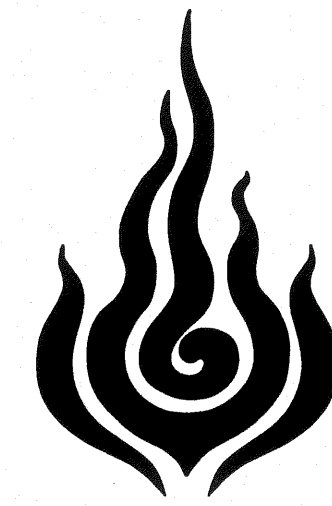




Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

HUAI LAM SIN HYDROPOWER PROJECT

AMPHOE KONGRA CHANGWAT PHATTHALUNG

CONTRACT C2

ELECTRO – MECHANICAL EQUIPMENT

VOLUME 4 DRAWINGS

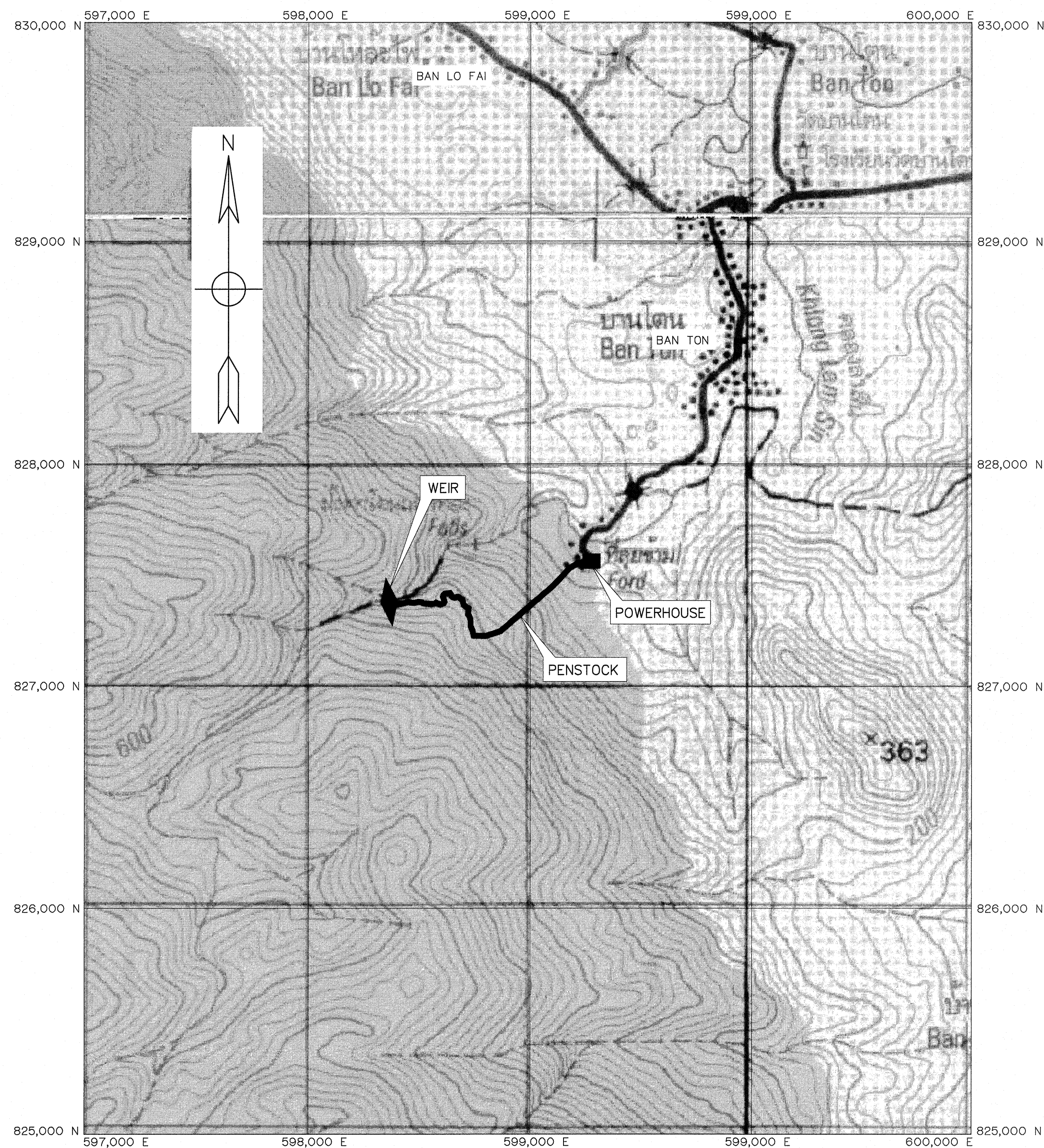


FRONTIER ENGINEERING CONSULTANTS CO.,LTD.

HUAI LAM SIN HYDROPOWER PROJECT
CONTRACT C2 : LIST OF DRAWINGS

SHEET NO.	DRAWING NO.	DRAWING DETAILS
GENERAL		
1	HLS-GN-01	LOCATION MAP AND PROJECT AREA MAP
2	HLS-GN-02	PROJECT MAP
3	HLS-GN-03	SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES
4	HLS-GN-04	HYDROLOGY DATA
5	HLS-GN-05	HYDRAULIC GRADE LINE
INTAKE STRUCTURE		
6	HLS-IS-01	GENERAL LAY-OUT
7	HLS-IS-02	PLAN AND SECTION A-A
8	HLS-IS-03	SECTION B-B, C-C, D-D AND E-E
PENSTOCK		
9	HLS-PS-01	PLAN AND PROFILE, STA. 0+000 TO STA. 0+400
10	HLS-PS-02	PLAN AND PROFILE, STA. 0+400 TO STA. 0+800
11	HLS-PS-03	PLAN AND PROFILE, STA. 0+800 TO STA. 1+000
12	HLS-PS-04	PLAN AND PROFILE, STA. 1+000 TO STA. 1+171.00

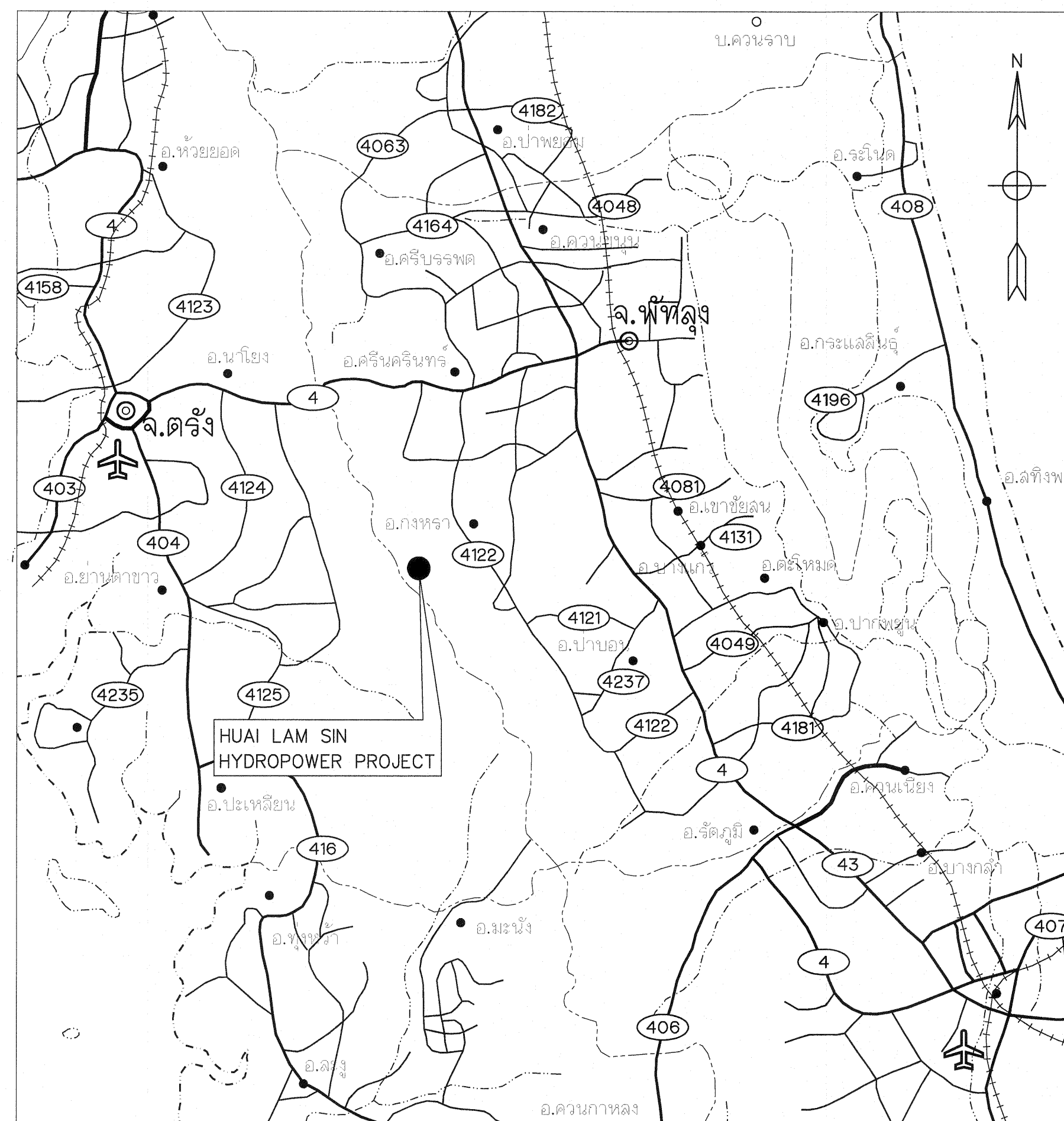
SHEET NO.	DRAWING NO.	DRAWING DETAILS
POWER HOUSE		
13	HLS-PH-01	GENERAL LAY-OUT
14	HLS-PH-02	PLAN AND ROOF PLAN
15	HLS-PH-03	ELEVATIONS
16	HLS-PH-04	SECTIONS
17	HLS-PH-05	TRANSFORMER, SWITCHYARD AND GROUNDING SYSTEM
18	HLS-PH-06	TRANSFORMER AND SWITCHYARD, SECTIONS
19	HLS-PH-07	TRANSFORMER AND SWITCHYARD, DETAILS
TAILRACE		
20	HLS-TR-01	PLAN AND SECTION A-A
21	HLS-TR-02	SECTIONS B-B, C-C AND D-D
ELECTRO – MECHANICAL EQUIPMENT		
22	HLS-EM-01	MAIN POWER SINGLE LINE DIAGRAM
23	HLS-EM-02	MAIN CONTROL SWITCH BOARD
24	HLS-EM-03	0.4 kV AIR CIRCUIT BREAKER CUBICLE
25	HLS-EM-04	COMPRESS AIR SYSTEM SCHEMATIC DIAGRAM



PROJECT AREA MAP
SCALE 1:15,000

LEGENDS :

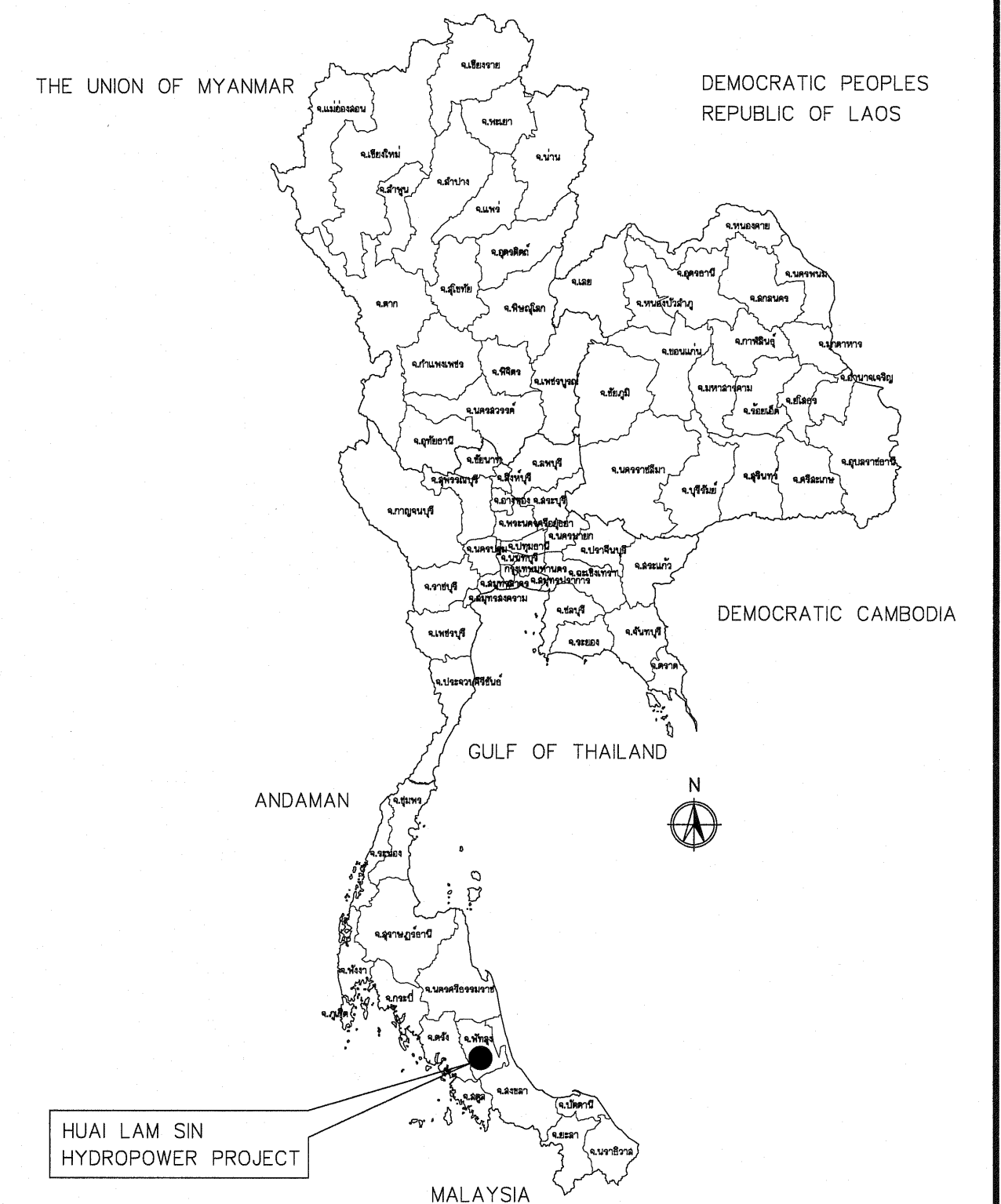
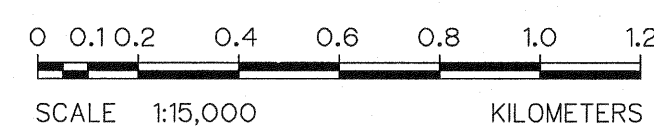
- STREAM
- WEIR
- PENSTOCK
- POWERHOUSE



LOCATION MAP
NOT TO SCALE

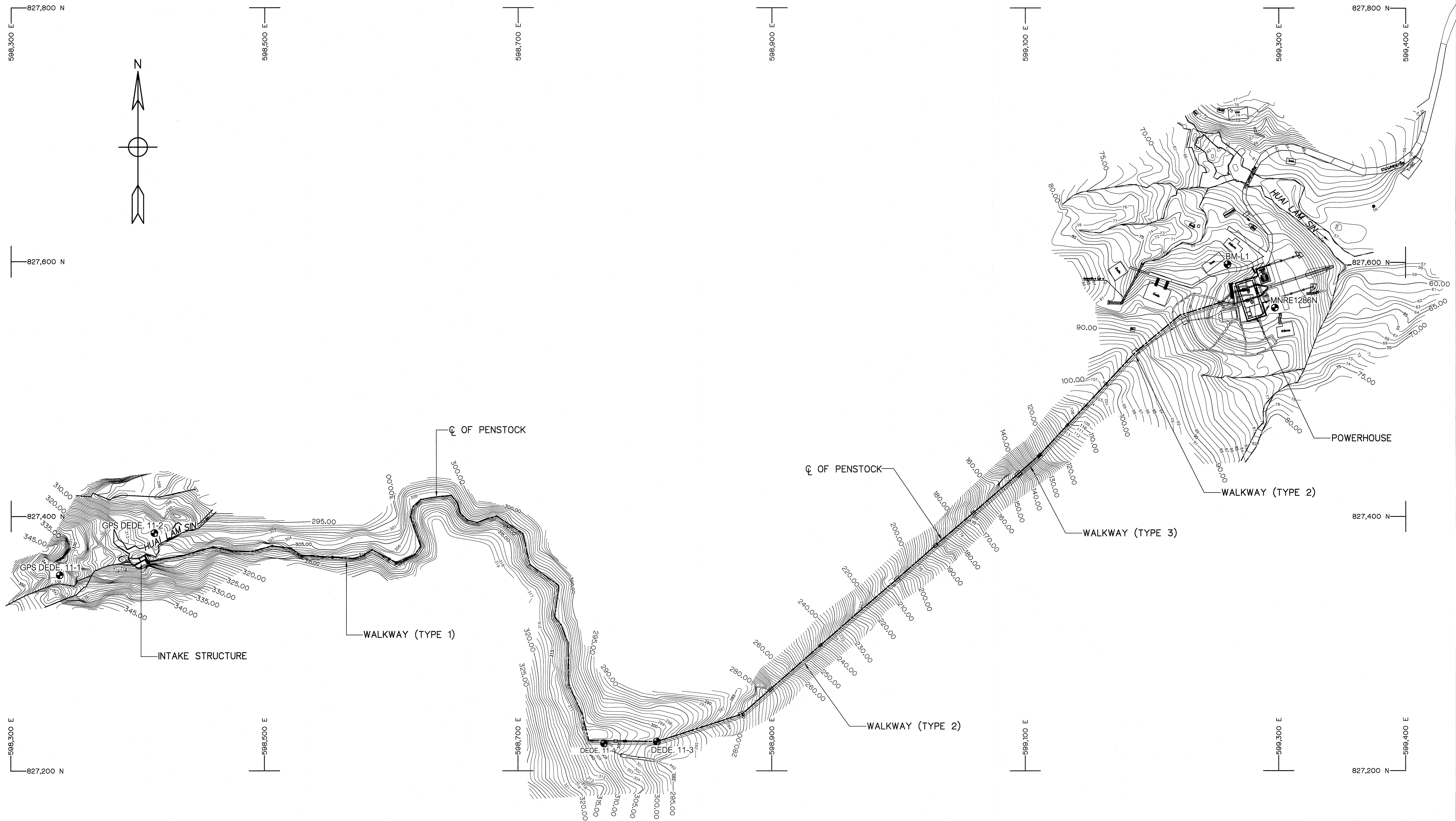
NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03



LOCATION MAP
NOT TO SCALE

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUIAI LAM SIN HYDROPOWER PROJECT			
ELECTRO – MECHANICAL EQUIPMENT GENERAL LOCATION MAP AND PROJECT AREA MAP			
FRONTIER ENGINEERING CONSULTANTS CO., LTD.		REVIEWED S. KITCHAI	
DESIGNED S. KITCHAI	DATE 14/01/62	SUBMITTED S. KITCHAI	
DRAWN S. KITCHAI		RECOMMENDED S. KITCHAI	
CHECKED S. KITCHAI	DATE 14/01/62	APPROVED S. KITCHAI	
CONSULTANTS		DEDE	
PROJECT MANAGER		DATE	
HLS-GN-01		SHEET NO. 1 OF 25	



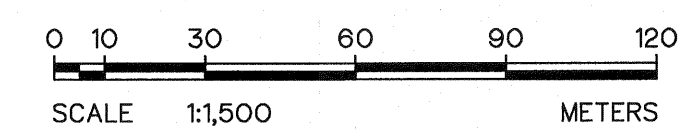
BM. DESCRIPTIONS

BM NO.	COORDINATE		ELEVATION M. (MSL.)
	N	E	
GPS DEDE. 11-1	827,354.129	598,338.669	+339.199
GPS DEDE. 11-2	827,387.233	598,413.286	+308.463
DEDE. 11-3	827,223.464	598,809.441	+301.019
DEDE. 11-4	827,221.905	598,767.983	+307.643
BM-L1	827,588.487	599,259.619	+73.947
MNRE1286N	827,564.329	599,296.961	+68.789

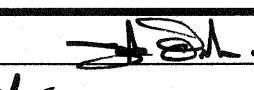
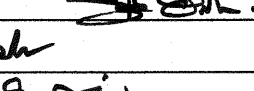
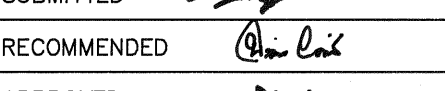
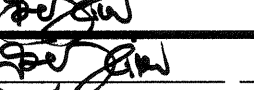
PROJECT MAP
SCALE 1:1,500

NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS. UNLESS OTHERWISE SHOWN.
2. SYMBOLE, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03



3				
2				
1				
NO.	DATE	REVISIONS	CHECKED	APPROVED
		CONSULTANTS	DEDE	

 KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUI LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT GENERAL PROJECT MAP			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		 Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED  281.6651		REVIEWED  281.6651	
DRAWN  281.7324		RECOMMENDED  281.7324	
CHECKED  14/01/62		APPROVED  14/01/62	
PROJECT MANAGER		DATE	
DRAWING NO.		SHEET NO.	
HLS-GN-02		2 OF 25	

ABBREVIATIONS :

A	CROSS-SECTION AREA OF FLOW
AC.	ASBESTOS CEMENT PIPE
AGG.	AGGREGATE
ALT.	ALTERNATIVE
APPROX.	APPROXIMATE
AZ.	AZIMUTH
B.	BEGINNING OF SURVEY
BC.	BEGINNING OF CURVE
BEG.	BEGINNING
BF.	BOTTOM FACE
B	BEAM
B.M.	BENCH MARK
BOTT.	BOTTOM
BRG.	BEARING
C.B.R.	CALIFORNIA BEARING RATIO
C/C	CENTER TO CENTER
CL	CENTER LINE
CL.	CLEARANCE
CM. OR cm.	CENTIMETER
CM./S OR cm./s	CENTIMETER PER SECOND
COL.	COLUMN
CONC.	CONCRETE
D	DEGREE OF CURVE
DB.	DEFORM BAR
d.	DEPTH OF WATER
DIA. OR Ø	DIAMETER
DOH.	DEPARTMENT OF HIGHWAY
DWG.	DRAWING
DEDE.	DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY
E	EAST
E	END OF SURVEY
EA.	EACH
E.C.	END OF CURVE
E.F.	END OF FACE
EL. OR ELEV.	ELEVATION
EXIST.	EXISTING
EXP.	EXPANSION
EXT.	EXTERIOR
EX.	EXTERNAL DISTANCE OF CURVE
f	FREE BOARD , FINISH
F.F.	FAR FACE
F.S.L.	FULL SUPPLY LEVEL
FTG.	FOOTING
HD.	HEAD
HEX.	HEXAGONAL
HOR.	HORIZONTAL
I.D.	INSIDE DIAMETER
I.F.	INSIDE FACE
IN. OR "	INCH
INT.	INTERIOR
INV.	INVERT
Kg.	KILOGRAM
Km.	KILOMETER
KPH.	KILOMETER PER HOUR
KSC.	KILOGRAM PER SQUARE CENTIMETER
L	LENGTH OF CURVE
LC.	LENGTH OF HORIZONTAL CURVE
LONG.	LONGITUDINAL
LT.	LEFT
L.W.L.	LOW WATER LEVEL
M. OR m.	METER
M. ² OR m. ²	SQUARE METER
M. ³ OR m. ³	CUBIC METER
MM. OR mm.	MILLIMETER
M./S OR m./s	METER PER SECOND
MIN.	MINIMUM

MAX.	MAXIMUM
M.S.L.	MEAN SEA LEVEL
MISC.	MISCELLANEOUS
N.	NORTH
n.	MANNING'S ROUGHNESS COEFFICIENT
N.F.	NEAR FACE
NGL.	NATURAL GROUND LEVEL
NO. OR #	NUMBER
N.W.L.	NORMAL WATER LEVEL
OD.	OUTSIDE DIAMETER
O.F.	OUTSIDE FACE
O&M	OPERATION & MAINTENANCE
PC.	POINT OF HONRIZONTAL CURVATURE
PI.	POINT OF HORIZONTAL INTERSECTION
PL.	PLATE
P.O.C.	POINT ON CURVE
P.O.T.	POINT ON TANGENT
P.O.S.T.	POINT ON SUB-TANGENT
PRC.	POINT OF HORIZONTAL REVERSE CURVE
PT.	POINT OF TANGENT
PVC.	POLYVINYL CHLORIDE
PVC.	POINT OF VERTICAL CURVATURE
PVI.	POINT OF VERTICAL INTERSECTION
PVRG.	POINT OF VERTICAL REVERSE CURVE
PVT.	POINT OF VERTICAL TANGENT
Q.	DISCHARGE
QTY. QUAN.	QUANTITY
R	RADIUS OF CURVATURE
r	HYDRAULIC RADIUS
RØ , Ø	ROUND BAR
RC.	REINFORCED CONCRETE
RD.	ROAD
REF.	REFERENCE
REINF.	REINFORCEMENT
REQ'D	REQUIRED
RID.	ROYAL IRRIGATION DEPARTMENT
SCH.	SCHEDULE
SE.	SUPERELEVATION
SETC.	SECTION
S.P.C.T.	STANDARD PROCTOR COMPACTION TEST
S.S.	SIDE SLOPE
STIR.	STIRRUP
STA.	STATION
STD.	STANDARD
STR.	STRUCTURE
SYMM.	SYMMETRICAL
T.	TANGENT LENGTH , THICKNESS
T	TON
THK.	THICKNESS
T.F.	TOP FACE
T.I.S.	THAI INDUSTRIAL STANDARD
Ts.	SUPERELEVATION TRANSITION LENGTH
TYP.	TYPICAL
V.	VELOCITY OF FLOW
V.C.	VERTICAL CURVE
Vc.	LENGTH OF VERTICAL CURVE
VER.	VERTICAL
VOL.	VOLUME
W/	WITH
W.C.	WATER CLOSET
⊙	ANGLE
△	DEFLECTION ANGLE

