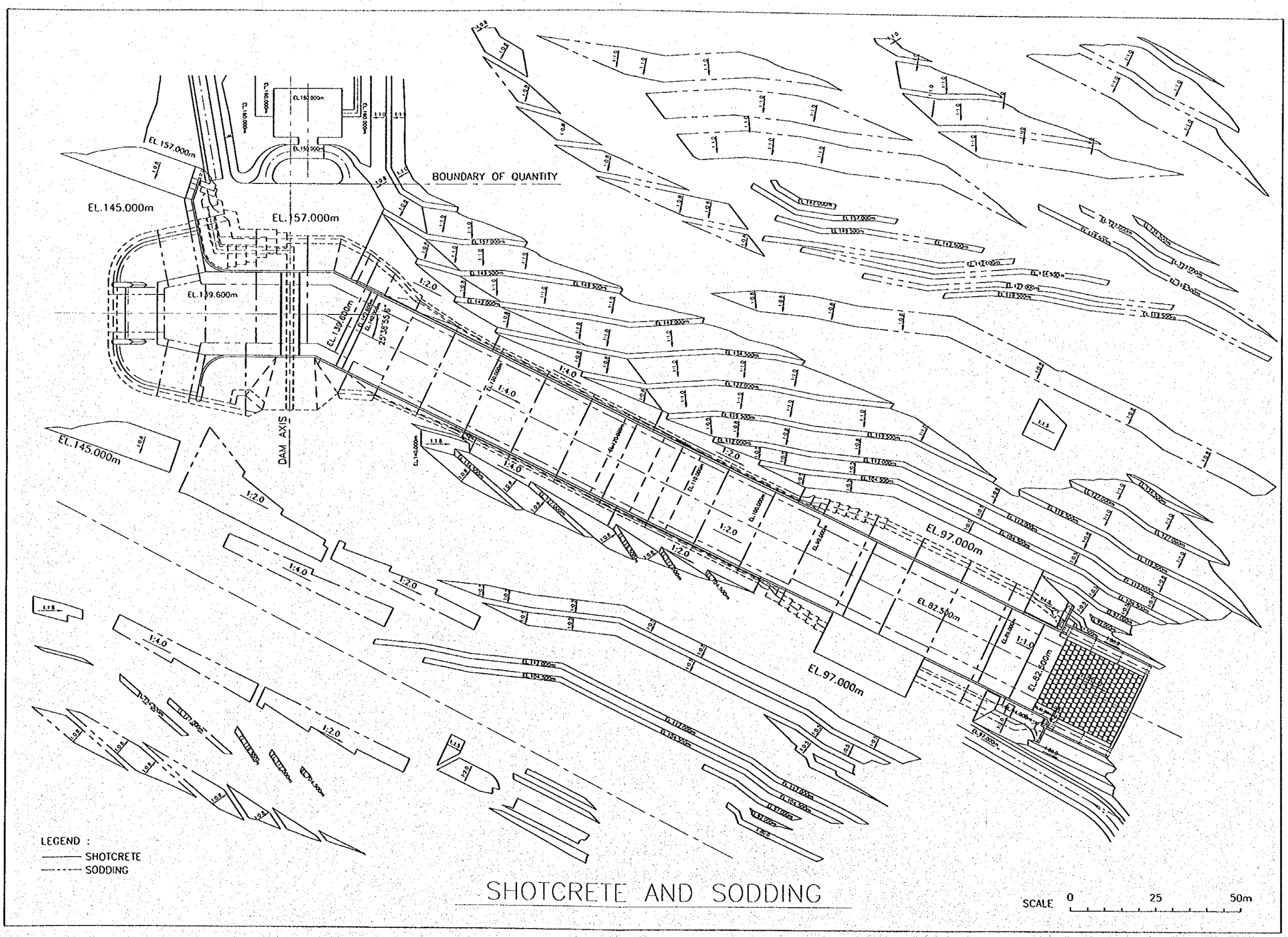
Slope of Backfill					
1:2.0		1:4.0		1:1.5	
Horizontal Area Ah (m^2)	Area of Slope (m^2)	Horizontal Area Ah (m^2)	Area of Slope (m^2)	Horizontal Area Ah (m^2)	Area of Slope (m^2)
	Ah x 1.1		Ah x 1.0		Ah x 1.2
520.7	582.2	271.7	280.0	104.5	125.5
229.2	256.2				
Total	838.4	Total	280.0	Total	125.5

(5) Sodding on Backfill Slope (2/2)

Sub-Total :	641.7 (m^2)

Right Side of Spillway

Slope of Backfill					
1:2.0		1:4.0		1:1.5	
Horizontal Area Ah (m^2)	Area of Slope (m^2)	Horizontal Area Ah (m^2)	Area of Slope (m^2)	Horizontal Area Ah (m^2)	Area of Slope (m^2)
	Ah x 1.1		Ah x 1.0		Ah x 1.2
230.6	257.8	237.4	244.7	31.3	37.6
90.9	101.6				
Total	359.4	Total	244.7	Total	37.6



SHOTCRETE AND SODDING

2.5 Diversion Tunnel

1. SUMMARY

DESCRIPTION		UNIT	UPPER	UNDER	TOTAL	LEGEND
EXCAVATION	EXCAVATION	m^3	8,421.4	8,859.4	17,280.8	
	OVERBREAK	m^3	639.8	321.9	961.7	13cm
	TOTAL	m^3	9,061.2	9,181.3	18,242.5	
STEEL RIB SUPPORT	H-125	kg	110,802.1	58,253.3	169,055.4	
	PLATE(t=9)	kg	1,856.7	1,738.4	3,595.1	
	PLATE(t=16)	kg	-	5,860.0	5,860.0	
	BOLT NUT	kg	2,646	-	2,646	
	COLLAR BRACE	kg	4,498.4	1,499.5	5,997.9	Φ16
	Total	kg	119,803.2	67,351.2	187,154.3	
	Total x 1.05	kg	125,800.0	70,700.0	196,500.0	
	STEEL PIPE		5,292	1,764	7,056	Φ21.7x1.9×80
WIRE NET		m^2	2,646.9	2,469.4	5,116.3	Φ5x150x150 (2.13 kg/m2)
		(kg)			10,897.7	
				x 1.05	11,400.0	
CURTAIN GROUT			-	-	18	L=10.00m
CONSOLIDATION GROUT			-	-	56	L=5.00m
ROCK BOLT	D25 L=3.0m		-	-	4,823	TYPICAL
	D25 L=4.0m		-	-	520	INLET, OUTLET
	TOTAL	m			16,550	
	TOTAL x 1.05	m			17,400	
SHOTCRETE	OVERBREAKAGE	m^3	248.2	123.0	371.2	5cm
	PRIMARY	m^3	245.1	123.0	368.1	5cm
	SECONDARY	m^3	766.7	246.9	1013.5	10cm
	TOTAL	m^3	1,260.0	492.8	1,752.8	
	OVERBREAKAGE	m^2	5,002.1	2,465.0	7,467.1	
	PRIMARY	m^2	4,522.0	2,466.0	6,987.9	
	SECONDARY	m^2	4,863.9	2,467.7	7,331.7	
	TOTAL	m^2	14,388.0	7,398.7	21,786.7	
CONCRETE	CONCRETE	m^3	3,033.4	2,872.7	5,906.1	
	OVERBREAKAGE	m^3	394.9	195.0	589.9	8cm
	TOTAL	m^3	3,428.3	3,067.8	6,496.0	
	TOTAL x 1.05	m^3	3,600.0	3,200.0	6,800.0	
FORM		m^2	402.4	357.0	759.4	JOINT, OUTLET
WATER STOP SEAL		m	440.7	473.3	914.0	
	x 1.05	m			960.0	
REINFORCING	D13	kg	-	-	270,296.1	
	D22	kg	-	-	4,124.2	
	TOTAL	kg	-	-	274,420.3	
	TOTAL x 1.06	kg	-	-	291,000.0	
PLUG	PLUG CONCRETE	m^3	-	-	903.7	
	FORM	m^2	-	-	257.8	
	MAIN SEAL COPPER	m	-	-	18.3	
	HEADER PIPE	m	-	-	60.0	Φ40mm (1.50 kg/m)
	AIR OUTLET PIPE	m	-	-	30.0	Φ40mm
	RIZER PIPE	m	-	-	113.3	Φ25mm (0.94 kg/m)
	COOLING PIPE	m	-	-	205.0	Φ25mm
	TOTAL	kg			434.2	
	x 1.05	kg			460.0	
	DRAIN PIPE	m	-	-	30.0	Φ150mm
	JOINT GROUT OUTLET		-	-	66	

SUMMARY (Upstream Portal and Temporary Cofferdam)

DESCRIPTION			UNIT	TOTAL	LEGEND
Upstream Portal	Excavation	Total	m^3	5,301.9	
		x 1.1	m^3	5,800.0	
	Concrete Type D	Total	m^3	1,761.0	
		x 1.05	m^3	1,850.0	
	Concrete Type C	Total	m^3	9.8	
		x 1.05	m^3	10.0	
	Reinforcing Bar	Total	kg	30.6	
		x 1.06	kg	32.0	
Temporary Cofferdam	Excavation	Total	m^3	1,800.0	
		x 1.1	m^3	2,000.0	
	Embankment	Total	m^3	21,335.9	
		x 1.1	m^3	23,500.0	

2. EXCAVATION

2-1. EXCAVATION(TYPICAL SECTION)

1) UPPER

v1	= 18.696×411.2247	= 7,688.674 m^3
v2(OVERBREAK)	= 1.436×411.247	= 590.551 m^3

2) UNDER

v1	= 19.674×411.247	= 8,090.873 m^3
v2(OVERBREAK)	= 0.720×411.247	= 296.098 m^3

2-2. EXCAVATION(PLUG SECTION)

1) UPPER

v1	= 24.508×29.016+1/2(18.696+24.508)x1.000	= 732.726 m^3
v2(OVERBREAK)	= 1.640×30.017	= 49.228 m^3

2) UNDER

v1	= 25.704×29.016+1/2(19.674+25.704)x1.000	= 768.516 m^3
v2(OVERBREAK)	= 0.859×30.017	= 25.785 m^3

2-3. EXCAVATION(TOTAL)

UPPER ΣV = v1+v1	= 7,688.67 + 732.73	= 8,421.400 m^3
UNDER ΣV = v1+v1	= 8,090.87 + 768.52	= 8,859.389 m^3
OVERBREAK UPPER ΣV = v2+v2	= 590.55 + 49.23	= 639.779 m^3
OVERBREAK UNDER ΣV = v2+v2	= 296.10 + 25.79	= 321.883 m^3

3. STEEL RIB SUPPORT

3-1. STEEL RIB SUPPORT(TYPICAL SECTION)

1) UPPER

ITEM	LENGTH	QUANTITIY	WHEIGHT/UNIT	WHEIGHT/m	EXTENSION	TOTAL WEIGHT
H-125x125x6.5x9 (kg)	5.225	2	23.8	248.710	411	102219.810
PL-155×180×9 (kg)	-	4	1.971	7.884	411	3240.324
BOLT NUT Φ25	0.070	6	-	-	411	2466
COLLAR BRACE Φ16(kg)	1.076	6	1.58	10.200	411	4192.397
STEEL PIPE Φ21.7×1.9	0.080	12	-	-	411	4932
WIRE NET(m^2)	10.681	1	-	10.681m^2	411.247	4392.326

2) UNDER

ITEM	LENGTH	QUANTITIY	WHEIGHT/UNIT	WHEIGHT/m	EXTENSION	TOTAL WEIGHT
H-125x125x6.5x9	2.748	2	23.8	130.805	411	53760.773
PL-155×180×9	-	2	1.971	3.942	411	1620.162
PL-230×230×16	-	2	6.644	13.288	411	5461.368
COLLAR BRACE Φ16	1.076	2	1.58	3.400	411	1397.466
STEEL PIPE Φ21.7×1.9	0.080	4	-	-	411	1644
WIRE NET(m^2)	2.771	2	-	5.542m^2	411.247	2279.026

3-2. STEEL RIB SUPPORT(PLUG SECTION)

1) UPPER

ITEM	LENGTH	QUANTITIY	WHEIGHT/UNIT	WHEIGHT/m	EXTENSION	TOTAL WEIGHT
H-125x125x6.5x9(kg)	6.010	2	23.8	286.076	30	8582.280
PL-155×180×9(kg)	-	4	1.971	7.884	30	236.520
BOLT NUT	0.07	6	-	-	30	180
COLLAR BRACE Φ16(kg)	1.076	6	1.58	10.200	30	306.014
STEEL PIPE Φ21.7×1.9	0.080	12	-	-	30	360
WIRE NET(m^2)	12.252	1	-	12.252m^2	30.017	367.768

2) UNDER

ITEM	LENGTH	QUANTITIY	WHEIGHT/UNIT	WHEIGHT/m	EXTENSION	TOTAL WEIGHT
H-125x125x6.5x9(kg)	3.146	2	23.8	149.750	30	4492.488
PL-155×180×9(kg)	-	2	1.971	3.942	30	118.260
PL-230×230×16	-	2	6.644	13.288	30	398.640
COLLAR BRACE Φ16(kg)	1.076	2	1.58	3.400	30	102.005
STEEL PIPE Φ21.7×1.9	0.080	4	-	-	30	120
WIRE NET(m^2)	3.169	2	-	6.338m^2	30.017	190.248

3-3. STEEL RIB SUPPORT(TOTAL)

1) UPPER

ITEM	TYPICAL SECTION	PLUG SECTION	TOTAL WEIGHT
H-125x125x6.5x9(kg)	102219.810	8582.280	110802.090
PL-155×180×9(kg)	1620.162	236.520	1856.682
BOLT NUT	2466	180	2646
COLLAR BRACE Φ16(kg)	4192.397	306.014	4498.412
STEEL PIPE Φ21.7×1.9	4932	360	5292
WIRE NET(m^2)	2279.131	367.768	2646.899

2) UNDER

ITEM	TYPICAL SECTION	PLUG SECTION	TOTAL WEIGHT
H-125x125x6.5x9(kg)	53760.773	4492.488	58253.261
PL-155×180×9(kg)	1620.162	118.260	1738.422
PL-230×230×16(kg)	5461.368	398.640	5860.008
COLLAR BRACE Φ16(kg)	1397.466	102.005	1499.471
STEEL PIPE Φ21.7×1.9	1644	120	1764
WIRE NET(m^2)	2279.131	190.248	2469.379

4. GROUTING

4-1. CURTAIN GROUT

L=10.00m n = 18

4-2. CONSOLIDATION GROUT

L=5.00m n=8×7 = 56

5. ROCK BOLT

5-1. TYPICAL SECTION

L=3.0m, n=13 n=13×371.208/1.000 =13×371 = 4,823

5-2. INLET, OUTLET SECTION

L=4.0m, n=13 n=13×40.022/1.000 =13×40 = 520

6. SHOTCRETE

6-1. SHOTCRETE(TYPICAL SECTION)

1) UPPER

v1(OVERBREKAGE)	= 0.558×411.247	=	229.476 m^3
v2(PRIMARY)	= 0.551×411.247	=	226.597 m^3
v3(SECONDARY)	= 1.776×411.247	=	730.375 m^3
a1(OVERBREKAGE)	= 11.246×411.247	=	4,624.884 m^2
a2(PRIMARY)	= 11.090×411.247	=	4,149.482 m^2
a3(SECONDARY)	= 10.933×411.247	=	4,496.163 m^2

2) UNDER

v1(OVERBREKAGE)	= 0.276×411.247	=	113.504 m^3
v2(PRIMARY)	= 0.276×411.247	=	113.504 m^3
v3(SECONDARY)	= 0.554×411.247	=	227.831 m^3
a1(OVERBREKAGE)	= 5.532×411.247	=	2,275.018 m^2
a2(PRIMARY)	= 5.534×411.247	=	2,275.841 m^2
a3(SECONDARY)	= 5.538×411.247	=	2,277.486 m^2

6-2. SHOTCRETE(PLUG SECTION)

1) UPPER

v1(OVERBREKAGE)	= 0.624×30.017	=	18.720 m^3
v2(PRIMARY)	= 0.617×30.017	=	18.510 m^3
v3(SECONDARY)	= 1.210×30.017	=	36.300 m^3
a1(OVERBREKAGE)	= 12.566×30.017	=	377.194 m^2
a2(PRIMARY)	= 12.409×30.017	=	372.481 m^2
a3(SECONDARY)	= 12.252×30.017	=	367.768 m^2

2) UNDER

v1(OVERBREKAGE)	= 0.316×30.017	=	9.485 m^3
v2(PRIMARY)	= 0.316×30.017	=	9.485 m^3
v3(SECONDARY)	= 0.634×30.017	=	19.031 m^3
a1(OVERBREKAGE)	= 6.330×30.017	=	190.008 m^2
a2(PRIMARY)	= 6.334×30.017	=	190.128 m^2
a3(SECONDARY)	= 6.338×30.017	=	190.248 m^2

6-3. SHOTCRETE(TOTAL)

OVERBREAKAGE UPPER	ΣV = v1+v1 = 229.476 + 18.72	=	248.196 m^3
PRIMARY UPPER	ΣV = v2+v2 = 226.60 + 18.510	=	245.107 m^3
SECONDARY UPPER	ΣV = v3+v3 = 730.375 + 36.300	=	766.675 m^3
OVERBREAKAGE UNDER	ΣV = v1+v1 = 113.504 + 9.485	=	122.989 m^3
PRIMARY UNDER	ΣV = v2+v2 = 113.504 + 9.485	=	122.989 m^3
SECONDARY UNDER	ΣV = v3+v3 = 227.831 + 19.031	=	246.862 m^3
OVERBREAKAGE UPPER	ΣA = a1+a1 = 4,624.884 + 377.194	=	5,002.078 m^2
PRIMARY UPPER	ΣA = a1+a1 = 4,149.482 + 372.481	=	4,521.963 m^2
SECONDARY UPPER	ΣA = a1+a1 = 4,496.163 + 367.768	=	4,863.931 m^2
OVERBREAKAGE UNDER	ΣA = a1+a1 = 2,275.018 + 190.008	=	2,465.026 m^2
PRIMARY UNDER	ΣA = a1+a1 = 2,275.841 + 190.128	=	2,465.969 m^2
SECONDARY UNDER	ΣA = a1+a1 = 2,277.486 + 190.248	=	2,467.734 m^2

7. CONCRETE

7-1. CONCRETE(TYPICAL SECTION)

1) UPPER

v1	= 6.381×411.247	=	2,624.167 m^3
v2(OVERBREAK)	= 0.877×411.247	=	364.776 m^3

2) UNDER

v1	= 5.981×411.247	=	2,459.668 m^3
v2(OVERBREAK)	= 0.442×411.247	=	181.771 m^3

7-2. CONCRETE(PLUG SECTION)

1) UPPER

v1	= 12.193×29.016+1/2(6.381+12.193)x1.000	=	363.079 m^3
v2(OVERBREAK)	= 1.003×30.017	=	30.107 m^3

2) UNDER

v1	= 12.048×29.016+1/2(5.981+12.048)x1.000	=	358.599 m^3
v2(OVERBREAK)	= 0.442×30.017	=	13.268 m^3

7-3. CONCRETE(OUTLET PRPJECTION)

UPPER v1	= 7.687×6.00	=	46.122 m^3
UNDER v2	= 9.007×6.00	=	54.462 m^3

7-4. CONCRETE(TOTAL)

UPPER ΣV = v1+v1+v1	= 2,624.167 + 363.079+46.122	=	3,033.368 m^3
UNDER ΣV = v1+v1+v2	= 2,459.668 + 358.599+54.462	=	2,872.729 m^3
OVERBREAK UPPER ΣV = v2+v2	= 364.776 + 30.107	=	394.883 m^3
OVERBREAK UNDER ΣV = v2+v2	= 181.771 + 13.268	=	195.039 m^3

8. FORM

8-1. FORM(JOINT)

1) TYPICAL SECTION

UPPER A1	= 6.381×411.247/9.000	=6.381×46	=	293.526 m^2
UNDER A2	= 5.981×411.247/9.000	=5.981×46	=	275.126 m^2

2) PRUG SECTION

UPPER A1	= 12.193×2	=	24.386 m^2
UNDER A2	= 12.048×2	=	24.096 m^2

3) OUTLET PROJECTION

UPPER A1	= 11.516×6.000+7.687×2	=	84.470 m^2
UNDER A2	= 6.600×6.000+9.077×2	=	57.754 m^2

2) FORM(TOTAL)

UPPER A1	= 293.526 + 24.386 + 84.470	=	402.382 m^2
UNDER A2	= 275.126 + 24.096 + 57.754	=	356.976 m^2

9. WATER STOP SEAL

UPPER L1	= 9.581×441.247/9.000	=9.581×46	=	440.726 m
UNDER L2	= 10.289×441.247/9.000	=10.289×46	=	473.294 m

10. REINFORCING

10-1. TYPE (A)

(kg/m)

NO.	DIA	LENGTH (mm)	WEIGHT (kg/m)	WEIGHT (kg)	N	WEIGHT (kg)	LEGEND
1	D 13	4,910	0.995	4.885	3.33	16.28	
2	D 13	2,450	0.995	2.438	6.67	16.25	
3	D 13	9,110	0.995	9.064	3.33	30.21	
4	D 13	5,390	0.995	5.363	3.33	17.88	
5	D 13	2,690	0.995	2.677	3.33	8.92	
6	D 13	10,050	0.995	10.000	3.33	33.33	
7	D 13	1,000	0.995	0.995	88	87.56	
8	D 13	500	0.995	0.498	58	28.88	
					D13	239.31	
				TOTAL		239.31 kg	

10-2. TYPE (B)

(kg/m)

NO	DIA	LENGTH (mm)	WEIGHT (kg/m)	WEIGHT (kg)	N	WEIGHT (kg)	LEGEND
1	D 13	4,910	0.995	4.885	5.00	24.43	
2	D 13	2,450	0.995	2.438	10.00	24.38	
3	D 13	1,000	0.995	0.995	51	50.75	
					D13	99.56	
				TOTAL		99.56 kg	

10-3. TYPE (C)

(kg/m)

NO	DIA	LENGTH (mm)	WEIGHT (kg/m)	WEIGHT (kg)	N	WEIGHT (kg)	LEGEND
1	D 13	4,910	0.995	4.885	5.00	24.43	
2	D 13	2,450	0.995	2.438	10.00	24.38	
3	D 13	9,110	0.995	9.064	5.00	45.32	
4	D 13	1,000	0.995	0.995	96	95.52	
					D13	189.65	
				TOTAL		189.65 kg	

10-4. TYPE (D)

(kg/m)

NO	DIA	LENGTH (mm)	WEIGHT (kg/m)	WEIGHT (kg)	N	WEIGHT (kg)	LEGEND
1	D 22	4,910	3.04	14.926	3.33	49.75	
2	D 22	2,450	3.04	7.448	6.67	49.65	
3	D 22	9,110	3.04	27.694	3.33	92.31	
4	D 22	1,000	3.04	3.040	82	249.28	
5	D 22	6,700	3.04	20.368	3.33	67.89	
6	D 22	4,660	3.04	14.166	6.67	94.44	
7	D 22	2,670	3.04	8.117	6.67	54.11	
8	D 22	2,920	3.04	8.877	3.33	29.59	
					D22	687.02	
				TOTAL		687.02 kg	

10-5. TOTAL

TYPE(A)	=239.31x40.022	D13	9,577.66	
TYPE(B)	=83.82x371.206	D13	255,025.95	
TYPE(C)	=158.26x30.016	D13	5,692.53	
TYPE(D)	=595.82x6.003	D22	4,124.18	
	TOTAL	D13	270,296.15	kg
		D22	4,124.18	kg
		TOTAL	274,420.33	kg

11. PLUG

11-1. CONNRETE

MAIN PLUG	v1	=	21.437×30.017	=	643.474 m^3
TEMPORARY PLUG	v2	=	26.008×10.006	=	260.236 m^3
	ΣV	=	v1+v2 = 643.474 + 260.236	=	903.71 m^3

11-2. FORM

MAIN PLUG	a1	=	6.142×30.017+21.437×2	=	227.238 m^3
TEMPORARY PLUG	a2	=	26.008+4.571	=	30.579 m^3
	ΣA	=	v1+v2 = 227.238 + 30.579	=	257.82 m^3

11-3. MAIN SEAL CUPPER

	L	=		=	18.295 m

11-4. COOLING PIPE

HEADER PIPE Φ40mm	=		=	60.00 m
AIR OUTLET PIPE Φ40mm	=		=	30.00 m
RISER PIPE Φ25mm	=	(4.96+2.42+2.92)×11	=	113.30 m
COOLING PIPE Φ25mm	=	106+99	=	205.00 m
DRAIN PIPE Φ150mm	=		=	30.00 m
JOINT GROUT OUTLET		6×11	=	66

TYPE OF WORK : Production and Construction of concrete (Type D)
LOCATION : Upstream Portal of Diversion Facility

CALCULATION	RESULT
$A_1 = 1.00 \times 2.50 = 2.500\ m^2$	
$A_2 = 1/2 \times (1.00 + 3.26) \times 11.300 = 24.069\ m^2$	
$A_3 = 1/2 \times (12.120 + 13.320) \times 3.00 + 1/2 \times 1.80 \times 1.50 \times 2 = 40.860\ m^2$	
$A_4 = (A_1 + A_2) \times 2 + A_3 = 93.998\ m^2$	
$V_1 = A_4 \times 11.128 = 1046.010\ m^3$	
$A_5 = 1/2 \times (8.150 + 1.878) \times 3.800 = 19.053\ m^2$	
$V_2 = A_5 \times 5.60 = 106.700\ m^3$	
$A_6 = 0.40 \times 2.50 = 1.000\ m^2$	
$A_7 = 1/2 \times (0.40 + 2.88) \times 12.400 = 20.336\ m^2$	
$A_8 = 1/2 \times (12.560 + 13.320) \times 1.90 + 1/2 \times 1.80 \times 1.50 \times 2 = 27.286\ m^2$	
$A_9 = (A_6 + A_7) \times 2 + A_8 = 69.958\ m^2$	
$V_3 = A_9 \times 1.522 + (0.40 \times 0.40 \times 8.400) + (0.50 \times 0.40 \times 8.400) = 109.500\ m^3$	
$A_{10} = 1/2 \times (1.00 + 1.88) \times 4.40 = 6.336\ m^2$	
$A_{11} = 1/2 \times (9.36 + 13.320) \times 9.90 + 1/2 \times 1.80 \times 1.50 \times 2 - (5.60 \times 5.60) = 83.606\ m^2$	
$V_4 = (A_1 + A_{10}) \times (9.72 + 6.67) \times 1/2 \times 2 = 144.822\ m^3$	
$V_5 = A_{11} \times (6.67 + 1.320) \times 1/2 = 334.006\ m^3$	
$V_6 = 1/2 \times 1.80 \times 1.50 \times (16.320 + 13.320) \times 1/2 = 20.007\ m^3$	
$\Sigma V = V_1 + \cdots + V_6 =$	$1761.095\ m^3$

TYPE OF WORK :
LOCATION : Upstream Portal of Diversion Facility

CALCULATION	RESULT
(Formwork)	
$A_1 = \{1.00 \times 2.50 + 1/2 \times (1.00 + 3.26) \times 11.30\} \times 2 = 53.14\ m^2$	
$A_2 = 1/2 \times (12.12 + 12.72) \times 1.50 = 18.63\ m^2$	
$A_3 = 1/2 \times (22.37 + 21.12) \times 2.50 \times 2 = 108.73\ m^2$	
$A_4 = 1/2 \times (21.12 + 15.821) \times 12.80 \times 1.019 \times 2 = 481.83\ m^2$	
$A_5 = \{12.25 \times 13.80 - 1/2 \times (1.878 + 8.150) \times 3.80\} \times 2 = 299.99\ m^2$	
$A_6 = 3.80 \times 5.60 = 21.28\ m^2$	
$A_7 = 5.60 \times (0.785 + 0.882) = 9.34\ m^2$	
$A_8 = 5.60 \times 7.538 = 42.21\ m^2$	
$A_9 = 1/2 \times (10.120 + 6.670) \times 6.90 \times 2 = 115.85\ m^2$	
$A_{10} = 1/2 \times (5.577 + 2.695) \times 5.60 \times 2 = 46.32\ m^2$	
$A_{11} = 5.577 \times 5.60 = 31.23\ m^2$	
$A_{12} = 0.60 \times 6.10 \times 2 \times 4 = 29.28\ m^2$	
$A_{13} = 0.60 \times 6.90 \times 2 \times 2 = 16.56\ m^2$	
$A_{14} = 0.40 \times 6.80 \times 2 = 5.44\ m^2$	
$A_{15} = 2.014 \times 5.60 = 11.28\ m^2$	
$\Sigma A = A_1 + \sim + A_{15} =$	$1291.11\ m^2$
(Scaffolding)	
$A_1 = 53.14\ m^2$	
$A_2 = 18.63\ m^2$	
$A_3 = 108.73 + 481.83 = 590.56\ m^2$	
$A_4 = 299.99\ m^2$	
$A_5 = 21.28\ m^2$	
$A_6 = 115.85\ m^2$	
$A_7 = 46.32\ m^2$	
$A_8 = 29.28\ m^2$	
$A_9 = 16.56\ m^2$	
$A_{10} = 7.697 \times 5.60 = 43.10\ m^2$	
$\Sigma A = A_1 + \sim + A_{10} =$	$1234.71\ m^2$
(Supporting)	
$V = 1/2 \times (5.577 + 2.695) \times 5.60 \times 5.60 =$	$129.70\ m^3$

Upstream Portal

Excavation

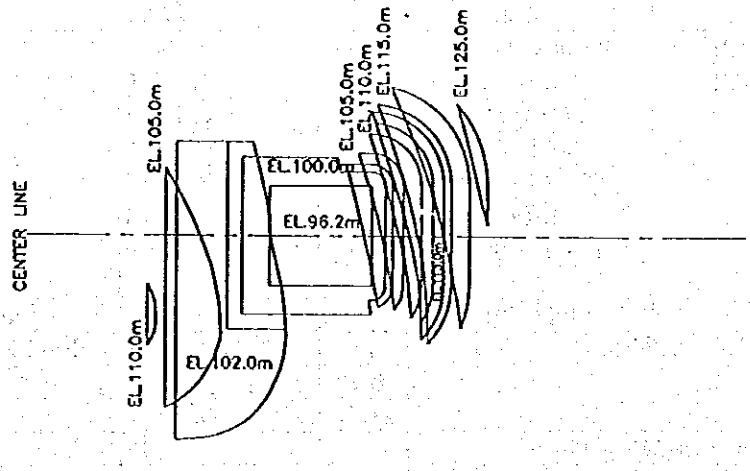
Elevation (m)	Area (m^2)			Volume (m^3)
	Area 1	Area 2	Total	
127.0	0.000		0.000	
125.0	19.207		19.207	19.2
120.0	123.224		123.224	356.1
115.0	142.726		142.726	664.9
113.0	140.246		140.246	283.0
113.0	89.134		89.134	0.0
110.0	79.558	6.655	86.213	263.0
105.0	65.063	161.388	226.451	781.7
102.0	74.772	508.412	583.184	1,214.5
102.0	74.772	150.539	225.311	0.0
100.0	393.356		393.356	618.7
96.2	186.080		186.080	1,100.9
Total				5,301.9
Total x 1.1				5,800.0