SYMBOLS :

	TYPICAL NORTH ARROW
	CENTER LINE
	PAVED ROAD
	DIRT ROAD, LATEITE ROAD OR TRACK
	VILLAGE
	CITY OR DISTRICT
	POND OR SWAMP
	CULVERT UNDER ROAD
	BRIDGE
	POLE
	TEST PIT
	EXISTING HAND AUGER
	EXISTING DRILL HOLES
	DRILL HOLES
	DEGREE, MINUTE, SECOND
	AT EQUAL DISTANCE BETWEEN CENTER TO CENTER
	B.M.
	STATION
	BC., EC., PC., PI., PT., PCV., PVT.
	WATER LEVEL
	PLAN OF RIPRAP
	PLAN OF SLOPE RIPRAP
	SECTION OF DUMPED RIPRAP
	SECTION OF HAND PLACED RIPRAP
	SECTION OF SAND
	SECTION OF GRAVEL OR COARSE AGGREGATE
	SECTION OF ROCK
	SECTION OF EARTH
	SECTION OF BACKFILL
	SECTION OF CONCRETE
	STEEL SECTION
	ELEVATION OR PLAN OF EARTH CUT OR FILL
	ELEVATION OR PLAN OF ROCK CUT
	ELEVATION OR PLAN OF SLOPE
	NATURAL GROUND LEVEL
	CONTOUR LINE
	RIVER, STREAM OR NATURAL DRAIN
	FLOW DIRECTION
	SLOPE DIRECTION
	SLOPE RATIO

GENERAL NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS UNLESS OTHERWISE SHOWN.
- DURING THE CONTRUCTION PERIOD, IT IS THE CONTRACTOR'S DUTY TO CHECK THE CORRECTION OF ALL RELEVANT LOCATIONS, DIMENSIONS, ELEVATIONS AND OTHER DATA AS PROVIDED BY THE DRAWING AND TECHNICAL SPECIFICATIONS BEFORE THE IMPLEMENTATION OF THE WORKS.
- IN CASE OF ANY DETAILS BEING NOT MENTIONED OR NOT SHOWN IN THE DRAWING OR TECHNICAL SPECIFICATIONS, OR IN CASE OF ANY DISCREPANCY, DEFECTIVE DESCRIPTION, ERROR, DIMENSION OR AMBIGUTY BETWEEN OR IN ANY OF THE DRAWINGS, IT IS THE CONTRACTOR'S RESPONSIBILITY TO CORRECT AND/OR ADJUST THE RELEVENT DRAWINGS TO OBTAIN FIELD ENGINEER APPROVAL
- ADDITIONAL SYMBOLS, IF REQUIRED, ARE DEFINED IN THE RESPECTIVE DRAWINGS.
- THE SPECIFICATIONS AND THE QUANTITIES OF MATERIALS ARE SPECIFIED IN THE TECHNICAL SPECIFICATIONS.
- ALL PLAIN CONCRETE CORNERS ARE TO BE CHEMFERED 2 cm. UNLESS OTHERWISE SHOWN.
- SLOPE IN CUT AND FILL SECTIONS, UNLESS OTHERWISE SHOWN, SHALL BE CONFORMED TO THE FOLLOWING TABLE OR AS DIRECTED BY FIELD ENGINEER.

EXISTING GROUND SLOPE 1:S	EARTH		HARD ROCK	
	CUT 1:S	FILL 1:S	CUT 1:S	FILL 1:S
OVER 1:1	OVER 1:0.5 $\frac{2}{1}$	$\frac{1}{1}$	1:0	$\frac{1}{1}$
1:1 - 1:1.5	1:0.5	1	1:0	$\frac{1}{1}$
1:1.5 - 1:2	1:1	1:1	1:0	1:1
1:2 - 1:3	1:1	1:1.5	1:0	1:1.5
LOWER 1:3	1:1	1:2	1:0	1:2

$\frac{2}{1}$ = FILL SHOULD BE AVOIDED
 $\frac{1}{1}$ = FOR DOUBTFUL CASES CONSULT FIELD ENGINEER

STRUCTURAL DESIGN NOTES :

- THE ULTIMATE COMPRESSIVE STRENGTH OF CONCRETE OF STANDARD CYLINDER (Ø0.15x0.30 m.) TEST AT AGE 28 DAYS SHALL BE AS THE FOLLOWING, UNLESS OTHERWISE SHOWN.

fc' (ksc)	DESCRIPTION
350	PRESTRESS CONCRETE
210	1. WEIR / INTAKE STRUCTURE
	2. POWERHOUSE, TAILRACE
	3. TAILRACE
	4. MANHOLE
	5. ANCHOR BLOCK, PIPE SUPPORT
	6. BOX CULVERT
140	LEAN CONCRETE

- UNLESS OTHERWISE SHOWN, THE FOLLOWING CLEAR COVER OF CONCRETE OVER OF THE REINFORCEMENT SHALL BE USED :
 - FACE EXPOSED TO SCOUR 5.0 cm.
 - FACE EXPOSED TO EARTH OR WEATHER 5.0 cm.
 - FACE UNEXPOSED TO EARTH OR WEATHER 3.0 cm.
- THE REINFORCEMENT LAP SPLICES SHALL NOT BE LESS THAN 50 DIAMETERS OF BIGGER THAN BAR WITH HOOKS, UNLESS OTHERWISE SHOWN.
- EMBEDDED METALWORK SHALL BE SECURELY FASTENED IN POSITION BEFORE PLACING CONCRETE.
- ALL CONSTRUCTION JOINT SHOULD BE TREATED AS DIRECTED IN ORDER TO ASSURE THE BEST BOND.
- A 5 cm. (MIN.) LAYER OF LEAN CONCRETE (1:3:5 BY VOLUME) SHOULD BE PLACED BELOW CONCRETE STRUCTURES.
- THE STRUCTURES SHOULD BE PLACED ON UNDISTURBED SOILS OR COMPACTED FILL AND BACKFILL AROUND THE STRUCTURES SHOULD BE COMPACTED.
- THE FOUNDATION ELEVATIONS ARE SUBJECT TO CHANGE AS DIRECTED ACCORDING TO THE SOIL CONDITIONS.
- ALL SIZES OF REINFORCING BARS AND STRUCTURAL STEELS ARE IN MILLIMETERS.
- ALL STRUCTURAL STEELS ARE THOSE OF T.I.S. DESIGNATION Fe24.
- REINFORCED STEEL BARS SHALL BE CONFORM TO T.I.S. AS FOLLOW :
 - DEFORMED BARS (SD30) - T.I.S. 24-2559
 - ROUND BARS (SR24) - T.I.S. 20-2559
- ALLOWABLE BEARING CAPACITY OF FOUNDATION SHALL NOT BE LESS THAN AS FOLLOW :
 - INTAKE STRUCTURE $Q_a = 25 \text{ T/M.}^2$
 - POWERHOUSE $Q_a = 10 \text{ T/M.}^2$
 - PENSTOCK $Q_a = 15 \text{ T/M.}^2$
 - WALKWAY $Q_a = 10 \text{ T/M.}^2$

3				
2				
1				
NO.	DATE	REVISIONS	CHECKED	APPROVED
CONSULTANTS			DEDE	

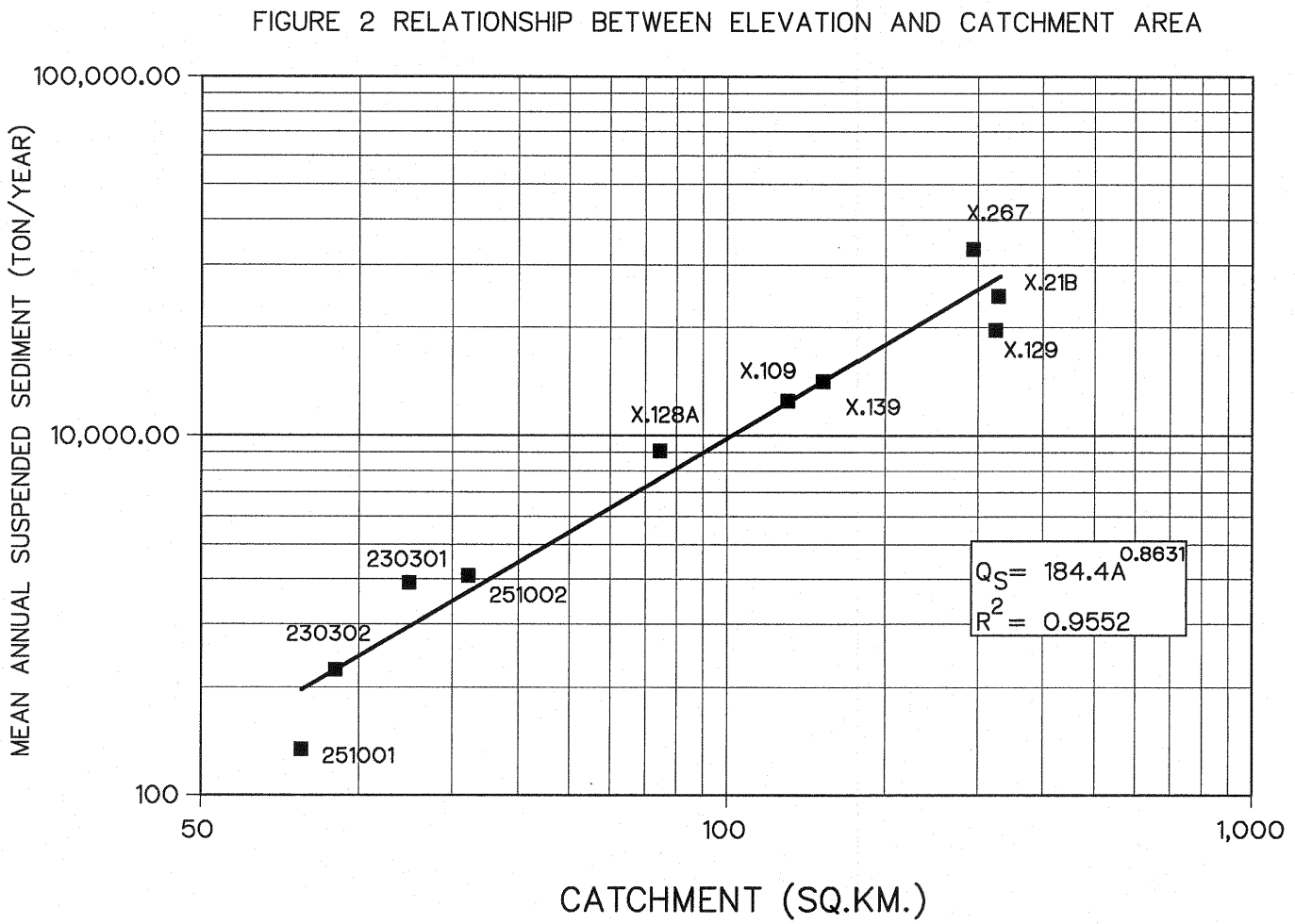
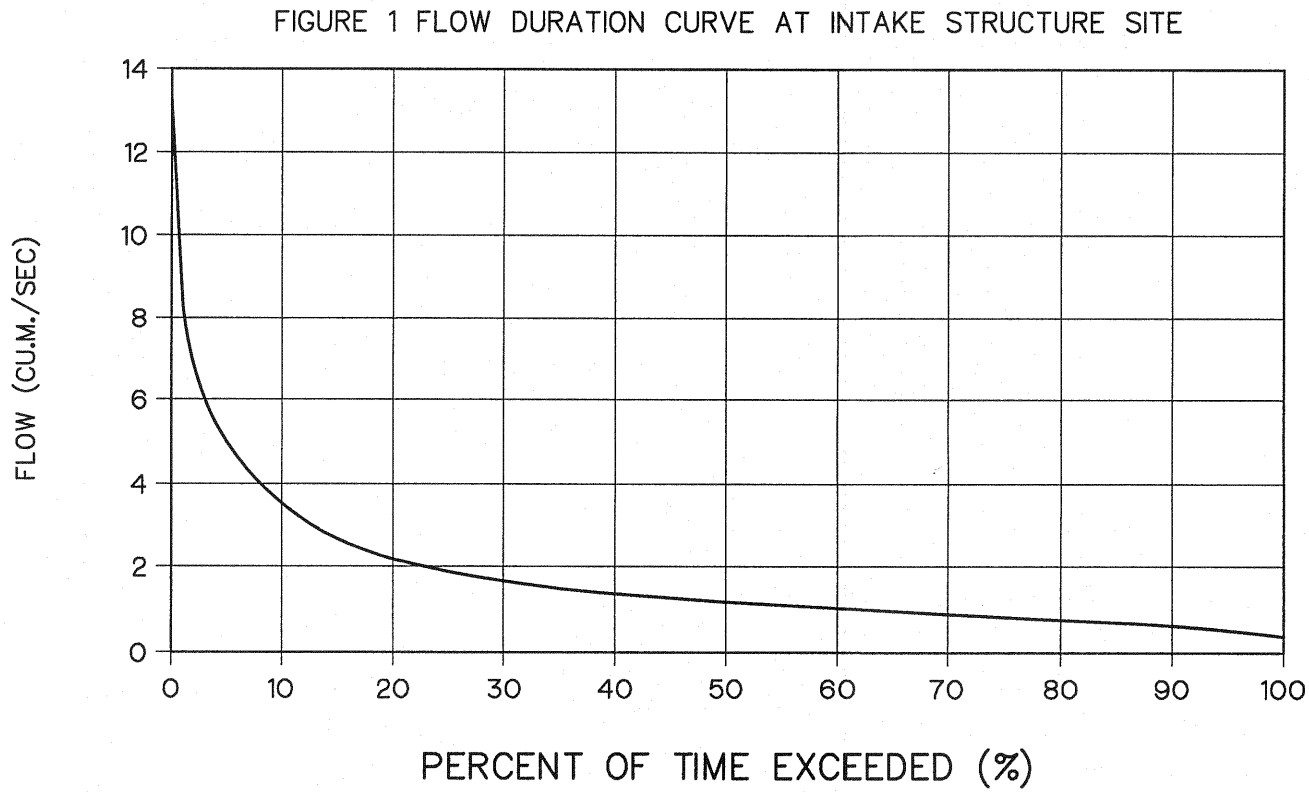
KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUA1 LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT GENERAL SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
REVIEWED S.KITICHAI		REVIEWED S.KITICHAI	
DESIGNED		SUBMITTED	
DRAWN		RECOMMENDED	
CHECKED		APPROVED	
PROJECT MANAGER		DATE	
14/01/82		DRAWING NO.	
		HLS-GN-03	
		SHEET NO.	
		3 OF 25	

TABLE 1 CLIMATOLOGICAL DATA FOR THE PERIOD 1980–2009

Station	KASETPHATTHALUNG												Elevation of station above M.S.L.		2.00 Meters	
Index station	48560															
Latitude	7° 35' 0.0" N															
Longitude	100° 10' 0.0" E															
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL			
Pressure (Hectopascal)																
Mean	1011.5	1010.9	1010.1	1009.1	1008.4	1008.0	1008.4	1008.7	1009.3	1009.8	1009.6	1010.4	1009.5			
Ext. max.	1019.3	1018.6	1016.5	1015.6	1013.7	1015.1	1013.8	1013.7	1014.9	1015.9	1015.7	1017.1	1019.3			
Ext. min.	1003.9	1004.4	1003.4	1002.8	1002.6	1002.3	1003.2	1003.6	1004.1	1003.4	1001.6	1004.0	1001.6			
Mean daily range	3.6	3.8	4.2	4.2	3.8	3.4	3.4	3.7	4.0	4.1	3.9	3.7	3.8			
Temperature (Celsius)																
Mean	26.8	27.4	28.1	28.7	28.5	28.3	27.9	27.9	27.6	27.2	26.8	26.6	27.7			
Mean max.	30.4	31.6	32.6	33.6	33.9	33.5	33.3	33.3	32.9	31.9	30.3	29.8	32.3			
Mean min.	23.7	23.6	24.2	25.0	25.0	24.6	24.4	24.3	24.3	24.2	24.4	24.2	24.3			
Ext. max.	32.6	34.5	35.6	37.0	37.3	36.5	36.7	37.7	36.6	36.1	34.4	32.8	37.7			
Ext. min.	20.3	18.5	20.3	23.0	23.0	22.5	22.0	21.9	22.5	21.2	19.8	21.8	18.5			
Dew Point (Celsius)																
Mean	23.7	23.5	24.2	24.8	24.7	24.2	23.8	23.7	23.8	24.1	24.4	24.2	24.1			
Relative Humidity (%)																
Mean	84	80	80	81	81	80	80	80	81	84	88	87	82			
Mean max.	94	93	93	94	94	94	94	94	94	95	96	95	94			
Mean min.	72	66	65	65	63	62	61	60	63	68	76	77	66			
Ext. min.	55	47	49	47	44	42	38	34	40	43	52	61	34			
Visibility (km.)																
07.00 LST	8.5	9.0	9.2	9.2	9.1	9.0	8.9	9.1	8.8	8.5	7.9	8.1	8.8			
Cloudiness (0–10)																
Mean	6.3	4.7	5.1	5.7	6.6	6.8	7.2	6.8	7.2	7.4	7.3	7.1	6.5			
Wind (knots)																
Mean wind speed	1.9	2.1	2.0	1.9	1.8	2.1	2.3	2.4	2.5	1.9	1.4	1.7	2.0			
Max. wind speed	21	20	25	25	30	25	30	30	32	31	40	22	40			
Evaporation (mm.)																
Mean–pan	87.6	105.0	120.1	120.3	122.7	116.0	121.9	125.2	108.5	93.6	69.3	71.2	1261.4			
Rainfall (mm.)																
Mean	119.6	70.5	118.7	113.0	103.7	80.6	80.4	98.5	115.7	250.5	549.3	448.2	2148.7			
Mean rainy day	12	5	7	10	13	10	12	13	14	20	22	21	158			
Daily maximum	176.1	312.8	199.1	128.2	120.3	68.2	76.2	134.4	84.5	111.6	312.7	253.8	312.8			
Number of days with																
Haze	1	0	0	0	0	0	0	0	0	1	0	0	3			
Fog	1	3	3	4	4	7	6	5	6	2	1	0	41			
Hail	0	0	0	0	0	0	0	0	0	0	0	0	0			
Thunderstorm	1	1	4	7	10	6	5	6	6	8	8	3	66			
Squall	0	0	0	1	1	1	1	1	1	0	0	0	5			

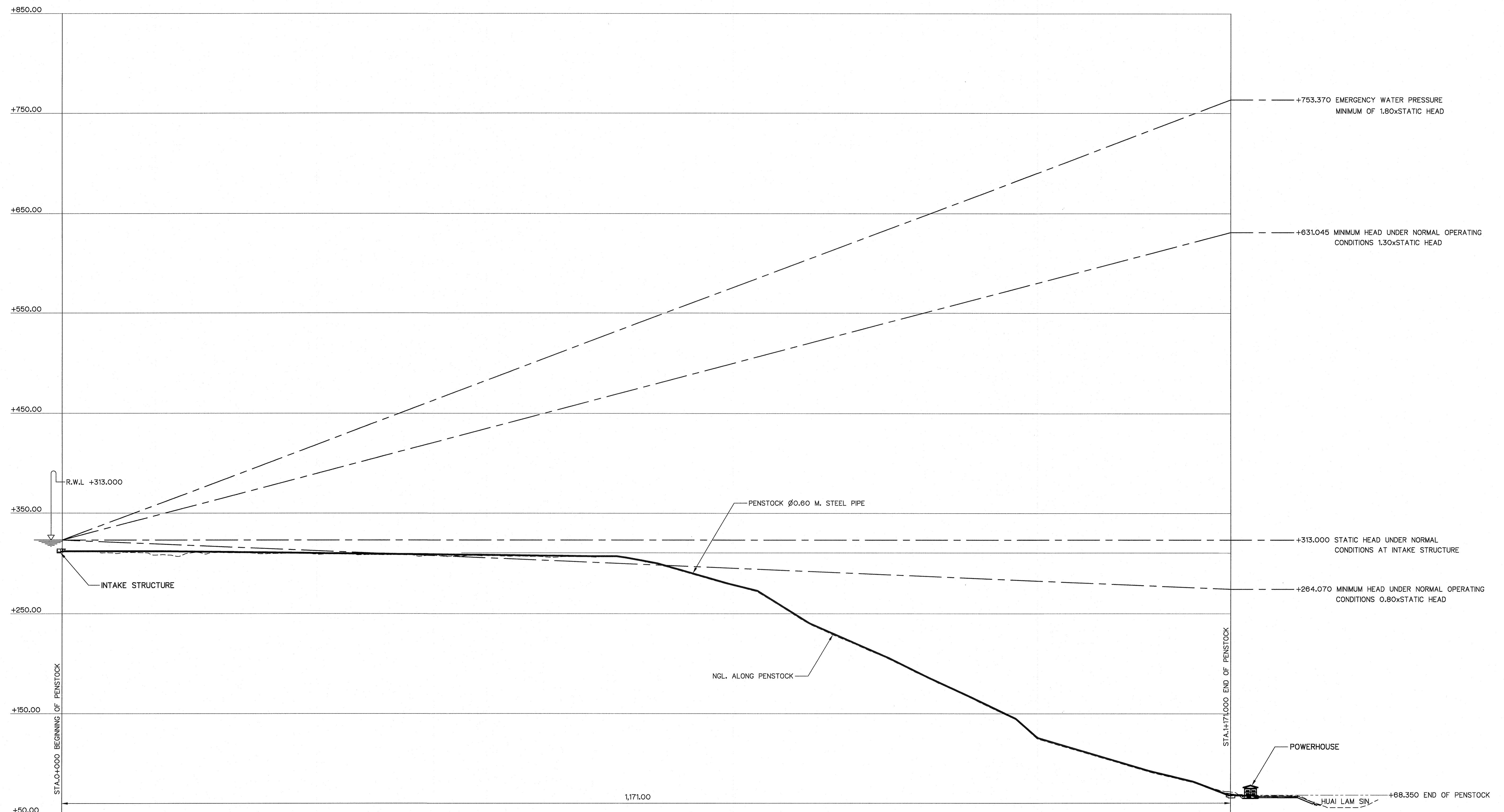
TABLE 2 FLOOD PEAK DISCHARGE FOR VARIOUS RETURN PERIODS

RETURN PERIOD (YEAR)	FLOOD PEAK DISCHARGE (M. ³ /SEC.)	
	REGIONAL FLOOD FREQUENCY ANALYSIS	UNIT HYDROGRAPH
10	70.6	58.8
25	90.5	81.5
50	105.3	100.6
100	119.9	121.6
200	134.5	144.4
500	153.8	177.5
1,000	168.3	204.6



KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUA I LAM SIN HYDROPOWER PROJECT			
ELECTRO – MECHANICAL EQUIPMENT GENERAL HYDROLOGY DATA			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED <i>[Signature]</i> ๑๒1.6651		REVIEWED S. KITICHAI <i>[Signature]</i>	
DRAWN <i>[Signature]</i>		SUBMITTED <i>[Signature]</i>	
CHECKED <i>[Signature]</i> ๑๒1.7324		RECOMMENDED <i>[Signature]</i>	
APPROVED <i>[Signature]</i> 14/01/62		APPROVED <i>[Signature]</i>	
PROJECT MANAGER		DATE	
CONSULTANTS		DEDE	
SHEET NO.		HLS-GN-04	
4		OF 25	

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2				
1				
NO.	DATE	REVISIONS	CHECKED	APPROVED



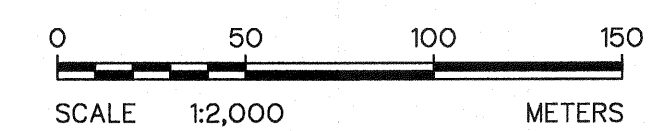
NOTES :

1. THE DATA SHOWN ON THIS DRAWING IS PROVISIONAL AND WILL BE REVIEWED WHEN THE ACTUAL TURBINE CHARACTERISTICS ARE KNOWN.
2. IT HAS BEEN ASSUMED THAT STEEL FOR THE PRESSURE PIPELINE CONFORMS TO STEEL TYPE SS41 OF THE JAPANESE INDUSTRIAL STANDARD JIS G 3101
3. THE THICKNESS OF THE PIPE SHELL SHALL INCLUDE A TOLERANCE OF 2 MM. FOR CORROSION AND SHALL BE DESIGNED FOR THE LOAD CASES SHOWN IN THE TABLE BELOW
4. WELD EFFICIENCY ON THE PRESSURE PIPELINE SHALL BE AT LEAST 90%
5. THE LOADING CASES MAY BE MORE FULLY DEFINED AS FOLLOWING:
 - NORMAL — INCLUDES NORMAL WATER PRESSURE AND NORMAL LONGITUDINAL LOADS SUCH AS WEIGHT OF PIPELINE, ANCHOR BLOCK, EXTERNAL SOIL AND WATER PRESSURE
 - EMERGENCY — INCLUDES LOSS OF A SUPPORT OR LOADING DUE TO TEST PRESSURE OR IMPOSITION OF DESIGN EARTHQUAKE ON NORMAL CASE
 - EXTREME — INCLUDES EXTREME WATER PRESSURES IN PIPELINE OR INCIDENCE OF MAXIMUM CREDIBLE EARTHQUAKE PLUS NORMAL WATER PRESSURE
6. THICKNESS OF PENSTOCK DESIGNED BASE ON PRESSURE RISE HEAD (WATER HAMMER) TURBINE PERFORMANCE, CLOSING TIME (6 SECONDS APPROXIMATELY) WILL BE SPECIFIED IN THE BIDDING DOCUMENTS.

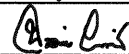
PROFILE ALONG PENSTOCK C

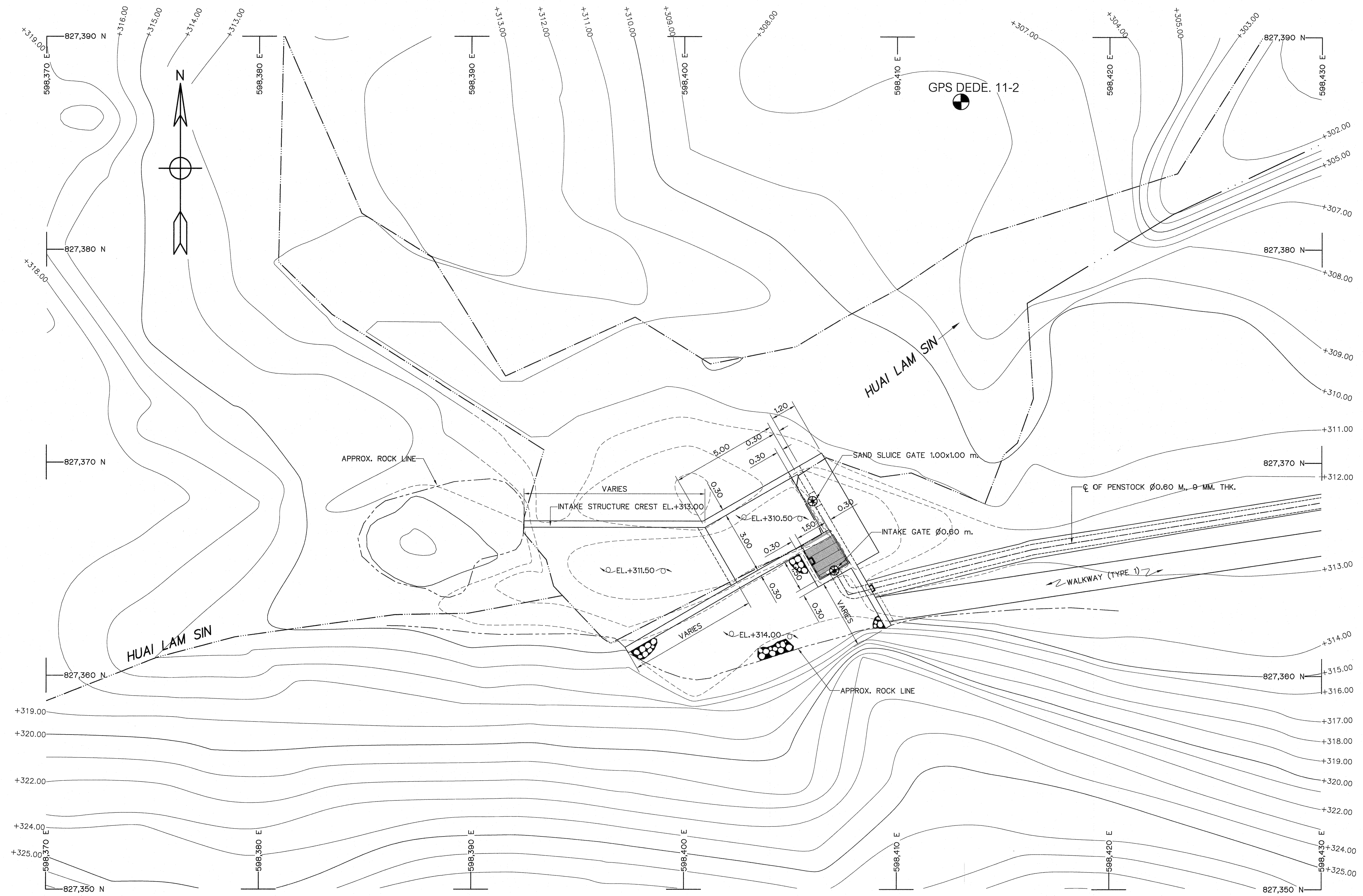
SCALE { VERTICAL 1 : 2,000
HORIZONTAL 1 : 2,000

LOAD CASES	ALLOWABLE TENSILE STRESS
EXTREME WATER PRESSURE RESULTING FROM SLOWDOWN CLOSURE OF THE TABLE VALVE	1.00 x MINIMUM YIELD STRESS
EMERGENCY WATER PRESSURE AND ALL OTHER NORMAL LONGITUDINAL LOADS	0.75 x MINIMUM YIELD STRESS
NORMAL WATER PRESSURE AND ALL OTHER NORMAL LONGITUDINAL LOADS	0.60 x MINIMUM YIELD STRESS



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NO.	DATE	REVISIONS	CHECKED	APPROVED
	CONSULTANTS		DEDE	

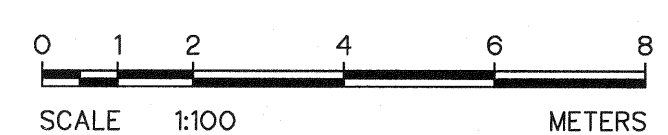
 KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI LAM SIN HYDROPOWER PROJECT			
ELECTRO — MECHANICAL EQUIPMENT GENERAL HYDRAULIC GRADE LINE			
 FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		 Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED		NO. 6651	REVIEWED S. Kitchaiwara
DRAWN			SUBMITTED 
CHECKED		NO. 7324	RECOMMENDED 
		14/01/82	APPROVED 
PROJECT MANAGER		DATE	DRAWING NO. HLS-GN-05
			SHEET NO. 5 OF 25



GENERAL LAY-OUT
SCALE 1:100

- NOTES :
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
 2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03

- REFERENCE DRAWINGS :
1. INTAKE STRUCTURE, PLAN AND SECTION A-A HLS-IS-02



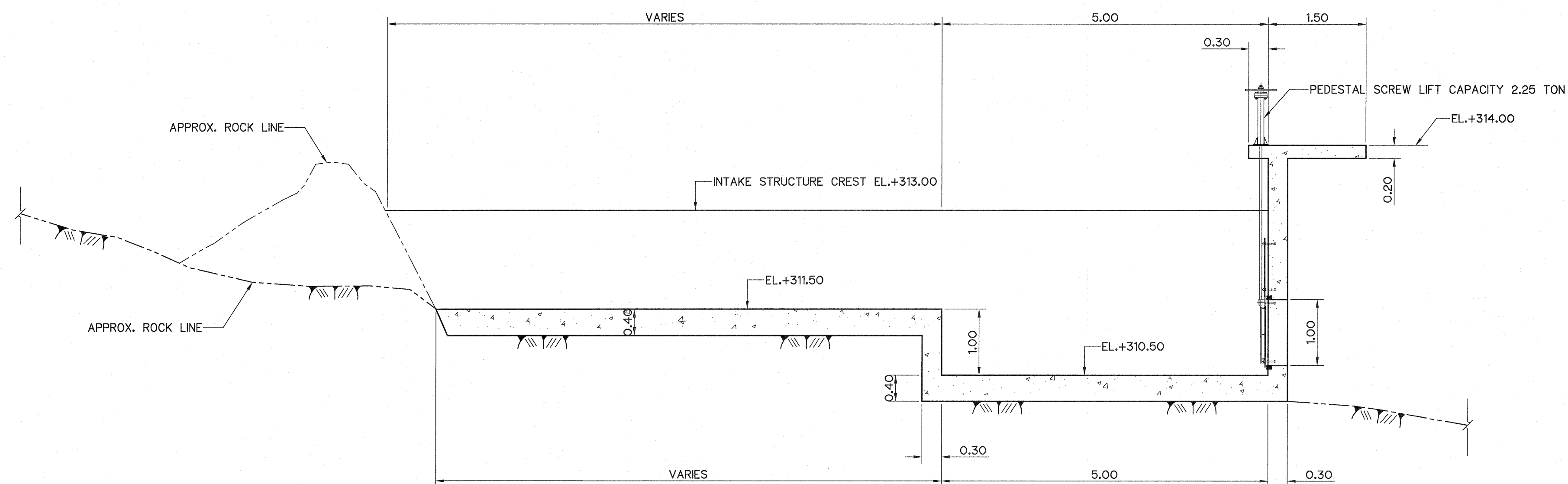
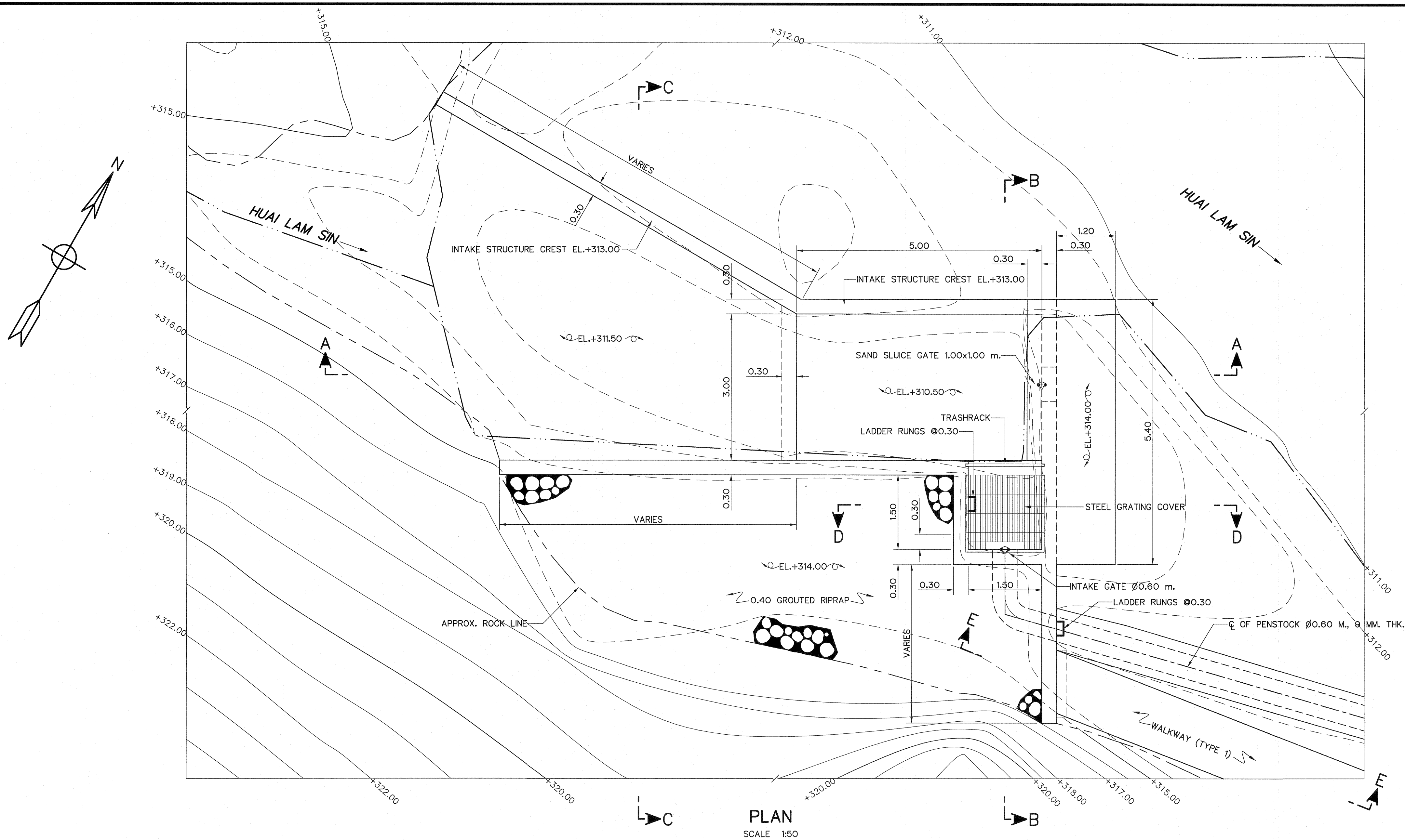
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1				
NO.	DATE	REVISIONS	CHECKED	APPROVED
		CONSULTANTS	DEDE	

KINGDOM OF THAILAND
Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

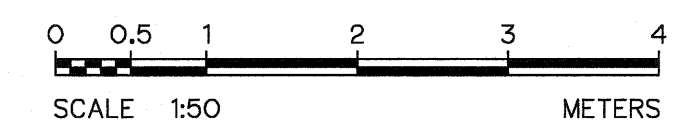
HUAI LAM SIN HYDROPOWER PROJECT

ELECTRO - MECHANICAL EQUIPMENT
INTAKE STRUCTURE
GENERAL LAY-OUT

FRONTIER ENGINEERING CONSULTANTS CO., LTD.	REVIEWED
DESIGNED	SUBMITTED
DRAWN	RECOMMENDED
CHECKED	APPROVED
PROJECT MANAGER	DRAWING NO. HLS-IS-01
DATE 14/01/82	SHEET NO. 6 OF 25

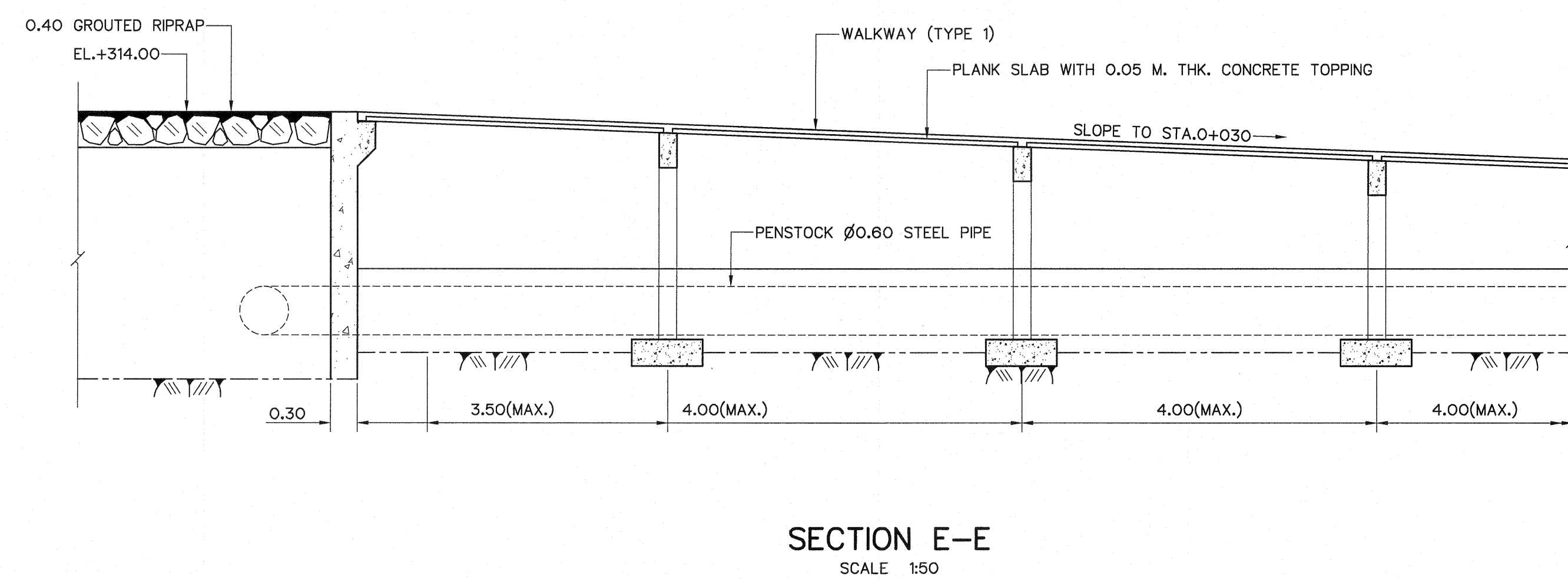
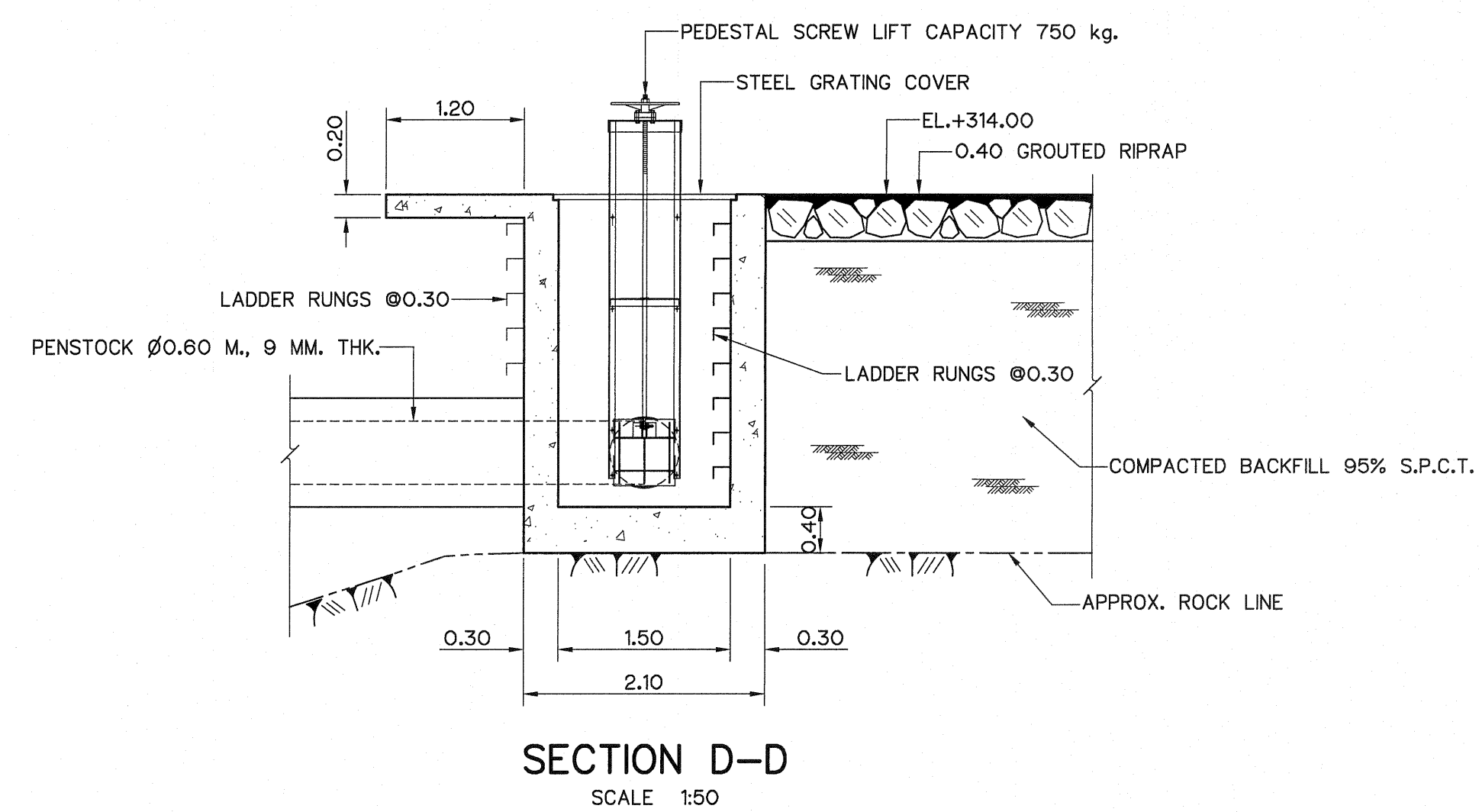
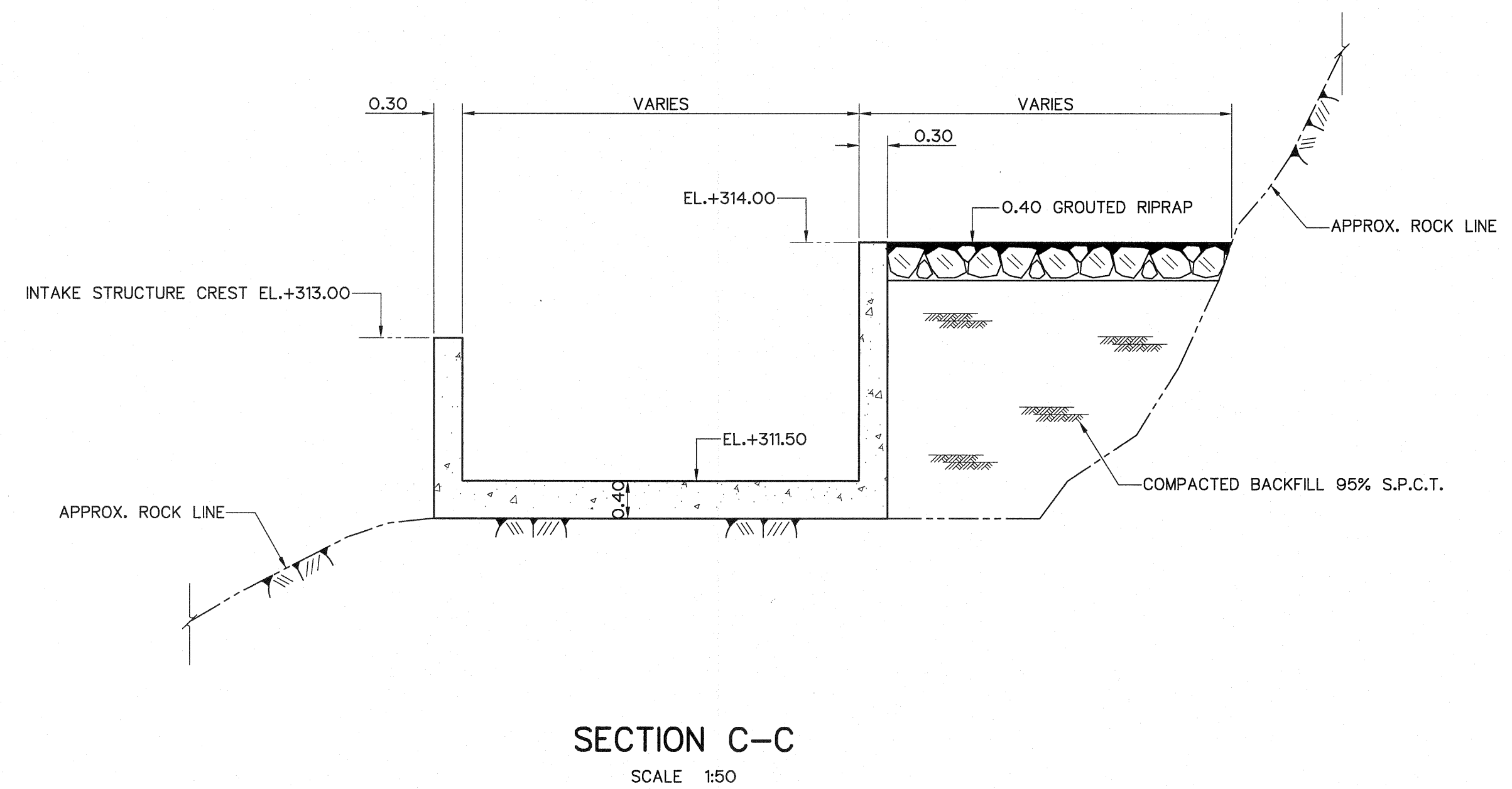
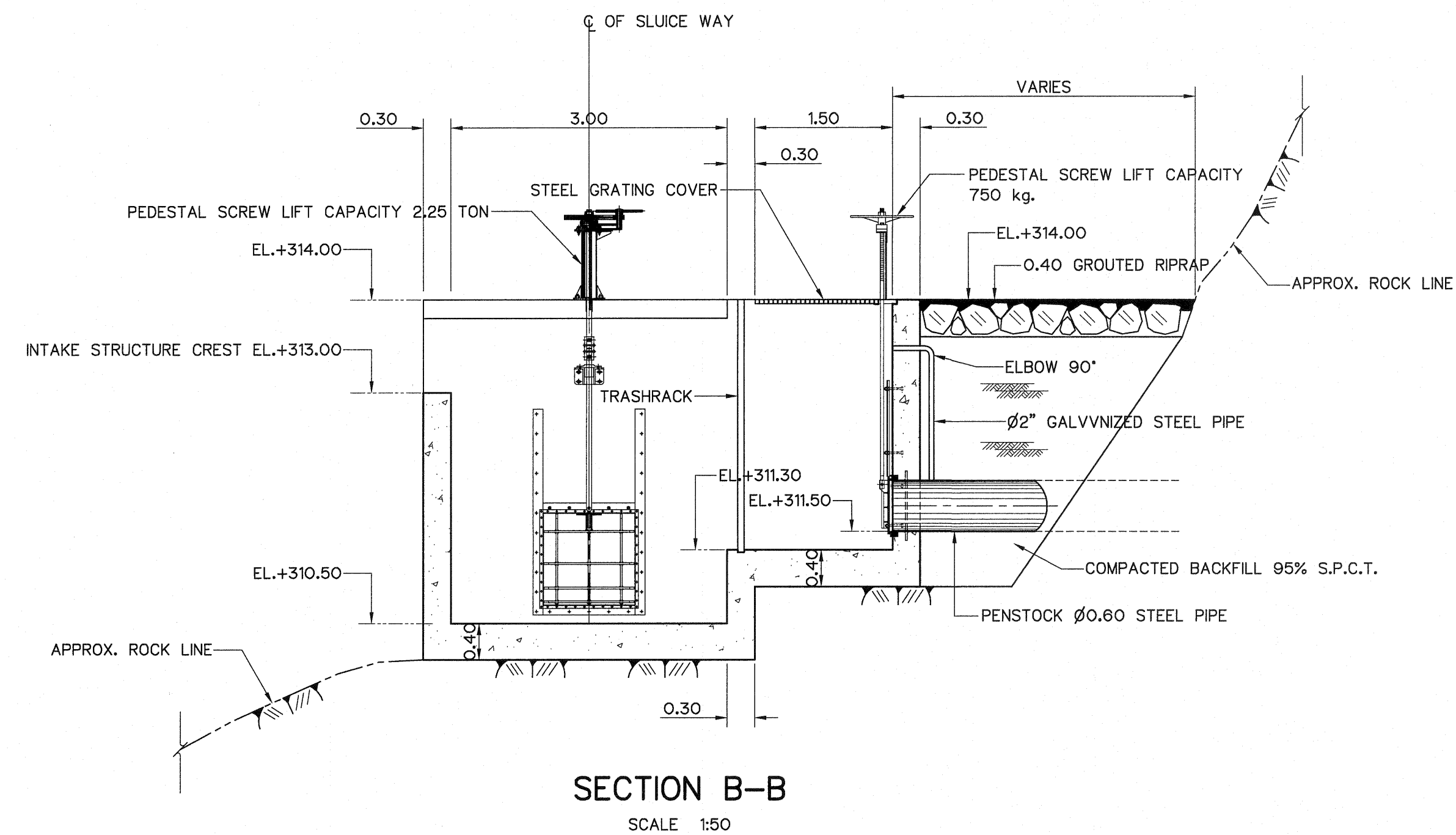