Temporary Cofferdam

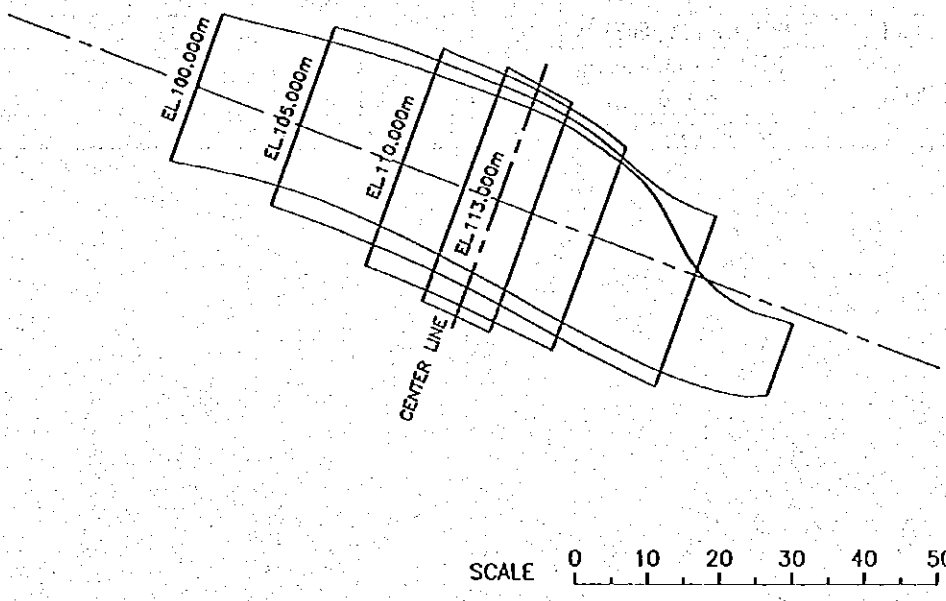
Embankment

Elevation (m)	Area (m^2)			Volume (m^3)
	Area 1	Area 2	Total	
113.0	330.386		330.386	
110.0	852.640		852.640	1,774.5
105.0	1,497.322		1,497.322	5,874.9
100.0	1,742.388		1,742.388	8,099.3
99.0	1,742.388		1,742.388	1,742.4
95.0	180.000		180.000	3,844.8
Total				21,335.9
Total x 1.1				23,500.0

UPSTREAM PORTAL EXCAVATION



TEMPORARY COFFERDAM EMBANKMENT



2.6 Outlet Facilities

1. Summary

DESCRIPTION		UNIT	QUANTITY	LEGEND
EXCAVATION	EXCAVATION	m^3	2,148.2	
	OVERBREAK	m^3	121.9	5cm
	TOTAL	m^3	2,270.0	
STEEL RIB SUPPORT	H-100x100x6x8	kg	26,533.0	
	PLATE(t=9)	kg	1,017.0	
	PLATE(t=16)	kg	3,428.3	
	BOLT NUT		516	
	COLLAR BRACE	kg	3,793.0	Φ16
	Total	kg	35,287.4	
	Total x 1.05	kg	37,100.0	
	STEEL PIPE		3,096	Φ21.7x1.9×80
WIRE NET		m^2	2,397.7	Φ5x150x150 (2.13 kg/m2)
		(kg)	5,107.2	
		x1.05	5,400.0	
CURTAIN GROUT			18	L=10.00m
CONSOLIDATION GROUT			48	L=5.00m
ROCK BOLT	D22 L=1.50m		777	
	TOTAL	m	1,166	
	TOTAL x 1.05	m	1,200	
SHOTCRETE	OVERBREAKAGE	m^3	121.9	5cm
	SHOTCRETE	m^3	234.4	10cm
	TOTAL	m^3	356.3	
	OVERBREAKAGE	m^2	2,464.1	
	SHOTCRETE	m^2	2,403.9	
	TOTAL	m^2	4,868.0	
CONCRETE	OUTLET PROJECTION	m^3	49.2	
	x 1.05	m^3	50.0	
FORM	OUTLET PROJECTION	m^2	83.5	
PLUG	FILLING CONCRETE	m^3	1,313.1	
	x 1.05	m^3	1,400.0	
	WATER STOP SEAL	m	7.4	

SUMMARY (Inclined Intake Structure)

DESCRIPTION			UNIT	TOTAL	LEGEND
Inclined Intake Structure	Excavation	Total	m^3	9,295.9	
		x 1.1	m^3	10,200.0	
	Concrete Type B	Total	m^3	803.5	
		x 1.05	m^3	840.0	
	Concrete Type C	Total	m^3	84.9	
		x 1.05	m^3	89.0	
	Reinforcing Bar	Total	kg	40.6	
		x 1.06	kg	43.0	
	Excavated Slope	Total	m^2	2,387.0	
		x 1.1	m^2	2,620.0	

2. EXCAVATION

2-1. EXCAVATION(TYPICAL SECTION)

v1	= 5.373×368.476	= 1,979.822 m^3
v2(OVERBREAK)	= 0.310×368.476	= 114.228 m^3

2-2. EXCAVATION(PLUG SECTION)

v1	= 8.476×19.044+1/2(5.373+8.476)x1.000	= 168.341 m^3
v2(OVERBREAK)	= 0.381×20.047	= 7.638 m^3

2-3. EXCAVATION(TOTAL)

EXCAVATION ΣV = v1+v1 = 1,979.82 + 168.34 = 2,148.163 m^3

OVERBREAK ΣV = v2+v2 = 114.23 + 7.64 = 121.866 m^3

3. STEEL RIB SUPPORT

3-1. STEEL RIB SUPPORT(TYPICAL SECTION)

N=367.470/1.50=245

ITEM	LENGTH	QUANTITIY	WHEIGHT/UNIT	WHEIGHT/m	EXTENSION	TOTAL WEIGHT
H-100x100x6x8 (kg)	2.955	2	17.2	101.652	245	24,904.740
PL-155×180×9 (kg)	-	2	1.971	3.942	245	965.790
PL-230×230×16 (kg)	-	2	6.644	13.288	245	3,255.560
BOLT NUT Φ25	0.070	2	-	-	245	490
COLLAR BRACE Φ16(kg)	1.576	6	1.58	14.940	245	3,660.418
STEEL PIPE Φ21.7×1.9	0.080	12	-	-	245	2,940
WIRE NET(m^2)	6.114	1	-	6.114m^2	367.470	2,246.712

3-2. STEEL RIB SUPPORT(PLUG SECTION)

N=20.047/1.50=13

ITEM	LENGTH	QUANTITIY	WHEIGHT/UNIT	WHEIGHT/m	EXTENSION	TOTAL WEIGHT
H-100x100x6x8 (kg)	3.641	2	17.2	125.250	13	1,628.255
PL-155×180×9(kg)	-	2	1.971	3.942	13	51.246
PL-230×230×16 (kg)	-	2	6.644	13.288	13	172.744
BOLT NUT	0.07	2	-	-	13	26
COLLAR BRACE Φ16(kg)	1.076	6	1.58	10.200	13	132.606
STEEL PIPE Φ21.7×1.9	0.080	12	-	-	13	156
WIRE NET(m^2)	7.534	1	-	7.534m^2	20.047	151.034

3-3. STEEL RIB SUPPORT(TOTAL)

ITEM	TYPICAL SECTION	PLUG SECTION	TOTAL WEIGHT
H-100x100x6x8 (kg)	24,904.740	1628.255	26,532.995
PL-155×180×9(kg)	965.790	51.246	1,017.036
PL-230×230×16 (kg)	3,255.560	172.744	3,428.304
BOLT NUT	490	26	516
COLLAR BRACE Φ16(kg)	3,660.418	132.606	3,793.024
STEEL PIPE Φ21.7×1.9	2,940.000	156	3,096
WIRE NET(m^2)	2,246.712	151.034	2,397.746

4. GROUTING

4-1. CURTAIN GROUT

L=10.00m	n		=	18

4-2. CONSOLIDATION GROUT

L=5.00m	n=6×8		=	48

5. ROCK BOLT

D22, L=1.50m, n=8	n=3×388.523/1.500	=3×259	=	777

5. SHOTCRETE

5.1 TYPICAL SECTION

V1 (OVERBREAKAGE)	= 0.310×368.476	=	114.228 m^3
V2 (SHOTCRETE)	= 0.596×368.477	=	219.612 m^3
A1 (OVERBREAKAGE)	= 6.269×368.476	=	2,309.976 m^2
A2 (SHOTCRETE)	= 6.114×368.477	=	2,252.862 m^2

5.1 PLUG SECTION

V1 (OVERBREAKAGE)	= 0.381×20.047	=	7.638 m^3
V2 (SHOTCRETE)	= 0.738×20.047	=	14.795 m^3
A1 (OVERBREAKAGE)	= 7.688×20.047	=	154.121 m^2
A2 (SHOTCRETE)	= 7.534×20.047	=	151.034 m^2

5.1 TOTAL

OVERBREAKAGE ΣV	= v1+v1 = 114.23 + 7.64	=	121.866 m^3
SHOTCRETE ΣV	= v2+v2 = 219.61 + 14.80	=	234.407 m^3
OVERBREAKAGE ΣA	= v1+v1 = 2,309.98 + 154.12	=	2,464.097 m^2
SHOTCRETE ΣA	= v2+v2 = 2,252.86 + 151.03	=	2,403.896 m^2

7. CONCRETE (OUTLET PROJECTION)

V1	= 4.471×5.012	=	22.409 m^3

8. FORM (OUTLET PROJECTION)

A1	= 6.780×5.012+4.471×2	=	42.923 m^2

9. PLUG

9-1. CONCRETE

V1 = 5.875×20.047 = 117.776 m^3

9-2 FORM

A1 = 5.875×3 = 17.625 m^2

9-3. WATER STOP SEAL

L1 = 7.38×1 = 7.380 m

TYPE OF WORK : Production and Construction of concrete (Type B)
LOCATION : Inclined Intake Structure

CALCULATION	RESULT
(Between EL+110.00m and EL+130.00m)	
$A_1 = 0.70 \times 3.90 - (0.55 \times 0.25) \times 2 = 2.455\ m^2$	
$A_2 = 1.60 \times 0.95 - (0.90 \times 0.40) = 1.160\ m^2$	
$A_3 = 1/2 \times (4.95 + 3.90) \times 1.050 - (0.60 \times 0.30) \times 2 - \pi/4 \times 0.20^2 = 4.255\ m^2$	
$A_4 = A_1 + A_2 \times 2 + A_3 = 9.030\ m^2$	
$V_1 = A_4 \times (24.377 - 1.00) = 211.094\ m^3$	
$A_5 = 0.70 \times 3.90 - (3.40 \times 0.25) = 1.880\ m^2$	
$A_6 = 0.55 \times 1.050 = 0.578\ m^2$	
$A_7 = A_5 + A_6 \times 2 + A_2 \times 2 = 5.356\ m^2$	
$V_2 = A_7 \times 1.90 + A_4 \times 0.50 = 14.691\ m^3$	
$V_3 = 1/2 \times (EL+114.666 - EL+110.000) \times 3.100 \times 3.900 - \pi/4 \times 1.40^2 \times 1.470 = 25.943\ m^3$	
$V_4 = 1/6 \times 3.00 \times 1.800 \times \{(2 \times 1/2 \times (6.70 + 3.10) + 6.70\} \times 2 = 29.700\ m^3$	
$V_5 = 1/2 \times 1.240 \times 3.00 \times (7.50 + 3.90) \times 1/2 = 10.602\ m^3$	
$V_6 = 1/2 \times (3.941 + 1.200) \times 3.350 \times 3.900 - (1.40 \times 0.60 \times 2.800) + 1/2 \times (0.858 \times 1.200) \times 3.900 - 1/2 \times (0.957 + 0.600) \times 0.50 \times 3.40 = 31.916\ m^3$	
$\Sigma V = V_1 + \sim + V_6 =$	323.946 m^3
(Between EL+130.00 and EL+152.00)	
$A_1 = \{2.30 \times 0.95 - (0.55 \times 0.40 + 0.40 \times 0.90)\} \times 2 = 3.210\ m^2$	
$A_2 = 1/2 \times (3.90 + 4.95) \times 1.050 - \pi/4 \times 0.20^2 = 4.615\ m^2$	
$V_1 = (A_1 + A_2) \times 37.85 = 296.176\ m^3$	
$V_2 = (A_1 + A_2) \times 1/2 \times (1.376 + 4.450) = 22.794\ m^3$	
$\Sigma V = V_1 + V_2 =$	318.970 m^3

TYPE OF WORK : Production and Construction of concrete (Type B)
LOCATION : Inclined Intake Structure

CALCULATION	RESULT
(Operation Deck)	
$V_1 = 0.60 \times 11.700 \times 6.20 = 43.524\ m^3$	
$V_2 = -0.60 \times 3.780 \times 0.60 = -1.361\ m^3$	
$V_3 = \{1/2 \times (0.656 + 0.369) \times 0.10 \times 2 + 0.30 \times 0.56\} \times 0.60 \times 2 = -0.325\ m^3$	
$V_4 = -\{1/2 \times (0.656 + 0.369) \times 0.10 \times 2 + 0.30 \times 0.56\} \times 1.82 = -0.492\ m^3$	
$V_5 = 1/2 \times (6.194 + 7.571) \times 0.80 \times 6.20 = 34.137\ m^3$	
$V_6 = 1/2 \times (10.168 + 9.774) \times 3.60 \times 0.60 \times 2 = 43.075\ m^3$	
$V_7 = 0.80 \times 10.03) \times 6.20 = 49.754\ m^3$	
$V_8 = -(0.914 + 0.430) \times 0.80 \times 0.55 \times 2 = -1.183\ m^3$	
$V_9 = -0.914 \times 0.80 \times 2.00 = -1.462\ m^3$	
$V_{10} = -(0.631 + 0.745 + 0.688) \times 0.80 \times 0.40 \times 2 = -1.321\ m^3$	
$V_{11} = -1.344 \times 0.80 \times 2.00 = -2.150\ m^3$	
$V_{12} = -0.40 \times 0.40 \times 6.194 \times 2 = -1.982\ m^3$	
$V_{13} = 1/2 \times 0.210 \times 0.294 \times 0.60 \times 14 = 0.259\ m^3$	
$V_{14} = 1/2 \times 0.60 \times 0.210 \times 2.80 = 0.176\ m^3$	
$V_{15} = 1/2 \times (0.210 + 0.219) \times 0.294 \times 0.60 \times 5 = 0.189\ m^3$	
$V_{16} = -\pi/4 \times 0.20^2 \times 7.566 = -0.238\ m^3$	
$\Sigma V = V_1 + \sim + V_{16} =$	160.600 m^3
TOTAL =	803.516 m^3

TYPE OF WORK : Production and Construction of concrete (Type C)
LOCATION :

CALCULATION		RESULT
(Upstream portal of Diversion Facility)		
$V_1 = 0.40 \times 6.10 \times 0.60 \times 2$	$= 2.928\ m^3$	
$V_2 = 0.50 \times 6.10 \times 0.60 \times 2$	$= 3.660\ m^3$	
$V_3 = 1.522 \times 0.60 \times 0.40 \times 2$	$= 0.731\ m^3$	
$V_4 = 0.50 \times 5.60 \times 0.40$	$= 1.120\ m^3$	
$V_5 = 0.60 \times 5.60 \times 0.40$	$= 1.344\ m^3$	
$\Sigma V = V_1 + \sim + V_5$	$=$	$9.783\ m^3$
(Inclined Intake Structure)		
$V_1 = 0.55 \times 0.25 \times 23.877 \times 2$	$= 6.566\ m^3$	
$V_2 = 0.25 \times 3.40 \times 0.50$	$= 0.425\ m^3$	
$V_3 = 1/2 \times (0.60 + 0.957) \times 0.50 \times 3.40$	$= 1.323\ m^3$	
$V_4 = 0.40 \times 0.40 \times (24.377 + 1.400) \times 2$	$= 8.249\ m^3$	
$V_5 = (0.60 \times 0.30 + 0.10 \times 0.40) \times (24.377 + 1.400) \times 2$	$= 11.342\ m^3$	
$V_6 = 1.050 \times 1.00 \times 2.000$	$= 2.100\ m^3$	
$V_7 = 0.60 \times 1.50 \times 2.000$	$= 1.800\ m^3$	
$V_8 = 0.55 \times 0.40 \times (37.85) \times 2$	$= 16.654\ m^3$	
$V_9 = 0.40 \times 0.40 \times (37.85 + 4.690) \times 2$	$= 13.613\ m^3$	
$V_{10} = (0.60 \times 0.30 + 0.10 \times 0.40) \times (37.85 + 4.690) \times 2$	$= 18.718\ m^3$	
$V_{11} = 0.25 \times 0.25 \times 3.10$	$= 0.194\ m^3$	
$V_{12} = 0.40 \times 0.40 \times 6.194 \times 2$	$= 1.982\ m^3$	
$V_{13} = 0.983 \times 0.25 \times 0.55 \times 2$	$= 0.270\ m^3$	
$V_{14} = (0.631 + 0.745 + 0.688) \times 0.40 \times 2$	$= 1.651\ m^3$	
$\Sigma V = V_1 + \sim + V_{14}$	$=$	$84.887\ m^3$

TYPE OF WORK :
LOCATION : Inclined Intake Structure

CALCULATION		RESULT
(Between El. +130.00 and El. + 152.00m)		
(Formwork)		
$A_1 = 2.30 \times 37.85 \times 4$	= 348.22 m²	
$A_2 = 1/2 \times 2.30 \times 1.690 \times 4$	= 21.57 m²	
$A_3 = 0.95 \times 37.85 \times 2$	= 71.92 m²	
$A_4 = 0.40 \times (37.85 + 1.960) \times 2$	= 31.85 m²	
$A_5 = 2.80 \times (37.85 + 3.640)$	= 116.17 m²	
$\Sigma A = A_1 + \sim + A_5$	=	589.73 m²
(Scaffolding)		
$A_1 = 348.22$ m²	=	348.22 m²
(Supporting)		
$V_1 = 0.40 \times 0.40 \times (37.85 + 3.640) \times 2$	=	13.28 m³
(Operation Deck)		
$A_1 = 10.168 \times 5.00 - (0.656 \times 0.60 \times 2 + 0.656 \times 1.820)$	= 48.86 m²	
$A_2 = 0.60 \times 6.20 \times 2$	= 7.44 m²	
$A_3 = 11.70 \times 0.60 \times 2$	= 14.04 m²	
$A_4 = 1/2 \times (10.168 + 9.774) \times 3.60 \times 4$	= 143.58 m²	
$A_5 = 1/2 \times (6.194 + 7.571) \times 0.60 \times 2$	= 8.26 m²	
$A_6 = 0.80 \times 10.030 \times 2$	= 16.05 m²	
$A_7 = 0.80 \times 6.20$	= 4.96 m²	
$A_8 = 6.194 \times 0.40 \times 2 \times 2$	= 9.91 m²	
$A_9 = 6.194 \times 5.00$	= 30.97 m²	
$A_{10} = 0.30 \times 6.032 \times 6$	= 1.86 m²	
$A_{11} = 1.032 \times 0.60 \times 2 \times 2$	= 2.48 m²	
$A_{12} = 1.032 \times 1.820$	= 1.88 m²	
$A_{13} = (0.914 + 0.430) \times 0.80 \times 2$	= 2.15 m²	
$A_{14} = 0.430 \times 0.80 \times 2$	= 0.69 m²	
$A_{15} = 3.10 \times 1.376 \times 2$	= 8.53 m²	
$A_{16} = 2.80 \times 1.376 \times 2$	= 3.85 m²	
$A_{17} = (0.631 + 0.745 + 0.688) \times 0.80 \times 2$	= 3.30 m²	

TYPE OF WORK :
LOCATION : Inclined Intake Structure

CALCULATION		RESULT
$A_{18} = 1.150 \times 7.544 \times 2$	$= 17.35\ m^2$	
$A_{19} = 2.673 \times 3.90$	$= 10.42\ m^2$	
$\Sigma A = A_1 + \sim + A_{19}$	$=$	$336.58\ m^2$
(Scaffolding)		
$A_1 = 1/2 \times (11.151 + 10.031) \times 4.40 \times 2$	$= 93.20\ m^2$	
$A_2 = 1/2 \times (10.168 + 9.774) \times 3.60 \times 2$	$= 71.79\ m^2$	
$\Sigma A = A_1 + A_2$	$=$	$164.99\ m^2$
(Supporting)		
$V_1 = 1/2 \times (10.168 + 9.774) \times 3.60 \times 5.00$	$= 179.48\ m^3$	
$V_2 = 1/2 \times 7.164 \times 10.03 \times 1.150 \times 2$	$= 82.63\ m^3$	
$V_3 = 1/2 \times 2.467 \times 1.762 \times 3.900$	$= 8.48\ m^3$	
$\Sigma V = V_1 + V_2 + V_3$	$=$	$270.59\ m^3$

TYPE OF WORK :
LOCATION : Inclined Intake Structure

CALCULATION	RESULT
(Between EL +110.00 to EL+130.00)	
(Formwork)	
A_1 = 2.30 x (24.377+1.40) x 2 = 118.57 m²	
A_2 = 1.90 x (24.377) x 2 = 92.63 m²	
A_3 = (3.90 + 2.00) x 24.377 = 143.82 m²	
A_4 = 0.40 x 24.377 x 2 = 19.50 m²	
A_5 = 0.25 x 24.377 x 4 = 24.377m²	
A_6 = 2.80 x 23.377 + 1.050 x 2.80 = 68.40 m²	
A_7 = 3.25 x 1.40 x 3 = 13.65 m²	
A_8 = (1.40 + 0.60 x 2) x 2.80 = 7.28 m²	
A_9 = 1/2 x (1.20 + 2.629) x 2.00 x 2 = 7.66 m²	
A_{10} = 2.00 x 3.90 = 7.80 m²	
A_{11} = 0.25 x 3.40 = 0.85 m²	
A_{12} = (1.40 + 1.05 + 1.40) x 2.80 = 10.78 m²	
$\Sigma A = A_1 + \sim + A_{12}$ =	515.32 m²
(Scaffolding)	
A_1 = 118.57m²	
A_2 = 7.66 m²	
A_3 = 3.25 x 2.80 x 2 = 18.20 m²	
A_3 = 2.00 x 3.90 = 7.80 m²	
A_4 = 3.35 x 3.90 = 13.07 m²	
$\Sigma A = A_1 + \sim + A_4$ =	165.30 m²
(Supporting)	
V = (2.00 x 0.70 + 2.80 x 0.90) x 24.377 =	95.56 m³

Inclined Intake Structure

Excavation

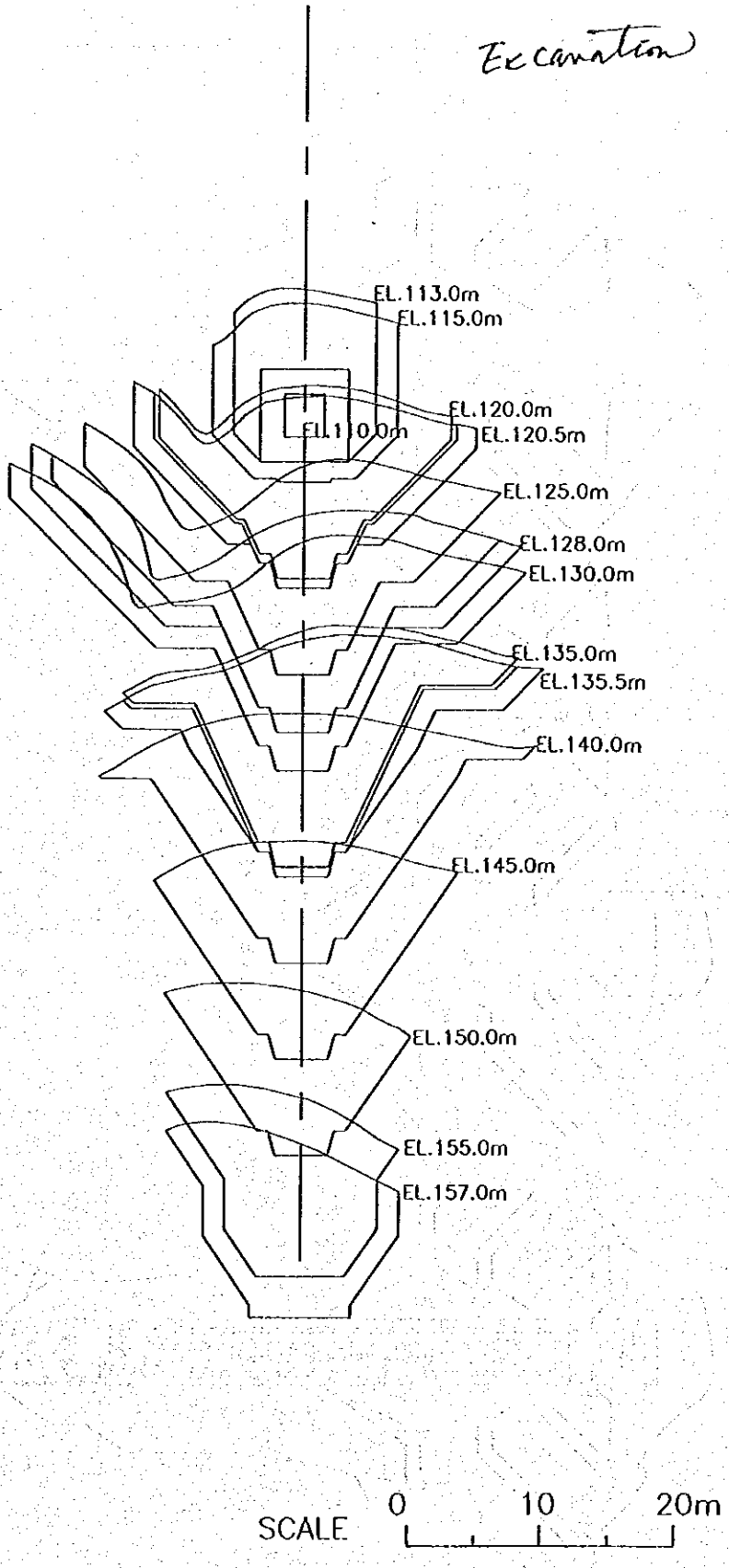
Elevation (m)	Area (m^2)			Volume (m^3)
	Area 1	Area 2	Total	
157.0	162.642		162.642	
155.0	154.021		154.021	316.7
150.0	136.288		136.288	725.8
145.0	214.630		214.630	877.3
140.0	283.078		283.078	1,244.3
135.5	228.113	43.543	271.656	1,248.2
135.5	228.113		228.113	0.0
135.0	229.650		229.650	114.4
130.0	273.616		273.616	1,258.2
128.0	227.600	46.137	273.737	547.4
128.0	227.600		227.600	0.0
125.0	227.117		227.117	682.1
120.5	176.470	39.282	215.752	996.5
120.5	176.470		176.470	0.0
120.0	178.929		178.929	88.8
115.0	155.616		155.616	836.4
113.0	44.220	79.920	124.140	279.8
113.0	44.220		44.220	0.0
110.0	9.300		9.300	80.3
110.0	0.000		0.000	0.0
Total				9,295.9
Total x 1.1				10,200.0

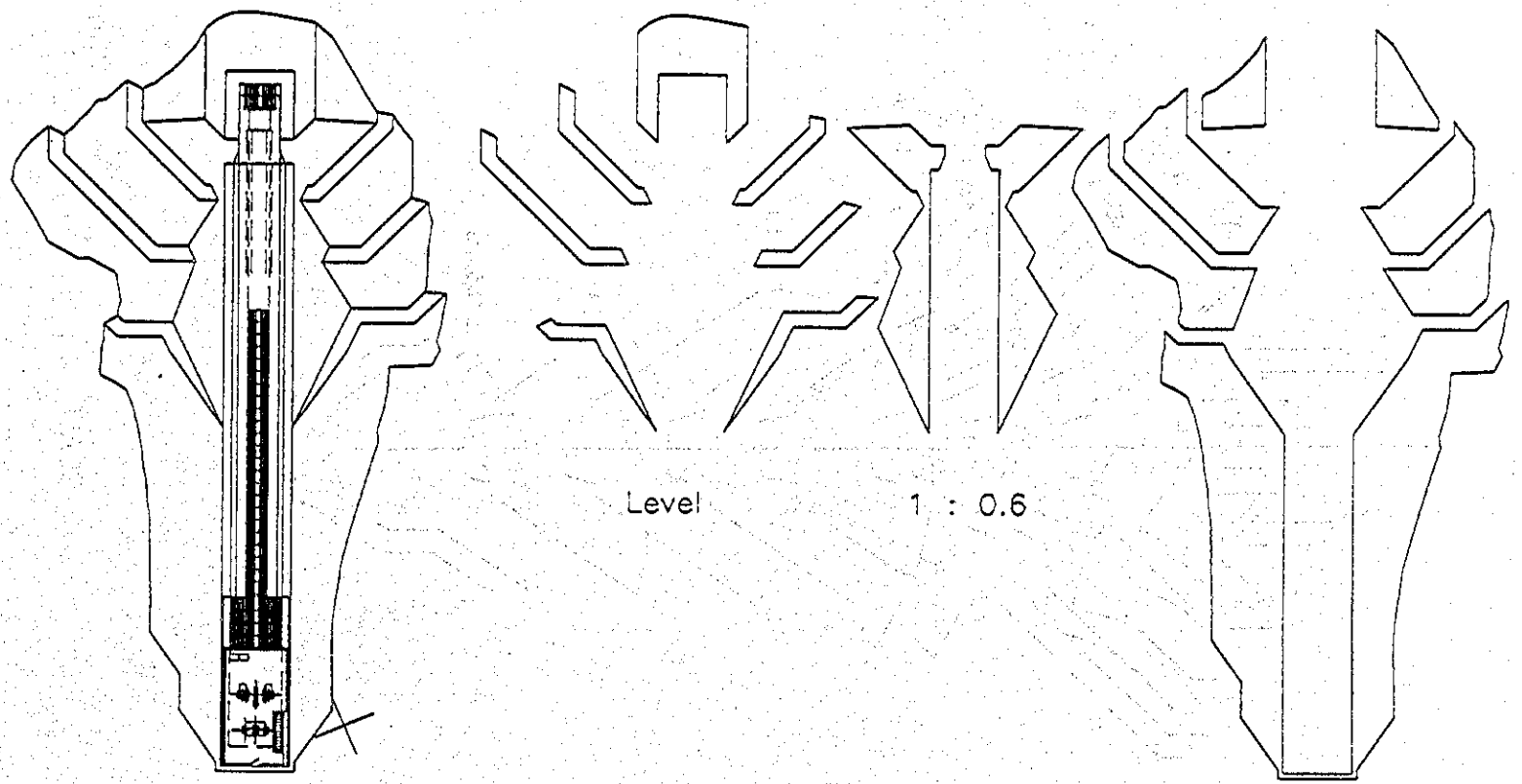
Excavated Slope

	1:0.6 (m2)	1:0.8 (m2)	1:1.4 (m2)	Level (m2)	total
	96.96	32.39	38.56	79.92	
	100.69	98.82	38.56	21.63	
		107.38		29.33	
		503.99		18.47	
		55.27		17.65	
		68.08		16.82	
		34.31		25.08	
Total	197.65	900.24	77.12	208.90	
x slope	384	1,441	95	467	
Total(x 1.1)	420	1,590	100	510	2,620

Intake Structure

Excavation





SCALE 0 10 20m

INCLINED INTAKE STRUCTURE

EXCAVATED SLOPE

2.7 Steel Structure

Total Quantity of Gate

ITEM	NEME	Steel Material (kg)	Material purchased (kg)	Machine single unit (kg)	Sub-total (kg)	Painting Priмer (m^2)	Painting Paint (m^2)	Acid cleaning (m^2)
BULK HEAD GATE	Gate Leaf	3334	139	0	3473	0.0	45.6	3.0
	Gate guide	19314	208	0	19522	468.5	44.3	39.1
	Hoist	7178	992	688	8858	2.4	92.2	0.5
	1 Gate Total	29826	1339	688	31853	470.9	182.1	42.6
EMERGENCY GATE	Gate Leaf	1639	51	0	1690	0.0	27.8	1.8
	Lifting Beam	428	4	0	432	0.0	9.5	0.2
	Gate guide	10902	6	0	10908	258.4	26.7	18.7
	Hoist	7512	987	504	9003	2.4	105.4	0.5
	1 Gate Total	20481	1048	501	22033	260.8	169.4	21.2
Trash Rack		14993	64	0	15057	0.0	477.2	0.4
STEEL PENSTOCK	Outlet pipe	140483	0	0	140483	2115.7	1833.7	0.0
	Installation stand	102417	5756	0	108173	3574.8	0.0	0.0
	Total	242900	5756	0	248656	5690.5	1833.7	0.0
OUT LET STRUCTURES (ϕ650)	Control Gate	5697	247	650	6594	8.4	39.7	0.9
	Guard Gate	5121	266	650	6037	8.2	34.8	0.5
	Auxiliary Facilities	1444	70	845	2359	32.8	0.0	0.0
	Installation stand	335	19	0	354	13.8	0.0	0.0
	Total	12597	602	2145	15344	63.2	74.5	1.4
OUT LET STRUCTURES (ϕ250)	Control Gate	829	30	217	1076	0.6	11.9	0.9
	Guard Gate	802	642	217	1661	0.5	7.8	0.0
	Auxiliary Facilities	756	13	285	1054	27.8	0.0	0.0
	Installation stand	235	13	0	248	9.5	0.0	0.0
	Total	2622	698	719	4039	38.4	19.7	0.9
Operating Stand		4192	30	0	4222	0.0	130.0	0.0
DIVERSION GATE	Gate Leaf	17207	126	0	17333	0.0	251.6	6.7
	Gate guide	3121	12	0	3133	58.4	11.2	7.1
	1 Gate Total	20328	138	0	20466	58.4	262.8	13.8
Electrical Equ				2020	531			
Total		347939	9675	6076	362201	6582.2	3149.4	80.3

BULK HEAD GATE(Gate Leaf) (1/3)

No.	Item	Material	Dimensions (mm) Shape	Dimensions (mm) × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m^2) Painting I.S.	Painting Area (m^2) Painting O.S.	Painting Area (m^2) Acid
	Gate Leaf									
	Skin Plate	SS400	PL	14×1800×2200	1		435		7.9	
	Main Girder Flange	SS400	PL	14×90×2000	4		79		1.4	
	Main Girder Web	SS400	PL	9×(422×2055)	2		122		3.5	
	Main Girder Flange	SS400	PL	14×120×2000	6		158		2.9	
	Main Girder Web	SS400	PL	9×(422×2055)	3		183		5.2	
	Side Girder Flange	SS400	PL	14×100×1800	4		79		1.4	
	Side Girder Web	SM400C	PL	45×272×1800	2		311		1.8	
	Vertical sub beam Flange	SS400	PL	9×70×265	3		4		0.1	
	Vertical sub beam Flange	SS400	PL	9×70×305	9		14		0.4	
	Vertical sub beam Web	SS400	PL	9×442×1700	1		53		1.5	
	Vertical sub beam Web	SS400	PL	16×282×1700	2		113		1.8	
	Vertical sub beam Web	SS400	PL	9×160×1700	2		38		1.1	
	Main Wheel	SSW-Q1S	RB	φ400×70	8		555		2.7	
	Wheel pin	SCM435	RB	φ126×500	8		392		1.6	
	Key Plate	SUS304	PL	12×50×180	16		14			0.3
	Shaft End-Plate	SUS304	PL	16×φ170	8		23			0.4
	Side Shoe	CAC603	t	12×50×100	4		2		-	
	Bracket	SS400	PL	9×100×120	4		3		0.1	
	Bracket	SS400	PL	9×(100×150)	4		2		0.1	
	Seal base	SUS304	t	10×70×2100	1		12			0.2
	Seal base	SUS304	t	10×70×1750	2		19			0.2
	Seal guide	SUS304	PL	20×30×2000	1		10			0.1
	Seal clamp bar	SUS304	PL	12×50×2100	1		10			0.2
	Seal clamp bar	SUS304	PL	12×50×1750	2		17			0.4
	Seal clamp bar	SUS304	PL	12×95×2100	1		19			0.4
	Trash rack bar	SS400	FB	50×6×310	28		20		0.9	
	Trash rack Washer	SS400	PL	12×120×680	4		31		0.7	
	Water filling pipe	SGP	Pipe	150A×60	4		5		0.2	
	Water filling valve	SUS304	RB	φ350×120	2		87			0.5
	Bellmouth	SUS304	t	50×(φ350−φ150)	2		62			0.3
	Flange	SS400	t	22×(φ280−φ166)	4		28		0.3	

BULK HEAD GATE(Gate Leaf) (2/3)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Rod cover	SGP	Pipe	65A×700	2		10		0.3	
	Flange	SS400	PL	12×(φ250−φ76.3)	2		8		0.2	
	Blind plate	SS400	PL	12×φ250	2		9		0.2	
	Rod	SS400	RB	φ40×1750	2		34		0.4	
	Head plate	SS400	t	60×100×200	2		19		0.2	
	Rod pin	S45C	RB	φ50×150	2		5		-	
	Bearing	SS400	RB	(φ80−φ56)×70	4		6		0.1	
	Bearing	SS400	PL	12×(φ200−φ60)	4		11		0.2	
	Rib	SS400	PL	6×50×70	8		1		0.0	
	Lifting beam	SS400	[	200×80×7.5×2000	2		98		3.0	
	Pin	S45C	RB	φ50×150	2		4		0.0	
	Bracket	SS400	PL	12×200×600	4		45		1.0	
	Bracket	SS400	PL	12×300×600	4		68		1.4	
	Bracket base	SS400	PL	12×300×400	2		26		0.6	
	Reinforcement	SS400	PL	9×250×500	4		35		1.0	
	Rib	SS400	PL	9×75×178	8		8		0.2	
	Lubricating Unit	SUS304	RB	φ10×(t=1.0)×5000	5		7			-
	Lubricating Unit	SS400	PL	12	1 set		20		0.4	
	Lubricating Unit	SS400	PL	19	1 set		15		0.4	
	Lubricating Unit	SS400	PL	3.2	1 set		5		0.4	
				Sub Total			3334		45.6	3.0

BULK HEAD GATE(Gate Leaf)

(3/3)

No.	Item	Material	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Elbow	SGP	150A 90° E(S)	2		10			
	Bush	Oilless	#500SP(φ151−φ126)×90	8		32			
	Bush	Oilless	#500SP(φ56−φ41)×70	4		3			
	Bush	Oilless	#500SP(φ68−φ42)×70	2		3			
	Seal Rubber	Synthetic	φ10-P type×5600	1		22			
	Seal Rubber	Synthetic	t15×100 Flat type×2100	1		5			
	Lubrication parts	SUS304	3/8" nipple, connector, elbow	1 set		10			
	Seal Washer	SUS304+Synthetic rubbe	For M16	80	0.012	1			
	Bolt	SUS304	M16×80 N, W	80	0.203	16			
	Bolt	SUS304	M20×60 N, SW	32	0.296	9			
	Bolt	SUS304	M20×80 N, SW	32	0.345	11			
	Bolt	SUS304	M16×60 N, W	40	0.171	7			
	Bolt	SUS304	M12×60 N	100	0.085	9			
	Flash Bolt	SUS304	M12×50 N	16	0.082	1			
			Sub Total			139			
			Gate Leaf Total			3473	0.0	15.6	3.0

BULK HEAD GATE(Gate guide) (1/3)

No.	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S.	Painting O.S.	Acid
	Sill beam									
	Rail	SS400	[	300×90×9×2300	2		175	4.4		
	Rail	SS400	H	200×200×8/12×1000	2		100	2.4		
	Seal Plate	SUS304	PL	12×150×2600	1		37			0.4
	Cover Plate	SS400	PL	12×450×2600	1		110	1.2	1.2	
	Cover Plate	SS400	PL	12×300×350	2		20	0.2	0.2	
	Rib	SS400	PL	9×300×300	5		32	0.9		
	Installation beam	SS400	L	75×75×9×600	5		30	0.9		
	Installation beam	SS400	L	75×75×9×300	4		12	0.4		
	Installation beam	SS400	RB	16×250 M16	23		9	0.3		
	Anchor bar	SD295A	D	16×400	23		14	0.5		
	Lintel beam									
	Rail	SS400	[	200×90×8×2300	1		70	1.7		
	Seal Plate	SUS304	t	13×150×2000	1		31			0.3
	Cover Plate	SS400	PL	12×(1021×2024)	1		178	1.9	1.9	
	Sub beam	SS400	L	100×100×12×2300	1		34	0.7	0.2	
	Rib	SS400	PL	9×90×120	20		15	0.4		
	Installation beam	SD295A	D	16×300	10		5	0.2		
	Installation beam	SD295A	D	16×400	10		6	0.2		
	Side guide(Main rail)									
	Rail Flange	SS400	PL	22×150×1950	4		202	2.3		
	Rail Web	SS400	PL	19×256×1950	2		149	2.0		
	Wheel track	SUS304N2	t	13×200×1950	2		80			0.8
	Cover Plate	SS400	PL	12×(1078×1950)	2		292	3.1	3.1	
	Rib	SS400	PL	9×300×400	10		85	2.4		
	Installation beam	SS400	RB	16×250 M16	10		4	0.1		
	Anchor bar	SD295A	D	16×400	10		6	0.2		
	Joint plate	SS400	PL	12×100×256	8		19	0.3		
	Side guide(Front rail)									
	Front rail	SS400	CT	150×150×6.5/9×1950	2		72	2.3		
	Front rail	SUS304	L	75×75×9×1950	2		39	1.2		
	Wheel track	SUS304	PL	10×120×1950	2		37			0.5
	Bearing Plate	SS400	PL	10×50×1950	2		15			0.2
	Rib	SS400	PL	9×100×200	10		14	0.4		

BULK HEAD GATE(Gate guide) (2/3)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	O.S.	Acid
	Installation beam	SS400	L	75×75×9×150	10		15	0.4		
	Installation beam	SS400	RB	16×250 M16	20		8	0.3		
	Anchor bar	SD295A	D	16×400	20		12	0.4		
	Joint plate	SS400	PL	12×100×141	8		11	0.2		
	Side guide(Sub rail)									
	Main Rail	SS400	H	194×150×6/9×65714	2		4022	129.1		
	Wheel track	SUS304	PL	10×100×65714	2		1,042			13.1
	Joint plate	SS400	PL	12×100×176	80		133	2.8		
	Installation beam	SS400	L	75×75×9×300	264		789	23.8		
	Installation beam	SS400	RB	16×250 M16	792		313	10.0		
	Anchor bar	SD295A	D	16×400	792		494	15.9		
	Side guide(Sub front rail)									
	Rail	SS400	CT	150×150×6.5/9×65108	2		2396	78.1		
	Rail	SS400	L	75×75×9×65108	2		1297	39.1		
	Wheel track	SS400	PL	10×120×65108	2		1239			15.6
	Bearing Plate	SS400	PL	10×50×165108	2		516			6.5
	Rib	SUS304	PL	9×100×200	264		373	10.6		
	Joint plate	SS400	PL	12×100×141	80		106	2.3		
	Installation beam	SS400	L	75×75×9×200	264		526	15.8		
	Installation beam	SS400	RB	16×250 M16	792		313	10.0		
	Anchor bar	SD295A	D	16×400	792		494	15.9		
	Inspection stand									
	Rail	SS400	H	150×150×7/10×3000	2		187		5.4	
	Rail	SS400	H	150×150×7/10×3500	2		218		6.3	
	Post	SS400	H	150×150×7/10×900	14		392		11.3	
	Beam	SS400	H	150×150×7/10×850	4		106		3.1	
	Beam	SS400	H	150×150×7/10×400	2		25		0.7	
	Beam	SS400	H	150×150×7/10×433	6		81		2.3	
	Rib	SS400	PL	12×71.5×130	56		49		1.0	
	Side roller rail	SS400	L	75×75×9×3500	2		70		2.1	
	Sub beam	SS400	L	75×75×9×1200	2		24		0.7	
	Sub beam	SS400	L	75×75×9×800	2		16		0.5	
	Gusset	SS400	PL	9×200×200	8		23		0.6	

BULK HEAD GATE(Gate guide) (3/3)

No,	Item	Material	Dimensions(mm) Shape	Dimensions(mm) × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Wheel track	SUS304	PL	10×100×3000	2		48			0.6
	Bearing Plate	SUS304	PL	10×100×3500	2		56			0.7
	Bearing Plate	SUS304	PL	10×50×3500	2		28			0.4
	Anchor Pad	SS400	PL	16×250×250	20		157	1.3	1.3	
	Stiffener	SS400	FB	65×9×230	20		21	0.6		
	Stiffener	SS400	FB	65×9×230	40		32	0.9		
	Anchor	SD295A	D	16×300	80		37	1.2		
	Liner plate	SS400	PL	12×100×130	40		49		1.0	
	Liner plate	SS400	PL	12×100×100	20		19		0.4	
	Gate resting device	SS400			1 set		100		1	
	Air pipe									
	Air pipe	SGP	Pipe	150A×450	1		8	0.5		
	Air pipe	SGP	Pipe	150A×4700000	1		1386	72.7		
	Elbow	SGP	Pipe	150A 90° E(L)	4		28	0.5		
	Joint plate	SS400	FB	90×6×269	48		55	2.3		
	Installation beam	SS400	L	75×75×9×300	36		108	3.2		
				Sub Total			19314	468.5	44.3	39.1
	Side guide(Sub front rail)									
	Bolt	SUS304		M16×60 N	176	0.158	28			
	Nut	SUS304		M16	3274	0.034	111			
	Gate resting device									
	Bolt, Nut	SS400		M16×70 N	32	0.174	6			
	Air Pipe									
	U bolt	SS400		for 150A, A type, M16	36		34			
	Anchor bolt	SS400		M16×170	72		26			
	Anchor setter	glass		AP16	72		3			
				Sub Total			208			
				Gate guide Total			19522	468.5	44.3	39.1

BULK HEAD GATE(Hoist)

(1/5)

No.	Item	Material	Dimensions (mm)		Quantity	Weight (kg)		Painting Area (m²)		
			Shape	× Length		Unit	W	Painting		Acid
								I.S.	O.S.	
	Drum			P.C. D1000×1800						
	Shell	SM400C	t	40×1800×3016	1		1705		5.4	
	Side plate	SM400A	PL	32×(φ1300−φ880)	1		181		1.4	
	Side plate	SM400A	PL	28×(φ1200−φ100)	2		494		4.5	
	Shaft End-Plate	SM400A	PL	28×(φ1200−φ400)	1		221		2.0	
	Rib	SM400A	PL	28×(150×400)	6		59		0.5	
	Fastening plate	SS400	t	10×150×150	6		10		0.2	
	Boss	S25C	RB	(φ400−φ220)×250	1		172		0.4	
	Rope stopper	S25C	t	55×120×125	2		13		0.1	
	Bush	CAC603	RB	(φ220−φ190)×250	1		22		-	
	Drum gear			(M=12, Z=118, B=120)						
	Rim	SCM435	RB	(φ1440−φ1344)×120	1		148		0.8	
	Web	SCW410	t	25×(φ1344−φ400)	1		293		2.7	
	Rib	SCW410	t	25×85×472	6		37		0.9	
	Fastening plate	SCW410	t	16×100×180	6		12		0.3	
	Boss plate	SCW410	RB	(φ400−φ220)×250	1		172		0.4	
	Bush	CAC603	RB	(φ220−φ190)×250	1		22		-	
	Pinion gear	SCM440		(M=12, Z=21, B=130)	1		44		0.1	
	Drum shaft	S45C-N	RB	φ190×2400	1		534		1.4	
	Key Plate	SS400	PL	16×60×250	4		8		0.1	
	Pinion pin	S45C-N	RB	φ110×685	1		51		0.3	
	Bearing (2 pieces)	SC450	RB	φ100×160	2		120		0.2	
	Bush	CAC603	RB	(φ130−φ100)×160	2		11		-	

BULK HEAD GATE(Gate guide)

(2/5)

No.	Item	Material	Dimensions(mm) Shape	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Drum Bracket	SS400	PL	22×(750×1000)	2		207		2.4	
	Drum Bracket	SM400A	t	20(PL25)×200×1050	2		66		0.8	
	Drum Bracket	SM400A	t	20(PL25)×200×1100	2		69		0.9	
	Drum Bracket	SS400	PL	12×180×750	4		51		1.1	
	Drum Bracket	SS400	PL	12×100×600	2		11		0.2	
	Drum Bracket	SS400	PL	12×180×800	4		54		1.2	
	Drum Bracket	SS400	PL	14×400×400	2		35		0.6	
	Drum Bracket	SS400	t	14(PL19)×(400×400)	2		35		0.6	
	Drum Bracket	SS400	PL	12×96×374	16		54		1.1	
	Bearing Stand	SM400A	t	20(PL25)×160×410	2		21		0.3	
	Bearing Stand	SS400	PL	12×170×410	2		13		0.3	
	Bearing Stand	SS400	PL	12×65×170	8		8		0.2	
	Brake Stand	SS400	t	10(PL12)×85×430	2		6		0.1	
	Brake Stand	SS400	PL	12×350×450	1		15		0.3	
	Brake Stand	SS400	PL	12×98×450	2		8		0.2	
	Brake Stand	SS400	PL	12×98×400	2		7		0.2	
	Brake Stand	SS400	PL	12×90×173	4		6		0.1	
	Motor Stand	SS400	t	10×80×280	2		4		-	
	Motor Stand	SS400	PL	12×310×360	1		11		0.2	
	Motor Stand	SS400	PL	12×138×450	2		12		0.2	
	Motor Stand	SS400	PL	12×138×410	2		11		0.2	
	Position indicator stand	SS400	PL	12×400×400	1		15		0.3	
	Position indicator stand	SS400	L	65×65×6×150	2		2		0.1	
	Limit switch box stand	SS400	L	65×65×6×400	2		5		0.2	
	Limit switch box stand	SS400	L	65×65×6×200	2		2		0.1	
	Emergency opening device									
	Rod	SUS304	RB	φ25×1300	1		5			0.1
	Thrust	SUS304	RB	φ50×200	1		3			0.1
	Guide	SUS304	PL	30×(φ80−φ27)	2		2			0.1
	Guide	SUS304TPA	Pipe	80A(Sch40)×400	1		6			0.2
	Bracket	SS400	PL	12×180×250	1		4		0.1	
	Bracket	SS400	PL	6×80×250	1		1		-	
	Bracket	SS400	PL	6×50×220	1		1		-	

BULK HEAD GATE(Gate guide) (3/5)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	O.S.	Acid
	Control Stand	SS400	PL	12×220×240	1		5		0.1	
	Control Stand	SS400	PL	12×220×240	1		5		0.1	
	Control Stand	SS400	H	200×200×8/12×680	1		34		0.8	
	Control Stand	SS400	PL	9×85×300	2		4		0.1	
	Gear cover	SS400	PL	2.3×2.5㎡	2		90		10.0	
	Gear cover	SS400	L	50×50×6×400	16		28		0.8	
	Chain cover	SS400	PL	2.3×0.4㎡	2		20		1.6	
	Chain cover	SS400	L	50×50×6×200	4		4		0.1	
	Oil catch	SS400	PL	2.3×2.5㎡	2		90		10.0	
	Oil catch	SS400	L	50×50×6×1600	4		28		1.3	
	Oil catch	SS400	L	50×50×6×850	4		15		0.7	
	Hanger	SS400	PL	22×300×380	16		315		3.6	
	Hoist flame									
	Main girder	SS400	H	400×200×8/13×3380	2		442		10.8	
	Main girder	SS400	H	400×200×8/13×2000	4		523		12.8	
	Sub flame	SS400	[	250×90×9/13×2360	1		82		2.0	
	Sub flame	SS400	[	250×90×9/13×350	8		97		2.4	
	Sub flame	SS400	[	250×90×9/13×500	1		17		0.4	
	Rib	SS400	PL	PL12×96×374	12		41		0.9	
	Anchor Pad	SS400	PL	16×200×200	12		60	1.0		
	Anchor	SD295A	D	16×150	48		11	0.4		
	Liner	SS400	t	100×100×200	12		188	1.0		
				Sub Total			7178	2.4	92.2	0.5

BULK HEAD GATE(Gate guide) (4/5)

No.	Item	Material	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Motor		1.5kw, 6P, 50Hz	1		53			
	Helical speed reducer		QBG-496 i=1/500	1		550			
	Limit switch Box		MD233	1		30			
	Gate Position Indicator		STX110-S1-D	1		50			
			Sub Total			683			
	Brake		BMS4-1316UPS	1		109			
	Chain coupling		CR-5016-J	2		7			
	Gear coupling		KSS-280	1		116			
	Limit switch		Direct moving type	1		10			
	Limit switch		Roller hand type	3		3			
	Chain sprocket		RS40 T=60	2		6			
	Chain sprocket		RS40 T=18	2		1			
	Roller chain		RS40 160 rink	1		1			
	Roller chain		RS40 100 rink	1		1			
	Wire Rope	JIS(6×37)	φ20×140m G type	1		202			
	Rope socket		for φ20	1		6			
	Pin		for φ20	1		3			
	Tool box			1 set		25			
	Name plate(operation)	White acryle	t=5.0 mm	1		-			
	Name plate	C2801P		1		-			
	Inbricating Oil			1 set		330			
	Hand pomp		MP-113 3 ℓ	2		30			
	Distributing Valve		VS32	2		3			
	Distributing Valve		VS33	4		8			
	Distributing Valve		VS34	2		5			
	Y type strainer		3/8	4		4			
	Oil pack		SGP-104	1		12			
	Lubricating parts		High pressure screwed union 3/8	34		6			
			High pressure screwed tee 3/8	4		1			
			High pressure screwed elbow 3/8	18		3			
			High pressure screwed elbow 3/8	5		1			

BULK HEAD GATE(Gate guide) (5/5)

No.	Item	Material	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Lubrication parts		High pressure plug 3/8	10		-			
			High pressure nipple 3/8	24		1			
			High pressure long nipple 3/8	10		2			
		SUS304	Pipe joint φ10×1/4	24		1			
		SUS304	Pipe union φ10	16		-			
		SUS304	Pipe elbow φ10×1/4	19		1			
			Tube clump φ10×1	66		1			
			Tube clump φ10×2	35		1			
			Tube clump φ10×3	12		-			
			Tube clump 3/8×2P	12		1			
		4T	M6 + screw bolt M6×10	125		1			
			+ screw bolt M8×30	12		-			
			1/4B×500 ℓ			1			
	Bolt, Nut								
	Reamer bolt	S45C	φ29×160 with N, SW	6		7			
	Bolt	SS400	M24×160 with N, SW	6		5			
	Bolt	SS400	M42×180 with N, SW	8		27			
	Bolt	SS400	M24×40 with N, SW	8		5			
	Bolt	SS400	M30×120 with N, SW	8		10			
	Knock pin	S45C	φ20×90 with N, SW	4		1			
	Bolt	SS400	M24×120 with N, SW	10		7			
	Knock pin	S45C	φ20×90 with N, SW	4		2			
	Bolt	SS400	M10×60 with N, SW	4					
	Bolt	SS400	M10×60 with N, SW	4					
	Bolt	SS400	M12×45 with N, SW	4		5			
	Bolt	SS400	M12×60 with N, SW	4					
	Bolt	SS400	M10×60 with N, SW	4					
	Bolt	SS400	M12×60 with N, SW	24					
	Bolt	SS400	M24×150 N2	24		20			
			Sub Total			992			
			Hoist Total			8853	2.4	92.2	0.5

EMERGENCY GATE(Gate Leaf) (1/1)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Gate Leaf									
	Skin Plate	SS400	PL	16×1650×2700	1		560		8.9	
	Main girder	SS400	[	300×90×12/16×2600	4		505		10.0	
	Side girder	SS400	[	300×90×12/16×1630	2		158		3.1	
	Side girder	SS400	PL	9×100×595	6		25		0.7	
	Side girder	SS400	PL	9×291×775	6		96		2.7	
	Bearing Plate	CAC603	t	35×50×1630	2		51		-	
	Guide shoe	CAC603	t	45×50×150	6		18		-	
	Slide plate seat	SUS304	t	10×70×1630	2		18			0.2
	Seal base	SUS304	t	10×70×1630	2		18			0.2
	Seal base	SUS304	t	10×70×2300	1		13			0.2
	Rubber stopper	SUS304	PL	20×30×2300	1		10			0.2
	Seal clamp bar	SUS304	PL	12×50×1630	2		16			0.3
	Seal clamp bar	SUS304	PL	12×50×2300	1		11			0.2
	Seal clamp bar	SUS304	PL	12×95×2300	1		21			0.4
	Hanger	SS400	PL	12×200×480	4		36		0.8	
	Bracket	SS400	PL	12×60×200	4		5		0.1	
	Bracket	SS400	PL	12×(90×480)	8		25		0.5	
	Bracket	SS400	PL	12×(φ100−φ50)	8		4		0.1	
	Pin	SUS304	RB	φ50×175	2		5			0.1
	Rein forcement plate	SS400	PL	12×90×1300	4		44		0.9	
				Sub Total			1639		27.8	1.8
	Seal Rubber	Synthetic		φ40-P type×5554	1		22			
	Seal Rubber	Synthetic		t15×100 Flat type×2300	1		7			
	Bolt	SUS304		M16×70 N.W	80	0.187	15			
	Seal Washer	SUS304+Synthetic rubber		for M16	80	0.012	1			
	Bolt	SUS304		M16×50 N	44	0.142	6			
				Sub Total			51			
				Gate Leaf Total			1,690		27.8	1.8

EMERGENCY GATE(Lifting beam) (1/1)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Beam Flange	SS400	PL	9×160×2650	2		60		1.7	
	Beam Web	SS400	PL	9×182×2650	2		68		1.9	
	Guide Flange	SS400	PL	9×160×500	8		45		1.3	
	Guide girder web	SS400	PL	9×152×500	8		43		1.2	
	Rib	SS400	PL	9×182×160	8		16		0.5	
	Rib	SS400	PL	9×152×160	4		7		0.2	
	Corner Rib	SS400	PL	9×(260×280)	4		10		0.3	
	Corner Rib	SS400	PL	9×160×400	4		18		0.5	
	Guide Roller	SUS304	RB	φ100×30	4		7			0.1
	Pin	SUS304	RB	φ28×87	4		2			-
	Key Plate	SUS304	t	6×26×76	4		-			-
	Bracket	SS400	PL	14×110×115	8		11		0.2	
	Bracket	SS400	PL	14×100×210	4		9		0.2	
	Liner	SS400	t	6×100×210	4		4		0.2	
	Seat plate	SS400	PL	16×110×220	4		12		0.2	
	Hook	SS400	t	50×(140×900)	2		58		0.4	
	Pin	SUS304	RB	φ45×160	2		4			-
	Key Plate	SS400	t	9×30×100	2		-		-	
	Hand bar	SUS304	PL	19	2		1			-
	Rein forcement	SS400	t	25×(φ100−φ45)	4		5		0.0	
	Weight	SS400			2		20		0.3	
	Pin	SUS304	RB	φ22×150	2		1			-
	Hanger	SS400	PL	12×150×150	2		4		0.1	
	Hanger	SS400	PL	9×100×160	4		5		0.1	
	Hanger	SS400	PL	9×180×210	2		5		0.1	
	Stopper	SUS304	t	50×100×100	2		8			0.1
	Stopper	SS400	PL	9×180×210	2		5		0.1	
				Sub Total			428		9.5	0.2
	Bolt	SUS304		M16×50 with N, SW	16		2			
	Nut	SUS304		M12, M10			2			
				Sub Total			4			
				Lifting beam Total			432		9.5	0.2

EMERGENCY GATE(Gate guide) (1/2)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	O.S.	Acid
	Sill beam									
	Rail	SS400	[	150×75×6.5×2700	1		50	1.6		
	Seal Plate	SUS304	PL	10×250×2700	1		54			0.7
	Rib	SS400	PL	9×(120×120)	6		4	0.1		
	Installation beam	SS400	L	75×75×9×200	6		12	0.4		
	Installation beam	SS400	RB	16×300 M16	18		9	0.3		
	Anchor bar	SD295A	D	16×400	18		11	0.4		
	Lintel guide									
	Rail	SS400	[	150×75×6.5×2300	1		43	1.4		
	Seal Plate	SUS304	t	10×250×2300	1		27			0.3
	Cover Plate	SS400	PL	9×450×2300	1		73	2.1		
	Rib	SS400	PL	9×100×150	5		5	0.2		
	Rib	SS400	PL	9×50×100	5		2	0.1		
	Installation beam	SS400	L	75×75×9×200	5		10	0.3		
	Installation beam	SS400	RB	16×200 M16	10		3	0.1		
	Anchor bar	SD295A	D	16×400	10		6	0.2		
	Side guide(Main rail)									
	Rail	SS400	[	200×90×8×1750	2		106	2.7		
	Bearing Plate	SUS304	t	10(30)×200×1750	2		13			0.2
	Cover Plate	SS400	PL	9×450×1750	2		111	3.2		
	Rib	SS400	PL	9×75×170	4		4	0.1		
	Rib	SS400	PL	9×75×150	4		3	0.1		
	Installation beam	SS400	L	75×75×9×250	8		20	6.0		
	Installation beam	SS400	RB	16×300 M16	16		8	0.2		
	Anchor bar	SD295A	D	16×400	16		10	0.3		
	Side guide(Sub rail)									
	Rail	SS400	H	125×125×6.5/9×63284	2		2,987	94.9		
	Bearing Plate	SUS304	t	10(30)×100×63284	2		1304			16.4
	Cover Plate	SS400	PL	9×450×63284	2		4,024	113.9		
	Rib	SS400	PL	9×50×84	128		38	1.0		
	Rib	SS400	PL	9×84×250	128		190	5.4		
	Joint Plate	SS400	PL	9×100×300	40		85	2.4		
	Bearing Plate	SS400	L	75×75×9×250	128		319	9.6		0.2
	Rib	SS400	RB	16×300 M16	256		121	3.9		

EMERGENCY GATE(Gate guide) (2/2)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	Anchor bar	SD295A	D	16×400	256		160	5.1		
	Inspection stand									
	Rail	SS400	H	125×125×6.5/9×3500	2		165		5.3	
	Post	SS400	H	150×150×7/10×850	6		159		4.6	
	Post	SS400	H	150×150×7/10×600	6		112		3.2	
	Joint	SS400	H	125×125×6.5/9×1300	4		123		3.9	
	Joint	SS400	H	125×125×6.5/9×900	2		42		1.4	
	Joint	SS400	H	125×125×6.5/9×975	4		92		2.9	
	Sub beam	SS400	L	75×75×9×1100	6		66		2.0	
	Gusset Plate	SS400	PL	9×200×200	12		34		1.0	
	Bearing Plate	SUS304	t	10(30)×100×3500	2		72			0.9
	Stopper	SS400	PL	12×100×100	2		2		0.0	
	Stopper	SS400	PL	12×100×200	4		8		0.2	
	Rib	SS400	PL	9×59.3×107	24		11		0.3	
	Rib	SS400	PL	9×72×130	24		16		0.4	
	Anchor pad	SS400	PL	16×250×250	12		94	0.7	0.7	
	Stiffener	SS400	FB	65×9×230	12		13	0.4		
	Stiffener	SS400	FB	65×9×230	24		19	0.6		
	Anchor	SD295A	D	16×300	48		22	0.7		
	Liner	SS400	PL	12×100×130	24		29		0.6	
	Liner	SS400	PL	12×100×100	12		11		0.2	
				Sub Total			10902	258.4	26.7	18.7
	Bolt	SS400		M16×70 N	32	0.174	6			
				Sub Total			6			
				Gate guide Total			10908	258.4	26.7	18.7

EMERGENCY GATE(Hoist)

(1/5)