- NOTES :**
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
 2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
- REFERENCE DRAWINGS :**
1. INTAKE STRUCTURE, GENERAL LAY-OUT HLS-IS-01
 2. INTAKE STRUCTURE, SECTION B-B, C-C, D-D AND E-E HLS-IS-03



KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUI LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT INTAKE STRUCTURE PLAN AND SECTION A-A			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		REVIEWED <i>S. KITTAKAI</i>	
DESIGNED <i>S. KITTAKAI</i>		SUBMITTED <i>S. KITTAKAI</i>	
DRAWN <i>S. KITTAKAI</i>		RECOMMENDED <i>S. KITTAKAI</i>	
CHECKED <i>S. KITTAKAI</i>		APPROVED <i>S. KITTAKAI</i>	
PROJECT MANAGER		DATE 14/01/62	SHEET NO. 7 OF 25

3				
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1				
NO.	DATE	REVISIONS	CHECKED	APPROVED
			CONSULTANTS	DEDE

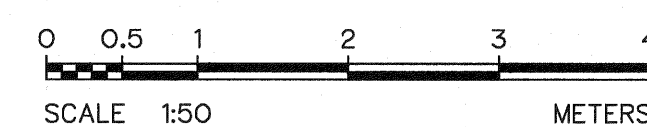


NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03

REFERENCE DRAWINGS :

1. INTAKE STRUCTURE, PLAN AND SECTION A-A HLS-IS-02

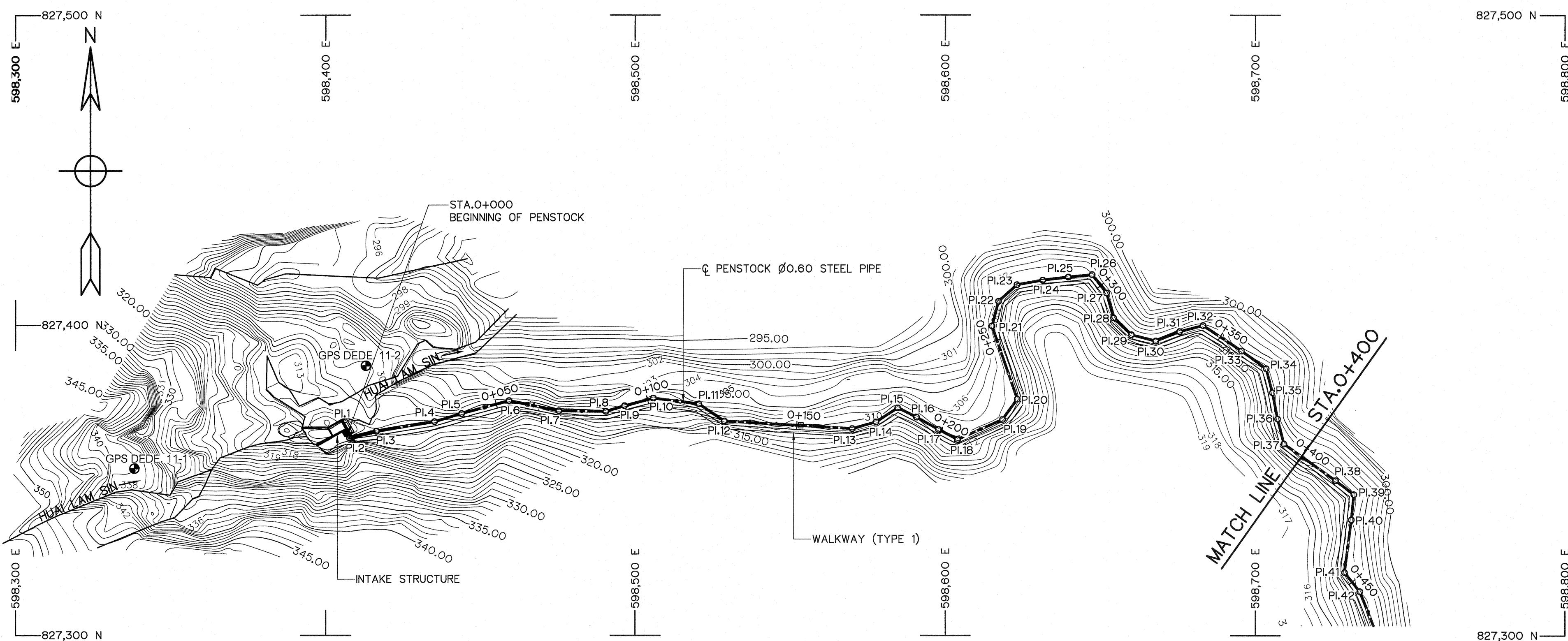


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NO.	DATE	REVISIONS	CHECKED	APPROVED

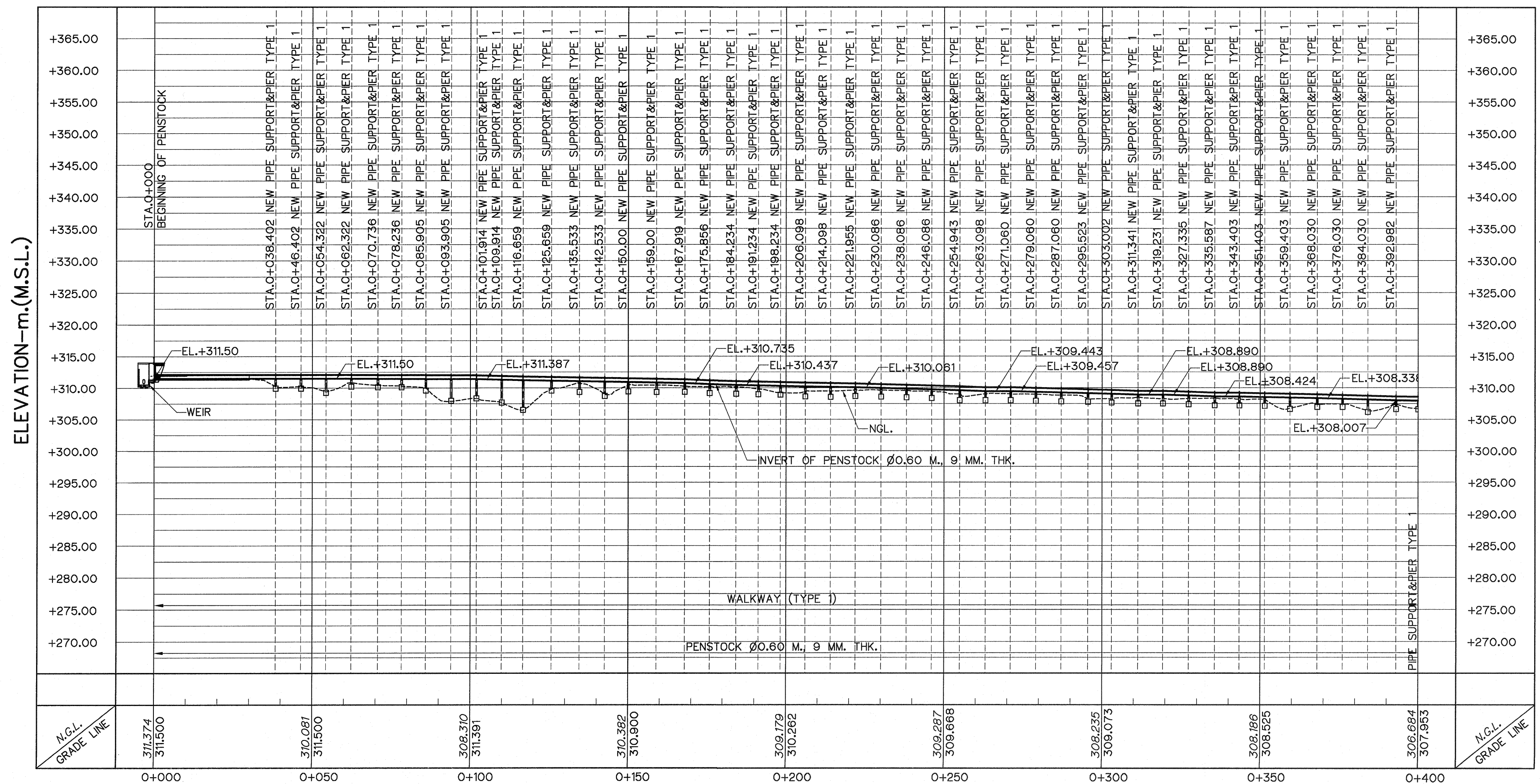
CONSULTANTS

DEDE

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI LAM SIN HYDROPOWER PROJECT	
ELECTRO - MECHANICAL EQUIPMENT INTAKE STRUCTURE SECTION B-B, C-C, D-D AND E-E	
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.	REVIEWED S.KITICHAI
DESIGNED SOL. ๒๒.๖๖๕๑	SUBMITTED SOL.
DRAWN SOL.	RECOMMENDED SOL.
CHECKED SOL. ๒๒.๗๓๒๔	APPROVED SOL.
PROJECT MANAGER SOL. 14/01/82	DRAWING NO. HLS-IS-03
DATE	SHEET NO. 8 OF 25



PLAN
SCALE 1:1,000



DISTANCE -- Km.

PROFILE

VERTICAL SCALE 1:500
HORIZONTAL SCALE 1:1,000

HORIZONTAL ALINEMENT OF HEADRACE

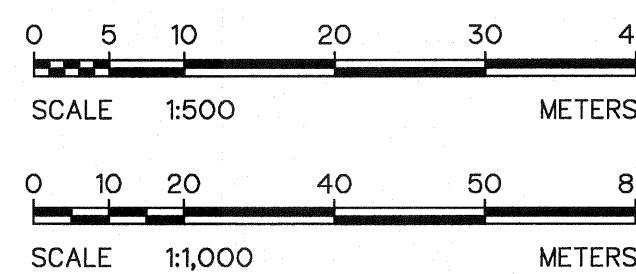
NO. PL	COORDINATE		PL. - PL. (m)	DEFLECTION ANGLE (' - ' - ")	PL. STA. (km)	BEARING (N/S ' - ' - " E/W)
	N	E				
PL1	827,364.921	598,407.056	-	-	0+000.000	-
PL2	827,363.779	598,407.716	1.319	73°-50'-36.53"	0+001.319	S 30°-01'-30.18" E
PL3	827,365.924	598,416.404	8.949	04°-36'-56.57"	0+010.268	N 76°-07'-53.27" E
PL4	827,368.982	598,435.175	19.018	07°-21'-54.54"	0+029.286	N 80°-44'-49.85" E
PL5	827,371.589	598,443.910	9.116	01°-21'-56.49"	0+038.402	N 73°-22'-55.31" E
PL6	827,375.777	598,459.269	15.920	26°-49'-05.66"	0+054.322	N 74°-44'-51.80" E
PL7	827,372.486	598,475.350	16.414	10°-50'-26.65"	0+070.736	S 78°-26'-02.54" E
PL8	827,372.294	598,490.518	15.169	17°-26'-27.05"	0+085.905	S 89°-16'-29.19" E
PL9	827,374.125	598,496.615	6.366	01°-56'-08.77"	0+092.271	N 73°-17'-03.76" E
PL10	827,376.585	598,505.939	9.643	21°-59'-29.86"	0+101.914	N 75°-13'-12.53" E
PL11	827,374.734	598,520.567	14.745	26°-48'-52.82"	0+116.659	S 82°-47'-17.62" E
PL12	827,369.209	598,528.750	9.874	30°-37'-32.44"	0+126.533	S 55°-58'-24.80" E
PL13	827,366.754	598,570.063	41.386	19°-15'-35.63"	0+167.919	S 86°-35'-57.24" E
PL14	827,368.923	598,577.698	7.937	17°-13'-19.48"	0+175.856	N 74°-08'-27.13" E
PL15	827,373.496	598,584.718	8.378	59°-23'-15.56"	0+184.234	N 56°-55'-07.66" E
PL16	827,370.510	598,590.758	6.738	03°-01'-30.56"	0+190.972	S 63°-41'-36.78" E
PL17	827,366.534	598,597.834	8.117	01°-33'-36.43"	0+199.089	S 60°-40'-06.22" E
PL18	827,363.268	598,604.036	7.009	51°-58'-30.04"	0+206.098	S 62°-13'-42.66" E
PL19	827,369.769	598,618.499	15.857	29°-59'-56.85"	0+221.955	N 65°-47'-47.30" E
PL20	827,376.364	598,623.255	8.131	54°-59'-35.88"	0+230.086	N 35°-47'-50.45" E
PL21	827,399.839	598,615.082	24.857	34°-12'-43.18"	0+254.943	N 19°-11'-45.42" W
PL22	827,407.716	598,617.195	8.155	33°-08'-39.47"	0+263.098	N 15°-00'-57.76" E
PL23	827,413.025	598,623.128	7.962	31°-40'-04.90"	0+271.060	N 48°-10'-37.23" E
PL24	827,414.514	598,631.441	8.445	03°-10'-09.96"	0+279.505	N 79°-50'-42.13" E
PL25	827,415.524	598,639.684	8.305	01°-17'-36.30"	0+287.810	N 83°-00'-52.09" E
PL26	827,416.289	598,647.359	7.713	57°-09'-07.01"	0+295.523	N 84°-18'-28.39" E
PL27	827,410.439	598,652.019	7.479	22°-53'-14.41"	0+303.002	S 38°-32'-24.60" E
PL28	827,402.409	598,654.269	8.339	31°-18'-32.43"	0+311.341	S 15°-39'-10.20" E
PL29	827,397.024	598,660.036	7.890	28°-44'-10.09"	0+319.231	S 46°-57'-42.62" E
PL30	827,395.022	598,667.889	8.104	35°-40'-17.48"	0+327.335	S 75°-41'-52.71" E
PL31	827,398.029	598,675.574	8.252	06°-50'-20.35"	0+335.587	N 68°-37'-49.81" E
PL32	827,399.990	598,683.140	7.816	47°-38'-41.80"	0+343.403	N 75°-28'-10.15" E
PL33	827,391.876	598,695.580	14.852	02°-36'-23.54"	0+358.255	S 56°-53'-08.04" E
PL34	827,386.169	598,703.516	9.775	39°-38'-12.15"	0+368.030	S 54°-16'-44.51" E
PL35	827,378.449	598,705.533	7.979	03°-27'-21.96"	0+376.009	S 14°-38'-32.36" E
PL36	827,369.984	598,707.207	8.629	03°-02'-35.55"	0+384.638	S 11°-11'-10.40" E
PL37	827,361.896	598,709.258	8.344	40°-12'-02.48"	0+392.982	S 14°-13'-45.96" E
PL38	827,349.984	598,725.915	20.478	01°-52'-20.66"	0+413.460	S 54°-25'-48.44" E

NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
- THE ALIGNMENT OF THE PENSTOCK AND RELATED STRUCTURES SHALL BE CHECK AND CORRECTED BY THE CONTRACTOR TO SUIT THE FIELD CONDITIONS AND SHALL BE SUBMITTED TO DEDE'S FIELD ENGINEER FOR APPROVAL

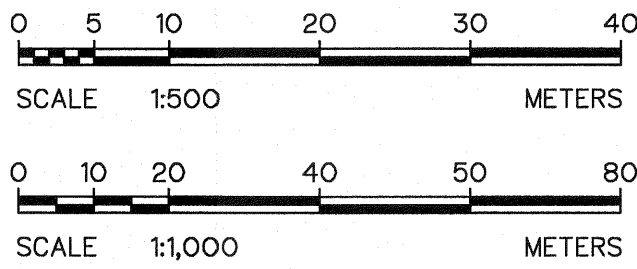
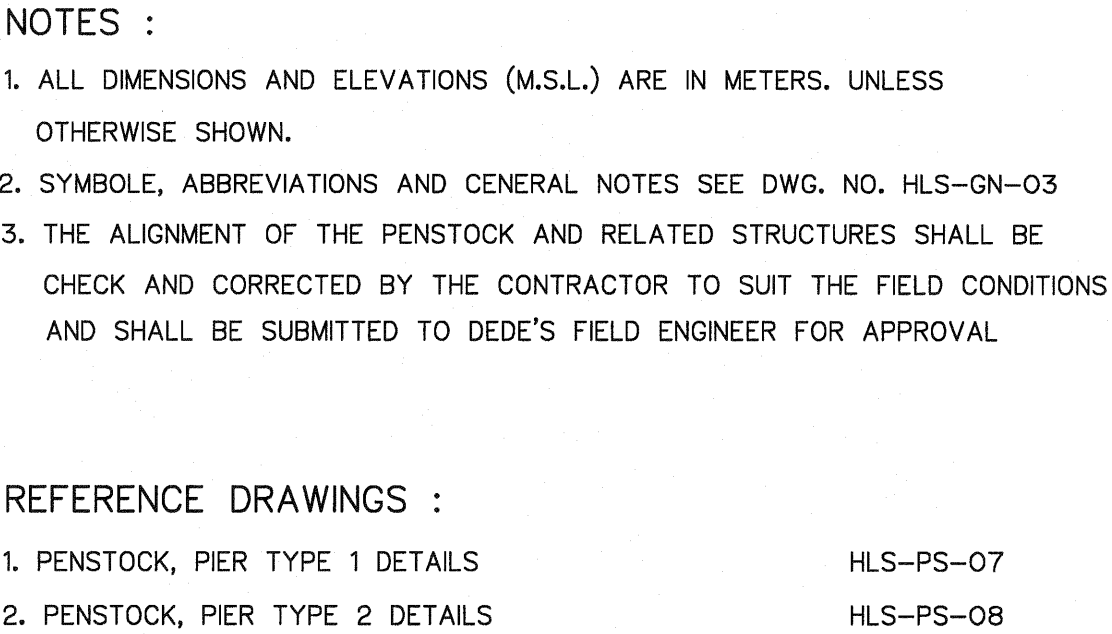
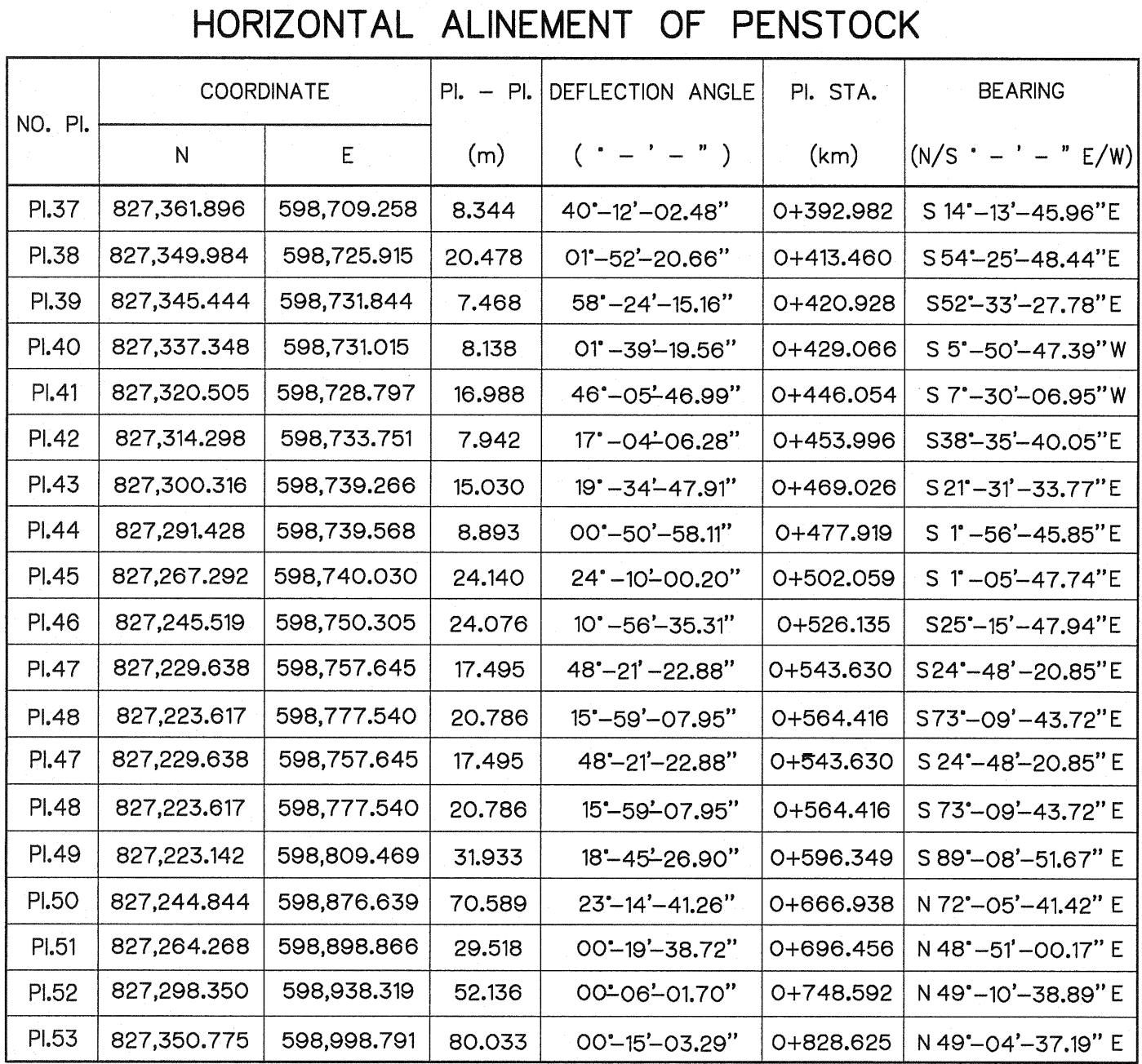
REFERENCE DRAWINGS :

- PENSTOCK, PIER TYPE 1 DETAILS HLS-PS-07

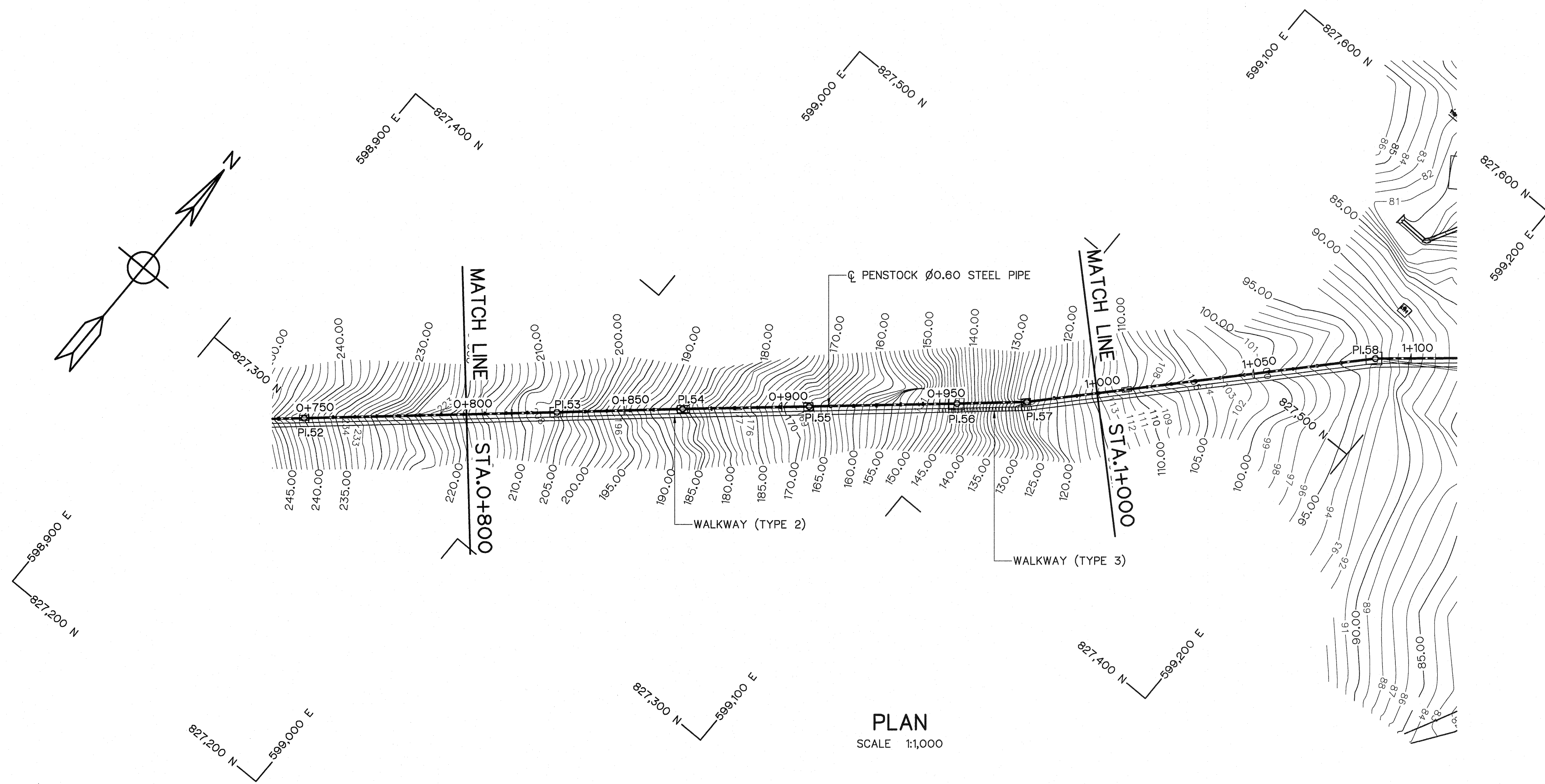


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NO.	DATE	REVISIONS	CHECKED	APPROVED
CONSULTANTS		DEDE		

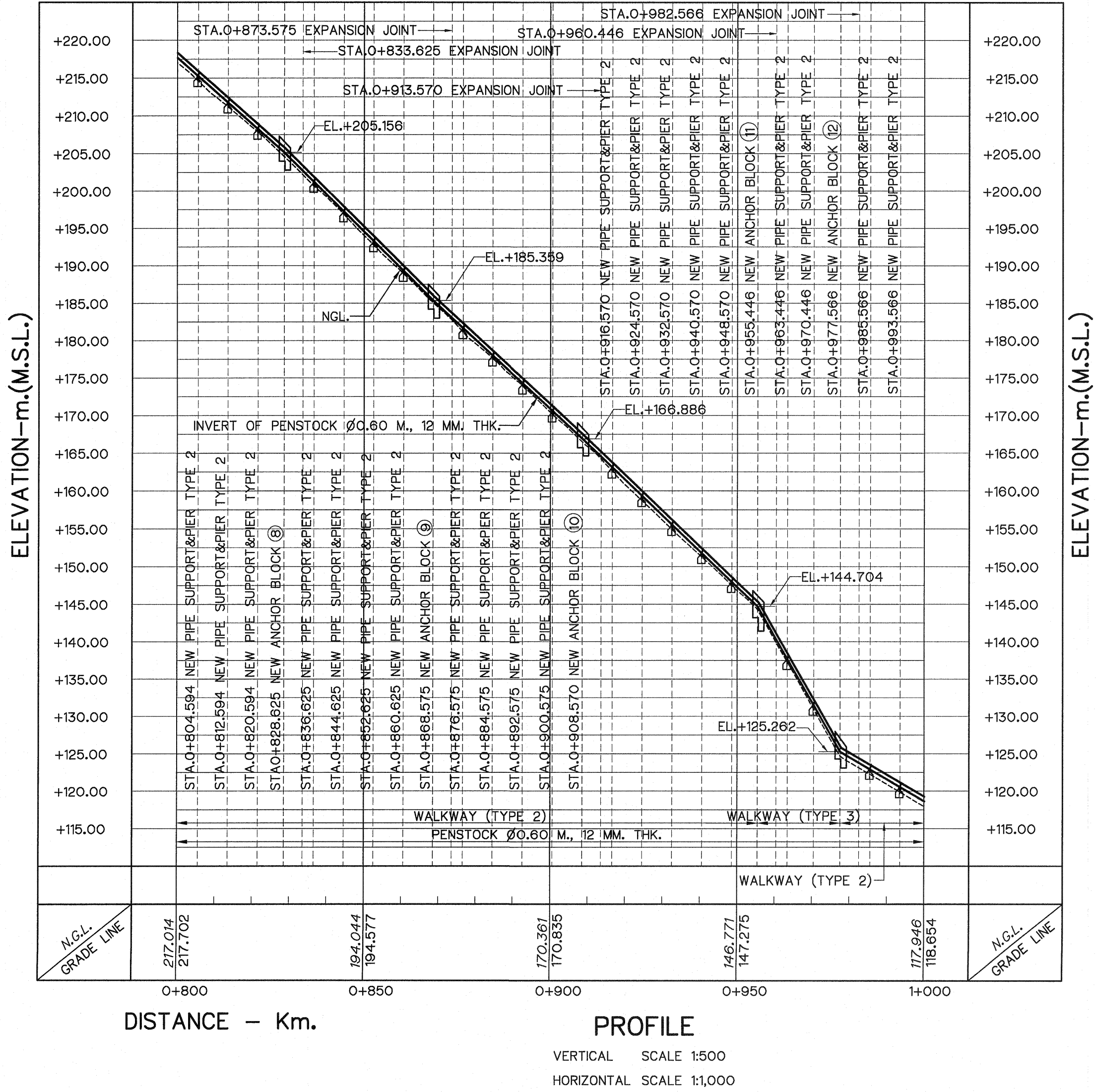
KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUA I LAM SIN HYDROPOWER PROJECT	
ELECTRO - MECHANICAL EQUIPMENT PENSTOCK PLAN AND PROFILE, STA. 0+000 TO STA. 0+400	
DESIGNED 821.651	REVIEWED S. KITCHAI
DRAWN 821.7324	SUBMITTED 821.7324
CHECKED 14/01/82	APPROVED 821.7324
PROJECT MANAGER DATE	DRAWING NO. HLS-PS-01
SHEET NO. 9 OF 25	



 KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI LAM SIN HYDROPOWER PROJECT			
ELECTRO – MECHANICAL EQUIPMENT			
PENSTOCK			
PLAN AND PROFILE, STA. 0+400 TO STA. 0+800			
 Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY		REVIEWED <u>S.KITIKUN</u> <i>[Signature]</i>	
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		DESIGNED <i>[Signature]</i> <u>๕๒๒.6651</u>	
DRAWN <i>[Signature]</i>		SUBMITTED <i>[Signature]</i>	
CHECKED <i>[Signature]</i> <u>๕๒๒.7324</u>		RECOMMENDED <i>[Signature]</i>	
<i>[Signature]</i>		APPROVED <i>[Signature]</i>	
PROJECT MANAGER		DRAWING NO. HLS-PS-02	
DATE		SHEET NO. 10 OF 25	

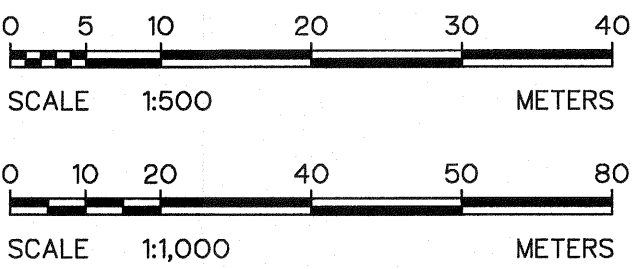


NO. PI.	COORDINATE		PI. - PI.	DEFLECTION ANGLE	PI. STA.	BEARING
	N	E	(m)	(° - ' - ")	(km)	(N/S ° - ' - " E/W)
PI.52	827,298.350	598,938.319	52.136	00°-06'-01.70"	0+564.416	N 49°-10'-38.89" E
PI.53	827,350.775	598,998.791	80.033	00°-15'-03.29"	0+828.625	N 49°-04'-37.19" E
PI.54	827,377.076	599,028.862	39.950	00°-23'-19.14"	0+868.575	N 48°-49'-33.90" E
PI.55	827,403.202	599,059.145	39.995	00°-00'-09.70"	0+908.570	N 49°-12'-53.03" E
PI.56	827,433.824	599,094.636	46.876	00°-11'-25.30"	0+955.446	N 49°-12'-43.33" E
PI.57	827,448.330	599,111.336	22.120	05°-48'-44.46"	0+977.566	N 49°-01'-18.03" E
PI.58	827,529.328	599,187.423	111.130	06°-51'-24.99"	1+088.696	N 43°-12'-33.58" E
PI.59	827,558.281	599,222.009	45.105	22°-14'-02.16"	1+133.801	N 50°-03'-58.56" E



- NOTES :
- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS. UNLESS OTHERWISE SHOWN.
 - SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
 - THE ALIGNMENT OF THE PENSTOCK AND RELATED STRUCTURES SHALL BE CHECK AND CORRECTED BY THE CONTRACTOR TO SUIT THE FIELD CONDITIONS AND SHALL BE SUBMITTED TO DEDE'S FIELD ENGINEER FOR APPROVAL

- REFERENCE DRAWINGS :
- PENSTOCK, PIER TYPE 2 DETAILS HLS-PS-08



KINGDOM OF THAILAND
Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

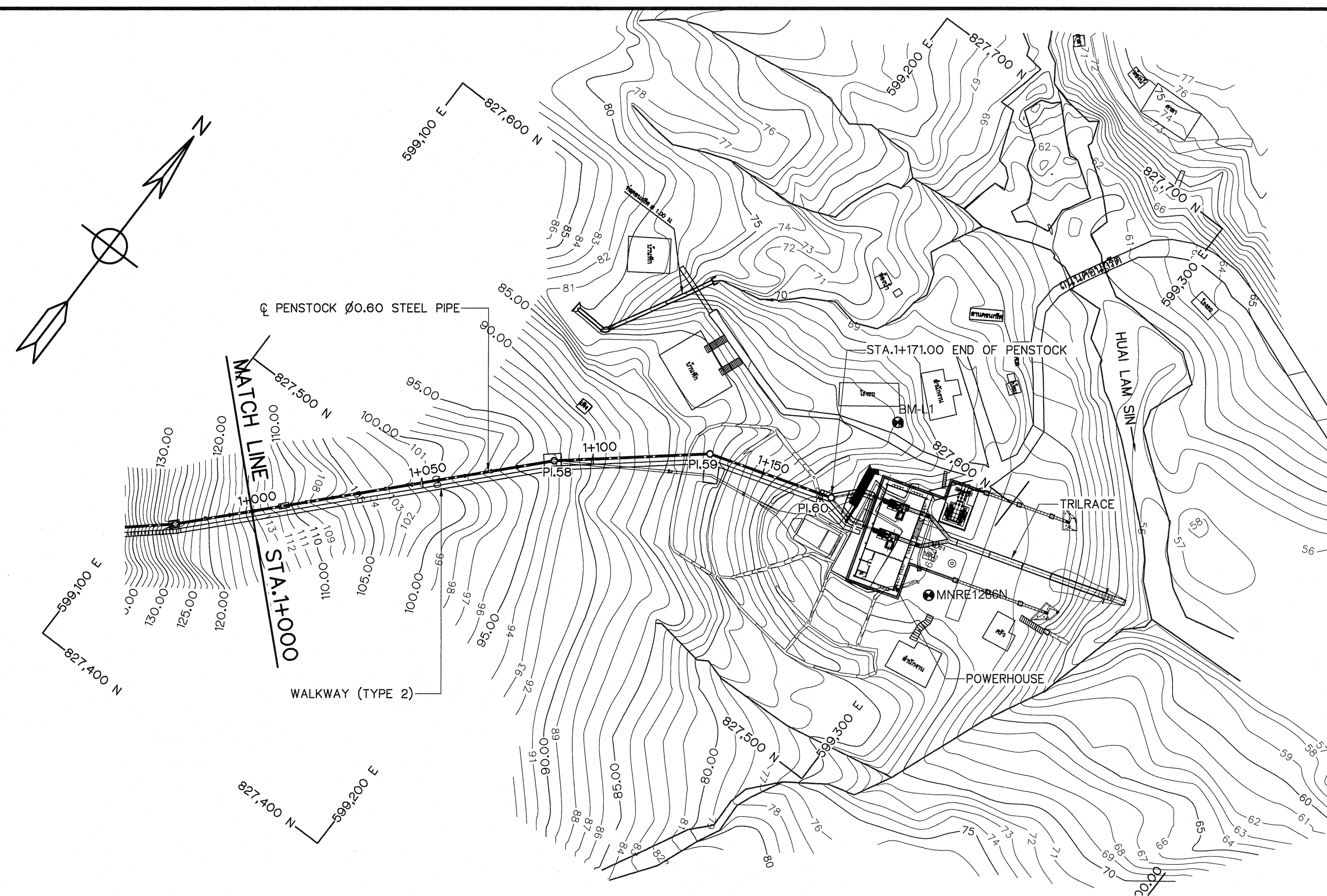
HUAI LAM SIN HYDROPOWER PROJECT

ELECTRO - MECHANICAL EQUIPMENT

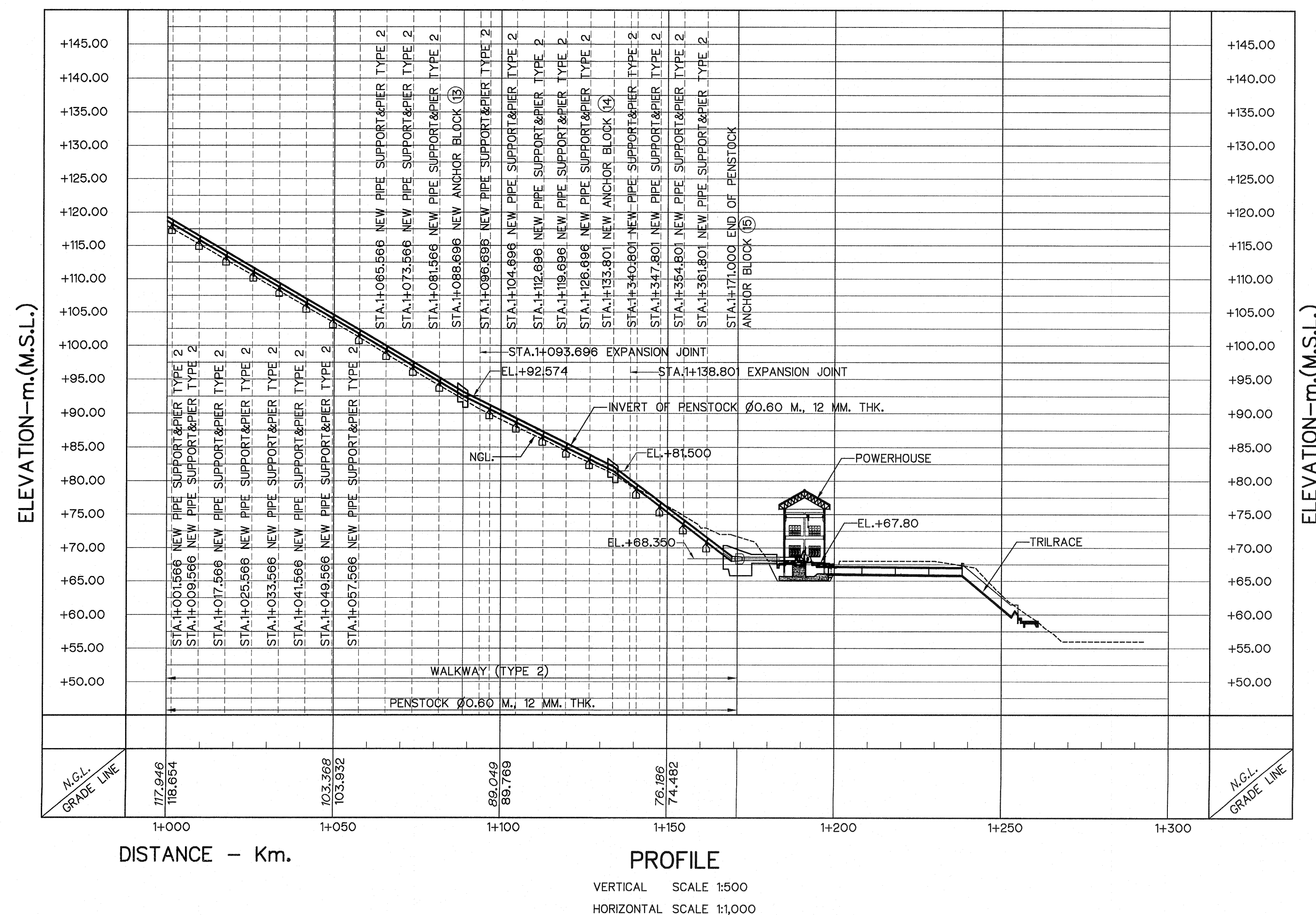
PENSTOCK

PLAN AND PROFILE, STA. 0+800 TO STA. 1+000

FRONTIER ENGINEERING CONSULTANTS CO., LTD.		REVIEWED S. KITTICHAI	
DESIGNED S. KITTICHAI	DATE 08.06.51	SUBMITTED S. KITTICHAI	DATE 08.06.51
DRAWN S. KITTICHAI	DATE 08.06.51	RECOMMENDED S. KITTICHAI	DATE 08.06.51
CHECKED S. KITTICHAI	DATE 08.06.51	APPROVED S. KITTICHAI	DATE 08.06.51
CONSULTANTS		DEDE	
PROJECT MANAGER		DATE	
DRAWING NO. HLS-PS-03		SHEET NO. 11 OF 25	



PLAN
SCALE 1:1,000

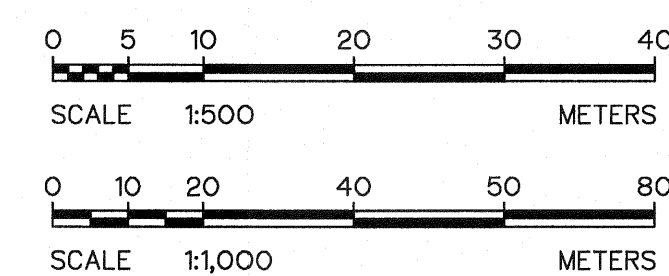


HORIZONTAL ALINEMENT OF PENSTOCK

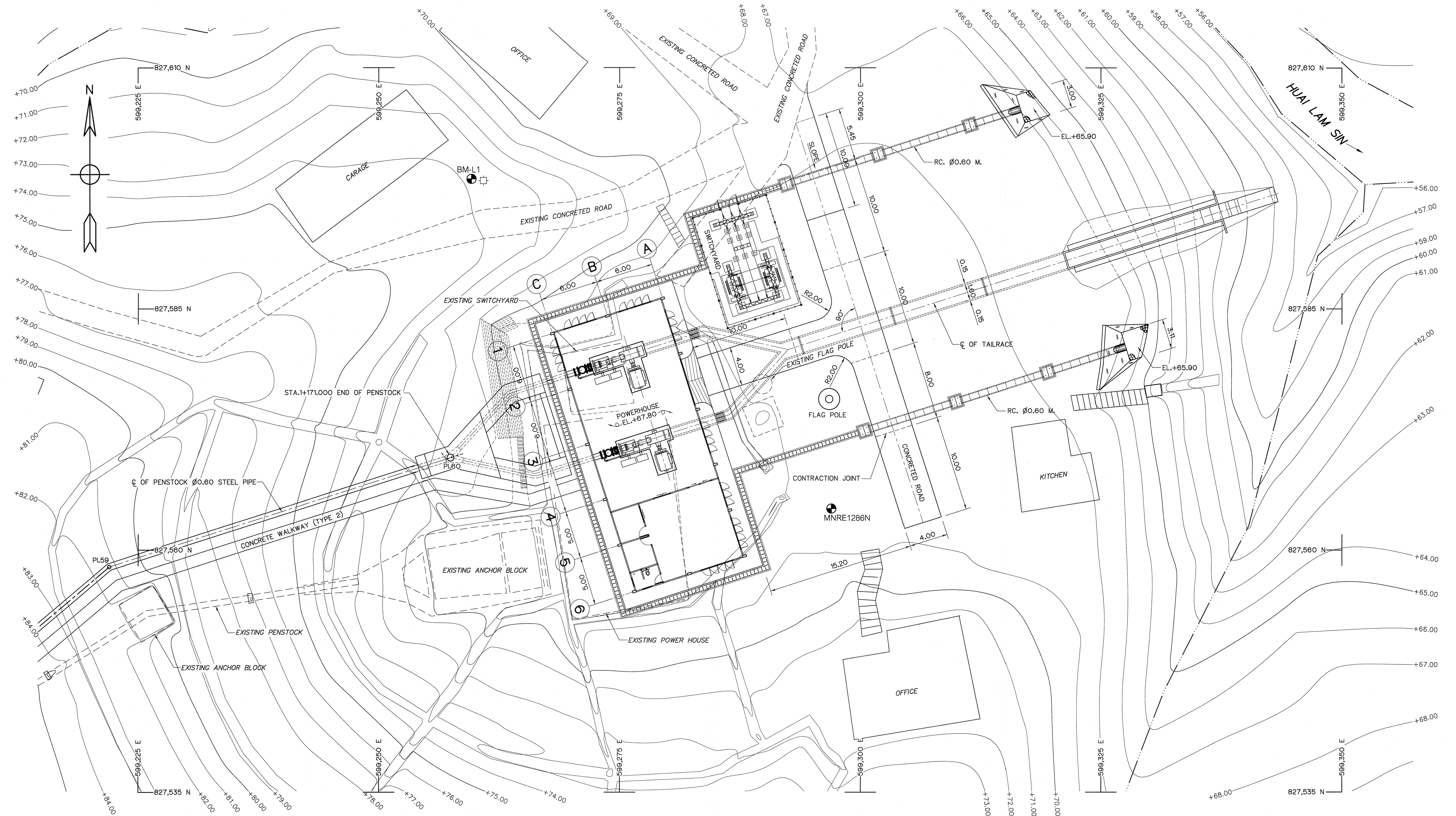
NO. PI.	COORDINATE		PI. - PI. (m)	DEFLECTION ANGLE (° - ' - ")	PI. STA. (km)	BEARING (N/S ° - ' - " E/W)
	N	E				
PI.57	827,448.330	599,111.336	22.120	05°-48'-44.46"	0+977.566	N 49°-01'-18.03" E
PI.58	827,529.328	599,187.423	111.130	06°-51'-24.99"	1+088.696	N 43°-12'-33.58" E
PI.59	827,558.281	599,222.009	45.105	22°-14'-02.16"	1+133.801	N 50°-03'-58.56" E
PI.60	827,569.591	599,257.447	37.199	-	1+171.000	N 72°-17'-58.46" E

- NOTES :
- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS. UNLESS OTHERWISE SHOWN.
 - SYMBOL, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
 - THE ALIGNMENT OF THE PENSTOCK AND RELATED STRUCTURES SHALL BE CHECK AND CORRECTED BY THE CONTRACTOR TO SUIT THE FIELD CONDITIONS AND SHALL BE SUBMITTED TO DEDE'S FIELD ENGINEER FOR APPROVAL