No.	Item	Material	Dimensions(mm)		Quantity	Weight(kg)		Painting Area(m²)		
				Shape × Length		Unit	W	Painting		Acid
								I.S.	O.S.	
	Drum			P.C.D860×600						
	Shell	SM400C	t	30×600×2608	2		737		3.1	
	Side plate	SM400A	PL	28×(φ1100−φ950)	2		224		2.0	
	Shaft End-Plate	SM400A	PL	28×(φ1000−φ330)	2		308		2.8	
	Rib	SM400A	PL	28×(100×300)	12		55		0.5	
	Fastening plate	SS400	t	10×150×150	12		21		0.4	
	Boss	S25C	RB	(φ330−φ220)×250	2		187		0.7	
	Rope stopper	S25C	t	35×80×85	2		3		-	
	Bush	CAC603	RB	(φ220−φ190)×250	2		43		-	
	Dram gear			(M=16, Z=98, B=160)						
	Rim	SCM435	RB	(φ1600−φ1492)×160	2		570		2.4	
	Web	SCW410	t	28×(φ1472−φ330)	2		772		6.7	
	Rib	SCW410	t	28×100×571	12		134		2.5	
	Fastening plate	SCW410	t	16×180×200	12		54		0.7	
	Boss	SCW410	RB	(φ330−φ220)×250	2		187		0.7	
	Bush	CAC603	RB	(φ220−φ190)×250	2		43		-	
	Pinion gear	SCM440		(M=16, Z=21, B=130)	2		207		0.3	
	Drum shaft	S45C-N	RB	φ190×1100	2		490		1.3	
	Key Plate	SS400	PL	16×60×250	8		15		0.2	
	Pinion pin	S45C-N	RB	φ80×500	2		39		0.3	
	Bearing(2 pieces)	SC450	RB	φ70×100	4		114		0.4	
	Bush	CAC603	RB	(φ80−φ70)×100	4		7		-	

EMERGENCY GATE(Hoist)

(2/5)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m^2) Painting I.S.	Painting O.S.	Acid
	Drum bracket	SS400	PL	16×(750×1000)	4		318		5.1	
	Drum bracket	SS400	t	16(PL19)×200×1050	4		106		1.7	
	Drum bracket	SS400	t	16(PL19)×200×1100	4		111		1.8	
	Drum bracket	SS400	PL	12×180×750	8		102		2.2	
	Drum bracket	SS400	PL	12×100×600	4		23		0.5	
	Drum bracket	SS400	PL	12×180×800	8		109		2.3	
	Drum bracket	SS400	PL	14×400×400	4		70		1.3	
	Drum bracket	SS400	t	14(PL19)×(400×400)	4		53		0.2	
	Drum bracket	SS400	PL	12×96×374	8		27		0.6	
	Bearing Stand	SS400	t	16(PL19)×150×410	2		30		0.5	
	Bearing Stand	SS400	PL	12×104×400	2		16		0.3	
	Bearing Stand	SS400	PL	12×120×104	8		9		0.2	
	Brake Stand	SS400	t	10(PL12)×85×430	2		6		0.1	
	Brake Stand	SS400	PL	12×350×450	1		15		0.3	
	Brake Stand	SS400	PL	12×98×450	2		8		0.2	
	Brake Stand	SS400	PL	12×98×400	2		7		0.2	
	Brake Stand	SS400	PL	12×90×173	4		6		0.1	
	Motor Stand	SS400	t	10×80×170	2		2		-	
	Motor Stand	SS400	PL	12×200×200	1		4		0.1	
	Motor Stand	SS400	PL	12×108×450	2		9		0.2	
	Motor Stand	SS400	PL	12×108×410	2		8		0.2	
	Position indicate stand	SS400	PL	12×400×400	1		15		0.3	
	Position indicate stand	SS400	L	65×65×6×150	2		2		0.1	
	Limit indicate stand	SS400	L	65×65×6×400	2		5		0.2	
	Limit indicate stand	SS400	L	65×65×6×200	2		2		0.1	
	Emergency opening device									
	Rod	SUS304	RB	φ25×1300	1		5			0.1
	Thrust	SUS304	RB	φ50×200	1		3			0.1
	Guide	SUS304	PL	30×(φ80−φ27)	2		2			0.1
	Guide	SUS304TPA	Pipe	80A(Sch40)×400	1		6			0.2
	Bracket	SS400	PL	12×180×250	1		4		0.1	
	Bracket	SS400	PL	6×80×250	1		1		-	
	Bracket	SS400	PL	6×50×220	1		1		-	

EMERGENCY GATE(Hoist) (3/5)

No.	Item	Material	Dimensions(mm) Shape × Length		Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Operating stand	SS400	PL	12×220×240	1		5		0.1	
	Operating stand	SS400	PL	12×220×240	1		5		0.1	
	Operating stand	SS400	H	200×200×8/12×680	1		34		0.8	
	Operating stand	SS400	PL	9×85×300	2		4		0.1	
	Gear cover	SS400	PL	2.3×2.5㎡	2		90		10.0	
	Gear cover	SS400	L	50×50×6×400	16		28		0.8	
	Chain cover	SS400	PL	2.3×0.4㎡	2		20		1.6	
	Chain cover	SS400	L	50×50×6×200	4		4		0.1	
	Oil catch	SS400	PL	2.3×2.5㎡	2		90		10.0	
	Oil catch	SS400	L	50×50×6×1600	4		28		1.3	
	Oil catch	SS400	L	50×50×6×850	4		15		0.7	
	Hanger	SS400	PL	22×300×380	16		315		3.6	
	Flame									
	Main girder	SS400	H	400×200×8/13×3600	2		471		11.5	
	Main girder	SS400	H	400×200×8/13×2100	4		549		13.4	
	Sub beam	SS400	[	250×90×9/13×2100	2		145		3.6	
	Sub beam	SS400	[	250×90×9/13×200	5		35		0.9	
	Sub beam	SS400	[	250×90×9/13×1000	2		69		1.7	
	Rib	SS400	PL	PL12×96×374	12		41		0.9	
	Rib	SS400	PL	PL9×80×224	8		10		0.3	
	Anchor	SS400	PL	16×200×200	12		60	1.0		
	Anchor	SD295A	D	16×150	48		11	0.4		
	Liner	SS400	t	100×100×200	12		188	1.0		
				Sub Total			7512	2.4	105.4	0.5

EMERGENCY GATE(Hoist)

(1/5)

No.	Item	Material	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Motor		0.75kw, 6P, 50Hz	1		39			
	Helical speed reducer		QBG-440 i=1/500	1		380			
	Limit Switch Box		MD233	1		30			
	Gate Position indicator		STX110-S1-D	1		50			
			Sub Total			499			
	Brake		BMS4-1316UPS	1		109			
	Chain coupling		CR-5016-J	2		7			
	Gear coupling		HS-SSA-90 ℓ=400	2		73			
	Limit switch		Direct moving type	1		10			
	Limit switch		Roller hand type	3		3			
	Chain sprocket		RS40 T=60	2		6			
	Chain sprocket		RS40 T=18	2		1			
	Roller chain		RS40 160 rink	1		1			
	Roller chain		RS40 100 rink	1		1			
	Wire Rope	JIS(6×37)	φ16×140m G type	2		258			
	Rope sket		for φ16	2		7			
	Pin		for φ16	2		3			
	Tool box			1式		25			
	Name plate(Operation)	White acryle	t=5.0 mm	1		-			
	Name plate	C2801P		1		-			
	Inbricating Oil			1式		330			
	Head pump		MP-113 3ℓ	2		30			
	Distributing Valve		VS32	2		3			
	Distributing Valve		VS33	4		8			
	Distributing Valve		VS34	2		5			
	Y Type strainer		3/8	4		4			
	Oil pack		SGP-104	1		12			
	Lubricating parts		High pressur screwed union 3/8	34		6			
			High pressur screwed tee 3/8	4		1			
			High pressur screwed elbow 3/8	18		3			
			High pressur screwed elbow 3/8	5		1			

EMERGENCY GATE (Hoist) (5/5)

No,	Item	Material	Dimensions (mm) Shape × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m^2) Painting I.S.	Painting Area (m^2) Painting O.S.	Painting Area (m^2) Acid
	Lubricatring parts		High pressure plug 3/8	10		-			
			High pressure nipple 3/8	24		1			
			High pressure nipple 3/8	10		2			
		SUS304	Pipe joint φ10×1/4	24		1			
		SUS304	Pipe union φ10	16		-			
		SUS304	Pipe ilbow φ10×1/4	19		1			
			Tube clump φ10×1	66		1			
			Tube clump φ10×2	35		1			
			Tube clump φ10×3	12		-			
			Tube clump 3/8×2P	12		1			
		4T	+ screw bolt M6×10	125		1			
			+ screw bolt M8×30	12		-			
			1/4B×500			1			
	Bolt, Nut								
	Reamer bolt	S45C	φ25×120 with N, SW付	12		7			
	Bolt	SS400	M20×120 with N, SW付	12		5			
	Bolt	SS400	M16×100 with N, SW付	16		4			
	Bolt	SS400	M20×35 with N, SW付	16		3			
	Bolt	SS400	M30×120 with N, SW付	16		19			
	Knock pin	S45C	φ20×90 with N, SW付	8		2			
	Bolt	SS400	M20×120 with N, SW付	6		3			
	Knock pin	S45C	φ20×90 with N, SW付	4		2			
	Bolt	SS400	M10×60 with N, SW付	4		-			
	Bolt	SS400	M10×60 with N, SW付	4					
	Bolt	SS400	M12×45 with N, SW付	4		5			
	Bolt	SS400	M12×60 with N, SW付	4					
	Bolt	SS400	M10×60 with N, SW付	4					
	Bolt	SS400	M12×60 with N, SW付	24		-			
	Bolt	SS400	M24×150 N2	24		20			
			Sub Total			987			
			Hoist Total			8998	2.4	105.4	0.5

TRASH RACK (Emergency Gate) (1/3)

No,	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S	O.S.	Acid
	EMERGENCY GATE Trash rack									
	Trash rack bar	SS400	FB	90×9×1900	40	12.1	483		13.7	
	Trash rack bar	SS400	FB	90×9×500	28	3.2	89		2.5	
	Binding bolt	SS400	RB	φ22×1500	18	4.5	81		1.9	
	Binding bolt	SS400	RB	φ22×650	12	1.9	23		0.5	
	Distance piece	SGP	Pipe	20A×91	312	0.15	48		4.9	
	Trash rack guide	SS400	L	75×75×9×1500	8	14.9	120		3.6	
	Trash rack guide	SS400	L	75×75×9×550	4	5.5	22		0.7	
	Hook Bolt	SS400	RB	16×180 M16	24	0.3	7		0.2	
	Support beam	SS400	H	200×200×8/12×3300	2	164.7	329		7.9	
	Support beam	SS400	H	200×200×8/12×600	4	29.9	120		2.9	
	Post	SS400	H	200×200×8/12×2500	3	124.8	374		9	
	Rib	SS400	PL	12×96×176	22	1.6	35		0.7	
	Bearing plate	SUS304	PL	10×100×1800	2	14.3	29			0.4
	Seat plate	SS400	PL	12×250×450	3	10.6	32		0.7	
	Liner	SS400	t	10×250×450	3	8.8	26		0.7	
	Installation beam	SS400	L	75×75×9×150	8	1.5	12		0.4	
	Installation bolt	SS400	RB	16×300 M16	32	0.5	15		0.5	
	Anchor bar	SD295A	D	16×400	32	0.6	20		0.6	
				Sub Total			1865		51.4	0.4
	Nut	SS400		M16	112	0.034	4			
	Nut	SS400		M22	120	0.074	9			
	Bolt	SS400		M22×60 N, SW	24	0.296	7			
				Sub Total			20			
				EMERGENCY GATE Trash rack Total			1885		51.4	0.4

TRASH RACK(Trash rack) (2/3)

No,	Item	Material	Dimensions(mm) Shape	Dimensions(mm) × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Trash Rack									
	Trash rack bar	SS400	FB	65×12×1470	456	9.0	4104		103.2	
	Trash rack bar	SS400	FB	65×12×863	19	5.28	100		2.5	
	Trash rack bar	SS400	FB	65×12×1817	19	11.13	211		5.3	
	Binding bolt	SS400	RB	φ22×1900	310	5.67	1758		40.7	
	Distance piece	SGP	Pipe	20A×88	5580	0.148	825		83.9	
	Trash rack guide	SS400	L	75×75×6×1900	26	13.0	338		14.8	
	Trash rack guide	SS400	FB	65×6×1900	26	5.8	151		6.4	
	Hook Bolt	SS400	RB	16×180 M16	208	0.3	59		1.9	
	Support beam	SS400	H	150×150×7/10×2600	27	81.9	2211		63.2	
	Rib	SS400	PL	9×71.5×130	108	0.66	71		2.0	
	Rib	SS400	PL	9×150×130	108	1.38	149		4.2	
	Installation beam	SS400	L	75×75×9×150	54	1.0	55		2.4	
	Installation bolt	SS400	RB	16×300 M16	108	0.47	51		1.6	
	Anchor bar	SD295A	D	16×400	108	0.62	67		2.2	
				Sub Total			10150		334.3	
	Bolt	SS400		M16×60 N	216	0.158	34			
	Nut	SS400		M16	216	0.034	7			
				Sub Total			41			
				Trash rack Total			10191		334.3	

TRASH RACK(Inspection room Trash rack) (3/3)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S	Painting O.S.	Acid
	Inspection room Trash Rack									
	Trash rack bar	SS400	FB	65×12×1470	168	9.0	1512		38.0	
	Binding bolt	SS400	RB	φ22×2100	48	6.3	301		7.0	
	Distance piece	SGP	Pipe	20A×88	960	0.14	142		14.4	
	Trash rack guide	SS400	L	75×75×6×2050	8	14.0	112		4.9	
	Trash rack guide	SS400	FB	65×6×2050	10	6.3	63		2.7	
	Hook bolt	SS400	RB	16×180 M16	64	0.28	18		0.6	
	Support beam	SS400	H	150×150×7/10×4600	5	144.9	725		20.7	
	Rib	SS400	PL	9×71.5×130	20	0.66	13		0.4	
	Rib	SS400	PL	9×150×130	20	1.38	28		0.8	
	Installation beam	SS400	L	75×75×9×200	10	1.99	20		0.6	
	Installation bolt	SS400	RB	16×300 M16	40	0.47	19		0.6	
	Anchor bar	SD295A	D	16×400	40	0.63	25		0.8	
				Sub Total			2978		91.5	
	Nut	SS400		M16	80	0.034	3			
				Sub Total			3			
				Inspection room Trash rack Total			2981		91.5	
				Trash rack Total(Steel Material)			14993		477.2	0.4
				Trash rack Total(Material Purchased)			64			

STEEL PENSTOCK(Trasition Pipe) (1/2)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	Transition Pipe	SM400A	PL	25×(□1400～φ1400)×1150	1	1148.4	1148	5.9	5.9	
	No.1 Ring girder Flange	SS400	PL	22×200×6413	1	221.5	222	2.6		
	No.1 Ring girder Web	SS400	PL	16×200×7425	1	186.5	187	3.6		
	No.2 Ring girder Flange	SS400	PL	22×200×5184	1	199.8	200	2.3		
	No.2 Ring girder Web	SS400	PL	16×200×6796	1	170.7	171	2.7		
	Bend Pipe	SM400A	PL	9×φ1400×2471	1	772.8	773	10.9	10.9	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	2	33.69	67	1.9		
	Straight Pipe	SM400A	PL	9×φ1400×14000	1	4378.3	4378	62.0	62.0	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	10	33.69	337	9.5		
	Bend Pipe	SM400A	PL	9×φ1400×70686	1	22,105.8	22,106	312.9	312.9	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	50	33.69	1685	47.7		
	Straight Pipe	SM400A	PL	9×φ1400×115000	1	35964.2	35964	509	509	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	76	33.69	2,561	72.5		
	Straight Pipe	SM400A	PL	9×φ1400×71505	1	22393.2	22393	317	317	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	48	33.69	1618	45.8		
	Bend Pipe	SM400A	PL	9×φ1400×35343	1	11052.9	11053	156.4	156.4	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	26	33.69	876	24.8		
	Bend Pipe	SM400A	PL	9×φ1400×86986	1	27203.4	27203	385	385.0	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	58	33.69	1,954	55.3		
	Bend Pipe	SM400A	PL	9×φ1400×7891	1	2,468	2,468	34.9	34.9	
	Stiffener	SS400	PL	9×(φ1618－φ1418)	6	33.69	202	5.7		
	Straight Pipe	SM400A	PL	9×φ650×1207	1	176.5	177	2.5	2.5	
	Straight Pipe	SM400A	PL	9×φ650×3917	1	572.9	573	8.1	8.1	
	Straight Pipe	SM400A	PL	9×φ650×6600	1	965.4	965	13.7	13.7	
	Bend Pipe	SM400A	PL	9×φ650×1046	1	152.9	153	2.2	2.2	
	Bend Pipe	SM400A	PL	9×φ650×3063	1	448.0	448	6.3	6.3	
	Reinforcement	SM400A	PL	12×(φ1000－φ650)	1	42.7	43	0.5		
	Stiffener	SS400	PL	9×(φ868－φ668)	12	17.0	204	5.8		
	Straight Pipe	SM400A	PL	6×φ300×200	1	9.1	9	0.2	0.2	
	Reducer pipe	SM400A	PL	6×(φ300～φ250)×250	1	10.2	10	0.2	0.2	
	Straight Pipe	SM400A	PL	6×φ250×182	1	6.9	7	0.1	0.1	
	Straight Pipe	SM400A	PL	6×φ250×972	1	35.1	35	0.7	0.7	
	Straight Pipe	SM400A	PL	6×φ250×6150	1	233.0	223	4.9	4.9	

STEEL PENSTOCK (Trasition Pipe)

(2/2)

No,	Item	Material	Dimensions (mm) Shape × Length		Quantity	Weight (kg)		Painting Area (m^2)		
						Unit	W	Painting		Acid
								I.S.	O.S.	
	Bend Pipe	SM400A	PL	6×φ250×216	1	8.2	8	0.2	0.2	
	Bend Pipe	SM400A	PL	6×φ250×785	1	29.7	30	0.6	0.6	
	Reinforcement	SM400A	PL	9×(φ500−φ250)	1	10.4	10	0.3		
	Stiffener	SS400	PL	6×(φ412−φ262)	6	3.7	22	1.0		
				Sub Total			140,483	2115.7	1833.7	

STEEL PENSTOCK(Installation stand)

(1/6)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	O.S.	Acid
	① Installation stand									
	Support beam	SS400	L	75×75×6×1400	6	9.6	58	2.5		
	Gusser Plate	SS400	PL	9×250×300	12	5.3	64	1.8		
	Installation stand(Post)	SS400	[	100×50×5/7.5×2500	6	23.4	140	9.0		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2500	6	23.4	140	9.0		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2500	6	23.4	140	9.0		
	Installation stand(Sub)	SS400	L	75×75×6×1500	12	10.3	123	5.4		
	Base Plate	SS400	PL	9×240×250	6	4.2	25	0.7		
	Gusser Plate	SS400	PL	9×200×200	6	2.8	17	0.5		
	Rail girder	SS400	[	150×75×6.5/10×1150	2	21.39	43	1.7		
	Base	SS400	PL	16×300×400	6	15.1	90	1.4		
	Liner	SS400	t	10×300×400	6	9.4	57	1.4		
	② Installation stand									
	Support beam	SS400	L	75×75×6×1400	36	9.6	345	15.1		
	Gusser Plate	SS400	PL	9×250×300	72	5.3	382	10.8		
	Installation stand(Post)	SS400	[	100×50×5/7.5×1000	24	9.4	225	14.4		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2000	12	18.7	225	14.4		
	Installation stand(Main)	SS400	[	100×50×5/7.5×1000	24	9.4	225	14.4		
	Installation stand(Sub)	SS400	L	75×75×6×1500	24	10.3	247	10.8		
	Installation stand	SS400	L	75×75×6×500	48	3.4	164	7.2		
	Base Plate	SS400	PL	9×240×250	24	4.2	102	2.9		
	Gusser Plate	SS400	PL	9×200×200	24	2.8	68	1.9		
	Rail girder	SS400	[	150×75×6.5/10×16471	2	30.6	61	25.0		
	Base	SS400	PL	16×300×400	66	15.1	995	15.8		
	Liner	SS400	t	10×300×400	66	9.4	622	15.8		

STEEL PENSTOCK(Installation stand)

(2/6)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	③ Installation stand									
	Support beam	SS400	L	75×75×6×1400	150	9.6	1439	63.0		
	Gusser Plate	SS400	PL	9×250×300	300	5.3	1590	45.0		
	Installation stand(Post)	SS400	[	100×50×5/7.5×1000	100	9.4	936	60.0		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2000	50	18.7	936	60.0		
	Installation stand(Main)	SS400	[	100×50×5/7.5×1000	100	9.4	936	60.0		
	Installation stand(Sub)	SS400	L	75×75×6×1500	100	10.3	1028	45.0		
	Installation stand	SS400	L	75×75×6×500	200	3.4	685	30.0		
	Base Plate	SS400	PL	9×240×250	100	4.2	424	12.0		
	Gusser Plate	SS400	PL	9×200×200	100	2.8	283	8.0		
	Rail girder	SS400	[	150×75×6.5/10×70686	2	1314.8	2630	107.4		
	Base	SS400	PL	16×300×400	282	15.1	4250	67.7		
	Liner	SS400	t	10×300×400	282	9.4	2656	67.7		
	④ Installation stand									
	Support beam	SS400	L	75×75×6×1400	228	9.6	2187	95.8		
	Gusser Plate	SS400	PL	9×250×300	456	5.3	2416	68.4		
	Installation stand(Post)	SS400	[	100×50×5/7.5×1000	152	9.4	1423	91.2		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2000	76	18.7	1423	91.2		
	Installation stand(Main)	SS400	[	100×50×5/7.5×1000	152	9.4	1423	91.2		
	Installation stand(Sub)	SS400	L	75×75×6×1500	152	10.3	1562	68.4		
	Installation stand	SS400	L	75×75×6×500	304	3.4	1041	45.6		
	Base Plate	SS400	PL	9×240×250	152	4.2	644	18.2		
	Gusser Plate	SS400	PL	9×200×200	152	2.8	430	12.2		
	Rail girder	SS400	[	150×75×6.5/10×115000	2	2139.0	4278	174.8		
	Base	SS400	PL	16×300×400	460	15.1	6933	110.4		
	Liner	SS400	t	10×300×400	460	9.4	4333	110.4		

STEEL PENSTOCK(Installation stand) (3/6)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	⑤ Installation stand									
	Support beam	SS400	L	75×75×6×1400	144	9.6	1381	60.5		
	Gusser Plate	SS400	PL	9×250×300	288	5.3	1526	32.4		
	Installation stand(Post)	SS400	[	100×50×5/7.5×1000	92	9.4	861	55.2		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2000	46	18.7	861	55.2		
	Installation stand(Main)	SS400	[	100×50×5/7.5×1000	92	9.4	861	55.2		
	Installation stand(Sub)	SS400	L	75×75×6×1500	92	10.3	945	41.4		
	Installation stand	SS400	L	75×75×6×500	184	3.4	630	27.6		
	Base Plate	SS400	PL	9×240×250	92	4.2	390	11.0		
	Gusser Plate	SS400	PL	9×200×200	92	2.8	260	7.4		
	Rail girder	SS400	[	150×75×6.5/10×71605	2	1331.9	2664	108.8		
	Base	SS400	PL	16×300×400	286	15.1	4311	68.6		
	Liner	SS400	t	10×300×400	286	9.4	2694	68.6		
	⑥ Installation stand									
	Support beam	SS400	L	75×75×6×1400	72	9.6	690	30.2		
	Gusser Plate	SS400	PL	9×250×300	144	5.3	763	21.6		
	Installation stand(Post)	SS400	[	100×50×5/7.5×1000	48	9.4	449	28.8		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2000	24	18.7	449	28.8		
	Installation stand(Main)	SS400	[	100×50×5/7.5×1000	48	9.4	449	28.8		
	Installation stand(Sub)	SS400	L	75×75×6×1500	48	10.3	493	21.6		
	Installation stand	SS400	L	75×75×6×500	96	3.4	329	14.4		
	Base Plate	SS400	PL	9×240×250	48	4.2	203	5.8		
	Gusser Plate	SS400	PL	9×200×200	48	2.8	136	3.8		
	Rail girder	SS400	[	150×75×6.5/10×71605	2	1331.9	2664	53.7		
	Base	SS400	PL	16×300×400	142	15.1	2140	34.1		
	Liner	SS400	t	10×300×400	142	9.4	1338	34.1		

STEEL PENSTOCK(Installation stand)

(1/6)

No,	Item	Material	Dimensions(mm) Shape	Dimensions(mm) × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	⑦ Installation stand									
	Support beam	SS400	L	75×75×6×1400	174	9.6	1669	73.1		
	Gusser Plate	SS400	PL	9×250×300	348	5.3	1844	52.2		
	Installation stand(Post)	SS400	[	100×50×5/7.5×1000	116	9.4	1086	69.6		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2000	58	18.7	1086	69.6		
	Installation stand(Main)	SS400	[	100×50×5/7.5×1000	116	9.4	1086	69.6		
	Installation stand(Sub)	SS400	L	75×75×6×1500	116	10.3	1192	52.2		
	Installation stand	SS400	L	75×75×6×500	232	3.4	795	34.8		
	Base Plate	SS400	PL	9×240×250	116	4.2	492	13.9		
	Gusser Plate	SS400	PL	9×200×200	116	2.8	328	9.3		
	Rail girder	SS400	[	150×75×6.5/10×71605	2	1331.9	2664	132.2		
	Base	SS400	PL	16×300×400	348	15.1	5245	83.5		
	Liner	SS400	t	10×300×400	348	9.4	3278	83.5		
	⑧ Installation stand									
	Support beam	SS400	L	75×75×6×1400	24	9.6	230	10.1		
	Gusser Plate	SS400	PL	9×250×300	48	5.3	254	7.2		
	Installation stand(Post)	SS400	[	100×50×5/7.5×1000	16	9.4	150	9.6		
	Installation stand(Main)	SS400	[	100×50×5/7.5×2000	8	18.7	150	9.6		
	Installation stand(Main)	SS400	[	100×50×5/7.5×1000	16	9.4	150	9.6		
	Installation stand(Sub)	SS400	L	75×75×6×1500	16	10.3	164	7.2		
	Installation stand	SS400	L	75×75×6×500	32	3.4	110	4.8		
	Base Plate	SS400	PL	9×240×250	16	4.2	68	1.9		
	Gusser Plate	SS400	PL	9×200×200	16	2.8	45	1.3		
	Rail girder	SS400	[	150×75×6.5/10×7891	2	146.8	294	12.0		
	Base	SS400	PL	16×300×400	32	15.1	482	7.7		
	Liner	SS400	t	10×300×400	32	9.4	301	7.7		

STEEL PENSTOCK(Installation stand) (5/6)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m^2) Painting I.S.	Painting O.S.	Acid
	⑨ Installation stand(Branch)									
	Installation stand(Post)	SS400	L	75×75×6×1000	20	6.9	137	6.0		
	Installation stand(Main)	SS400	L	75×75×6×900	10	6.2	62	2.7		
	Installation stand(Main)	SS400	L	75×75×6×1000	20	6.9	137	6.0		
	Installation stand(Sub)	SS400	L	75×75×6×1000	20	6.9	137	6.0		
	Installation stand	SS400	L	75×75×6×500	40	3.4	137	6.0		
	Sub beam	SS400	L	75×75×6×1000	20	6.9	137	6.0		
	Gusser Plate	SS400	PL	9×200×200	20	2.8	57	1.6		
	Seat plate	SS400	PL	16×200×200	20	5.0	100	1.6		
	Adjusting	SS400	PL	16×75×150	40	1.4	57	0.9		
	Installation stand(Post)	SS400	L	75×75×6×1000	8	6.9	55	2.4		
	Installation stand(Main)	SS400	L	75×75×6×500	4	3.4	14	0.6		
	Installation stand(Main)	SS400	L	75×75×6×1000	8	6.9	55	2.4		
	Installation stand(Sub)	SS400	L	75×75×6×800	8	5.5	44	1.9		
	Installation stand	SS400	L	75×75×6×500	16	3.4	55	2.4		
	Sub beam	SS400	L	75×75×6×1000	8	6.9	55	2.4		
	Gusser Plate	SS400	PL	9×200×200	8	2.8	23	0.6		
	Seat plate	SS400	PL	16×200×200	8	5.0	40	0.6		
	Adjusting	SS400	PL	16×75×150	16	1.4	23	0.4		
				Sub Total			102417	3574.8		
	① Installation stand									
	Anchor bolt	SS400		M20×250	24	0.779	19			
	Anchor setter	glass type		AP25	24	0.101	2			
	② Installation stand									
	Anchor bolt	SS400		M20×250	264	0.779	206			
	Anchor setter	glass type		AP25	264	0.101	27			

STEEL PENSTOCK(Installation stand)

(6/6)

No.	Item	Material	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	③ Installation stand								
	Anchor bolt	SS400	M20×250	1128	0.779	879			
	Anchor setter	glass type	AP25	1128	0.101	114			
	④ Installation stand								
	Anchor bolt	SS400	M20×250	1840	0.779	1433			
	Anchor setter	glass type	AP25	1840	0.101	186			
	⑤ Installation stand								
	Anchor bolt	SS400	M20×250	1144	0.779	891			
	Anchor setter	glass type	AP25	1144	0.101	116			
	⑥ Installation stand								
	Anchor bolt	SS400	M20×250	568	0.779	442			
	Anchor setter	glass type	AP25	568	0.101	57			
	⑦ Installation stand								
	Anchor bolt	SS400	M20×250	1392	0.779	1084			
	Anchor setter	glass type	AP25	1392	0.101	141			
	⑧ Installation stand								
	Anchor bolt	SS400	M20×250	128	0.779	100			
	Anchor setter	glass type	AP25	128	0.101	13			
	⑨ Installation stand								
	Anchor bolt	SS400	M16×170	112	0.362	41			
	Anchor setter	glass type	AP16	112	0.046	5			
	Roller		N04-Type 1-4S						
			Sub Total			5756			
			Installation stand Total			108173	3574.8		

OUT LET STRUCTURES(φ650 Main Control Gate) (1/5)

No.	Item	Material	Dimensions(mm) Shape × Length		Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	<Gate Leaf>									
	Gate Leaf	SUS304+SM490	t	125×1130×846	1	872.4	872		0.9	0.9
	Beading Plate	CAC403	t	20×80×650	2	9.3	19		-	
	Beading Plate	CAC403	t	25×80×650	2	11.6	23		-	
				Sub Total			914		0.9	0.9
	Bolt	SUS304		M12×25	28	0.059	2			
	Eye Bolt	SUS304		M24	2	0.9	2			
				Sub Total			4			
				<Gate Leaf> Total			918		0.9	0.9
	<Bonnet>									
	Bonnet									
	Pipe	SS400	PL	19×2322×659	1	228.2	228		3.1	
	Pipe Flange	SM400C	t	41×(φ855−φ650)	1	78.0	78		0.5	
	Pipe Stiffener	SS400	PL	9×(φ900−φ650)	1	21.5	22		0.6	
	Plate	SS400	PL	12×1194×2070	1	172.3	172		3.7	
	Side plate	SS400	PL	12×127×2070	2	25.0	50		1.1	
	Lower plate	SS400	PL	12×127×1220	1	14.7	15		0.3	
	Side Flange	SM400C	t	45×185×2070	2	136.7	273		1.5	
	Lower Flange	SM400C	t	45×185×1220	1	80.5	81		0.5	
	Stiffener	SS400	PL	16×127×160	2	2.6	5		0.1	
	Upper flange	SM400C	t	45×384×1540	1	137.9	138		0.8	
	Stiffener	SS400	PL	9×50×2156	2	7.6	15		0.4	
	Stiffener	SS400	PL	9×229×1540	2	13.2	26		0.7	
	Stiffener	SS400	PL	9×489×500	4	14.3	57		1.6	
	Stiffener	SS400	PL	9×489×350	2	10.0	20		0.5	
	Vertical stiffener	SS400	PL	9×90×361	1	2.3	2		0.1	
	Vertical stiffener	SS400	PL	9×350×300	1	5.9	6		0.2	
	Vertical stiffener	SS400	PL	16×320×321	2	10.3	21		0.4	

OUT LET STRUCTURES (ϕ 650 Main Control Gate)

(2/5)