- REFERENCE DRAWINGS :
- PENSTOCK, PIER TYPE 2 DETAILS



KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI LAM SIN HYDROPOWER PROJECT	
ELECTRO - MECHANICAL EQUIPMENT PENSTOCK PLAN AND PROFILE, STA. 1+000 TO STA. 1+171.00	
FRONTIER ENGINEERING CONSULTANTS CO.,LTD. DESIGNED: <i>[Signature]</i> 821.6651 DRAWN: <i>[Signature]</i> CHECKED: <i>[Signature]</i> 821.7324 PROJECT MANAGER: <i>[Signature]</i> 14/01/82	REVIEWED: <i>[Signature]</i> 821.6651 SUBMITTED: <i>[Signature]</i> RECOMMENDED: <i>[Signature]</i> APPROVED: <i>[Signature]</i> 821.7324 DRAWING NO. HLS-PS-04 SHEET NO. 12 OF 25



NOTES :

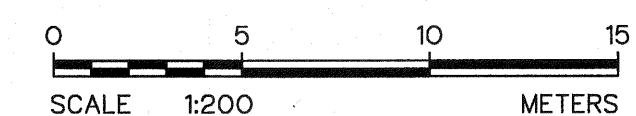
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
3. THE CONTRACTOR SHALL CHECK THE STABILITY OF THE EXCAVATION LINE. IF IT IS NOT SUFFICIENTLY STABLE, THE CONTRACTOR SHALL SUBMIT A REPORT TO THE PROJECT ENGINEER FOR CONSIDERING THE WAY TO IMPROVE ITS STABILITY.
4. FOR THE DETAILS OF THE STABILITY OF THE EXCAVATION LINE, SEE DWG. NO. HLS-PH-02

REFERENCE DRAWINGS :

- | | |
|-----------------------------------|-----------|
| 1. POWERHOUSE, PLAN AND ROOF PLAN | HLS-PH-02 |
| 2. POWERHOUSE, ELEVATIONS | HLS-PH-03 |
| 3. POWERHOUSE, SECTIONS | HLS-PH-04 |

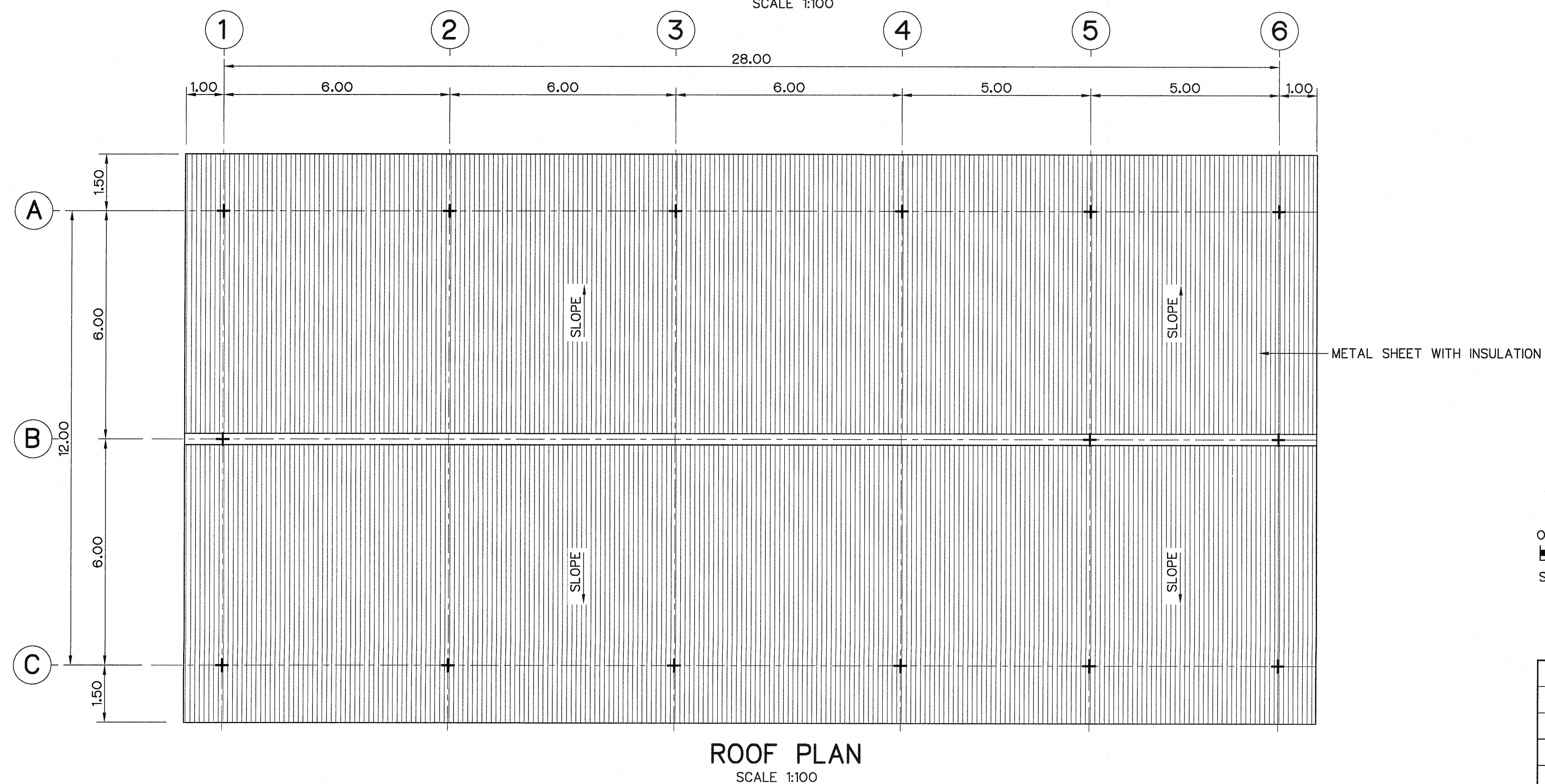
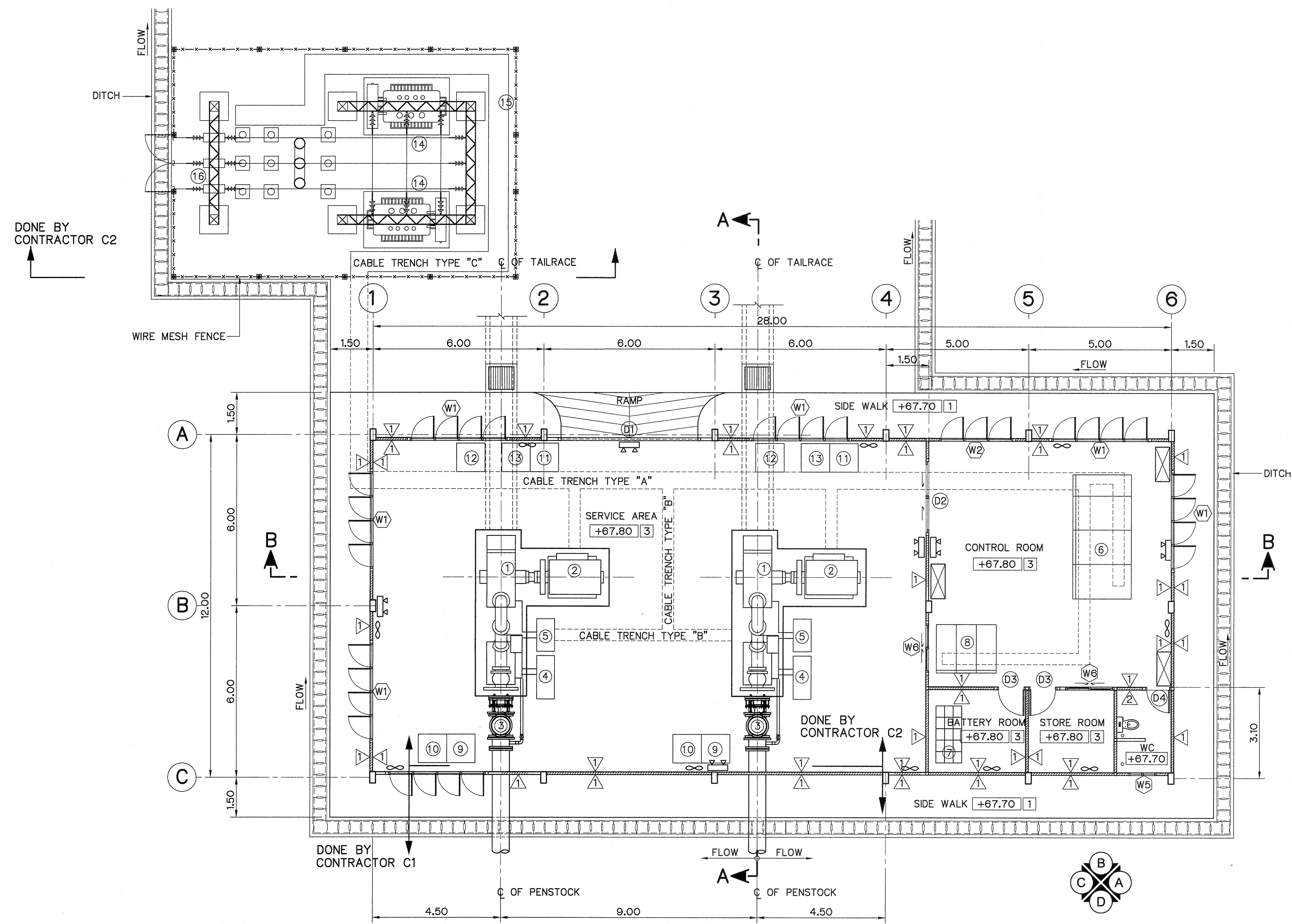
GENERAL LAY-OUT

SCALE 1:200



3				
2				
1				
NO.	DATE	REVISIONS	CHECKED	APPROVED
CONSULTANTS			DEDE	

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT POWERHOUSE GENERAL LAY-OUT			
FRONTIER ENGINEERING CONSULTANTS CO., LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED <i>[Signature]</i> 281.6651		REVIEWED & <i>[Signature]</i> <i>[Signature]</i>	
DRAWN <i>[Signature]</i>		SUBMITTED <i>[Signature]</i>	
CHECKED <i>[Signature]</i> 281.7324		RECOMMENDED <i>[Signature]</i>	
APPROVED <i>[Signature]</i> 14/01/82		APPROVED <i>[Signature]</i>	
PROJECT MANAGER		DRAWING NO. HLS-PH-01	SHEET NO. 13 OF 25



DESCRIPTION :

- ① PELTON TURBINE
- ② SYNCHRONOUSE GENERATOR
- ③ INLET VALVE AND BYPASS VALVE
- ④ PRESSURE OIL EQUIPMENT
- ⑤ GOVERNOR AND TURBINE CONTROL PANEL
- ⑥ MAIN CONTROL SWITCHBOARD
- ⑦ BATTERRIES AND RACKS
- ⑧ AC AND DC SWITCHBOARD AND BATTERY CHARGER CUBICLE
- ⑨ OIL PRESSURE TANK
- ⑩ OIL SUMP TANK WITH OIL PUMP SETS
- ⑪ NGR CUBICLE
- ⑫ AVR CUBICLE
- ⑬ GENERATOR DISCONNECTING SWITCH CUBICLE
- ⑭ MAIN TRANSFORMER
- ⑮ SWICTHYARD FENCE
- ⑯ TAKE OFF STRUCTURE

SYMBOLS :

- ∞ EXHAUST FAN $\phi 10"$
- ☒ AIR CONDITIONING
- ☒ EMERGENCY LAMP

FLOOR FINISH SYMBOLS :

- ① COARSE FINISHED
- ② 12"x12" CERAMIC FLOOR TILES
- ③ COATED WITH EPOXY RESIN

WALL FINISH SYMBOLS :

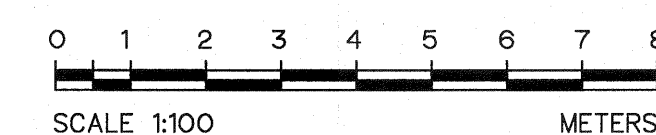
- △ CEMENT PLASTER
- △ 8"x8" CERAMIC WALL TILES

NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
3. CONTRACT C1 OF INCLUDE PENSTOCK BEYOND POWERHOUSE WALL 1.00 M. (INCLUDE FLANGE)
4. ALL OF CABLE TRENCH TYPE "C" (INCLUDE INSIDE SWITCHYARD FENCE) SHALL BE DONE BY CONTRACT C1.

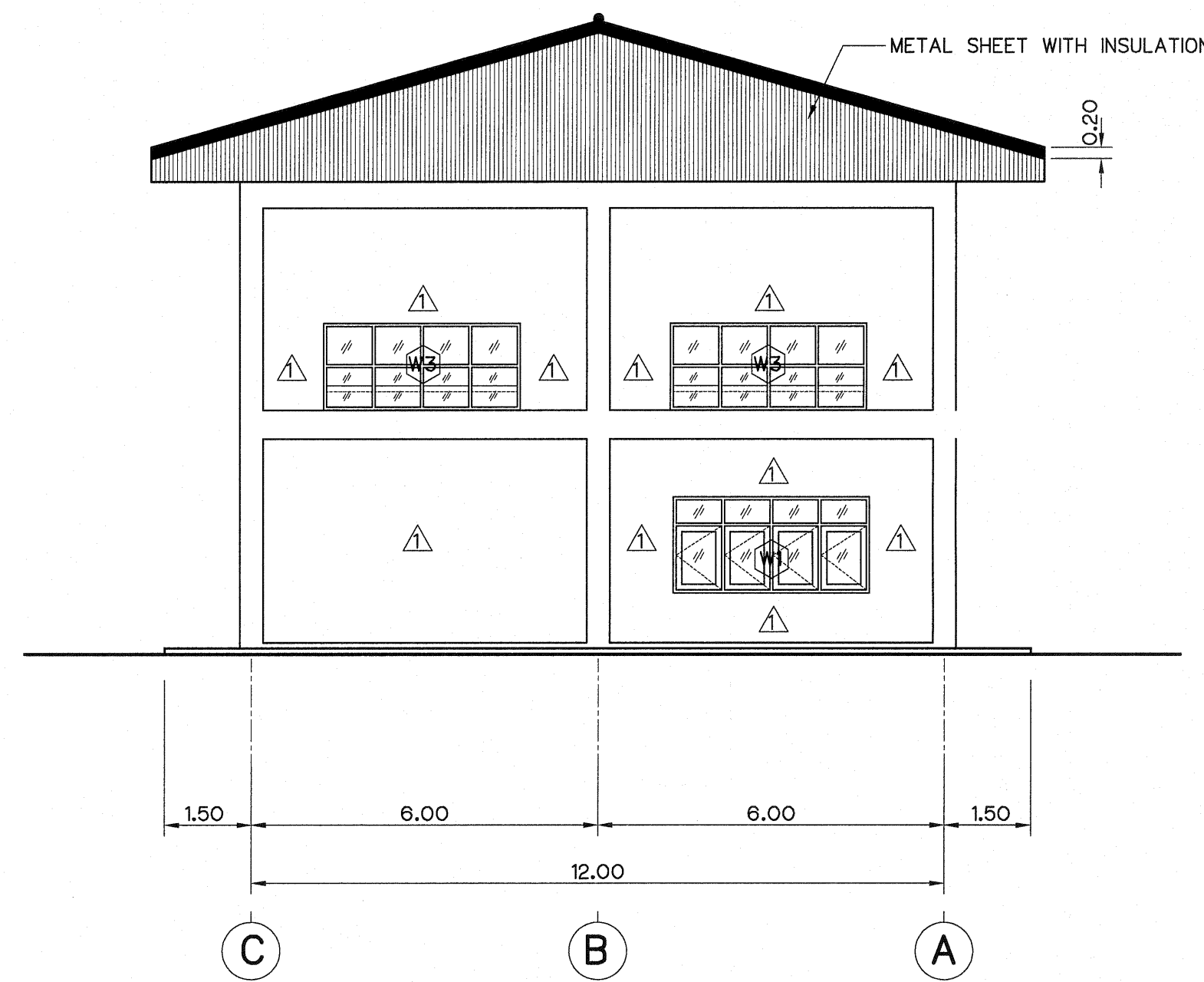
REFERENCE DRAWINGS :

1. POWERHOUSE, GENERAL LAY-OUT HLS-PH-01
2. POWERHOUSE, ELEVATIONS HLS-PH-03
3. POWERHOUSE, SECTIONS HLS-PH-04

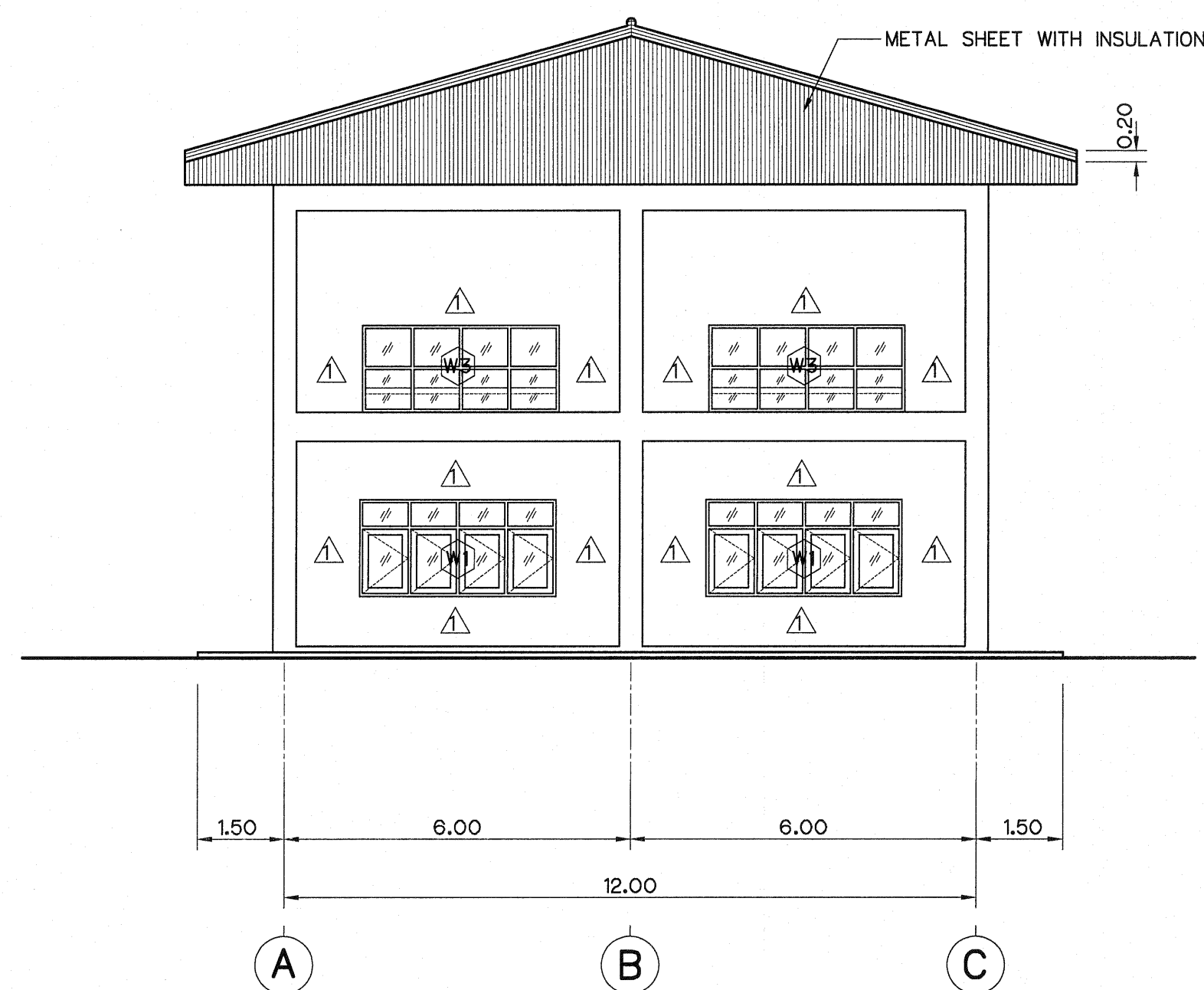


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1				
NO.	DATE	REVISIONS	CHECKED	APPROVED

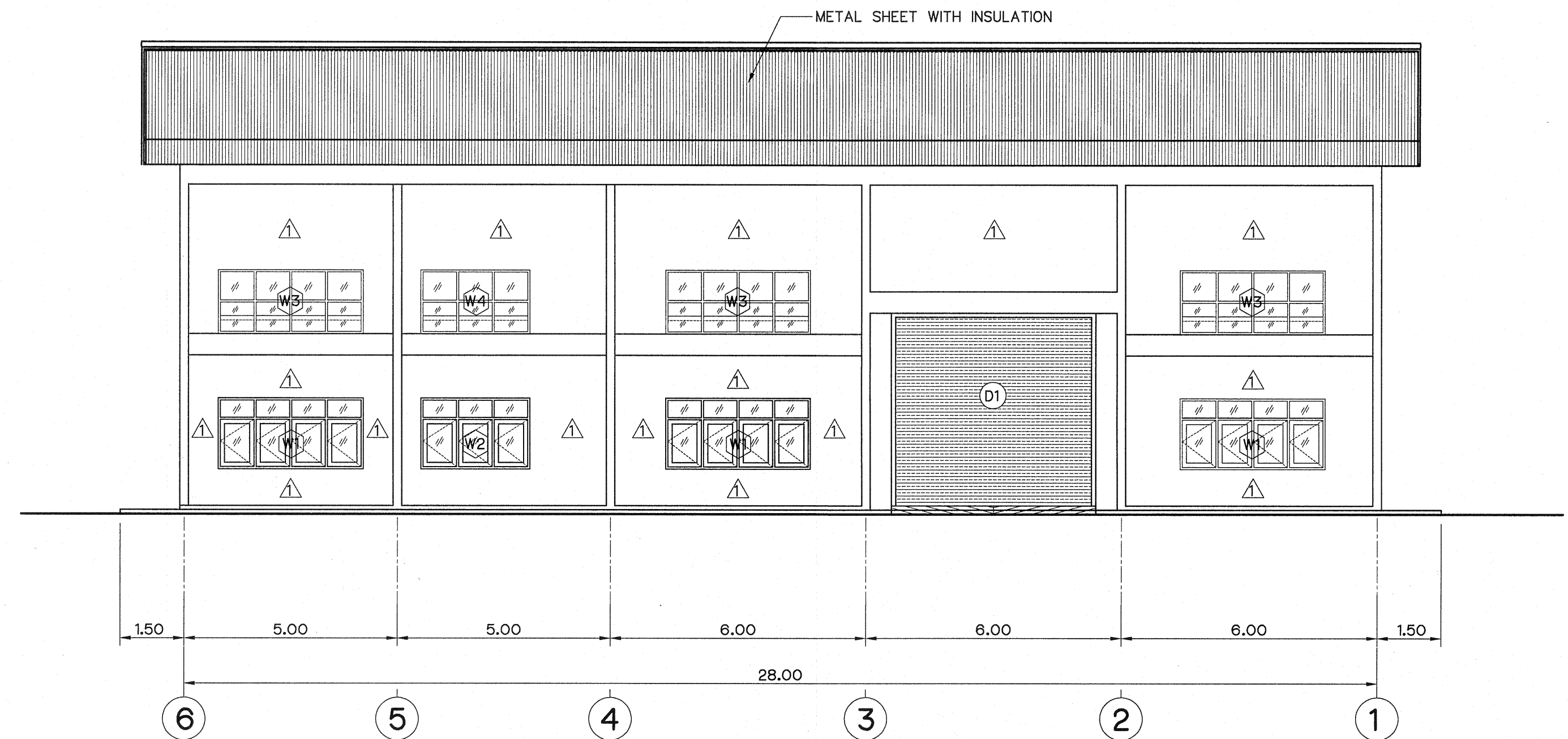
KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT POWERHOUSE PLAN AND ROOF PLAN			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED <i>[Signature]</i> 28.6651		REVIEWED <i>[Signature]</i> 28.6651	
DRAWN <i>[Signature]</i> 28.6651		SUBMITTED <i>[Signature]</i> 28.6651	
CHECKED <i>[Signature]</i> 28.6651		APPROVED <i>[Signature]</i> 28.6651	
PROJECT MANAGER		DATE 14/01/62	
CONSULTANTS		DEDE	
DRAWING NO.		SHEET NO.	
HLS-PH-02		14 OF 25	