No,	Item	Material	Dimensions (mm) Shape	Dimensions (mm) × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m^2) Painting I.S.	Painting Area (m^2) Painting O.S.	Painting Area (m^2) Acid
	Seat plate	SM400C	PL	45×160×400	2	22.6	45		0.3	
	Stiffener	SS400	PL	9×300×350	2	5.2	10		0.2	
	Stiffener	SS400	PL	9×250×361	2	6.4	13		0.1	
	Bearing Plate	SUS304	t	9×85×1720	2	10.4	21			-
	Conical ring	SM400C	t	65×(ϕ 880 − ϕ 746)	1	78.6	79		0.3	
	Seal ring	CAC703	t	53×(ϕ 759 − ϕ 650)	1	40.0	40		-	
	Seal ring clamp bar	SUS304	PL	25×(ϕ 850 − ϕ 736)	1	25.3	25			-
	Bonnet									
	Pipe	SS400	PL	19×2887×261	1	112.4	112		1.5	
	Ring beam	SM400C	t	39×(ϕ 1100 − ϕ 900)	1	96.2	96		0.6	
	Skinplate	SM400C	PL	50×1540×2070	1	988.5	989		5.0	
	Upper Flange	SM400C	t	45×196×1540	1	106.6	107		0.6	
	Stiffener	SS400	PL	9×50×1888	2	6.7	13		0.4	
	Stiffener	SS400	PL	9×95×1540	2	10.3	21		0.6	
	Stiffener	SS400	PL	9×160×450	4	5.1	20		0.7	
	Stiffener	SS400	PL	9×160×320	2	3.6	7		0.2	
	Vertical stiffener	SS400	PL	9×95×361	1	2.4	2		0.1	
	Vertical stiffener	SS400	PL	9×192×261	1	3.5	4		0.1	
	Vertical stiffener	SS400	PL	9×95×321	2	2.2	4		0.1	
	Vertical stiffener	SS400	PL	9×95×361	4	2.4	10		0.3	
	Vertical stiffener	SS400	PL	9×95×311	4	2.1	8		0.2	
	Vertical stiffener	SS400	PL	9×95×361	2	2.4	5		0.1	
	Vertical stiffener	SS400	PL	16×320×321	2	10.3	21		0.4	
	Seat plate	SM400C	PL	45×160×400	2	22.6	45		0.3	
	stiffener	SS400	PL	9×250×261	2	4.1	8		0.2	
	stiffener	SS400	PL	9×95×361	2	2.4	5		0.1	
	Bearing Plate	SUS304	t	20×95×1720	2	24.6	49			-

OUT LET STRUCTURES(φ650 Main Control Gate) (3/5)

No,	Item	Material	Dimensions(mm) Shape × Length		Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Bonnet cover									
	Upper Flange	SM400C	t	45×580×800	1	147.5	148		0.8	
	Lower Flange	SM400C	t	45×580×1540	1	302.9	303		1.7	
	Cover	SS400	PL	22×610×1520	2	128.1	256		3.0	
	Stiffener	SS400	PL	22×610×240	2	25.3	51		0.6	
	Stiffener	SS400	PL	22×610×140	4	14.7	59		0.7	
	Stiffener	SS400	PL	22×140×250	4	4.5	18		0.2	
	Packing case	SUS304	RB	(φ205−φ125)×105	1	17.6	18			-
	Packing clamp bar	CAC403	t	35×(φ190−φ105)	1	3.3	3		-	
	Packing clamp bar	CAC403	t	42×(φ125−φ105)	1	1.3	1		-	
				Sub Total			3,825		35.5	0.0
	Reamer pin·Nut	SUS304		36×100	4	0.8	3			
	Bolt, Nut	SUS304		M36×150 N, SW	30	2.08	62			
	Bolt	SUS304		M12×30	32	0.063	2			
	"O"ring	NBR		φ8.4×2523	1	0.22	-			
	"O"ring	NBR		φ8.4×2372	1	0.21	-			
	"O"ring	NBR		φ8.4×3173	1	0.28	-			
	Bolt, Nut	SUS304		M30×120 N, SW	24	1.168	28			
	Bolt, Nut	SUS304		M30×120 N, SW	28	1.168	33			
	Bolt, Nut	SUS304		M36×150 N, SW	20	2.08	42			
	Bolt	SUS304		M16×50	8	0.12	1			
	"V"packing	Cloth inserted rubber		F105	4	0.03	-			
				Sub Total			171			
				<Bonnet>Total			3,996		35.5	

OUT LET STRUCTURES(φ650 Main Control Gate) (1/5)

No,	Item	Material	Dimensions(mm) Shape × Length		Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	<Hoist>									
	Stand Base	SM400C	t	45×580×800−φ240	1	147.9	148	0.1	0.8	
	Stand	SS400	PL	19×813.7×760	1	92.2	92		1.2	
	Hoist Base	SM400C	t	45×(φ560−φ245)	1	71.0	71		0.4	
	Rib	SS400	PL	19×141×760	4	16.0	64		0.9	
	Spindle	SUS304N2	RB	100×2970	1	185.0	185			-
	Cooling	SUS304	RB	(φ210−φ105)×250	1	53.1	53			-
				Sub Total			613	0.1	3.3	0.0
	Spindle motor			Spindle motor	1	650.0	650			
				Rasing Height 0.870m						
				Motor 5.5kw						
				A/D converter electrical position transmiter						
				Spindle rod Tr100×12						
				JMB-2 B-3						
				Sub Total			650			
	Studbolt·Nut	SUS304		M36×148 N, SW	12	2.079	25			
	Bolt	SUS304		M20×70 SW	6	0.316	2			
	Bolt, Nut	SUS304		M36×215 N, SW	10	2.593	26			
	Reamerbolt, Nut	SUS304		φ36×215 N, SW	2	2.593	5			
				Sub Total			58			
				<Hoist>Total			1,321	0.1	3.3	0.0

OUT LET STRUCTURES (φ650 Main Control Gate) (5/5)

No,	Item	Material	Dimensions (mm) Shape × Length		Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting I.S.	Painting Area (m²) Painting O.S.	Painting Area (m²) Acid
	Gate stand									
	Main beam	SS400	H	150×150×7/10×550	2	17.3	35	0.7		
	Main beam	SS400	H	150×150×7/10×1100	2	34.7	69	1.4		
	Post	SS400	H	150×150×7/10×300	4	9.5	38	0.8		
	Sub beam	SS400	L	75×75×6×450	2	3.1	6	0.3		
	Sub beam	SS400	L	75×75×6×450	4	3.1	12	0.5		
	Stiffener	SS400	PL	9×65×130	20	0.6	12	0.4		
	Seat plate	SS400	PL	22×200×400	4	13.8	55	0.6		
	Hoist stand	SS400	PL	22×150×150	4	3.9	16	0.2		
	Hoist stand	SS400	PL	22×150×150	4	2.3	9	0.1		
	Liner	SS400	PL	6×200×400	4	3.8	15	0.6		
	Liner	SS400	PL	4.5×200×400	4	2.8	11	0.6		
	Liner	SS400	PL	3.2×200×400	8	2.0	16	1.3		
	Anchor Base	SS400	PL	22×250×250	4	10.8	43	0.5		
	Stopper	SS400	L	75×75×6×150	8	1.0	8	0.3		
				Sub Total			345	8.3		
	Anchor bolt	SS400		M20×250	16	0.779	12			
	Anchor setter	glass type		AP25	16	0.101	2			
				Sub Total			14			
				Installation stand Total			359	8.3		
				Steel Material			5,697	8.4	39.7	0.9
				Material purchased			247			
				Material single unit			650			

OUT LET STRUCTURES (ϕ 650 Guard Gate)

No.	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m^2) Painting I.S.	Painting O.S.	Acid
	<Gate Leaf>									
	Gate Leaf	SM400C	t	105×880×885	1	564.9	565		1.5	
	Seal clamp bar	SUS304	t	15×79×718	1	6.7	7			-
	Beading Plate	CAC403	t	30×75×775	2	15.5	31		-	
	Seal Plate	CAC403	t	30×75×720	1	14.5	15		-	
	Guide Plate	CAC403	t	20.5×50×670	2	6.1	12		-	
				Sub Total			630		1.5	0.0
	Rubber seal	N, R	t	10×29 Flat seal] =830	1		-			
	Bolt	SUS304		M16×30	9	0.080	1			
	Bolt	SUS304		M16×35	28	0.089	2			
	Bolt	SUS304		M12×25	18	0.036	1			
	Eyebolt	SUS304		M24	2	0.768	2			
				Sub Total			6			
				<Gate Leaf> Total			636		1.5	0
	<Bonnet>									
	Bonnet									
	Intake pipe	SS400	PL	19×669×287	1	87.1	87		1.2	
	Intake pipe Flange	SM400C	t	41×(ϕ 855− ϕ 650)	1	78.0	78		0.5	
	Skin plate	SM400A	PL	25×980×1870	1	291.3	291		3.0	
	Side plate	SM400A	PL	25×105×1870	2	38.9	78		0.8	
	Side Flange	SM400C	t	50×160×1870	2	118.6	237		0.4	
	Upper Flange	SM400C	t	50×358×1250	1	119.4	119		0.6	
	Guide shoe	SUS304	t	9×60×1570	2	6.7	13			-
	Silly guide	SUS304	t	155×165×930	1	188.6	189			0.4
	Horizontal girder	SS400	PL	16×280×1250	3	28.6	86		1.4	
	Horizontal girder	SS400	FB	75×19×1825	3	20.4	61		0.8	
	Horizontal stiffener	SS400	PL	16×271×417	2	9.2	18		0.3	
	Horizontal stiffener	SS400	PL	19×342×417	4	12.5	50		0.8	
	Horizontal stiffener	SS400	PL	16×171×287	1	4.9	5		0.1	

OUT LET STRUCTURES (ϕ 650 Guard Gate) (2/5)

No,	Item	Material	Dimensions (mm)		Quantity	Weight (kg)		Painting Area (m^2)		
			Shape × Length			Unit	W	Painting		Acid
								I.S.	O.S.	
	Horizontal stiffener	SS400	PL	16×163×287	2	4.7	9		0.1	
	Horizontal stiffener	SS400	PL	16×100×294	2	3.7	7		0.1	
	Vertical stiffener	SS400	PL	19×242×283	2	8.1	16		0.2	
	Seat plate	SS400	PL	22×125×1050	1	22.7	23		0.2	
	Bonnet									
	Outlet pipe	SS400	PL	19×699×762	1	242.1	242		3.2	
	Outlet pipe Flange	SM400C	t	41×(ϕ 855− ϕ 650)	1	78.0	78		0.5	
	Skin plate	SM400C	PL	50×1250×1870	1	779.8	780		3.5	
	Upper Flange	SM400C	t	50×198×1250	1	97.1	97		0.5	
	Bearing Plate	SUS304	PL	25×95×1610	2	20.0	40			0.1
	Bearing Plate	SUS304	t	15×105×760	1	9.4	9			-
	Air Pipe	SGP	Pipe	350A×450	1	30.4	30		1.0	
	Reinforcement plate	SS400	PL	19×(ϕ 540− ϕ 270)	1	25.6	26		0.2	
	Horizontal girder	SS400	PL	16×200×1230	1	30.9	31		0.5	
	Horizontal girder	SS400	FB	75×19×1140	1	12.8	13		0.2	
	Horizontal girder	SS400	PL	16×115×1230	2	17.8	36		0.6	
	Horizontal girder	SS400	FB	75×19×1140	2	12.8	26		0.4	
	Horizontal stiffener	SS400	PL	16×271×762	2	18.2	36		0.6	
	Horizontal stiffener	SS400	PL	16×342×762	4	22.9	92		1.5	
	Vertical stiffener	SS400	PL	16×171×762	1	11.4	11		0.2	
	Vertical stiffener	SS400	PL	16×163×355	2	5.1	10		0.2	
	Vertical stiffener	SS400	PL	16×166×242	1	3.1	3		0.1	
	Vertical stiffener	SS400	PL	16×100×294	2	3.7	7		0.1	
	Vertical stiffener	SS400	PL	19×242×253	2	7.3	15		0.2	
	Air Pipe Flange	SM400A	t	26×(ϕ 498− ϕ 358.1)	1	18.2	18		0.1	
	Seat plate	SS400	PL	22×150×1200	1	31.0	31		0.4	
	Side stiffener	SS400	PL	16×100×291	2	3.7	7		0.1	
	Side stiffener	SS400	PL	16×100×225	4	2.8	11		0.2	
	Side stiffener	SS400	PL	16×100×203	2	2.5	5		0.1	
	Side stiffener	SS400	PL	16×100×294	4	3.7	15		0.2	
	Side stiffener	SS400	PL	16×100×242	2	3.0	6		0.1	

OUT LET STRUCTURES (φ650 Guard Gate)

(3/5)

No,	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S.	Painting O.S.	Acid
	Bonnet cover									
	Vaner plate	SM400C	t	41×550×1250	1	221.3	221		1.4	
	Upper plate	SM400C	t	45×550×630	1	108.9	109		0.3	
	Web	SS400	PL	16×574×1230	2	83.0	166		2.0	
	Stiffener	SS400	PL	16×125×574	4	9.0	36		0.6	
	Stiffener	SS400	PL	16×248×574	2	17.9	36		0.6	
	Stiffener	SS400	PL	16×125×250	4	4.2	17		0.2	
	Air pipe	SUS304TP	Pipe	10A×Sch40×150	1		-			-
	Bush	CAC403	t	(φ115−φ95)×40	1	1.16	1		-	
	Boss	SS400	t	(φ195−φ98)×103	1	16.2	16		0.2	
	Packing clamp bar	CAC403	t	(φ180−φ95)×34	1	2.7	3		-	
				Sub Total			3,647		30.5	0.5
	"O"ring	NBR		φ8.4×2390	2	0.212	-			
	"O"ring	NBR		φ8.4×7260	1		1			
	Bolt	SUS304		M16×50	6	0.109	1			
	Bolt	SUS304		M12×40	3	0.051	-			
	Bolt, Nut	SUS304		M30×120 N, SW	48	1.19	57			
	Bolt, Nut	SUS304		M36×150 N, SW	28	2.102	59			
	Bolt, Nut	SUS304		M36×280 N, SW	8	3.113	25			
	Reamer pin	S45C		16×140	4	0.266	1			
	Bolt, Nut	SUS304		M36×140 N, SW	22	2.021	44			
	Reamerbolt, Nut	SUS304		φ32×140	2	1.357	3			
	"V"packing	Cloth inserted rubber		F95	4	0.034	-			
	Air valve	SUS304		Pall Valve	1					
				Sub Total			191			
				<Bonnet>Total			3,838		30.5	0.5

OUT LET STRUCTURES(φ650 Guard Gate) (4/5)

No,	Item	Material	Dimensions(mm) Shape × Length		Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	<Hoist>									
	Stand Base	SM400C	t	45×550×630−φ250	1	105.0	105	0.1	0.6	
	Stand	SS400	PL	19×845.1×660	1	83.2	83		1.1	
	Hoist Base	SM400C	t	45×(φ560−φ250)	1	69.7	70		0.4	
	Rib	SS400	PL	19×136×660	4	13.4	54		0.7	
	Spindle	SUS304N2	RB	100×2690	1	167.5	168			-
	Cooling	SUS304	RB	(φ190−φ95)×230	1	40.1	40			-
				Sub Total			520	0.1	2.8	0.0
	Spindle motor			Spindle motor	1	650.0	650			
				Rasing height 0.750m						
				Motor power 5.5kw						
				A/D converter electrical position transmiter						
				Spindle Tr100×12						
				JMB-2 B-3						
				Sub Total			650			
	Studbolt-Nut	SUS304		M36×148 N, SW	12	2.079	25			
	Bolt	SUS304		M16×55 SW	6	0.160	1			
	Bolt, Nut	SUS304		M36×193 N, SW	10	2.423	24			
	Reamerbolt, Nut	SUS304		M36×193 N, SW	2	2.423	5			
				Sub Total			55			
				<Hoist>Total			1,225	0.1	2.8	0.0

OUT LET STRUCTURES(ϕ 650 Guard Gate) (5/5)

No.	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S.	Painting O.S.	Acid
	Installation stand									
	Main girder	SS400	H	150×150×7/10×630	2	19.8	40	1.1		
	Main girder	SS400	H	150×150×7/10×750	2	23.6	47	1.3		
	Post	SS400	H	150×150×7/10×480	4	15.1	60	1.7		
	Sub beam	SS400	L	75×75×6×500	2	3.4	7	0.3		
	Sub beam	SS400	L	75×75×6×550	4	3.7	15	0.6		
	Stiffener	SS400	PL	9×65×130	20	0.6	12	0.3		
	Stand plate	SS400	PL	22×200×200	4	6.9	28	0.3		
	Liner	SS400	PL	6×200×200	4	1.9	8	0.3		
	Liner	SS400	PL	4.5×200×200	4	1.4	6	0.3		
	Liner	SS400	PL	3.2×200×200	8	1.000	8	0.6		
	Anchor Base	SS400	PL	22×250×350	4	15.100	60	0.7		
	Post stopper	SS400	L	75×75×6×150	8	1.0	8	0.3		
	Hoist stand	SS400	PL	22×150×150	4	3.9	16	0.2		
	Hoist stand	SS400	PL	22×150×150	4	2.3	9	0.1		
				Sub Total			324	8.1		
	Anchor bolt	SS400		M20×250	16	0.779	12			
	Anchor setter	glass type		AP25	16	0.101	2			
				Sub Total			14			
				Installation stand Total			338	8.1		
				Steel Material			5,121	8.2	34.8	0.5
				Material purchased			266			
				Material single unit			650			

OUT LET STRUCTURES (ϕ 650 Auxiliary facilities) (1/1)

No,	Item	Material	Dimensions (mm) Shape	Dimensions (mm) × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m^2) Painting I.S.	Painting Area (m^2) Painting O.S.	Painting Area (m^2) Acid
	Auxiliary facilities									
	Connecting pipe	SS400	PL	19×669π×1000	1	313.5	314	4.2		
	Flange	SM400C	t	41×(ϕ 855− ϕ 650)	2	78.0	156	1.0		
	Outlet pipe	STPY400	Pipe	900A(t8.7)×1000	1	195.0	195	5.7		
	Flange	SM400C	t	39×(ϕ 1100− ϕ 900)	1	96.2	96	0.6		
	Stiffener	SS400	PL	9×(ϕ 1114.4− ϕ 914.4)	4	22.5	90	2.5		
	Main Air pipe	SGP	Pipe	350A×4000	1	270.8	271	8.9		
	Flange	SM400A	t	26×(ϕ 498− ϕ 358.1)	1	18.2	18	0.1		
	Stiffener	SS400	PL	9×(ϕ 508− ϕ 358)	4	7.2	29	0.8		
	Sub Air pipe	SGP	Pipe	250A×2000	1	84.8	85	3.4		
	Flange	SM400A	t	24×(ϕ 400− ϕ 269.5)	3	12.9	39	0.4		
	Reinforcement	SS400	PL	12×(ϕ 450− ϕ 269.5)	1	9.6	10	0.2		
	Water filling device	SGP	Pipe	150A×4000	1	79.2	79	4.2		
	Flange	SM400A	t	22×(ϕ 280− ϕ 166.6)	8	6.9	55	0.6		
	Reinforcement	SS400	PL	9×(ϕ 300− ϕ 166.6)	2	3.5	7	0.2		
				Sub Total			1,444	32.8		
	Spring type air valve	SC450		250A	1		330			
	Hand gate valve	SC450		250A	1		210			
	Hand gate valve	SC450		150A	1		95			
	Electric gate valve	SC450		150A	1		210			
				Sub Total			845			
	Elbow	SGP		250A 45° E(L)	1	12.7	13			
	Elbow	SGP		150A 90° E(L)	2	7.1	14			
	Bolt	SUS304		M22×85 N,W	48	0.438	21			
	Bolt	SUS304		M20×65 N,W	72	0.308	22			
				Sub Total			70			
				Auxiliary facilities Total			2,359	32.8		

OUT LET STRUCTURES (φ650 Installation stand)

(1/1)

No.	Item	Material	Dimensions (mm)		Quantity	Weight (kg)		Painting Area (m²)		
			Shape	× Length		Unit	W	Painting		Acid
								I.S.	O.S.	
	Installation stand									
	For outlet pipe									
	Installation stand (Post)	SS400	L	75×75×6×1300	8	8.9	71	3.1		
	Installation stand (Main)	SS400	L	75×75×6×850	4	5.8	23	1.0		
	Installation stand (Main)	SS400	L	75×75×6×1000	8	6.9	55	2.4		
	Installation stand (Sub)	SS400	L	75×75×6×1000	8	6.9	55	2.4		
	Installation stand	SS400	L	50×50×6×500	16	2.2	35	1.6		
	Base	SS400	PL	12×200×200	8	3.8	30	0.6		
	Liner	SS400	PL	9×75×150	16	0.8	13	0.4		
	For main air pipe									
	Installation stand	SS400	L	50×50×6×500	6	2.2	13	0.6		
	For sub air pipe									
	Installation stand	SS400	L	50×50×6×1000	2	4.4	9	0.4		
	For water filling device									
	Installation stand	SS400	L	50×50×6×1000	4	4.4	18	0.8		
	Installation stand	SS400	L	50×50×6×250	4	1.1	4	0.2		
	Installation stand	SS400	PL	9×180×180	4	2.3	9	0.3		
				Sub Total			335	13.8		
	Anchor bolt	SS400		M16×170	48	0.362	17			
	Anchor setter	glass type		AP16	48	0.046	2			
				Sub Total			19			
				Installation stand Total			354	13.8		

OUT LET STRUCTURES (φ250 Main Control Gate) (1/5)

No.	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S.	Painting O.S.	Acid
	<Gate Leaf>									
	Gate Leaf	SUS304+SM490	t	58×490×368	1	74.7	75		0.9	0.9
	Beading Plate	CAC403	t	15×30×250	2	1	2		-	
	Beading Plate	CAC403	t	15×30×250	2	1	2		-	
				Sub Total			79		0.9	0.9
	Bolt	SUS304		M10×20	16	0.02	-			
	Eye Bolt	SUS304		M10	2	0.1	-			
				Sub Total			0			
				<Gate Leaf> Total			79		0.9	0.9
	<Bonnet>									
	Bonnet									
	Intake pipe	SS400	PL	12×902×222	1	19.1	19		0.4	
	Intake pipe Flange	SM400A	t	28×(φ400−φ250)	1	17.0	17		0.2	
	Intake pipe Stiffener	SS400	PL	9×(φ400−φ250)	1	5.4	5		0.2	
	Skin plate	SS400	PL	12×479×980	1	34.9	35		0.7	
	Side plate	SS400	PL	12×77×980	2	7.2	14		0.3	
	Lower plate	SS400	PL	12×77×520	1	3.8	4		0.1	
	Side Flange	SM400A	t	25×105×980	2	20.4	41		0.4	
	Lower Flange	SM400A	t	25×105×520	1	10.8	11		0.1	
	Stiffener	SS400	PL	12×77×80	2	0.6	1		-	
	Upper Flange	SM400A	t	25×201×721	1	19.2	19		0.2	
	Stiffener	SS400	PL	9×159×721	1	5.3	5		0.1	
	Stiffener	SS400	PL	9×214×270	2	3.1	6		0.2	
	Vertical Rib	SS400	PL	9×180×256	2	2.6	5		0.2	
	Seat plate	SM400A	PL	25×75×200	2	2.9	6		0.1	
	Stiffener	SS400	PL	9×125×195	2	1.6	3		0.1	
	Stiffener	SS400	PL	9×70×156	2	0.8	2		-	
	Bearing Plate	SUS304	t	9×40×830	2	2.4	5			-
	Vertical stiffener	SS400	PL	9×125×330	2	2.9	6		0.1	

OUT LET STRUCTURES (ϕ 250 Main Control Gate)

No,	Item	Material	Dimensions (mm) Shape	Dimensions (mm) × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m^2) Painting I.S.	Painting Area (m^2) Painting O.S.	Painting Area (m^2) Acid
	Conical ring	SM400C	t	35× (ϕ 360 − ϕ 292)	1	8.7	9		0.2	
	Seal ring	CAC703	t	25× (ϕ 299 − ϕ 250)	1	3.3	3		-	
	Seal ring clamp bar	SUS304	PL	12× (ϕ 350 − ϕ 288)	1	2.7	3			-
	Bonnet									
	Outlet pipe	STPG370	Pipe	400A (Sch20S) × 175	1	13.6	14		0.4	
	Outlet pipe Flange	SM400A	t	28× (ϕ 540 − ϕ 400)	1	22.9	23		0.2	
	Skin plate	SM400A	PL	32×721×980	1	145.5	146		1.2	
	Upper Flange	SM400A	t	25×99×721	1	14.2	14		0.1	
	Air duct	SS400	PL	9×70×241	1	1.2	1		-	
	Air duct	SS400	PL	9×241×525	1	6.8	7		0.2	
	Air Pipe	SGP	Pipe	200A×174	1	5.2	5		0.2	
	Air Pipe Flange	SM400A	t	20× (ϕ 320 − ϕ 203)	1	7.6	8		0.1	
	Vertical stiffener	SS400	PL	9×60×256	2	1.1	2		0.1	
	Vertical stiffener	SS400	PL	9×60×271	2	1.1	2		0.1	
	Vertical stiffener	SS400	PL	9×60×156	2	0.7	1		-	
	Vertical stiffener	SS400	PL	9×185×490	2	5.1	10		0.3	
	Seat plate	SM400A	PL	25×75×200	2	2.9	6		0.1	
	Stiffener	SS400	PL	9×175×195	2	2.2	4		0.1	
	Stiffener	SS400	PL	9×156×70	2	0.8	2		-	
	Stiffener	SS400	PL	9×70×236	2	1.2	2		0.1	
	Stiffener	SS400	PL	9×175×270	4	3.3	13		0.4	
	Bearing Plate	SUS304	t	15×45×830	2	4	8			-

OUT LET STRUCTURES (φ250 Main Control Gate)

(3/5)

No,	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S.	Painting O.S.	Acid
	Bonnet cover									
	Upper Flange	SM400C	t	25×300×360	1	19.1	19		0.2	
	Lower Flange	SM400C	t	25×300×721	1	40.8	41		0.4	
	Cover	SS400	PL	12×310×721	2	17.5	35		0.8	
	Stiffener	SS400	PL	12×310×140	2	4.1	8		0.2	
	Stiffener	SS400	PL	12×310×58	4	1.7	7		0.2	
	Stiffener	SS400	PL	12×75×58	4	0.3	1		0.2	
	Packing case	SUS304	RB	(φ120−φ61)×65	1	6.9	7			-
	Packing clamp bar	CAC403	t	26×(φ110−φ45)	1	1.2	1		-	
	Packing clamp bar	CAC403	t	20×(φ61−φ45)	1	0.5	1		-	
				Sub Total			607		9.2	0.0
	Reamer pin-Nut	SUS304		18×50	4	0.15	1			
	Bolt, Nut	SUS304		M18×65 N, SW	19	0.24	5			
	Bolt	SUS304		M8×16	14	0.01	-			
	"O" ring	NBR		φ5.7×935	1	0.03	-			
	"O" ring	NBR		φ5.7×942	1	0.03	-			
	"O" ring	NBR		φ5.7×1382	1	0.04	-			
	Bolt, Nut	SUS304		M22×85 N, SW	12	0.46	6			
	Bolt, Nut	SUS304		M24×100 N, SW	16	0.64	10			
	Bolt, Nut	SUS304		M18×65 N, SW	14	0.24	3			
	Bolt	SUS304		M10×35	4	0.01	-			
	"V" packing	Cloth inserted rubber		F45	4	0.01	-			
				Sub Total			25			
				<Bonnet> Total			632		9.2	

OUT LET STRUCTURES(φ250 Main Control Gate)

(4/5)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	<Hoist>									
	Stand Base	SS400	t	20×300×360−φ120	1	15.2	15		0.2	
	Stand	SS400	PL	8×402.1×310	1	7.8	8		0.2	
	Hoist Base	SS400	t	20×(φ300−φ120)	1	9.3	9		0.1	
	Stiffener	SS400	PL	8×82×310	4	1.6	6		0.2	
	Spindle	SUS304N2	RB	50×1580	1	24.6	25			-
	Coucling	SUS304	RB	(φ100−φ45)×110	1	5.6	6			-
				Sub Total			69		0.7	0.0
	Spindle motor			Spindle motor	1	217.0	217			
				Raising height 0.350m						
				Motor power 1.5kw						
				A/D converter electrical position transmiter						
				Spindle Tr50×10						
				JMB-1						
				Sub Total			217			
	Studbolt-Nut	SUS304		M16×67 N, SW	8	0.177	1			
	Bolt	SUS304		M10×30 SW	6	0.045	0			
	Bolt, Nut	SUS304		M16×190 N, SW	6	0.37	2			
	Reamerbolt, Nut	SUS304		φ16×190 N, SW	2	0.37	1			
				Sub Total			4			
				<Hoist>Total			290	0.0	0.7	0.0

OUT LET STRUCTURES (φ250 Main Control Gate) (5/5)

No.	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S.	Painting O.S.	Acid
	Valve stand									
	Flange	SS400	PL	9×600×300	2	12.7	25		0.7	
	Web	SS400	PL	9×600×112	2	4.7	9		0.3	
	Stiffener	SS400	PL	9×300×112	2	2.4	5		0.1	
	Liner plate	SS400	t	46×150×100	4	5.4	22	0.2		
	Anchor Base	SS400	PL	9×600×300	1	12.7	13	0.4		
				Sub Total			74	0.6	1.1	
	Anchor bolt	SS400		M16×170	4	0.362	1			
	Anchor setter	glass type		AP16	4	0.046	–			
				Sub Total			1			
				Valve stand Total			75	0.6	1.1	
				Steel Material			829	0.6	11.9	0.9
				Material purchased			30			
				Material single unit			217			

OUT LET STRUCTURES (φ250 Guard Gate) (1/5)

No.	Item	Material	Dimensions (mm)		Quantity	Weight (kg)		Painting Area (m²)		
			Shape × Length			Unit	W	Painting		Acid
								I. S.	O. S.	
	<Gate Leaf>									
	Gate Leaf	SM400C	t	50×380×388	1	46.3	46		0.3	
	Seal clamp bar	SUS304	t	10×74×298	1	1.7	2			-
	Beading Plate	CAC403	t	20×35×320	2	2	4		-	
	Seal Plate	CAC403	t	20×35×300	1	1.8	2		-	
	Guide Plate	CAC403	t	15.7×25×275	2	0.9	2		-	
				Sub Total			56		0.3	0.0
	Rubber seal	N, R	t	10×29 Flat seal ℓ=360	1		-			
	Bolt	SUS304		M12×20	5	0.034	-			
	Bolt	SUS304		M10×20	19	0.023	-			
	Bolt	SUS304		M8×16	6	0.012	-			
	Eyebolt	SUS304		M8	2	0.028	-			
				Sub Total			0			
				<Gate Leaf> Total			56		0.3	0.0
	<Bonnet>									
	Bonnet									
	Intake pipe	SS400	RB	(φ280−φ250)×156	1	15.3	15		0.3	
	Intake pipe Flange	SM400A	t	28×(φ400−φ250)	1	16.8	17		0.1	
	Skin plate	SS400	PL	16×442×810	1	39.1	39		0.6	
	Side plate	SS400	PL	16×55×810	2	5.7	11		0.2	
	Side Flange	SM400A	t	30×115×810	2	22.2	44		0.2	
	Upper Flange	SM400A	t	30×225×640	1	25.8	26		0.1	
	Guide shoe	SUS304	t	9×35×630	2	1.6	3			-
	Sill guide	SM400C	t	115×85×410	1	31.5	32		0.2	
	Horizontal girder	SS400	PL	9×151×640	2	4.6	9		0.3	
	Horizontal girder	SS400	FB	44×12×938	2	3.9	8		0.2	
	Horizontal stiffener	SS400	PL	9×170×227	2	2.3	5		0.1	
	Horizontal stiffener	SS400	PL	9×120×156	1	1.3	1		-	
	Horizontal stiffener	SS400	PL	9×86×156	2	0.7	1		-	