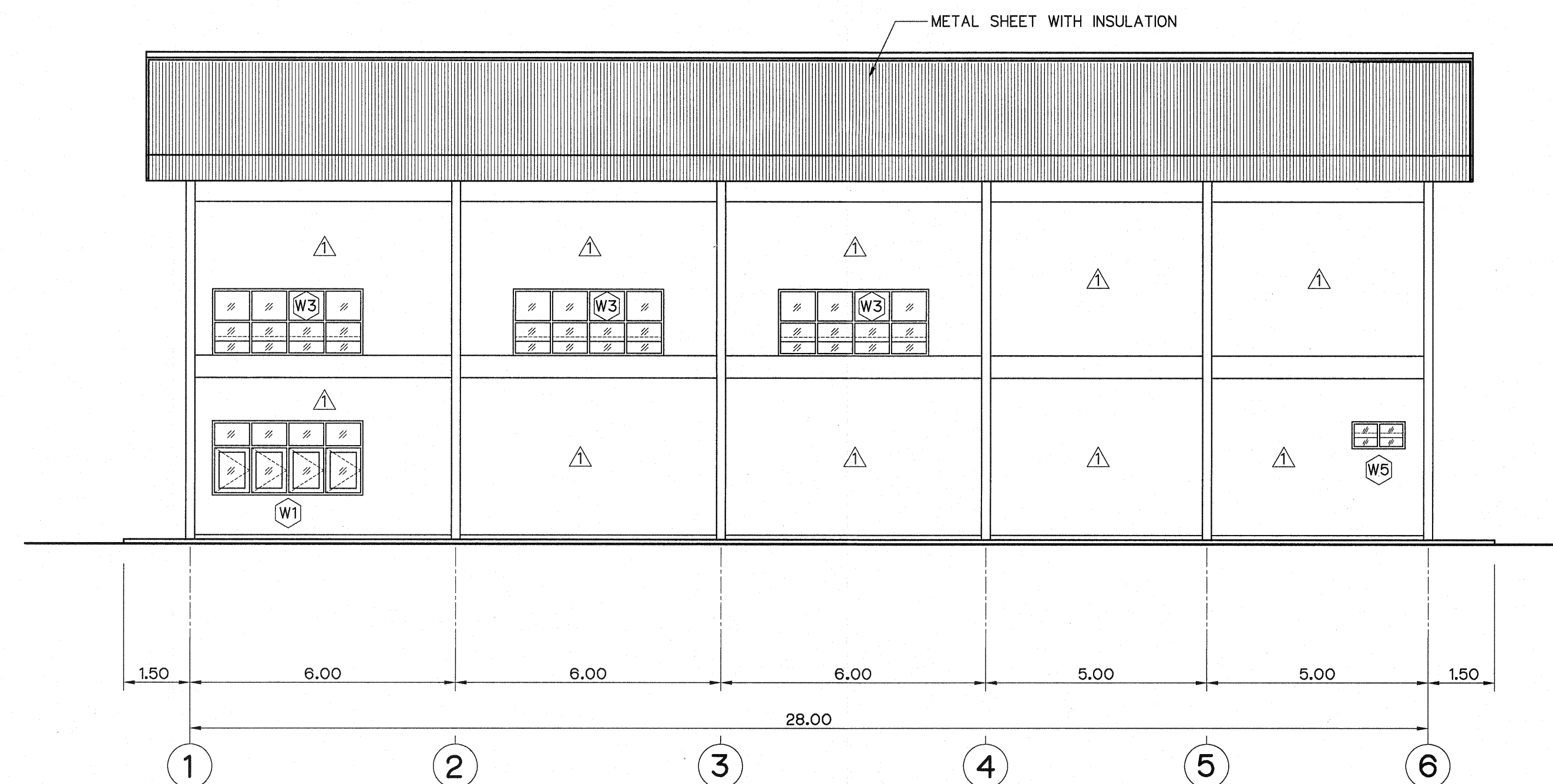
ELEVATION "A"
SCALE 1:100



ELEVATION "C"
SCALE 1:100



ELEVATION "B"
SCALE 1:100



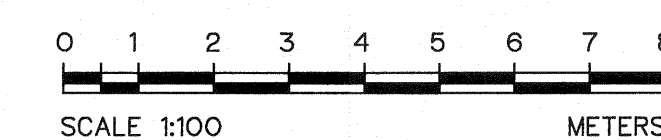
ELEVATION "D"
SCALE 1:100

NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03

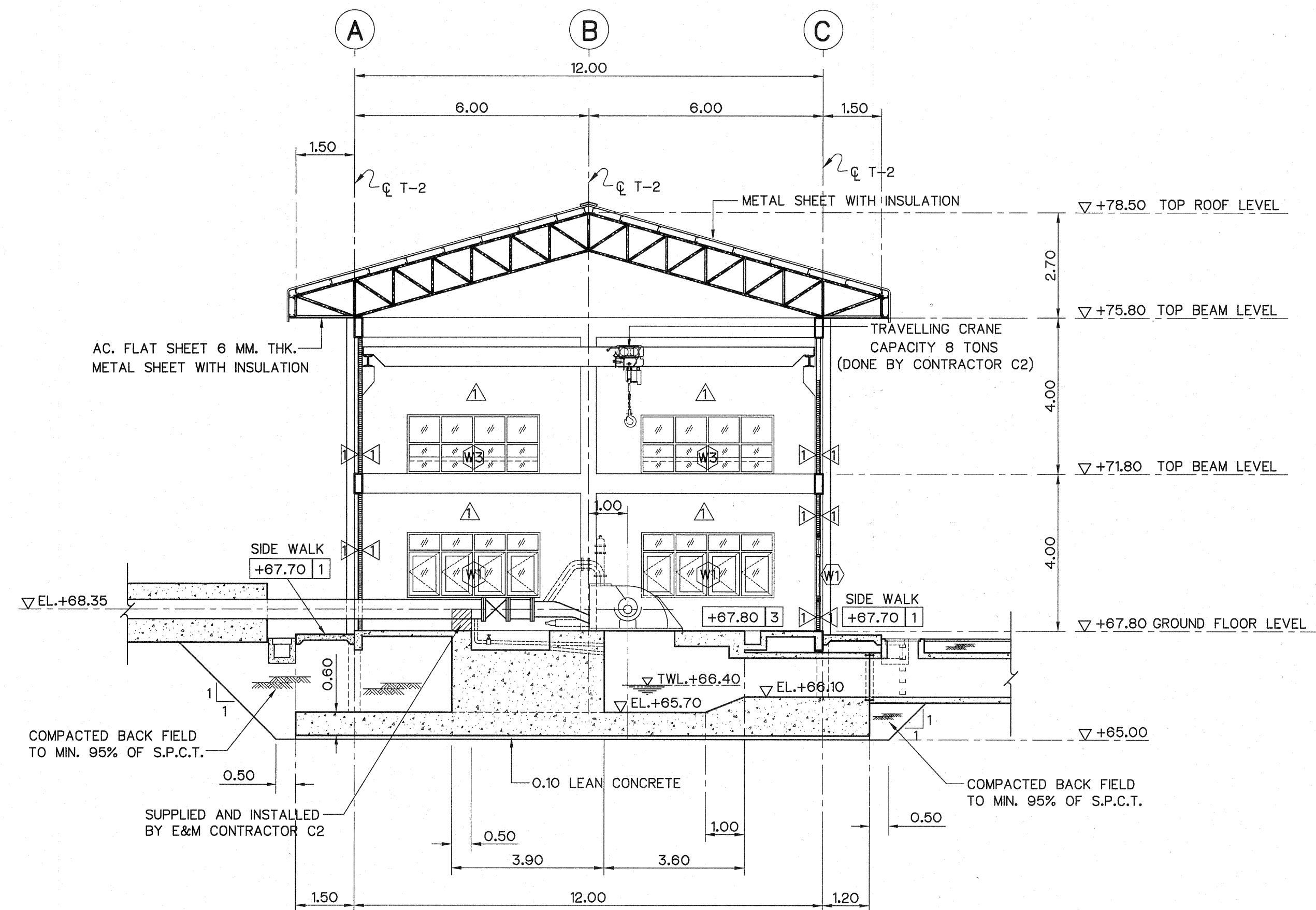
REFERENCE DRAWINGS :

1. POWERHOUSE, PLAN AND ROOF PLAN HLS-PH-02
2. POWERHOUSE, SECTIONS HLS-PH-04

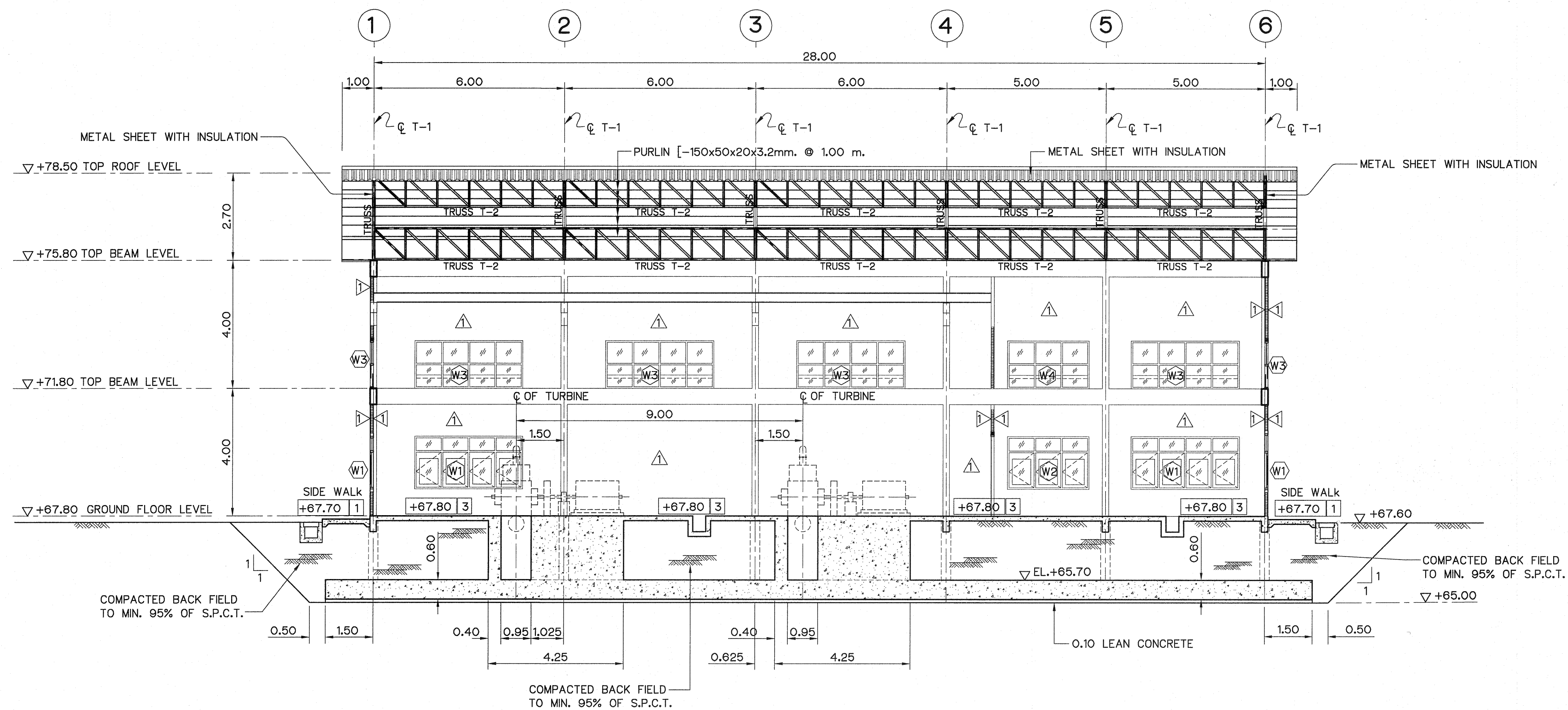


3				
2				
1				
NO.	DATE	REVISIONS	CHECKED	APPROVED

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT POWERHOUSE ELEVATIONS			
FRONTIER ENGINEERING CONSULTANTS CO., LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED <i>[Signature]</i> 081.6651		REVIEWED <i>S. Kitchai</i> <i>[Signature]</i>	
DRAWN <i>[Signature]</i>		RECOMMENDED <i>[Signature]</i>	
CHECKED <i>[Signature]</i> 081.7324		APPROVED <i>[Signature]</i>	
PROJECT MANAGER		DRAWING NO. HLS-PH-03	
DATE 14/01/62		SHEET NO. 15 OF 25	



SECTION A-A
SCALE 1:100



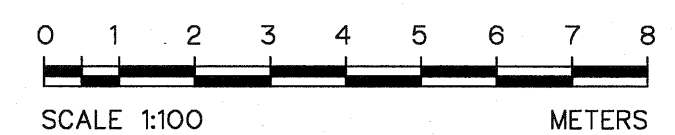
SECTION B-B
SCALE 1:100

NOTES :

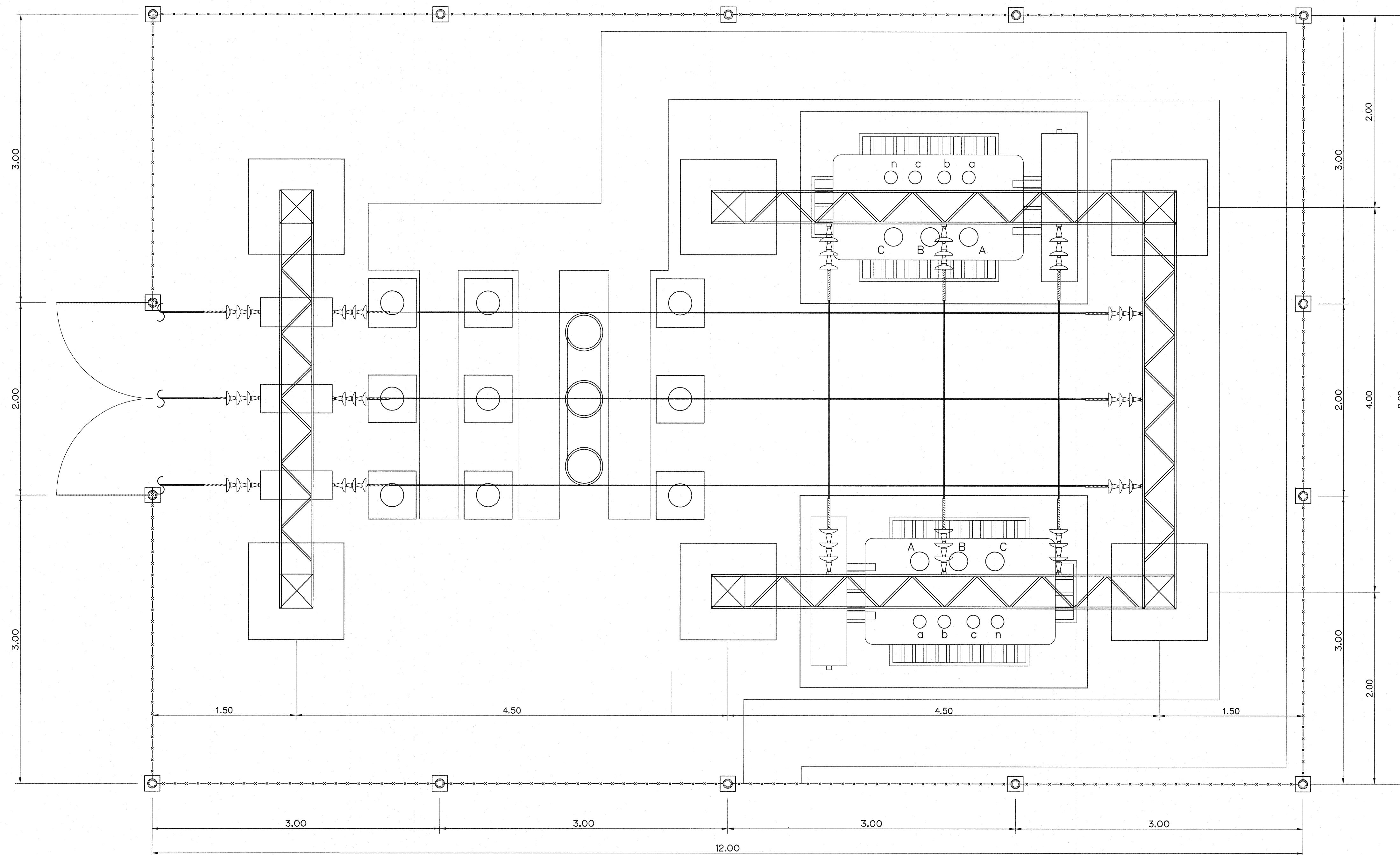
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03

REFERENCE DRAWINGS :

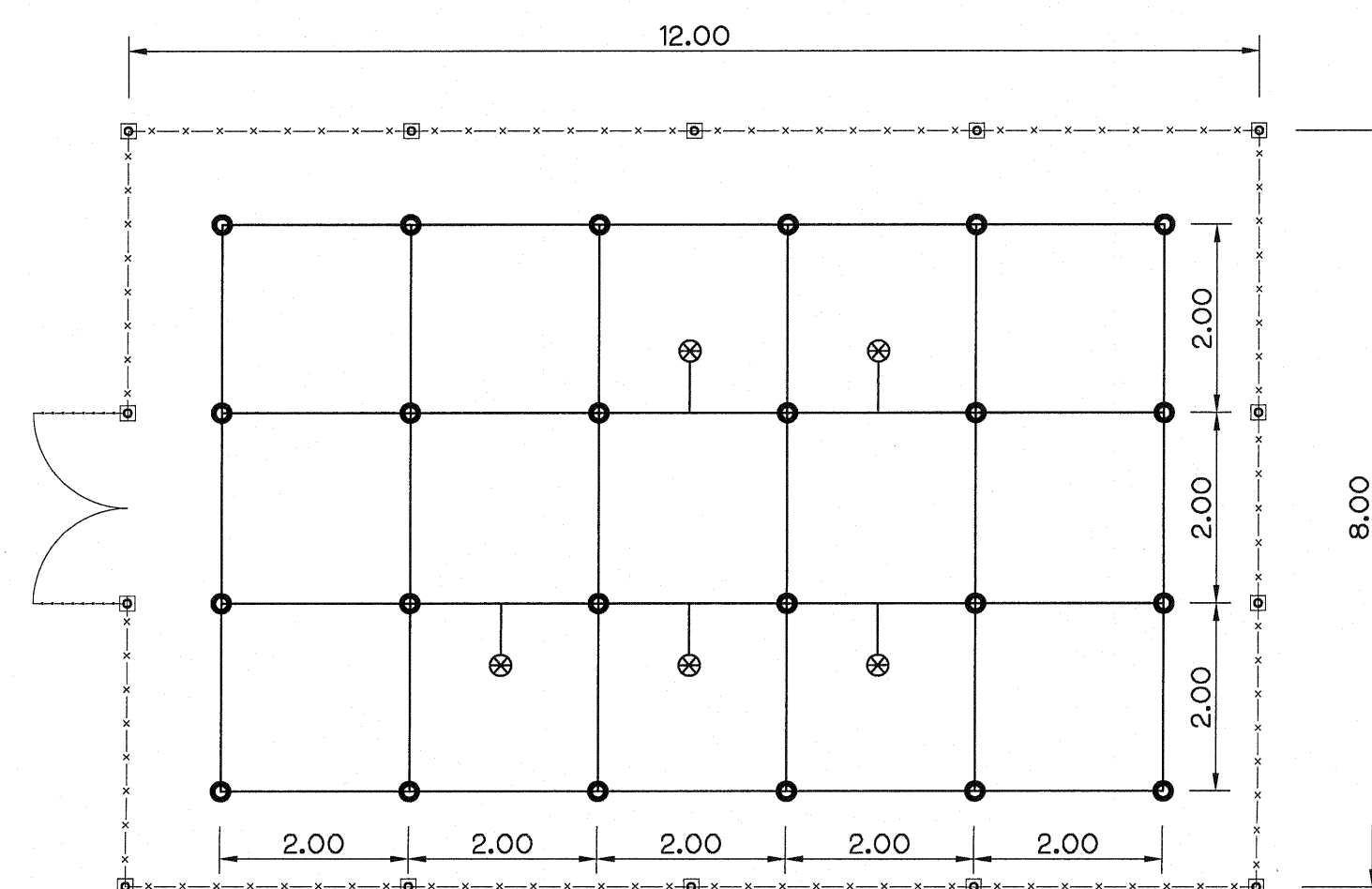
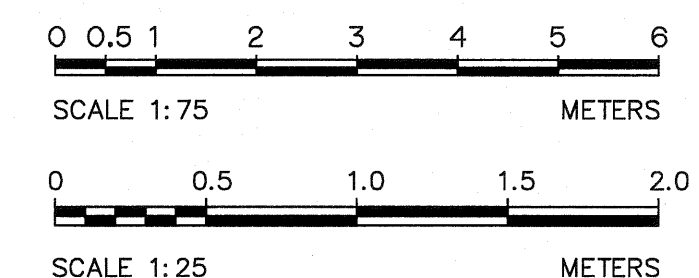
1. POWERHOUSE, PLAN AND ROOF PLAN HLS-PH-02
2. POWERHOUSE, ELEVATIONS HLS-PH-03



KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT POWERHOUSE SECTIONS			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED <i>[Signature]</i> 28.1.6651		REVIEWED <i>S. KITICHAI</i> <i>[Signature]</i>	
DRAWN <i>[Signature]</i>		SUBMITTED <i>[Signature]</i>	
CHECKED <i>[Signature]</i> 28.1.7324		RECOMMENDED <i>[Signature]</i>	
APPROVED <i>[Signature]</i> 14/01/82		APPROVED <i>[Signature]</i>	
CONSULTANTS		DEDE	
PROJECT MANAGER		DRAWING NO. HLS-PH-04	
DATE		SHEET NO. 16 OF 25	



PLAN
SCALE 1:25



GROUNDING SYSTEM
SCALE 1:75

NOTES :

1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
3. THE TRANSFORMER YARD WILL BE ACCORDING TO PEA STANDARD.
4. GROUNDING CONDUCTOR, TAP AND RISER FROM GROUNDING NETWORK TO POWER EQUIPMENT SHALL BE FORMED BY BARE COPPER CONDUCTOR NOT LESS THAN 95 SQ.MM.
5. GROUNDING SYSTEM RESISTANCE WILL NOT EXCEED 5 OHM.
6. CONNECTOR TO WITH IN & BETWEEN THE GROUNDING NETWORK TO POWER PLANT EQUIPMENT WILL BE MADE BY THERMAL CADWELD
7. GROUND ROD WILL BE COPPER COVER STEEL DIAMETER 15.87 MM. 2,400 MM. LONG
8. THIS DRAWING USE FOR GUIDE ONLY

REFERENCE DRAWINGS :

1. POWERHOUSE, TRANSFORMER AND SWITCHYARD, SECTIONS HLS-PH-06
2. POWERHOUSE, TRANSFORMER AND SWITCHYARD, DETAILS HLS-PH-07

LEGENDS :

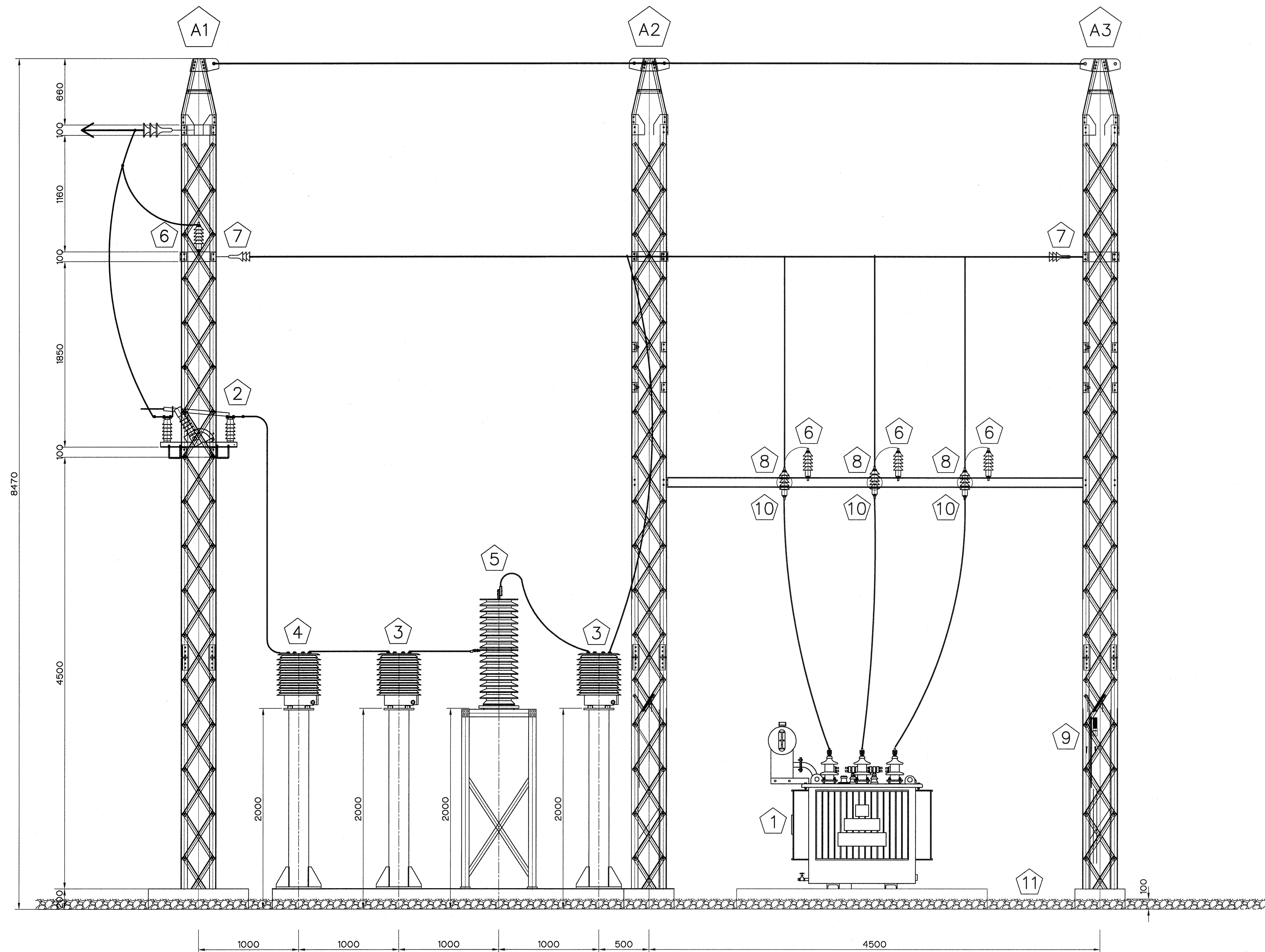
- GROUND ROD
- ⊗ GROUND POINT FOR POWER PLANT EQUIPMENT GROUNDING
- BARE COPPER CONDUCTOR