OUT LET STRUCTURES(ϕ 250 Guard Gate)

(2/5)

No.	Item	Material	Dimensions (mm) Shape	Dimensions (mm) × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m^2) Painting I.S.	Painting Area (m^2) Painting O.S.	Painting Area (m^2) Acid
	Horizontal stiffener	SS400	PL	9×50×181	2	0.6	1		-	
	Vertical stiffener	SS400	PL	9×156×199	2	1.5	3		0.1	
	Seat plate	SS400	PL	12×100×460	1	4.3	4		0.1	
	Bonnet									
	Outlet pipe	SS400	RB	(ϕ 300 − ϕ 250) ×392	1	52.5	53		0.5	
	Outlet pipe Flange	SM400A	t	28× (ϕ 400 − ϕ 250)	1	16.8	17		0.1	
	Skin plate	SM400A	PL	32×640×810	1	115.9	116		0.1	
	Upper Flange	SM400A	t	30×140×640	1	21.1	21		0.1	
	Bearing Plate	SUS304	PL	15×50×640	2	2.8	6			-
	Bearing Plate	SUS304	t	10×60×290	1	1.4	1			-
	Air Pipe	SGP	Pipe	150A×289	1	5.7	6		0.2	
	Horizontal girder	SS400	PL	9×75×620	1	3.3	3		0.1	
	Horizontal girder	SS400	FB	50×12×570	1	2.7	3		0.1	
	Horizontal girder	SS400	PL	9×65×620	1	2.8	3		0.1	
	Horizontal girder	SS400	PL	9×38×570	1	1.5	2		-	
	Horizontal stiffener	SS400	PL	9×160×392	2	3.2	6		0.2	
	Vertical stiffener	SS400	PL	9×110×392	1	2.3	2		0.1	
	Vertical stiffener	SS400	PL	9×127×155	2	1	2		0.1	
	Vertical stiffener	SS400	PL	9×94×147	1	0.6	1		-	
	Seat plate	SS400	PL	12×110×570	1	5.9	6		0.1	
	Side stiffener	SS400	PL	9×50×256	2	0.9	2		0.1	
	Side stiffener	SS400	PL	9×50×191	2	0.7	1		-	
	Side stiffener	SS400	PL	9×50×181	2	0.6	1		0.1	
	Side stiffener	SS400	PL	9×156×185	2	1.4	3		-	

OUT LET STRUCTURES(φ250 Guard Gate) (3/5)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	Bonnet cover									
	Lower plate	SM400A	t	30×360×640	1	51.5	52		0.2	
	Upper plate	SM400A	t	23×360×400	1	23.7	24		0.1	
	Web	SS400	PL	9×347×620	2	11.2	22		0.6	
	Stiffener	SS400	PL	9×85×347	4	2.1	8		0.2	
	Stiffener	SS400	PL	9×152×347	2	3.7	7		0.2	
	Bush	CAC403	t	(φ61−φ45)×20	1	0.2	0		-	
	Boss	S400	t	(φ120−φ47)×65	1	4.9	5		-	
	Packing clamp bar	CAC403	t	(φ110−φ45)×26	1	1.0	1		-	
				Sub Total			593		5.8	
	"O"ring	NBR		φ5.7×940	2	0.038	-			
	"O"ring	NBR		φ5.7×3210	1		-			
	Bolt	SUS304		M10×35	4	0.032	-			
	Bolt	SUS304		M8×30	2	0.016	-			
	Bolt, Nut	SUS304		M22×85 N, SW	24	0.491	12			
	Bolt, Nut	SUS304		M24×90 N, SW	14	0.571	8			
	Bolt, Nut	SUS304		M24×160 N, SW	6	0.822	5			
	Reamerbolt, Nut	SUS304		φ30×90	4	0.718	3			
	Bolt, Nut	SUS304		M24×90 N, SW	12	0.571	7			
	Reamerbolt, Nut	SUS304		φ25×90	2	0.571	1			
	"V"packing	Cloth inserted rubber		F45	4	0.012	-			
	Flange	SUS304		10K-150A	1		6			
				Sub Total			42			
				<Bonnet>Total			635		5.8	

OUT LET STRUCTURES (φ250 Guard Gate)

(4/5)

No,	Item	Material	Dimensions (mm) Shape × Length		Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting I.S.	Painting Area (m²) Painting O.S.	Painting Area (m²) Acid
	<Hoist>									
	Stand Base	SM400A	t	23×360×400−φ150	1	22.8	23	-	0.1	
	Stand	SS400	PL	9×499.5×254	1	9.0	9		0.3	
	Hoist Base	SM400A	t	23×(φ340−φ150)	1	13.2	13		0.1	
	Stiffener	SS400	PL	9×86×254	4	1.5	6		0.2	
	Spindle	SUS304N2	RB	50×1340	1	20.9	21			-
	Cooling	SUS304	RB	(φ100−φ45)×110	1	5.6	6			-
				Sub Total			78	0.0	0.7	0.0
	Spindle motor			Spindle motor	1	217.0	217			
				Raising height 0.290m						
				Motor power 1.5kw						
				A/D converter electrical position transmiter						
				Spindle Tr50×8						
				JMB-1						
				Sub Total			217			
	Studbolt·Nut	SUS304		M20×79 N, SW	8	0.341	3			
	Bolt	SUS304		M10×30 SW	6	0.045	-			
	Bolt, Nut	SUS304		M20×102 N, SW	6	0.39	2			
	Reamerbolt, Nut	SUS304		M20×102 N, SW	2	0.39	1			
				Sub Total			6			
				<Hoist> Total			301	0.0	0.7	0.0

OUT LET STRUCTURES(ϕ 250 Guard Gate) (5/5)

No.	Item	Material	Dimensions (mm) Shape	× Length	Quantity	Weight (kg) Unit	W	Painting Area (m²) Painting I.S.	Painting O.S.	Acid
	Valve stand									
	Main girder	SS400	Pl.	9×125×480	4	4.2	17	0.1	0.4	
	Main girder	SS400	Pl.	9×160×480	2	5.4	11		0.3	
	Main girder	SS400	Pl.	9×80×125	4	0.7	3		0.1	
	Main girder	SS400	Pl.	9×100×160	2	1.1	2		0.1	
	Stiffener	SS400	Pl.	9×95×160	4	1.1	4		0.1	
	Anchor Base	SS400	Pl.	9×330×530	1	12.3	12	0.3		
	Liner	SS400	t	66～25×100×180	4	6.4	26	0.1		
				Sub Total			75	0.5	1.0	
	Anchor bolt	SS400		M16×170	4	0.362	1			
	Anchor setter	glass type		AP16	4	0.046	-			
				Sub Total			1			
				Valve stand Total			76	0.5	1.0	
				Steel Material			802	0.5	7.8	0.0
				Material purchased			642			
				Material single unit			217			

OUT LET STRUCTURES(ϕ 250 Auxiliary facilities) (1/1)

No.	Item	Material	Dimensions (mm) Shape	Dimensions (mm) × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting I.S.	Painting Area (m²) Painting O.S.	Painting Area (m²) Acid
	Auxiliary facilities									
	Connecting pipe	SS400	PL	9×259π×1000	1	57.5	58	4.2		
	Flange	SM400A	t	28×(ϕ 400− ϕ 250)	2	17.0	34	1.0		
	Outlet pipe	SGP	Pipe	400A×4800	1	372.5	373	5.7		
	Flange	SM400A	t	28×(ϕ 560− ϕ 409)	1	25.2	25	0.6		
	Stiffener	SS400	PL	9×(ϕ 559− ϕ 409)	4	8.1	32	2.5		
	Main Air pipe	SGP	Pipe	200A×4800	1	144.5	145	8.9		
	Flange	SM400A	t	22×(ϕ 330− ϕ 218)	1	8.3	8	0.1		
	Stiffener	SS400	PL	9×(ϕ 350− ϕ 218)	4	4.2	17	0.8		
	Sub air pipe	SGP	Pipe	150A×2000	1	39.6	40	3.4		
	Flange	SM400A	t	22×(ϕ 280− ϕ 166.6)	3	6.9	21	0.4		
	Reinforcement	SS400	PL	9×(ϕ 300− ϕ 166.6)	1	3.4	3	0.2		
				Sub Total			756	27.8		
	Spring type air valve	SC450		150A	1		190			
	Hand gate valve	SC450		150A	1		95			
				Sub Total			285			
	Elbow	SGP		150A 45° E(L)	1	3.55	4			
	Bolt	SUS304		M20×65 N,W	28	0.308	9			
				Sub Total			13			
				Auxiliary facilities Total			1,054	27.8		

OUT LET STRUCTURES(φ250 Installation stand) (1/1)

No.	Item	Material	Dimensions(mm) Shape × Length		Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting I.S.	Painting Area(m²) Painting O.S.	Painting Area(m²) Acid
	Installation stand									
	For outlet pipe									
	Installation stand(Post)	SS400	L	75×75×6×700	8	4.8	38	1.7		
	Installation stand(Main)	SS400	L	75×75×6×600	4	4.1	16	0.7		
	Installation stand(Main)	SS400	L	75×75×6×800	8	5.5	44	1.9		
	Installation stand(Sub)	SS400	L	75×75×6×800	8	5.5	44	1.9		
	Installation stand	SS400	L	50×50×6×500	16	2.2	35	1.6		
	Base	SS400	PL	12×200×200	8	3.8	30	0.6		
	Liner	SS400	PL	9×75×150	16	0.8	13	0.4		
	For main air pipe									
	Installation stand	SS400	L	50×50×6×300	6	1.3	8	0.4		
	For sub air pipe									
		SS400	L	50×50×6×800	2	3.5	7	0.3		
				Sub Total			235	9.5		
	Anchor Bolt	SS400		M16×170	32	0.362	12			
	Anchor setter	glass type		AP16	32	0.046	1			
				Sub Total			13			
				Installation stand Total			248	9.5		

Operation stand (1/2)

No.	Item	Material	Dimensions (mm) Shape	Dimensions (mm) × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting I.S.	Painting Area (m²) Painting O.S.	Painting Area (m²) Acid
	Operation stand									
	Floor slab	SS400	chPL	4.5×900×4700	1	156.5	157		8.5	
	Floor slab	SS400	chPL	4.5×900×3100	1	103.2	103		5.6	
	Floor slab	SS400	chPL	4.5×500×900	1	16.6	17		0.9	
	Main girder	SS400	H	150×150×7/10×5500	2	173.3	347		9.9	
	Main girder	SS400	H	150×150×7/10×2200	2	69.3	139		4.0	
	Main girder	SS400	H	150×150×7/10×900	9	28.4	256		7.3	
	Main girder	SS400	H	150×150×7/10×500	2	15.8	32		0.9	
	Post	SS400	H	150×150×7/10×2850	14	89.8	1257		35.9	
	Post	SS400	H	150×150×7/10×650	2	20.5	41		1.2	
	Horizontal beam	SS400	H	150×150×7/10×750	10	23.6	236		6.8	
	Horizontal beam	SS400	H	150×150×7/10×1350	4	42.5	170		4.9	
	Horizontal beam	SS400	H	150×150×7/10×1450	8	45.7	366		10.4	
	Horizontal beam	SS400	H	150×150×7/10×600	8	18.9	151		4.3	
	Horizontal beam	SS400	H	150×150×7/10×550	4	17.3	69		2.0	
	Base	SS400	PL	12×300×300	16	8.5	136		2.9	
	Liner	SS400	t	10×300×300	16	7.1	114		2.9	
	Stiffener	SS400	PL	9×70×130	176	0.6	106		3.2	
	Sub beam	SS400	L	75×75×6×750	9	5.1	46		2.0	
	Hand Rail	SGP	Pipe	32A×5400	1	18.3	18		0.7	
	Hand Rail	SGP	Pipe	32A×4600	1	15.5	16		0.6	
	Hand Rail	SGP	Pipe	32A×2400	1	8.1	8		0.3	
	Hand Rail	SGP	Pipe	32A×1600	1	5.4	5		0.2	
	Hand Rail	SGP	Pipe	32A×1250	1	4.2	4		0.2	
	Hand Rail	SGP	Pipe	32A×1100	28	3.7	104		4.1	
	Hand Rail	SGP	Pipe	25A×5400	2	13.1	26		1.1	
	Hand Rail	SGP	Pipe	25A×4600	2	11.2	22		0.9	
	Hand Rail	SGP	Pipe	25A×2400	2	5.8	12		0.5	
	Hand Rail	SGP	Pipe	25A×1600	2	3.9	8		0.3	
	Hand Rail	SGP	Pipe	25A×1250	2	3.0	6		0.3	
	Hand Rail	SS400	FB	50×6×15250	1	35.9	36		1.5	

Operation stand (2/2)

No.	Item	Material	Dimensions (mm) Shape × Length		Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting I.S.	Painting Area (m²) Painting O.S.	Painting Area (m²) Acid
	Ladder	SS400	FB	75×9×2800	6	14.8	89		2.5	
	Ladder	SS400	RB	φ19×400	30	0.89	27		0.7	
	Ladder	SS400	FB	75×9×600	2	3.2	6		0.2	
	Ladder	SS400	RB	φ19×400	3	0.89	3		0.1	
	Ladder	SS400	L	75×75×6×300	22	2.1	46		2	
	Ladder	SS400	L	75×75×6×300	6	2.1	13		0.5	
				Sub Total			4,192		130.3	
	Anchor bolt	SS400		M16×170	64	0.362	23			
	Anchor setter	glass type		AP16	64	0.046	3			
	Bolt	SS400		M20×60 N	16	0.273	4			
				Sub Total			30			
				Operation stand Total			4,222		130.3	

LOCAL CONTROL CABINET FOR BULK HEAD GATE (1/2) (1/8)

No,	Item	Material	Dimensions (mm) Shape × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting	Painting Area (m²) Acid
	Local Control Cabinet		W1000×H2000×D600	1	400	400		
	Cables		600V CV3.5sq-3c	19m	0.215	4.1		
			600V IV3.5sq	9m	0.045	0.4		
			CVV2sq-7c	13m	0.300	3.9		
			cvv2sq-5c	13m	0.240	3.1		
			cvv2sq-2c	13m	0.135	1.8		
	Fittings for Cables		Compression terminals, tapes			1.3		
	Rigid Steel Conduits		Rigid Steel Conduits (G28)	6	6.95	41.7		
			Rigid Steel Conduits (G22)	4	5.01	20.0		
			Rigid Steel Conduits (G16)	4	3.88	15.5		
			Normal Bends (G28)	6	0.70	4.2		
			Normal Bends (G22)	6	0.43	2.6		
			Normal Bends (G16)	3	0.2	0.6		
			Couplings (G28)	16	0.18	2.9		
			Couplings (G22)	14	0.09	1.3		
			Couplings (G16)	9	0.05	0.5		
			Flexible Metal Conduits (#30)	1.0m	0.98	1.0		
			Flexible Metal Conduits (#24)	1.0m	0.80	0.8		
			Flexible Metal Conduits (#17)	0.5m	0.60	0.3		
			Union Couplings (#30)	2	0.30	0.6		
			Union Couplings (#24)	2	0.18	0.4		
			Union Couplings (#17)	1	0.10	0.1		

LOCAL CONTROL CABINET FOR BULK HEAD GATE (2/2)

No.	Item	Material	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Painting Area(m²) Painting	Painting Area(m²) Acid
			Box Connectors(#30)	2	0.24	0.5		
			Box Connectors(#24)	2	0.15	0.3		
			Box Connectors(#17)	1	0.10	0.1		
	Fittings of Metal Conduits					28.0		
			Total			535.8		

LOCAL CONTROL CABINET FOR EMERGENCY GATE (1/2)

(3/8)

No.	Item	Material	Dimensions (mm) Shape × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Paintinga Area (m²) Painting	Paintinga Area (m²) Acid
	Local Control Cabinet		W1000×H2000×D600	1	400	400		
	Cables		600V CV3.5sq-3c	12m	0.215	2.6		
			600V IV3.5sq	6m	0.045	0.3		
			CVV2sq-7c	7m	0.300	2.1		
			cvv2sq-5c	9m	0.240	2.2		
			cvv2sq-2c	9m	0.135	1.2		
	fittings for cables		Compression terminals, tapes			0.8		
	Rigid Steel Conduits		Rigid Steel Conduits (G28)	4	6.95	27.8		
			Rigid Steel Conduits (G22)	2	5.01	10.0		
			Rigid Steel Conduits (G16)	2	3.88	7.8		
			Normal Bends (G28)	4	0.70	2.8		
			Normal Bends (G22)	4	0.43	1.7		
			Normal Bends (G16)	2	0.2	0.4		
			Coupling (G28)	10	0.18	1.8		
			Coupling (G22)	8	0.09	0.7		
			Coupling (G16)	5	0.05	0.3		
			Flexible Metal Conduits (#30)	1.0m	0.98	1.0		
			Flexible Metal Conduits (#24)	1.0m	0.80	0.8		
			Flexible Metal Conduits (#17)	0.5m	0.60	0.3		
			Union Couplings (#30)	2	0.30	0.6		
			Union couplings (#24)	2	0.18	0.4		
			Union couplings (#17)	1	0.1	0.1		

LOCAL CONTROL CABINET FOR EMERGENCY GATE (2/2) (4/8)

No.	Item	Material	Dimensions (mm) Shape × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting	Painting Area (m²) Acid
			Box Connectors (#30)	2	0.24	0.48		
			Box Connectors (#24)	2	0.15	0.30		
			Box Connectors (#17)	1	0.10	0.10		
	Fittings of Metal Conduits					17.2		
			Total			483.6		

LOCAL CONTROL CABINET FOR OUT LET STRUCTURES φ650 (1/2)

(5/8)

No.	Item	Material	Dimensions (mm) Shape × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting	Painting Area (m²) Acid
	Local Control Cabinet		W800×H2000×D600	1	400	400		
	Cables		600V CV3.5sq-3c	13m	0.215	2.8		
			600V IV3.5sq	13m	0.045	0.6		
			CVV2sq-15c	13m	0.560	7.3		
			CVV2sq-2c	6m	0.200	1.2		
	fittings for cables		Compression terminals, tapes			1.2		
	Rigid Steel Conduits		Rigid Steel Conduits (G36)	3	8.89	26.7		
			Rigid Steel Conduits (G22)	3	5.01	15.0		
			Rigid Steel Conduits (G16)	1	3.88	3.9		
			Normal Bends (G36)	6	1.04	6.2		
			Normal Bends (G22)	6	0.43	2.6		
			Coupling (G36)	13	0.22	2.9		
			Coupling (G22)	13	0.09	1.2		
			Flexible Metal Conduits (#38)	1.0m	1.26	1.3		
			Flexible Metal Conduits (#24)	1.0m	0.80	0.8		
			Flexible Metal Conduits (#17)	0.5m	0.60	0.3		
			Union Couplings (#38)	2	0.41	0.8		
			Union Couplings (#24)	2	0.18	0.4		
			Union Couplings (#17)	1	0.10	0.1		
			Box Connectors (#38)	2	0.33	0.7		
			Box Connectors (#24)	2	0.15	0.3		
			Box Connectors (#17)	1	0.10	0.1		

LOCAL CONTROL CABINET FOR OUT LET STRUCTURES φ650 (2/2) (6/8)

No,	Item	Material	Dimensions(mm) Shape × Length	Quantity	Weight(kg) Unit	Weight(kg) W	Paintinga Area(m²) Painting	Paintinga Area(m²) Acid
	Fittings of Metal Conduits					19.0		
			Total			495.2		

LOCAL CONTROL CABINET FOR OUT LET STRUCTURES φ250 (7/8)

No.	Item	Material	Dimensions (mm) Shape × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Painting Area (m²) Painting	Painting Area (m²) Acid
	Local Control Cabinet		W800×H2000×D600	1	400	400		
	Cables		600V CV3.5sq-3c	21m	0.215	4.5		
			600V IV3.5sq	21m	0.045	0.9		
			CVV2sq-15c	20m	0.560	11.2		
	fittings for cables		Compression terminals, tapes			1.7		
	Rigid Steel Conduits		Rigid Steel Conduits (G36)	5	8.89	44.5		
			Rigid Steel Conduits (G22)	5	5.01	25.1		
			Normal Bends (G36)	8	1.04	8.3		
			Normal Bends (G22)	8	0.43	3.4		
			Coupling (G36)	19	0.22	4.2		
			Coupling (G22)	19	0.09	1.7		
			Flexible Metal Conduits (#38)	1.0m	1.26	1.3		
			Flexible Metal Conduits (#24)	1.0m	0.80	0.8		
			Union Couplings (#38)	2	0.41	0.8		
			Union Couplings (#24)	2	0.18	0.4		
			Box Connectors (#38)	2	0.33	0.7		
			Box Connectors (#24)	2	0.15	0.3		
	Fittings of Metal Conduits					27.4		
			Total			537.1		

FLOW METER CABINET

(8/8)

No,	Item	Material	Dimensions (mm) Shape × Length	Quantity	Weight (kg) Unit	Weight (kg) W	Paintinga Area (m²) Painting	Paintinga Area (m²) Acid
	Flow Meter Cabinet		W1000×H2000×D600	1	350	350		
	Ultrasonic Flow Meter (φ650)			1				
			[items]					
			1 - Main Unit		15	15		
			4 - Sensor		3	12		
			2 - Junction Box		2	4		
			Coaxial Cable (15m)		0.22	3.3		
	Ultrasonic Flow Meter (φ250)			1				
			[items]					
			1 - Main Unit		15	15		
			4 - Sensor		3	12		
			2 - Junction Box		2	4		
			Coaxial Cable (20m)		0.22	4.4		
	Rigid Steel Conduits		Rigid Steel Conduits (G28)	7	6.95	48.7		
			Normal Bends (G28)	8	0.70	5.6		
			Coupling (G28)	19	0.18	3.4		
			Flexible Metal Conduits (#30)	2.0m	0.98	2.0		
			Union Couplings (#30)	4	0.30	1.2		
	Fittings of Metal Conduits					18.2		
			Total			498.7		

DIVERSION GATE(Gate Leaf) (1/1)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	Gate Leaf									
	Skin Plate	SS400	PL	19×5800×6400	1	5536.4	5536		74.2	
	Main girder	SS400	H	700×300×13/24×6200	7	941.5	6591		95.3	
	Main girder	SM400A	PL	25×300×1500	14	88.3	1236		12.6	
	Side girder Flange	SM400A	PL	25×150×5800	4	170.7	683		7	
	Side girder web	SS400	PL	12×450×5800	2	245.9	492		10.4	
	Sub vertical beam	SS400	PL	12×150×620	30	8.8	263		5.6	
	Sub vertical beam	SS400	PL	12×150×600	6	8.5	51		1.1	
	Sub vertical beam	SS400	PL	9×676×920	20	43.9	879		24.9	
	Sub vertical beam	SS400	PL	9×676×900	4	43.0	172		4.9	
	Sub vertical beam	SS400	PL	9×475×920	10	30.9	309		8.7	
	Sub vertical beam	SS400	PL	9×475×900	2	30.2	60		1.7	
	Bearing Plate	SUS304	t	45×70×5800	2	144.9	290			1.9
	Guide shoe	SUS304	t	30×70×200	8	3.3	27			0.2
	Guide shoe	SUS304	t	30×70×200	8	3.3	27			0.2
	Guide shoe	SS400	L	150×90×9×300	8	4.9	39		1.2	
	Guide shoe	SS400	PL	12×(141×200)	16	2.0	32		0.7	
	Seal base	SUS304	t	10×70×5700	1	31.6	32			0.4
	Seal base	SUS304	t	10×70×5650	2	31.4	63			0.8
	Rubber stopper	SUS304	t	20×30×5700	1	27.1	27			0.4
	Seal clamp bar	SUS304	PL	12×50×5700	1	27.1	27			0.6
	Seal clamp bar	SUS304	PL	12×50×5650	2	26.9	54			1.1
	Seal clamp bar	SUS304	PL	12×95×5700	1	51.5	52			1.1
	Hanger	SM400A	PL	25×300×600	2	35.3	71		0.7	
	Hanger	SS400	PL	19×500×652	4	48.6	194		2.6	
				Sub Total			17,207		251.6	6.7
	Seal Rubber	Synthetic rubber		φ40-P type×17000	1	66.8	67			
	Seal Rubber	Synthetic rubber		t15×100 flat type×5700	1	13.0	13			
	Seal Washer	SUS304+Synthetic rubbe		For M16	230	0.012	3			
	Bolt	SUS304		M16×70 N,W	230	0.187	43			
				Sub Total			126			
				Gate Leaf Total			17,333		251.6	6.7

DIVERSION GATE(Gate guide)

(1/2)

No,	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	Painting O.S.	Acid
	Sill beam									
	Rail	SS400	H	200×200×8/12×6200	1	185.4	185	6.2		
	Rail	SS400	H	200×200×8/12×1100	2	32.9	66	2.2		
	Seal Plate	SUS304	PL	10×200×5400	1	85.6	86			1.1
	Seal Plate	SUS304	PL	10×500×1100	2	43.6	87			1.1
	Stiffener	SS400	PL	9×(191×400)	4	3.78	15	0.4		
	Stiffener	SS400	PL	9×(100×191)	6	1.21	7	0.2		
	Sub beam	SS400	L	75×75×9×350	11	3.49	38	1.2		
	Sub beam	SS400	RB	16×250 M16	33	0.39	13	0.4		
	Anchor bar	SD295A	D	16×400	33	0.62	21	0.7		
	Lintel beam									
	Rail	SS400	L	75×75×9×6200	1	61.8	62	1.9		
	Seal Plate	SUS304	t	10×100×5600	1	44.4	44			0.6
	Cover Plate	SS400	PL	9×350×5600	1	138.5	139	2.0	2.0	
	Stiffener	SS400	PL	9×75×250	6	1.32	8	0.2		
	Sub beam	SS400	L	75×75×9×250	6	2.49	15	0.5		
	Sub beam	SS400	RB	16×250 M16	18	0.39	7	0.2		
	Anchor bar	SD295A	D	16×400	18	0.02	11	0.4		
	Main side guide									
	Bearing Plate	SUS304	t	10×150×5700	2	67.8	136			1.7
	Seal Plate	SUS304	t	10×80×5700	2	36.2	72			0.9
	Cover Plate	SS400	PL	9×400×5700	2	161.1	322	4.6	4.6	
	Rail Flange	SS400	PL	9×100×5700	4	85.0	340	4.6		
	Rail Web	SS400	PL	12×212×5700	2	113.8	228	4.8		
	End girder	SS400	L	75×75×9×5700	2	56.7	114	3.4		
	Joint	SS400	FB	75×9×300	24	1.59	38	1.1		
	Joint	SS400	PL	9×100×212	2	1.50	3	0.1		
	Joint	SS400	PL	9×212×300	2	4.49	9	0.3		
	Sub beam	SS400	L	75×75×9×300	14	2.99	42	1.3		
	Sub beam	SS400	RB	16×250 M16	42	0.39	17	0.5		
	Anchor bar	SD295A	D	16×400	42	0.62	26	0.8		

DIVERSION GATE(Gate guide)

(2/2)

No.	Item	Material	Dimensions(mm) Shape	× Length	Quantity	Weight(kg) Unit	W	Painting Area(m²) Painting I.S.	O.S.	Acid
	Side guide(Front rail)									
	Bearing Plate	SUS304	t	10×150×5700	2	67.8	136			1.7
	Cover Plate	SS400	PL	9×400×5700	2	161.1	322	4.6	4.6	
	Rail	SS400	H	125×125×6.5/9×5700	2	134.5	269	8.6		
	End girder	SS400	L	75×75×9×5700	2	56.7	114	3.4		
	Joint	SS400	FB	75×9×300	24	1.59	38	1.1		
	Joint	SS400	PL	9×60×107	2	0.45	1	-		
	Joint	SS400	PL	9×116×300	2	2.50	5	0.1		
	Sub beam	SS400	L	75×75×9×300	14	2.99	42	1.3		
	Sub beam	SS400	RB	16×250 M16	42	0.39	17	0.5		
	Anchor bar	SD295A	D	16×400	42	0.62	26	0.8		
				Sub Total			3121	58.4	11.2	7.1
	Bolt	SS400		M16×60 N	20	0.158	3			
	Nut	SS400		M16	270	0.034	9			
				Sub Total			12			
				Gate guide Total			3133	58.4	11.2	7.1

2.8 ACCESS ROAD

2.8.1 Summary

Earth Works

Road	Length (m)	Excavation (m2)	Embankment			Stripping (m)	Base (m2)	Subbase (m2)	Hot Asphalt Surface (m2)
			Subshoulder (m2)	Subgrade (m2)	Common (m2)				
Left Bank Access Road	858.0	18,900	100	180	160	10,700	430	1,500	3,600
Access Road to Hydropower Station	656.5	57,400	10	200	1,000	17,700	350	1,200	2,800
Access Road to Intake Structure	207.1	12,300	0	0	0	3,600	90	300	900
Right Bank Access Road	1,688.1	56,600	280	1,600	1,500	29,500	830	2,900	7,100
Maintenance Road to Reservoir	397.5	6,100	10	10	40	5,700	0	300	
Dam Crest Road		0	0	970	0	0	280	1,100	2,600
Total	3,807.2	151,300	400	2,960	2,700	67,200	1,980	7,300	17,000

Drainage Ditch Type 3-1

Road	Length (m)	Drainage Ditch					
		Type 1-1	Type 1-2	Type 2-1	Type 2-2	Type 3-1	Type 3-2
Left Bank Access Road	858.0	410	280	60	10		
Access Road to Hydropower Station	656.5	460	290				
Access Road to Intake Structure	207.1	0	160				
Right Bank Access Road	1,688.1	1,750	220				
Maintenance Road to Reservoir	397.5					420	
Total	3,807.2	2,620	950	60	10	420	0

Excavated Slope

Sta	1:0.5 (m2)	1:0.8 (m2)	1:1.5 (m2)	Level (m2)	1:0.8 (m2)
Left Bank Access Road	0	2,170	390	0	
Access Road to Hydropower Station	3,970	7,260	20	1,110	
Access Road to Intake Structure	0	1,350	0	80	
Right Bank Access Road	520	9,560	2,780	560	
Maintenance Road to Reservoir			70		1,360
Total	4,490	18,170	2,870	1,750	1,360

Item	Area (m2)
Sodding	22,790
Shotcrete	5,850
Total	28,640

2.8.2 Left Bank Access Road

1. Cross Sectional Area

Sta	Distance (m)	Excavation (m2)	Embankment			Stripping (m)	Base (m2)	Subbase (m2)
			Subshoulder (m2)	Subgrade (m2)	Common (m2)			
0+00		260.01				45.81	0.46	1.51
0+50	50.000	33.29				16.64	0.46	1.51
BC1	38.057	4.14	0.21	3.18	3.19	14.22	0.47	1.87
1+00	11.943	6.38	0.21	2.62	2.94	15.11	0.47	1.81
EC1/BC2	29.843	13.10				9.90	0.47	1.50
1+50	20.157	21.63				13.18	0.47	1.50
2+00	50.000	36.93				16.13	0.47	1.50
EC2	32.206	33.23				14.14	0.47	1.05
2+50	17.794	28.85				13.47	0.48	1.51
2+80	30.000	41.04				16.06	0.48	1.51
BC3	22.049	37.74				15.57	0.48	1.50
3+50	47.951	20.19				10.92	0.48	1.50
EC3	18.982	22.53				11.59	0.46	1.51
3+90	21.018	15.46				13.99	0.46	1.50
BC4	11.284	10.19				9.80	0.48	1.50
4+50	48.716	3.37	0.21			7.98	0.48	1.50
EC4	37.678	5.67				8.63	0.48	1.50
5+00	12.322	5.18				7.66	0.48	1.50
BC5	11.570	4.33	0.07			7.70	0.48	1.50
5+50	38.430	2.17	0.15			7.37	0.48	1.50
EC5	26.008	0.51	0.43			7.15	0.49	2.22
6+00	23.992	2.36				5.18	0.48	1.51
6+50	50.000	1.15	0.11			6.48	0.48	1.51
7+00	50.000	1.52	0.28			6.40	0.48	2.15
7+50	50.000	0.12	0.29	0.67		7.31	0.48	2.21
8+00	50.000	0.00	0.50			7.26	0.50	2.24
8+50	50.000	0.04				6.63	0.46	1.51
8+58	8.000	0.00				6.63	0.46	1.50

2. Calculated Volume

Sta	Distance (m)	Excavation (m3)	Embankment			Stripping (m2)	Base (m3)	Subbase (m3)
			Subshoulder (m3)	Subgrade (m3)	Common (m3)			
0+00								
0+50	50.000	7,332.5	0.0	0.0	0.0	1,561.3	23.1	75.7
BC1	38.057	712.2	4.1	60.5	60.8	587.2	17.7	64.4
1+00	11.943	62.8	2.5	34.6	36.6	175.1	5.6	22.0
EC1/BC2	29.843	290.7	3.2	39.1	43.9	373.2	14.0	49.4
1+50	20.157	350.1	0.0	0.0	0.0	232.6	9.5	30.2
2+00	50.000	1,464.1	0.0	0.0	0.0	732.8	23.7	74.9
EC2	32.206	1,129.9	0.0	0.0	0.0	487.4	15.2	41.0
2+50	17.794	552.3	0.0	0.0	0.0	245.6	8.5	22.7
2+80	30.000	1,048.2	0.0	0.0	0.0	443.0	14.3	45.2
BC3	22.049	868.5	0.0	0.0	0.0	348.7	10.5	33.2
3+50	47.951	1,388.9	0.0	0.0	0.0	635.1	23.0	71.9
EC3	18.982	405.5	0.0	0.0	0.0	213.6	8.9	28.5
3+90	21.018	399.3	0.0	0.0	0.0	268.8	9.6	31.6
BC4	11.284	144.7	0.0	0.0	0.0	134.2	5.3	17.0
4+50	48.716	330.3	5.1	0.0	0.0	433.1	23.4	73.1
EC4	37.678	170.3	4.0	0.0	0.0	312.9	18.1	56.5
5+00	12.322	66.8	0.0	0.0	0.0	100.4	5.9	18.5
BC5	11.570	55.0	0.4	0.0	0.0	88.9	5.6	17.4
5+50	38.430	124.9	4.2	0.0	0.0	289.6	18.4	57.6
EC5	26.008	34.9	7.5	0.0	0.0	188.8	12.6	48.4
6+00	23.992	34.4	5.2	0.0	0.0	147.9	11.6	44.7
6+50	50.000	87.8	2.8	0.0	0.0	291.5	23.9	75.4
7+00	50.000	66.8	9.8	0.0	0.0	322.0	23.9	91.4
7+50	50.000	41.0	14.3	16.8	0.0	342.8	24.0	108.9
8+00	50.000	3.0	19.8	16.8	0.0	364.3	24.5	111.1
8+50	50.000	1.0	12.5	0.0	0.0	347.3	24.0	93.7
8+58	8.000	0.2	0.0	0.0	0.0	53.0	3.7	12.1
Total	858.0	17,166.0	95.2	167.7	141.3	9,721.0	408.7	1,416.6
		x 1.1	x 1.1	x 1.1	x 1.1	x 1.1	x 1.05	x 1.05
Total with Allowance		18,900.0	100.0	180.0	160.0	10,700.0	430.0	1,500.0

3. Drainage Ditch

Drainage Ditch Type 1-1	STA. 0+00 to STA. 3+68.982	368.982 x 1.05 =	390 m
	STA.0+18.0	19.000 x 1.05 =	20 m
Drainage Ditch Type 1-2	STA. 3+5.767 to STA. 5+70	264.233 x 1.05 =	280 m
Drainage Ditch Type 2-1		55.500 x 1.05 =	60 m
Drainage Ditch Type 2-2		14.000 x 1.05 =	10 m

4. Excavated Slope

	1:0.5 (m2)	1:0.8 (m2)	1:1.5 (m2)	Level (m2)
		10.52	76.33	
		198.37	10.90	
		1,023.05	206.70	
Total	0	1,231.94	293.93	0
x slope	0	1,972	353	0
Total (x 1.1)	0	2,170	390	0

2.8.3 Access Road to Hydropower Station

1. Cross Sectinal Area

Sta	Distance (m)	Excavation (m2)	Embankment			Stripping (m)	Base (m2)	Subbase (m2)
			Subshoulder (m2)	Subgrade (m2)	Common (m2)			
BC1								
EC1/BC2	31.416	78.19				27.19	1.18	3.61
0+50	18.584	25.95	0.30	8.82	35.93	27.50	0.94	3.73
EC2/BC3	22.257	26.80				14.14	0.47	1.50
0+90	17.743	20.39				10.77	0.47	1.51
EC3/BC4	13.149	11.60	0.26	0.09		9.80	0.47	1.57
EC4/BC5	25.307	19.57				11.58	0.47	1.50
1+50	21.544	36.29				15.70	0.43	1.36
EC5/BC6	40.852	30.17				15.10	0.47	1.51
2+10	19.148	25.42				14.25	0.47	1.51
EC6/BC7	27.714	40.30			0.78	19.14	0.47	1.62
2+50	12.286	12.81			4.89	14.22	0.48	1.84
EC7/BC8	26.809	34.10				15.77	0.47	1.50
EC8	20.726	34.87				16.77	0.47	1.50
3+20	22.465	15.97			3.83	13.81	0.48	1.79
3+50	30	77.95				22.74	0.46	1.51
BC9	46.705	118.98				23.36	0.46	1.51
4+10	13.295	64.17				18.60	0.46	1.51
EC9	8.696	44.71				17.76	0.47	1.53
BC10	0.913	43.44				17.54	0.46	1.51
4+50	30.391	60.10				23.29	0.46	1.51
EC10/BC11	12.675	95.31				24.40	0.46	1.51
EC11/BC12	21.991	103.01				26.02	0.47	1.50
5+05	20.334	61.42				22.35	0.47	1.50
EC12	29.408	87.16				30.93	0.47	1.50
5+50	15.592	77.60				30.01	0.48	1.51
BC13	25.492	197.65				39.69	0.46	1.51
EC13/BC14	21.467	133.11				29.86	0.47	1.50
6+10	13.041	134.13				32.65	0.47	1.51
EC14	18.113	271.57				38.70	0.47	1.51
6+50	21.887	245.09				49.64	0.47	1.51
6+67.564	17.564	91.33				50.66	0.47	1.51
6+80	12.436	222.70				60.12		
6+98.5	18.5	0.00				0.00		

2. Calculated Volume

Sta	Distance (m)	Excavation (m3)	Embankment			Stripping (m2)	Base (m3)	Subbase (m3)
			Subshoulder (m3)	Subgrade (m3)	Common (m3)			
BC1								
EC1/BC2	31.416	1,228.2	0.0	0.0	0.0	427.1	18.5	56.7
0+50	18.584	967.7	2.8	82.0	333.9	508.2	19.7	68.2
EC2/BC3	22.257	587.0	3.3	98.2	399.8	463.4	15.7	58.2
0+90	17.743	418.6	0.0	0.0	0.0	221.0	8.3	26.7
EC3/BC4	13.149	210.3	1.7	0.6	0.0	135.2	6.2	20.3
EC4/BC5	25.307	394.3	3.3	1.2	0.0	270.5	12.0	38.9
1+50	21.544	601.7	0.0	0.0	0.0	293.9	9.7	30.8
EC5/BC6	40.852	1,357.5	0.0	0.0	0.0	629.1	18.4	58.6
2+10	19.148	532.2	0.0	0.0	0.0	281.0	9.0	29.0
EC6/BC7	27.714	910.6	0.0	0.0	10.8	462.7	13.0	43.4
2+50	12.286	326.3	0.0	0.0	34.8	204.9	5.8	21.3
EC7/BC8	26.809	628.7	0.0	0.0	65.5	402.0	12.8	44.8
EC8	20.726	714.7	0.0	0.0	0.0	337.2	9.8	31.1
3+20	22.465	571.1	0.0	0.0	43.0	343.5	10.7	37.0
3+50	30.000	1,408.8	0.0	0.0	57.5	548.3	14.1	49.6
BC9	46.705	4,598.8	0.0	0.0	0.0	1,076.6	21.5	70.7
4+10	13.295	1,217.5	0.0	0.0	0.0	278.9	6.1	20.1
EC9	8.696	473.4	0.0	0.0	0.0	158.1	4.0	13.2
BC10	0.913	40.2	0.0	0.0	0.0	16.1	0.4	1.4
4+50	30.391	1,573.3	0.0	0.0	0.0	620.4	13.9	45.8
EC10/BC11	12.675	984.9	0.0	0.0	0.0	302.2	5.8	19.1
EC11/BC12	21.991	2,180.6	0.0	0.0	0.0	554.4	10.2	33.1
5+05	20.334	1,671.8	0.0	0.0	0.0	491.8	9.6	30.5
EC12	29.408	2,184.7	0.0	0.0	0.0	783.4	13.9	44.1
5+50	15.592	1,284.5	0.0	0.0	0.0	475.1	7.4	23.4
BC13	25.492	3,508.3	0.0	0.0	0.0	888.4	11.9	38.4
EC13/BC14	21.467	3,550.2	0.0	0.0	0.0	746.5	10.0	32.3
6+10	13.041	1,742.5	0.0	0.0	0.0	407.6	6.1	19.7
EC14	18.113	3,674.2	0.0	0.0	0.0	646.2	8.5	27.4
6+50	21.887	5,654.1	0.0	0.0	0.0	966.7	10.2	33.1
6+67.564	17.564	2,954.4	0.0	0.0	0.0	880.8	8.2	26.6
6+80	12.436	1,952.6	0.0	0.0	0.0	688.8	2.9	9.4
6+98.5	18.500	2,060.0	0.0	0.0	0.0	556.1	0.0	0.0
Total	698.5	52,163.9	11.2	181.9	945.4	16,066.2	334.4	1,102.6
		x 1.1	x 1.1	x 1.1	x 1.1	x 1.1	x 1.05	x 1.05
Total with Allowance		57,400.0	10.0	200.0	1,000.0	17,700.0	350.0	1,200.0

3. Drainage Ditch

Drainage Ditch Type 1-1	STA. 0+00 to STA. 0+72.257	63.000 x 1.05 =	70 m
	STA. 0+72.257 to STA. 4+45	372.743 x 1.05 =	390 m
Drainage Ditch Type 1-2	STA. 3+90 to STA. 6+67.564	277.564 x 1.05 =	290 m

4. Excavated Slope

	1:0.5 (m2)	1:0.8 (m2)	1:1.5 (m2)	Level (m2)
	56.25	47.21	15.54	24.57
	150.00	151.24		12.35
	118.83	78.40		23.05
	35.83	51.34		25.50
	36.91	286.66		108.06
	90.45	185.84		135.27
	159.13	17.70		105.37
	21.68	33.62		6.06
	6.31	106.22		64.45
	2.51	51.54		122.16
	79.99	86.18		137.82
	313.21	5.87		105.74
	297.63	243.65		94.08
	172.72	13.77		41.80
	74.02	319.52		
		298.02		
		272.11		
		262.87		
		251.08		
		66.36		
		99.95		
		56.82		
		59.74		
		110.59		
		91.66		
		52.93		
		314.64		
		60.88		
		224.18		
		131.32		
		92.15		
Total	1,615.47	4,124.06	15.54	1,006.28
x slope	3,612	6,603	19	1,006
Total(x 1.1)	3,970	7,260	20	1,110

2.8.4 Access Road to Intake Structure

1. Cross Sectional Area

Sta	Distance (m)	Excavation (m2)	Embankment			Stripping (m)	Base (m2)	Subbase (m2)
			Subshoulder (m2)	Subgrade (m2)	Common (m2)			
BC1								
EC1	39.794	42.49				19.11	0.57	1.71
0+50	10.206	14.96				8.30	0.62	1.88
BC2	7.926	18.63				9.04	0.47	1.51
EC2/BC3	40.142	32.16				13.02	0.47	1.50
1+20	21.932	49.00				17.52	0.46	1.50
EC3	31.824	31.68				16.72	0.47	1.50
1+80	28.176	222.93				36.58	0.46	1.51
2+07.110	27.11	7.51				7.76	0.26	0.99
2+08.780	1.67							

2. Calculated Volume

Sta	Distance (m)	Excavation (m3)	Embankment			Stripping (m2)	Base (m3)	Subbase (m3)
			Subshoulder (m3)	Subgrade (m3)	Common (m3)			
BC1								
EC1	39.794	845.4	0.0	0.0	0.0	380.2	11.3	34.0
0+50	10.206	293.2	0.0	0.0	0.0	139.9	6.1	18.3
BC2	7.926	133.1	0.0	0.0	0.0	68.7	4.3	13.4
EC2/BC3	40.142	1,019.4	0.0	0.0	0.0	442.8	18.9	60.4
1+20	21.932	890.0	0.0	0.0	0.0	334.9	10.2	33.0
EC3	31.824	1,283.8	0.0	0.0	0.0	544.8	14.8	47.8
1+80	28.176	3,586.9	0.0	0.0	0.0	750.9	13.2	42.4
2+07.110	27.11	3,123.6	0.0	0.0	0.0	601.0	9.8	33.9
2+07.110	1.67	6.3	0.0	0.0	0.0	6.5	0.2	0.8
Total	208.78	11,181.7	0.0	0.0	0.0	3,269.7	88.7	284.2
		x 1.1	x 1.1	x 1.1	x 1.1	x 1.1	x 1.05	x 1.05
Total with Allowance		12,300.0	0.0	0.0	0.0	3,600.0	90.0	300.0

3. Drainage Ditch

Drainage Ditch Type 1-1		0.000 x 1.05 =	0 m
		0.000 x 1.05 =	0 m
Drainage Ditch Type 1-2	STA. 0+57.926 to STA.2+8.3	150.374 x 1.05 =	160 m

4. Excavated Slope

	1:0.5 (m2)	1:0.8 (m2)	1:1.5 (m2)	Level (m2)
		617.42 150.69		75.34
Total	0.00	768.11	0.00	75.34
x slope	0	1,230	0	75
Total (x 1.1)	0	1,350	0	80

2.8.5 Right Bank Access Road

1. Cross Sectional Area

Sta	Distance (m)	Excavation (m2)	Embankment			Stripping (m)	Base (m2)	Subbase (m2)
			Subshoulder (m2)	Subgrade (m2)	Common (m2)			
BC1								
EC1	29.147	191.52				41.24	0.46	1.51
0+50	20.853	68.68				16.62	0.46	1.51
1+00	50	92.00				28.15	0.46	1.51
BC2	35.318	67.47				23.70	0.48	1.49
1+50	14.682	40.92				19.85	0.48	1.49
EC2/BC3	10.45	50.97				21.66	0.46	1.50
1+80	19.55	112.70				24.43	0.46	1.51
EC3/BC4	21.989	155.96				33.67	0.46	1.50
2+40	38.011	49.08	0.35	1.61	3.97	27.14	0.48	1.61
EC4	18.014	102.94				26.56	0.46	1.51
BC5	19.301	104.65				27.24	0.46	1.51
3+00	22.685	77.28				22.26	0.46	1.51
EC5/BC6	15.799	68.19				22.41	0.46	1.50
EC6/BC7	25.133	35.81				14.76	0.47	1.50
3+50	9.068	43.79				15.64	0.47	1.51
3+90	40	43.23				22.07	0.46	1.51
EC7	24.759	44.85				19.63	0.47	1.52
4+50	35.241	65.74				23.66	0.46	1.51
BC8	24.873	53.15				20.64	0.47	1.51
5+00	25.127	48.52				19.29	0.47	1.51
EC8	16.412	51.66				21.04	0.47	1.51
BC9	24.336	35.18				21.62	0.48	1.49
5+50	9.252	24.82				14.35	0.48	1.49
EC9	21.379	17.29				12.15	0.48	1.49
BC10	16.206	22.99				12.76	0.47	1.51
6+10	22.415	34.29				14.36	0.47	1.51
EC10	25.232	32.34				14.02	0.47	1.51
6+50	14.768	26.08	0.10			14.86	0.48	1.51
7+00	50	5.82	0.29	2.25	0.97	13.87	0.48	1.58
7+50	50	1.55	0.29	3.85	1.56	12.44	0.50	2.03
8+00	50	7.27				9.07	0.50	1.51
8+50	50	8.21				8.73	0.50	1.51
BC11	18.133	27.61				18.74	0.50	1.51
9+00	31.867	36.91				29.00	0.50	1.51
EC11/BC12	18.617	16.03				11.66	0.50	1.51
9+50	31.383	29.14				15.87	0.50	1.51
EC12	11.726	21.60				14.38	0.50	1.51
10+00	38.274	7.13	0.29		0.08	10.21	0.48	1.58
10+50	50	8.36	0.22			10.03	0.48	1.58
11+00	50	1.70	0.29	0.16		8.74	0.48	1.71
11+50	50	3.16	0.29	1.61		10.72	0.48	1.80
12+00	50	1.74	0.29	2.81	0.28	11.13	0.48	1.93
BC13	41.501	2.54	0.26			8.84	0.48	1.58
12+50	8.499	0.18	0.29	4.04		10.51	0.49	2.22
EC13	31.643	0.18	0.29	0.92	0.46	10.14	0.49	2.22
13+00	18.357	0.86	0.66			10.92	0.46	2.22
13+50	50	1.34	0.58	3.20		12.06	0.46	2.24
13+80	30	1.17	0.58	9.02	2.65	14.65	0.46	2.24
14+10	30	1.79	0.58	0.58		17.95	0.46	2.13
14+50	40	1.53	0.58			13.31	0.46	2.13
15+00	50	6.72				8.93	0.46	1.51
BC14	13.225	4.14				9.64	0.46	1.51
15+50	36.775	18.20				10.89	0.46	1.51
16+00	50	32.59				12.77	0.46	1.51
EC14/BC15	13.407	12.28				11.35	0.46	1.51
16+50	36.593	2.42	0.58	8.79	26.42	20.77	0.46	2.22
EC15	38.107					6.00	0.46	2.22

2. Calculated Volume

Sta	Distance (m)	Excavation (m3)	Embankment			Stripping (m2)	Base (m3)	Subbase (m3)
			Subshoulder (m3)	Subgrade (m3)	Common (m3)			
BC1								
EC1	29.147	2,791.1	0.0	0.0	0.0	601.0	6.7	22.1
0+50	20.853	2,713.0	0.0	0.0	0.0	603.3	9.6	31.6
1+00	50	4,017.0	0.0	0.0	0.0	1,119.3	23.1	75.7
BC2	35.318	2,816.1	0.0	0.0	0.0	915.6	16.5	53.1
1+50	14.682	795.7	0.0	0.0	0.0	319.7	7.0	21.9
EC2/BC3	10.45	480.1	0.0	0.0	0.0	216.9	4.9	15.7
1+80	19.55	1,599.9	0.0	0.0	0.0	450.5	8.9	29.4
EC3/BC4	21.989	2,953.8	0.0	0.0	0.0	638.8	10.1	33.1
2+40	38.011	3,896.9	6.6	30.6	75.5	1,155.7	17.9	59.2
EC4	18.014	1,369.2	3.1	14.5	35.8	483.7	8.5	28.0
BC5	19.301	2,003.3	0.0	0.0	0.0	519.2	8.8	29.1
3+00	22.685	2,063.5	0.0	0.0	0.0	561.5	10.4	34.2
EC5/BC6	15.799	1,149.1	0.0	0.0	0.0	352.9	7.2	23.8
EC6/BC7	25.133	1,306.9	0.0	0.0	0.0	467.1	11.7	37.8
3+50	9.068	360.9	0.0	0.0	0.0	137.8	4.3	13.7
3+90	40	1,740.4	0.0	0.0	0.0	754.2	18.5	60.4
EC7	24.759	1,090.4	0.0	0.0	0.0	516.2	11.4	37.4
4+50	35.241	1,948.7	0.0	0.0	0.0	762.8	16.4	53.4
BC8	24.873	1,478.6	0.0	0.0	0.0	550.9	11.6	37.6
5+00	25.127	1,277.3	0.0	0.0	0.0	501.7	11.8	37.9
EC8	16.412	822.1	0.0	0.0	0.0	330.9	7.7	24.8
BC9	24.336	1,056.7	0.0	0.0	0.0	519.1	11.5	36.5
5+50	9.252	277.6	0.0	0.0	0.0	166.4	4.4	13.8
EC9	21.379	450.1	0.0	0.0	0.0	283.3	10.2	31.9
BC10	16.206	326.4	0.0	0.0	0.0	201.8	7.6	24.3
6+10	22.415	642.0	0.0	0.0	0.0	304.0	10.5	33.8
EC10	25.232	840.6	0.0	0.0	0.0	358.1	11.8	38.1
6+50	14.768	431.4	0.7	0.0	0.0	213.3	7.0	22.3
7+00	50	797.6	9.8	56.3	24.3	718.3	23.9	77.2
7+50	50	184.3	14.5	152.5	63.3	657.8	24.5	90.2
8+00	50	220.5	7.3	96.3	39.0	537.8	25.0	88.4
8+50	50	387.0	0.0	0.0	0.0	445.0	25.0	75.4
BC11	18.133	324.8	0.0	0.0	0.0	249.1	9.1	27.3
9+00	31.867	1,028.0	0.0	0.0	0.0	760.7	15.9	48.0
EC11/BC12	18.617	492.8	0.0	0.0	0.0	378.5	9.3	28.1
9+50	31.383	708.8	0.0	0.0	0.0	432.0	15.7	47.3
EC12	11.726	297.5	0.0	0.0	0.0	177.3	5.9	17.7
10+00	38.274	549.8	5.5	0.0	1.5	470.4	18.8	59.2
10+50	50	387.3	12.7	0.0	2.0	506.0	24.0	79.1
11+00	50	251.6	12.8	4.1	0.0	469.5	24.0	82.2
11+50	50	121.7	14.5	44.4	0.0	486.6	24.0	87.7
12+00	50	122.6	14.5	110.7	6.9	546.3	24.0	93.3
BC13	41.501	88.9	11.4	58.4	5.7	414.5	19.9	72.8
12+50	8.499	11.6	2.3	17.2	0.0	82.2	4.1	16.1
EC13	31.643	5.7	9.2	78.5	7.3	326.7	15.5	70.1
13+00	18.357	9.5	8.7	8.4	4.2	193.3	8.7	40.7
13+50	50	55.0	31.0	80.0	0.0	574.5	22.9	111.4
13+80	30	37.7	17.4	183.3	39.8	400.7	13.7	67.2
14+10	30	44.4	17.4	144.0	39.8	489.0	13.7	65.6
14+50	40	66.4	23.2	11.6	0.0	625.2	18.3	85.2
15+00	50	206.3	14.5	0.0	0.0	556.0	22.9	91.0
BC14	13.225	71.8	0.0	0.0	0.0	122.8	6.1	20.0
15+50	36.775	410.8	0.0	0.0	0.0	377.5	16.8	55.5
16+00	50	1,269.8	0.0	0.0	0.0	591.5	22.9	75.3
EC14/BC15	13.407	300.8	0.0	0.0	0.0	161.7	6.1	20.2
16+50	36.593	269.0	10.6	160.8	483.4	587.7	16.8	68.2
EC15	38.107	46.1	11.1	167.5	503.4	510.1	17.5	84.6
Total	1688.107	51,466.6	258.9	1,418.9	1,331.7	26,854.0	791.0	2,805.2
		x 1.1	x 1.1	x 1.1	x 1.1	x 1.1	x 1.05	x 1.05
Total with Allowance		56,600.0	280.0	1,600.0	1,500.0	29,500.0	830.0	2,900.0

3. Drainage Ditch

Drainage Ditch Type 1-1	STA. 0+00 to STA. 0+50	38.000 x 1.05 =	40 m
	STA. 0+50 to STA. 13+90	1340.00 x 1.05 =	1410 m
	STA. 14+00 to STA. 16+88.107	288.107 x 1.05 =	300 m
Drainage Ditch Type 1-2	STA. 14+00 to STA. 16+13.407	213.407 x 1.05 =	220 m

4. Excavated Slope

	1:0.5 (m2)	1:0.8 (m2)	1:1.5 (m2)	Level (m2)
	97.94	159.37	47.16	46.74
	112.50	629.93	451.05	232.26
		81.65	87.70	44.78
		420.98	176.29	45.01
		202.50	285.68	6.29
		90.67	115.11	90.17
		177.91	113.72	43.90
		179.64	69.45	
		283.76	58.40	
		173.18	47.44	
		17.50	112.59	
		149.61	537.86	
		7.05		
		135.15		
		80.91		
		132.09		
		360.68		
		58.68		
		235.88		
		83.41		
		313.77		
		184.36		
		459.77		
		127.60		
		296.98		
		30.44		
		61.53		
		93.67		
		198.17		
Total	210.44	5,426.84	2,102.45	509.15
x slope	471	8,688	2,527	509
Total(x 1.1)	520	9,560	2,780	560

2.8.6 Maintenance Road to Reservoir

1. Cross Sectional Area

Sta	Distance (m)	Excavation (m2)	Embankment			Subbase (m2)	Stripping (m)
			Subshoulder (m2)	Subgrade (m2)	Common (m2)		
0+00		1.72				0.75	0.00
0+15	15	1.26	0.17	0.45	0.10	0.88	4.10
BC1	30.481	2.47	0.17	0.10	0.10	0.80	7.43
0+60	14.519	5.33			0.10	0.72	7.61
EC1	15.326	9.29			0.10	0.75	9.24
0+90	14.674	9.79			0.10	0.75	9.30
BC2	17.255	9.49			0.10	0.74	10.37
1+25	17.745	7.93			0.10	0.74	9.96
EC2	31.037	10.92			0.10	0.74	9.83
2+00	43.963	15.73			0.10	0.75	16.65
BC3	46.42	24.82			0.10	0.75	14.28
2+60	13.58	16.34			0.10	0.75	11.38
EC3/BC4	16.266	17.68			0.10	0.75	14.09
3+00	23.734	18.39			0.10	0.74	14.58
EC4/BC5	12.394	20.31			0.10	0.75	16.26
3+40	27.606	16.29			0.10	0.75	15.50
EC5	31.037	21.89			0.10	0.75	26.04
3+97.5	26.463	32.17			0.10	0.75	22.46

2. Calculated Volume

Sta	Distance (m)	Excavation (m2)	Embankment			Subbase (m2)	Stripping (m)
			Subshoulder (m2)	Subgrade (m2)	Common (m2)		
0+00							
0+15	15	22.4	1.3	3.4	0.8	12.2	30.8
BC1	30.481	56.8	5.2	8.4	3.0	25.6	175.8
0+60	14.519	56.6	1.2	0.7	1.5	11.0	109.2
EC1	15.326	112.0	0.0	0.0	1.5	11.3	129.2
0+90	14.674	140.0	0.0	0.0	1.5	11.0	136.1
BC2	17.255	166.3	0.0	0.0	1.7	12.9	169.7
1+25	17.745	154.6	0.0	0.0	1.8	13.2	180.4
EC2	31.037	292.5	0.0	0.0	3.1	23.1	307.2
2+00	43.963	585.8	0.0	0.0	4.4	32.8	582.1
BC3	46.42	941.2	0.0	0.0	4.6	34.9	717.9
2+60	13.58	279.5	0.0	0.0	1.4	10.2	174.2
EC3/BC4	16.266	276.7	0.0	0.0	1.6	12.2	207.1
3+00	23.734	428.0	0.0	0.0	2.4	17.7	340.1
EC4/BC5	12.394	239.8	0.0	0.0	1.2	9.2	191.1
3+40	27.606	505.2	0.0	0.0	2.8	20.7	438.4
EC5	31.037	592.5	0.0	0.0	3.1	23.3	644.7
3+97.5	26.463	715.3	0.0	0.0	2.6	19.9	641.7
Total	397.5	5,565.2	7.7	12.5	39.0	301.2	5,175.8
		x 1.10	x 1.10	x 1.10	x 1.10	x 1.10	x 1.10
Total with Allowance		6,100	10	10	40	300	5,700

3. Drainage Ditch

Drainage Ditch Type 3-1 STA. 0+00 to STA. 3+97.5 397.500 x 1.05 = 420 m

4. Excavated Slope

Sta	1:0.5 (m2)	1:0.8 (m2)	1:1.5 (m2)	Level (m2)
		261.10	49.98	
		65.27		
		12.19		
		3.48		
		4.22		
		19.27		
		135.31		
		271.24		
Total	0	772.08	49.98	0.00
x slope	0	1,236	60	0
Total(x 1.1)	0	1,360	70	0

2.9 Grouting

2.9.1 Summary

Drilling and grouting	Unit	Total	Curtain (Dam)	Blanket (Dam)	Consolidation (Dam)	Consolidation (Spillway)	Curtain Consolidation (Tunnel)
Core Drilling (66 mm dia) :							
from within Gallery	m	1,200	1,200				
from Surface	m	4,900	4,900				
Rotary Drilling Holes for Grouting (46 mm dia) :							
from within Gallery	m	5,200	4,000		1,200		
from Surface	m	14,400	11,700	2,200		500	
from Tunnels	m	1,050					1,050
Drill set-up for drilling grout hole	No.	4,050	3,200	390	200	80	180
Wash and Water Pressure Testing	No.	4,050	3,200	390	200	80	180
Cement used in Pressure Grouting	tonne	409	324	39	20	8	18

2.9.2 Curtain (Dam)

1. Drilling from within Gallery

(m)

Zone No.	Pilot (66mm dia.)	Primary (46mm dia.)	Secondary (46mm dia.)		Tertiary (46mm dia.)				Check (66mm dia.)
			1	2	1	2	3	4	
L1									
L2									
L3									
L4									
L5									
L6									
L7									
L8									
L9									
L10									
L11									
L12									
L13									
L14									
L15									
L16									
L17									
L18									
L19									
L20									
L21									
L22									
L23									
C1									
C2									
C3									
C4									
C5									
C6									
C7									
C8									
C9									
C10									
C11									
C12	31.3	22.6	22.4	22.8	22.0	22.5	22.7	22.9	21.0
C13	33.0	23.5	23.3	23.7	23.2	23.4	23.6	23.8	21.4
C14	33.8	26.1	25.0	27.3	24.4	25.5	26.7	27.9	16.9
C15	38.5	30.8	29.6	34.0	29.0	30.2	32.1	34.5	21.9
C16	45.1	37.5	36.3	38.6	35.7	36.9	38.0	39.2	25.9
C17	49.8	33.8	36.8	30.8	38.3	35.3	32.3	29.3	30.1
C18	37.8	26.5	26.5	26.5	26.5	26.5	26.5	26.5	29.2
C19	36.5	26.5	26.5	26.5	26.5	26.5	26.5	27.8	29.2
C20	39.3	35.3	32.3	38.3	30.8	33.8	36.8	39.8	31.5
C21	51.3	41.0	41.2	40.9	41.2	41.1	41.0	40.9	31.0
C22	50.8	38.5	39.4	38.4	40.7	38.6	38.5	38.4	30.6
C23	48.3	38.0	38.2	37.9	38.2	38.1	38.0	37.9	28.3
C24	47.8	36.8	37.7	35.5	37.7	37.4	36.1	34.9	27.8
C25	44.2	36.2	35.2	37.2	34.7	35.7	36.7	37.6	32.9
C26	48.1	40.1	39.1	41.1	38.6	39.6	40.6	41.6	36.6
C27	52.1	44.0	43.0	43.7	42.6	43.5	44.2	43.3	40.3
C28									
R1									
R2									
R3									
R4									
R5									
R6									
R7									
R8									
Total	687.7	537.3	532.4	543.2	530.3	534.7	540.3	546.2	454.7

Total (66mm dia)		1,142.5
Total (46mm dia)		3,764.4
Total (66mm dia)	x 1.05 =	1,200.0
Total (46mm dia)	x 1.05 =	4,000.0
Total		5,200.0

2. Drilling from Surface

(m)

Zone No.	Pilot (66mm dia.)	Primary (46mm dia.)	Secondary (46mm dia.)		Tertiary (46mm dia.)				Check (66mm dia.)
			1	2	1	2	3	4	
L1	51.1	42.4	41.8	43.0	0.0	0.0	0.0	0.0	62.7
L2	53.6	44.9	44.2	45.5	0.0	0.0	0.0	0.0	58.7
L3	50.0	47.4	46.7	48.0	0.0	0.0	0.0	0.0	57.1
L4	56.4	49.8	49.2	50.5	0.0	0.0	0.0	0.0	56.9
L5	61.8	52.2	51.6	52.7	0.0	0.0	0.0	0.0	57.2
L6	63.3	54.4	53.8	54.9	0.0	0.0	0.0	0.0	57.5
L7	65.4	56.3	55.9	56.8	0.0	0.0	0.0	0.0	57.0
L8	67.2	57.1	57.2	57.2	0.0	0.0	0.0	0.0	57.5
L9	67.3	57.7	57.5	58.0	0.0	0.0	0.0	0.0	59.9
L10	68.5	60.0	59.1	60.8	0.0	0.0	0.0	0.0	62.6
L11	71.6	63.1	62.4	63.9	0.0	0.0	0.0	0.0	64.8
L12	74.7	64.5	64.6	64.4	64.6	64.5	64.5	64.4	66.8
L13	74.3	64.1	64.2	63.8	64.3	64.2	63.9	63.6	65.3
L14	73.5	62.7	63.2	61.2	63.4	63.0	62.4	59.7	57.6
L15	68.2	53.7	56.7	51.7	57.7	55.2	52.2	51.7	54.0
L16	61.7	53.2	51.7	53.2	51.7	51.8	53.2	53.2	55.5
L17	63.2	53.2	53.2	51.7	53.2	53.2	51.8	51.7	54.0
L18	61.7	52.2	51.7	52.2	51.7	52.2	52.2	52.2	54.5
L19	62.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	54.5
L20	62.2	52.2	52.2	52.1	52.2	52.2	52.2	50.9	50.3
L21	59.6	48.2	48.2	48.2	48.3	48.2	48.2	48.2	50.3
L22	58.2	48.2	48.2	48.2	48.2	48.2	48.2	47.7	47.2
L23	56.5	45.2	45.2	45.2	45.2	45.2	45.2	45.2	47.2
C1	55.2	45.2	45.2	42.8	45.2	45.2	44.3	39.8	40.7
C2	49.8	35.3	36.8	33.8	36.8	36.8	35.3	33.8	30.9
C3	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C4	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C5	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C6	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C7	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C8	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C9	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C10	37.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	30.9
C11	37.8	26.8	27.8	26.8	27.8	26.8	26.8	26.8	24.7
C12									
C13									
C14									
C15									
C16									
C17									
C18									
C19									
C20									
C21									
C22									
C23									
C24									
C25									
C26									
C27									
C28	56.4	47.3	45.2	51.4	46.1	45.2	49.9	51.6	45.0
R1	63.1	57.7	55.9	57.6	54.5	57.4	57.7	57.5	48.7
R2	67.4	57.5	57.4	57.4	57.4	57.5	57.5	57.3	55.0
R3	67.2	56.8	57.0	56.6	57.1	56.9	56.7	56.5	55.6
R4	66.4	55.9	56.1	55.7	56.2	56.0	55.8	55.6	56.0
R5	65.5	55.0	55.2	54.8	0.0	0.0	0.0	0.0	56.2
R6	64.5	53.5	54.0	53.0	0.0	0.0	0.0	0.0	57.0
R7	62.5	51.3	51.9	50.8	0.0	0.0	0.0	0.0	59.3
R8	60.2	48.9	49.6	48.0	0.0	0.0	0.0	0.0	64.4
	57.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	2,527.4	2,048.6	2,045.4	2,046.5	1,256.3	1,254.3	1,252.5	1,242.0	2,149.6
Total (66mm dia)									4,677.0
Total (46mm dia)									11,145.5
Total (66mm dia)								x 1.05 =	4,900.0
Total (46mm dia)								x 1.05 =	11,700.0
Total									16,600.0

3. Drilling (only)

(m)

Zone No.	Pilot (66mm dia.)	Primary (46mm dia.)	Secondary (46mm dia.)		Tertiary (46mm dia.)				Check (66mm dia.)
			1	2	1	2	3	4	
L1	31.1	31.0	31.1	31.0					47.1
L2	30.9	30.8	30.8	30.7					41.2
L3	24.5	30.5	30.6	30.5					37.6
L4	28.2	30.3	30.4	30.2					35.1
L5	30.9	29.9	30.0	29.8					33.1
L6	29.6	29.4	29.5	29.2					31.0
L7	29.0	28.6	28.8	28.4					28.1
L8	28.1	26.7	27.4	26.0					26.1
L9	25.5	24.6	25.0	24.2					25.9
L10	23.9	24.1	23.9	24.2					26.0
L11	24.3	24.5	24.4	24.6					25.7
L12	24.7	24.5	24.6	24.4	24.6	24.5	24.5	24.4	25.0
L13	24.3	24.1	24.2	23.8	24.3	24.2	23.9	23.6	23.5
L14	23.5	22.7	23.2	21.2	23.4	23.0	22.4	19.7	15.8
L15	18.2	13.7	16.7	11.7	17.7	15.2	12.2	11.7	12.2
L16	11.7	13.2	11.7	13.2	11.7	11.8	13.2	13.2	13.8
L17	13.2	13.2	13.2	11.7	13.2	13.2	11.8	11.7	12.2
L18	11.7	12.2	11.7	12.2	11.7	12.2	12.2	12.2	12.7
L19	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.7
L20	12.2	12.2	12.2	12.1	12.2	12.2	12.2	10.9	8.6
L21	9.6	8.2	8.2	8.2	8.3	8.2	8.2	8.2	8.6
L22	8.2	8.2	8.2	8.2	8.2	8.2	8.2	7.7	5.4
L23	6.5	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.4
C1	5.2	5.2	5.2	4.0	5.2	5.2	4.3	2.9	3.7
C2	4.7	3.0	3.6	7.5	3.6	3.6	6.0	9.0	3.3
C3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C4	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C6	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C7	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C8	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C10	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.3
C11	3.0	2.0	3.0	2.8	3.0	2.0	2.0	6.3	0.9
C12	0.8	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.8
C13	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8
C14	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.8
C15	1.1	1.1	1.1	1.1	1.1	1.1	0.8	1.1	0.8
C16	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.8
C17	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.9
C18	1.1	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9
C19	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.1	0.9
C20	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.9
C21	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.9
C22	1.1	1.1	0.8	1.1	1.1	1.1	1.1	1.1	0.9
C23	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.8
C24	1.1	0.9	1.1	0.9	1.1	0.9	0.9	0.9	0.8
C25	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8
C26	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8
C27	0.9	0.9	0.9	1.5	0.9	0.9	1.5	1.5	0.8
C28	5.0	7.7	4.7	12.7	5.2	5.2	10.7	13.3	5.2
R1	15.2	21.6	19.0	22.3	17.1	20.8	22.0	22.7	12.3
R2	23.0	24.8	23.9	25.7	23.5	24.4	25.3	26.0	21.8
R3	26.3	27.6	27.0	28.3	26.7	27.3	28.0	28.6	25.7
R4	28.9	30.2	29.6	30.9	29.3	29.9	30.6	31.2	29.2
R5	31.5	32.8	32.2	33.5					32.4
R6	34.0	34.8	34.4	35.1					36.3
R7	35.5	36.1	35.8	36.4					41.2
R8	36.7	37.2	37.0	37.1					48.8
	37.1								
Total	809.0	783.2	778.6	790.0	326.4	328.6	335.4	341.7	813.7
Total									5,306.6
Total								x 1.05 =	5,600.0

4. Grouting (m)

Zone No.	Pilot (66mm dia.)	Primary (46mm dia.)	Secondary (46mm dia.)		Tertiary (46mm dia.)				Check (66mm dia.)
			1	2	1	2	3	4	
L1	20.0	11.4	10.7	12.0					15.6
L2	22.7	14.1	13.4	14.8					17.5
L3	25.5	16.8	16.1	17.5					19.6
L4	28.2	19.5	18.9	20.2					21.8
L5	30.9	22.3	21.6	23.0					24.1
L6	33.6	25.0	24.3	25.7					26.5
L7	36.4	27.7	27.0	28.4					29.0
L8	39.1	30.5	29.8	31.1					31.5
L9	41.8	33.2	32.5	33.9					34.0
L10	44.5	35.9	35.2	36.6					36.6
L11	47.3	38.6	38.0	39.3					39.2
L12	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L13	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L14	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L15	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L16	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L17	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L18	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L19	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L20	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L21	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L22	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
L23	50.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8
C1	50.0	40.0	40.0	38.8	40.0	40.0	40.0	36.9	37.1
C2	45.1	32.3	33.2	26.3	33.2	33.2	29.3	24.8	27.6
C3	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C4	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C5	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C6	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C7	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C8	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C9	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C10	34.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8	27.6
C11	34.8	24.8	24.8	24.0	24.8	24.8	24.8	20.5	23.8
C12	30.5	21.7	21.5	22.0	21.2	21.6	21.8	22.1	20.2
C13	32.2	22.6	22.4	22.8	22.3	22.5	22.7	23.0	20.6
C14	32.7	25.0	23.8	26.2	23.3	24.4	25.6	26.8	16.1
C15	37.3	29.7	28.5	32.8	27.9	29.1	31.3	33.4	21.1
C16	44.0	36.3	35.2	37.5	34.6	35.8	36.9	38.1	25.1
C17	48.7	32.7	35.7	29.7	37.2	34.2	31.2	28.2	29.2
C18	36.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	28.4
C19	35.7	25.7	25.7	25.7	25.7	25.7	25.7	26.7	28.4
C20	38.2	34.2	31.2	37.2	29.7	32.7	35.7	38.7	30.6
C21	50.2	39.9	40.0	39.8	40.1	40.0	39.9	39.7	30.2
C22	49.7	37.4	38.6	37.3	39.6	37.5	37.4	37.2	29.7
C23	47.2	36.9	37.0	36.8	37.1	37.0	36.9	36.7	27.4
C24	46.7	35.8	36.5	34.5	36.6	36.5	35.2	33.9	27.0
C25	43.3	35.2	34.3	36.2	33.8	34.7	35.7	36.7	32.1
C26	47.2	39.2	38.2	40.1	37.7	38.7	39.7	40.6	35.8
C27	51.1	43.1	42.1	42.2	41.6	42.6	42.7	41.8	39.5
C28	51.4	39.6	40.5	38.7	40.9	40.0	39.2	38.3	39.7
R1	47.9	36.1	37.0	35.3	37.4	36.6	35.7	34.8	36.4
R2	44.4	32.6	33.5	31.8	33.9	33.1	32.2	31.3	33.1
R3	40.9	29.2	30.0	28.3	30.5	29.6	28.7	27.9	29.9
R4	37.4	25.7	26.5	24.8	27.0	26.1	25.2	24.4	26.8
R5	33.9	22.2	23.1	21.3					23.7
R6	30.5	18.7	19.6	17.8					20.8
R7	27.0	15.2	16.1	14.4					18.0
R8	23.5	11.7	12.6	10.9					15.6
	20.0								
Total	2,406.2	1,802.7	1,799.2	1,799.8	1,460.1	1,460.3	1,457.4	1,446.5	1,790.6
Total									15,422.8
Total								x 1.05 =	16,200.0
Total								x 20kg/m=	324,000.0

5. Water Pressure Test

(times)

Zone No.	Pilot (66mm dia.)	Primary (46mm dia.)	Secondary (46mm dia.)		Tertiary (46mm dia.)				Check (66mm dia.)
			1	2	1	2	3	4	
L1	4.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	3.0
L2	5.0	3.0	3.0	3.0	0.0	0.0	0.0	0.0	3.0
L3	5.0	3.0	3.0	4.0	0.0	0.0	0.0	0.0	4.0
L4	6.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0	4.0
L5	6.0	4.0	4.0	5.0	0.0	0.0	0.0	0.0	5.0
L6	7.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0	5.0
L7	7.0	6.0	5.0	6.0	0.0	0.0	0.0	0.0	6.0
L8	8.0	6.0	6.0	6.0	0.0	0.0	0.0	0.0	6.0
L9	8.0	7.0	7.0	7.0	0.0	0.0	0.0	0.0	7.0
L10	9.0	7.0	7.0	7.0	0.0	0.0	0.0	0.0	7.0
L11	9.0	8.0	8.0	8.0	0.0	0.0	0.0	0.0	8.0
L12	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L13	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L14	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L15	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L16	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L17	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L18	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L19	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L20	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L21	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L22	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
L23	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
C1	10.0	8.0	8.0	8.0	8.0	8.0	8.0	7.0	7.0
C2	9.0	6.0	7.0	5.0	7.0	7.0	6.0	5.0	6.0
C3	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C4	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C5	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C6	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C7	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C8	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C9	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C10	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C11	7.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
C12	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
C13	6.0	5.0	4.0	5.0	4.0	5.0	5.0	5.0	4.0
C14	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0
C15	7.0	6.0	6.0	7.0	6.0	6.0	6.0	7.0	4.0
C16	9.0	7.0	7.0	8.0	7.0	7.0	7.0	8.0	5.0
C17	10.0	7.0	7.0	6.0	7.0	7.0	6.0	6.0	6.0
C18	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C19	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
C20	8.0	7.0	6.0	7.0	6.0	7.0	7.0	8.0	6.0
C21	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	6.0
C22	10.0	7.0	8.0	7.0	8.0	7.0	7.0	7.0	6.0
C23	9.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5.0
C24	9.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	5.0
C25	9.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.0
C26	9.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.0
C27	10.0	9.0	8.0	8.0	8.0	9.0	9.0	8.0	8.0
C28	10.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
R1	10.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
R2	9.0	7.0	7.0	6.0	7.0	7.0	6.0	6.0	7.0
R3	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
R4	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
R5	7.0	4.0	5.0	4.0	0.0	0.0	0.0	0.0	5.0
R6	6.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0	4.0
R7	5.0	3.0	3.0	3.0	0.0	0.0	0.0	0.0	4.0
R8	5.0	2.0	3.0	2.0	0.0	0.0	0.0	0.0	3.0
	4.0								
Total	480.0	360.0	360.0	360.0	291.0	293.0	290.0	289.0	356.0
Total									3,079.0
Total								x 1.05 =	3,200.0

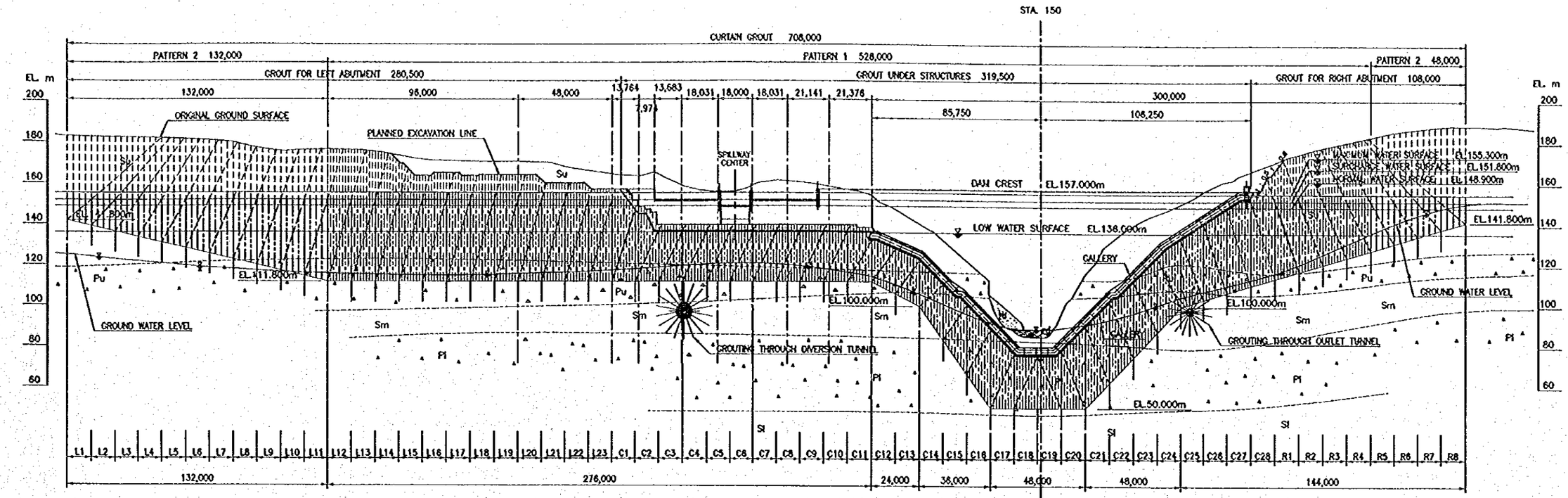
2.9.3 Consolidation and Blanket Grouting (46 mm dia.)

Grouting	Drilling (m)	Holes	Total (m)	Grouting (m)	Holes	Total (m)	Pressure Test	Holes	Total
Consolidation									
from Gallery	6.0	192	1152.0	5.0	192	960.0	1.0	192	192.0
Dam		x 1.05 =	1,200.0		x 1.05 =	1,010.0		x 1.05 =	200.0
Total					x 20kg/m=	20,000.0			
from Surface	6.5	77	500.5	5.0	77	385.0	1.0	77	77.0
Spillway		x 1.05 =	500.0		x 1.05 =	400.0		x 1.05 =	80.0
Total					x 20kg/m=	8,000.0			

Grouting	Drilling (m)	Holes	Total (m)	Grouting (m)	Holes	Total (m)	Pressure Test	Holes	Total
Blanket									
from Surface	11.0	188	2068.0	10.0	188	1880.0	2.0	188	376.0
(Dam)		x 1.05 =	2,200.0		x 1.05 =	1,970.0		x 1.05 =	390.0
Total					x 20kg/m=	39,000.0			

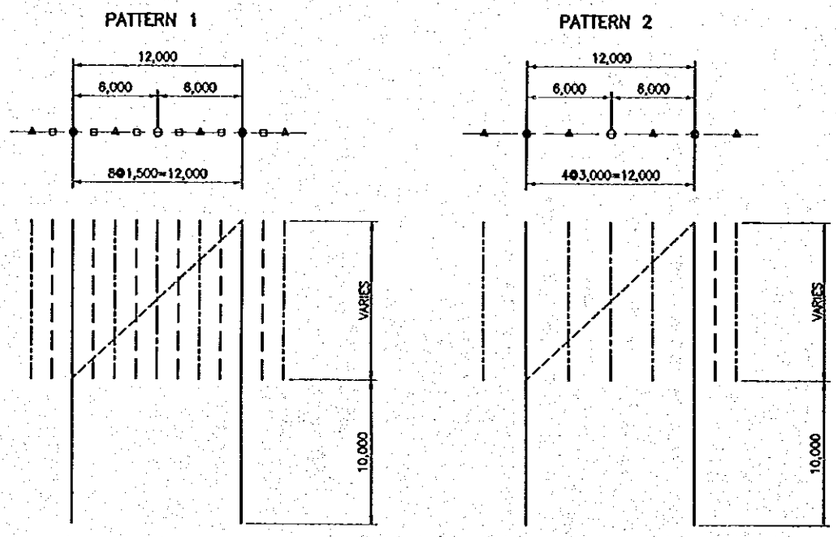
2.9.4 Drilling and Grouting from Tunnels (46mm dia.)

Grouting	No.	Drilling (m)	Holes	Total (m)	Grouting (m)	Holes	Total (m)	Pressure Test	Holes	Total
Diversion										
Curtain	1	13.0	1	13.0	10.0	1	10.0	2.0	1	2.0
	2	13.0	2	25.9	10.0	2	20.0	2.0	2	4.0
	3	13.0	2	25.9	10.0	2	20.0	2.0	2	4.0
	4	13.0	2	25.9	10.0	2	20.0	2.0	2	4.0
	5	13.0	2	25.9	10.0	2	20.0	2.0	2	4.0
	6	13.0	2	25.9	10.0	2	20.0	2.0	2	4.0
	7	13.1	2	26.2	10.0	2	20.0	2.0	2	4.0
	8	12.8	2	25.6	10.0	2	20.0	2.0	2	4.0
	9	12.3	2	24.7	10.0	2	20.0	2.0	2	4.0
	10	12.3	1	12.3	10.0	1	10.0	2.0	1	2.0
Consolidation-1	1	6.2	4.0	24.6	5.0	4.0	20.0	1.0	4.0	4.0
	2	6.2	8.0	49.2	5.0	8.0	40.0	1.0	8.0	8.0
	3	6.2	8.0	49.2	5.0	8.0	40.0	1.0	8.0	8.0
	4	6.1	8.0	48.5	5.0	8.0	40.0	1.0	8.0	8.0
	5	6.0	4.0	24.0	5.0	4.0	20.0	1.0	4.0	4.0
Consolidation-2	1	6.2	6.0	36.9	5.0	6.0	30.0	1.0	6.0	6.0
	2	6.2	6.0	36.9	5.0	6.0	30.0	1.0	6.0	6.0
	3	6.2	6.0	37.2	5.0	6.0	30.0	1.0	6.0	6.0
	4	6.1	6.0	36.3	5.0	6.0	30.0	1.0	6.0	6.0
Outlet Tunnel										
Curtain	1	10.1	1	10.1	10.0	1	10.0	2.0	1	2.0
	2	10.1	2	20.2	10.0	2	20.0	2.0	2	4.0
	3	10.1	2	20.2	10.0	2	20.0	2.0	2	4.0
	4	10.1	2	20.2	10.0	2	20.0	2.0	2	4.0
	5	10.1	2	20.2	10.0	2	20.0	2.0	2	4.0
	6	10.1	2	20.2	10.0	2	20.0	2.0	2	4.0
	7	10.1	2	20.2	10.0	2	20.0	2.0	2	4.0
	8	10.0	2	20.0	10.0	2	20.0	2.0	2	4.0
	9	10.0	2	20.0	10.0	2	20.0	2.0	2	4.0
	10	10.0	1	10.0	10.0	1	10.0	2.0	1	2.0
Consolidation-1	1	5.1	3.0	15.3	5.0	3.0	15.0	1.0	3.0	3.0
	2	5.1	6.0	30.6	5.0	6.0	30.0	1.0	6.0	6.0
	3	5.1	6.0	30.6	5.0	6.0	30.0	1.0	6.0	6.0
	4	5.0	6.0	30.0	5.0	6.0	30.0	1.0	6.0	6.0
	5	5.0	3.0	15.0	5.0	3.0	15.0	1.0	3.0	3.0
Consolidation-2	1	5.1	6.0	30.6	5.0	6.0	30.0	1.0	6.0	6.0
	2	5.1	6.0	30.6	5.0	6.0	30.0	1.0	6.0	6.0
	3	5.1	6.0	30.6	5.0	6.0	30.0	1.0	6.0	6.0
	4	5.0	6.0	30.0	5.0	6.0	30.0	1.0	6.0	6.0
Total				998.7			880.0			176.0
Total			x 1.05 =	1,050.0		x 1.05 =	920.0		x 1.05 =	180.0
Total						x 20kg/m=	18,000.0			



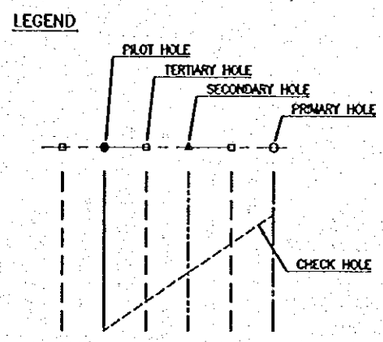
LONGITUDINAL PROFILE ALONG CUTAIN GROUT LINE

SCALE A



PATTERN OF CURTAIN GROUT HOLES

SCALE B



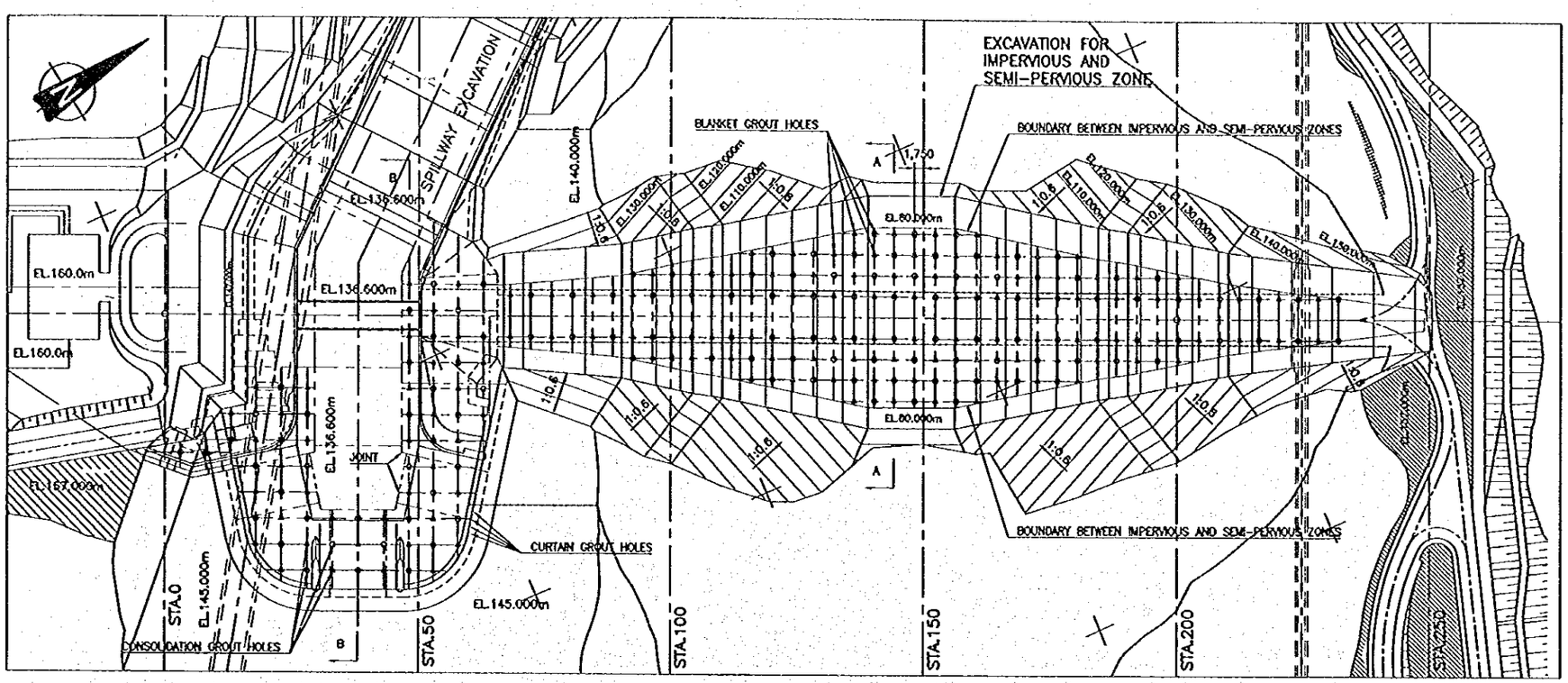
LEGEND

- rd : RIVER DEPOSIT
- td : TALUS DEPOSIT
- Su : UPPER SEDIMENTARY ROCK UNIT
- Pu : UPPER PYROCLASTIC ROCK UNIT
- Sm : MIDDLE SEDIMENTARY ROCK UNIT
- Pl : LOWER PYROCLASTIC ROCK UNIT

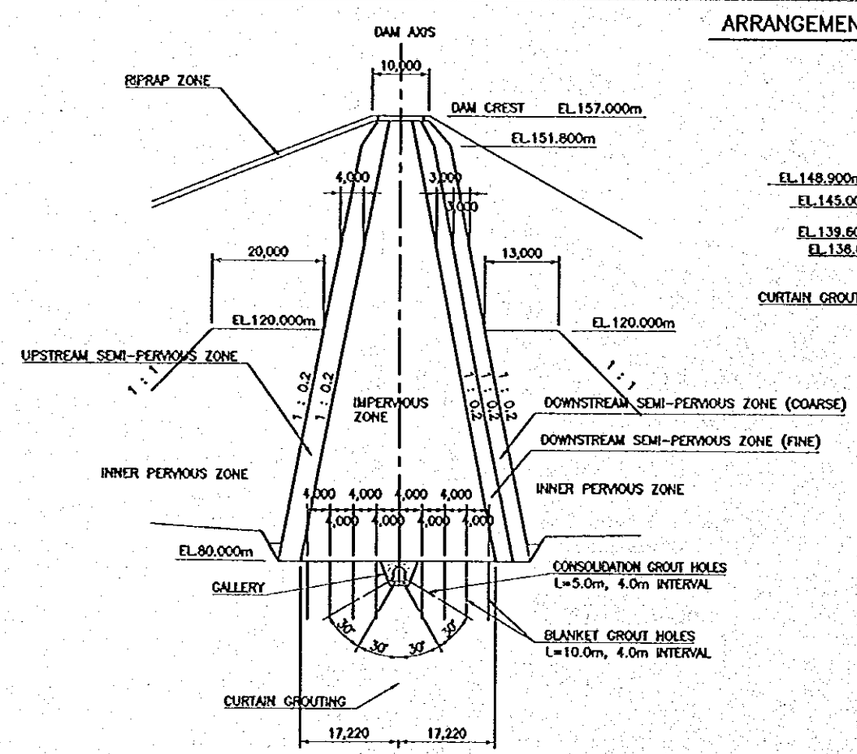
SCALE A 0 20 40 60 80 100m

SCALE B 0 4 8 12 16 20m

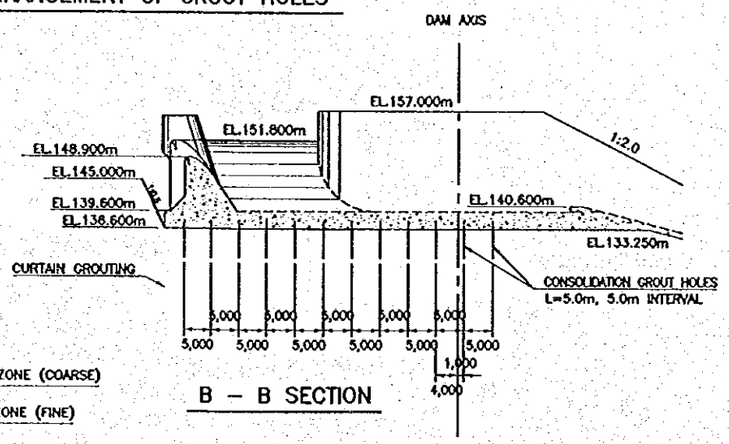
EMBANKMENT DAM
ARRANGEMENT OF FOUNDATION GROUTING (2/3)



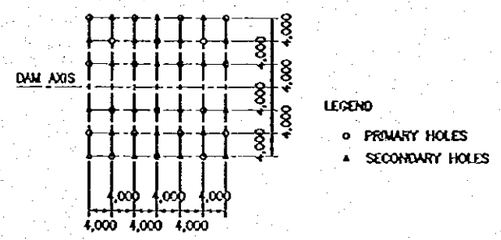
ARRANGEMENT OF GROUT HOLES



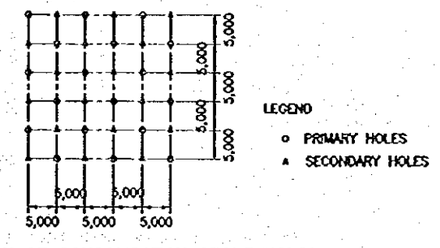
A – A SECTION



B – B SECTION



PATTERN OF BLANKET GROUT HOLES



PATTERN OF CONSOLIDATION GROUT HOLES

SCALE 0 10 20 30 40 50m

EMBANKMENT DAM
ARRANGEMENT OF FOUNDATION GROUTING (3/3)