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1				
NO.	DATE	REVISIONS	CHECKED	APPROVED

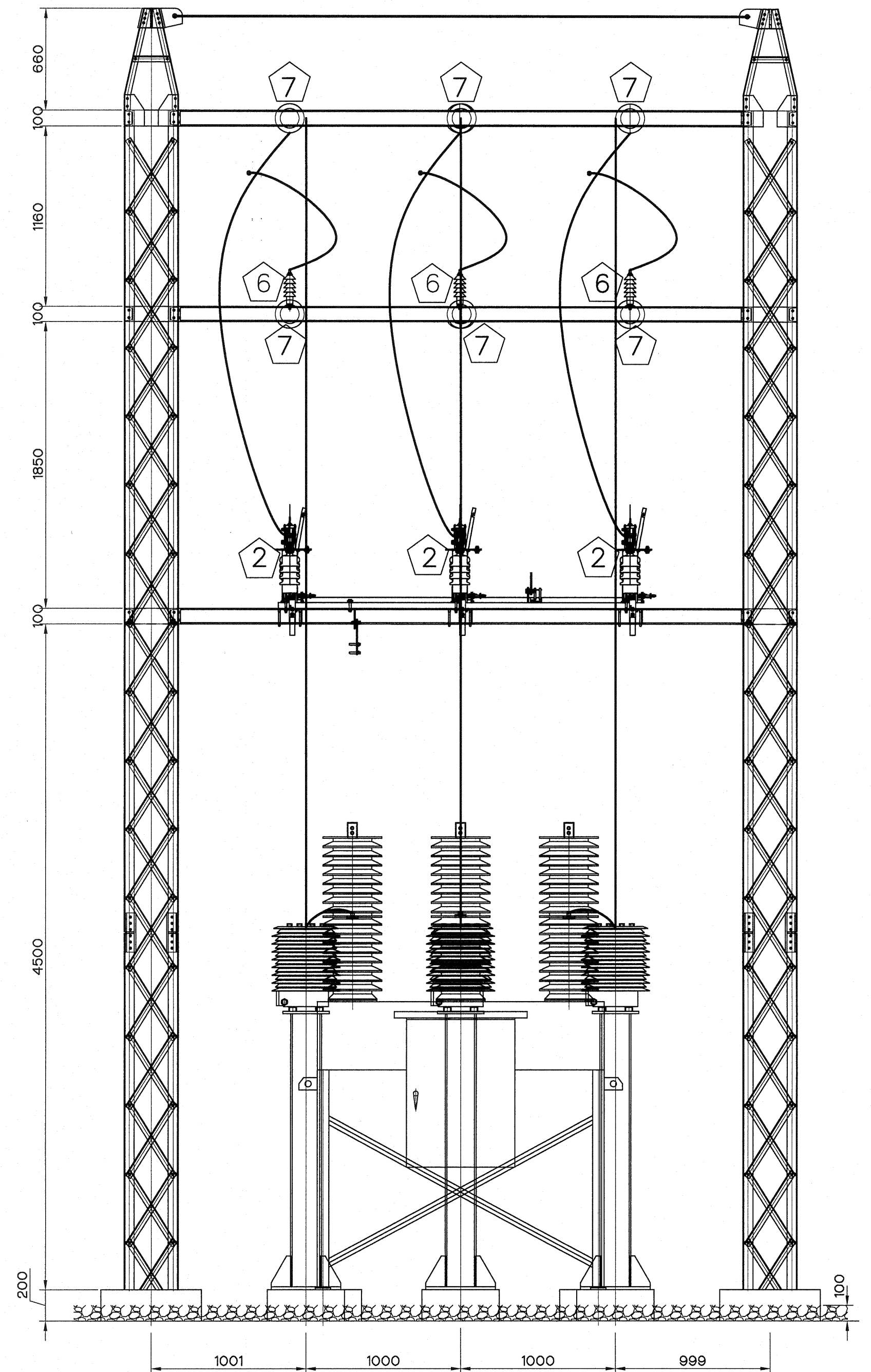
CONSULTANTS

DEDE

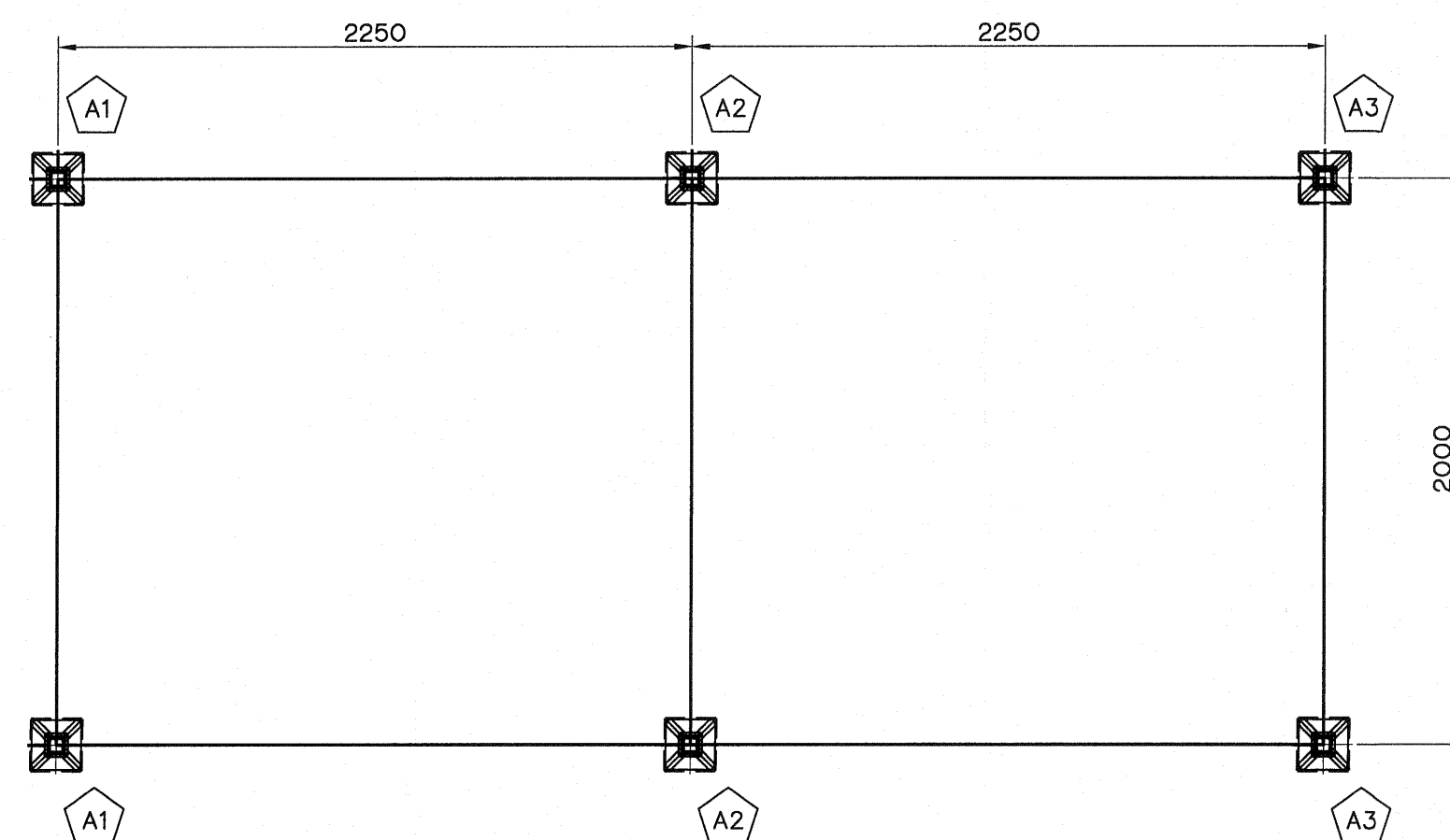
KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI LAM SIN HYDROPOWER PROJECT	
ELECTRO - MECHANICAL EQUIPMENT POWERHOUSE TRANSFORMER, SWITCHYARD AND GROUNDING SYSTEM	
FRONTIER ENGINEERING CONSULTANTS CO.,LTD. DESIGNED: <i>[Signature]</i> 3/11/1029 DRAWN: <i>[Signature]</i> CHECKED: <i>[Signature]</i> 3/11/1029	REVIEWED: S.KITICHAN <i>[Signature]</i> SUBMITTED: <i>[Signature]</i> RECOMMENDED: <i>[Signature]</i> APPROVED: <i>[Signature]</i> 14/01/62
PROJECT MANAGER DATE	DRAWING NO. HLS-PH-05 SHEET NO. 17 OF 25



SIDE VIEW
SCALE 1:25



FRONT VIEW
SCALE 1:25

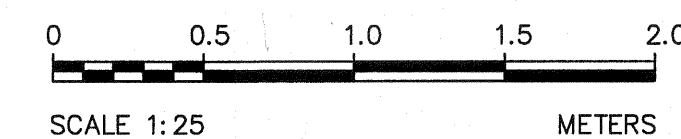


OVERHEAD GROUND WIRE PLAN
SCALE 1:50

ITEM.	DESCRIPTION	Q'TY.	REMARK.
1	MAIN TRANSFORMER 33000/400 V.	2	
2	DISCONNECTING SWITCH	1	
3	OUTDOOR CURRENT TRANSFORMERS RATIO	6	
4	OUTDOOR VOLTGE TRANSFORMER RATIO	3	
5	SF6 CIRCUIT-BREAKER (VCB1)	1	
6	SURGE ARRESTERS	9	
7	SUSPENSION INSULATORS	45	
8	LINE POST INSULATORS	6	
9	LINE GROUND SWITCH	2	
10	33 KV. DROP OUT FUSE	6	
11	GRAVEL	1	

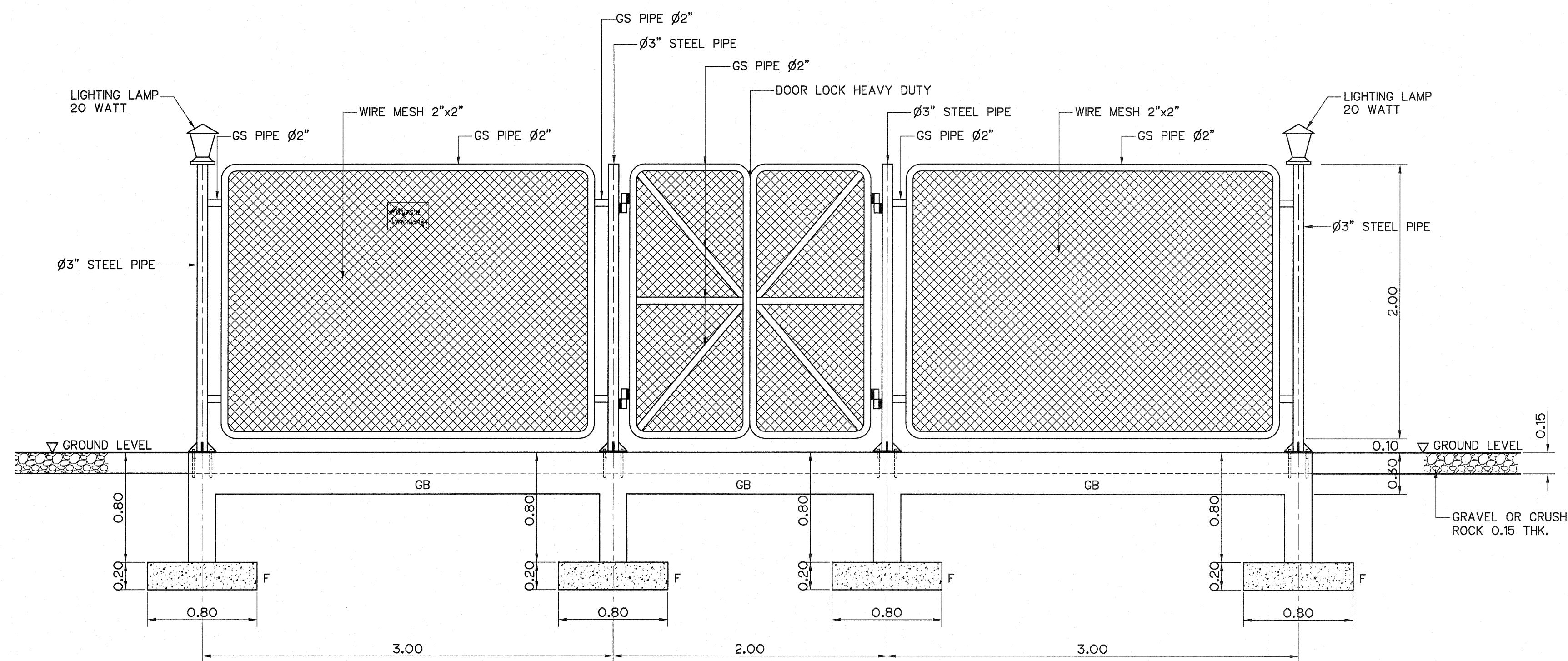
- NOTES :
- ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
 - SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
 - THE TRANSFORMER YARD WILL BE ACCORDING TO PEA STANDARD.

- REFERENCE DRAWINGS :
- POWERHOUSE, TRANSFORMER, SWITCHYARD AND GROUNDING SYSTEM HLS-PH-05
 - POWERHOUSE, TRANSFORMER AND SWITCHYARD, DETAILS HLS-PH-07

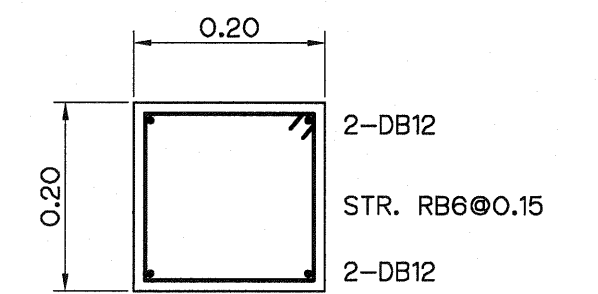
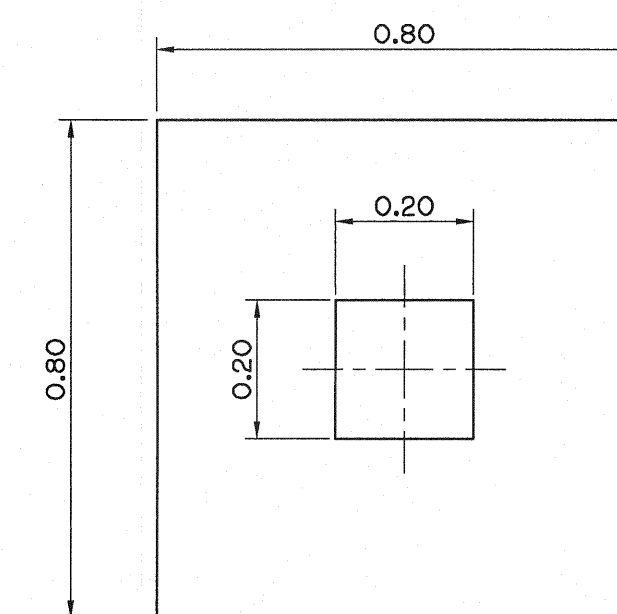


3									
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NO.	DATE	REVISIONS	CHECKED	APPROVED					
CONSULTANTS					DEDE				
PROJECT MANAGER					DATE				
14/01/82					DRAWING NO.				
HLS-PH-06					SHEET NO.				
18					OF 25				

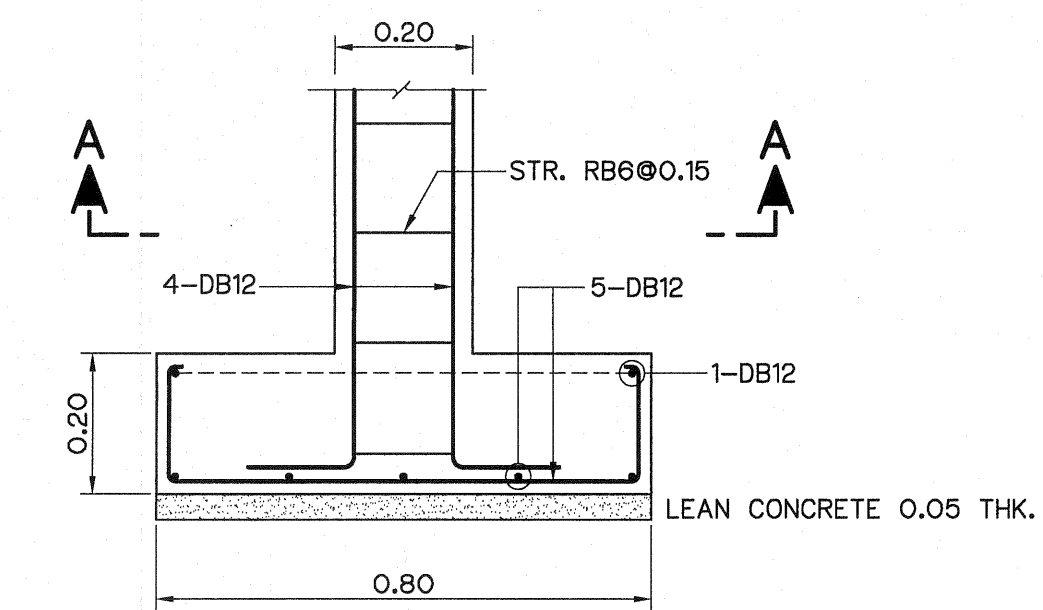
KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI LAM SIN HYDROPOWER PROJECT	
ELECTRO - MECHANICAL EQUIPMENT POWERHOUSE TRANSFORMER AND SWITCHYARD, SECTIONS	
FRONTIER ENGINEERING CONSULTANTS CO., LTD. DESIGNED: [Signature] 21/11/1029 DRAWN: [Signature] 21/11/1029 CHECKED: [Signature] 21/11/1029 PROJECT MANAGER	REVIEWED: S. KITCHAI [Signature] SUBMITTED: [Signature] RECOMMENDED: [Signature] APPROVED: [Signature] DRAWING NO. HLS-PH-06



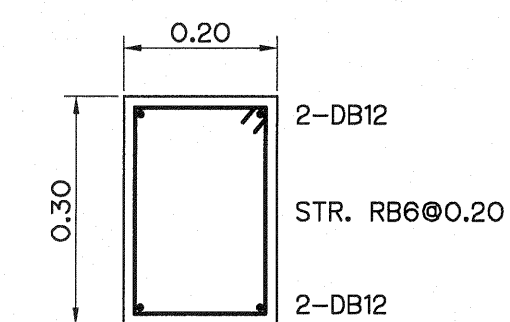
FENCE DETAIL
NOT TO SCALE



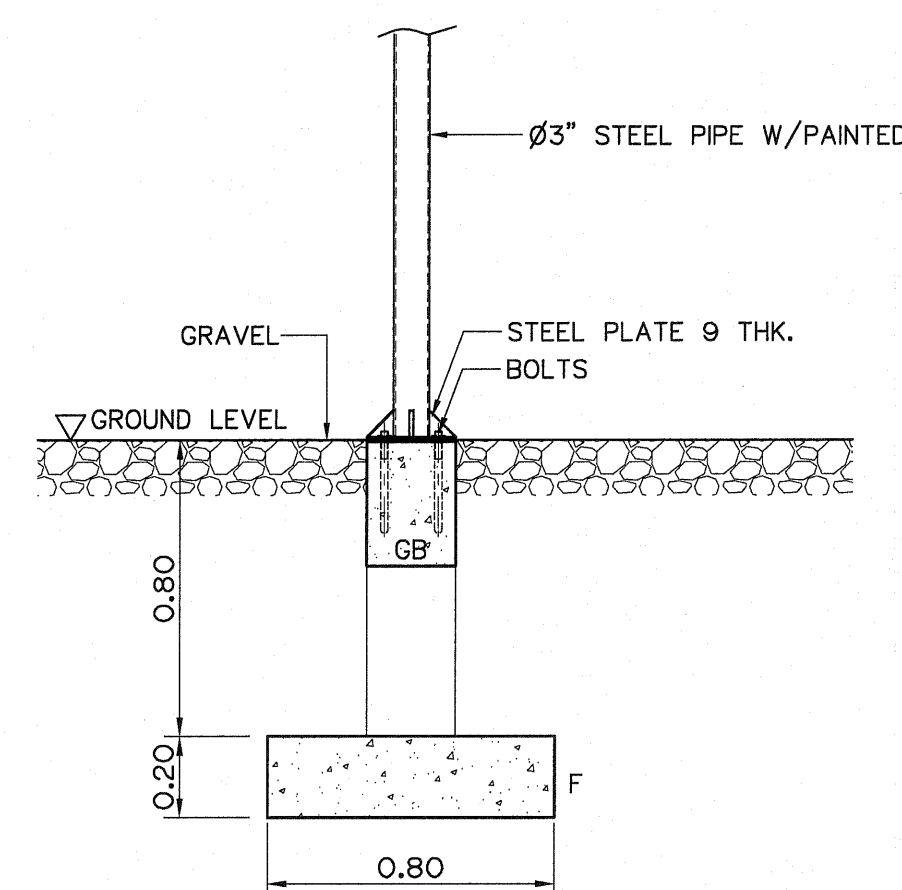
SECTION A-A
NOT TO SCALE



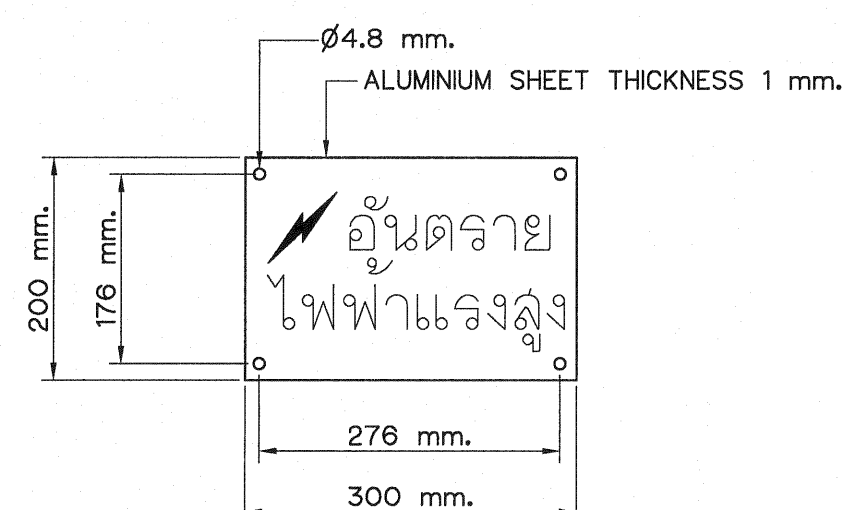
REINFORCEMENT OF FOOTING (F)
NOT TO SCALE



REINFORCEMENT OF BEAM (GB)
NOT TO SCALE



DETAIL OF FOOTING (F)
NOT TO SCALE



WARNING SIGN
NOT TO SCALE

NOTES :

1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
3. THE TRANSFORMER YARD WILL BE ACCORDING TO PEA STANDARD.

REFERENCE DRAWINGS :

1. POWERHOUSE, TRANSFORMER, SWITCHYARD AND GROUNDING SYSTEM HLS-PH-05
2. POWERHOUSE, TRANSFORMER AND SWITCHYARD, SECTIONS HLS-PH-06

3									
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NO.	DATE	REVISIONS	CHECKED	APPROVED					
					CONSULTANTS	DEDE			

FRONTIER ENGINEERING CONSULTANTS CO., LTD.		REVIEWED 3.MITICHAI		DESIGNED 3.MITICHAI		SUBMITTED	
CHECKED 3.MITICHAI		APPROVED 3.MITICHAI		DRAWN 3.MITICHAI		RECOMMENDED 3.MITICHAI	
PROJECT MANAGER		DATE 14/01/82		DRAWING NO. HLS-PH-07		SHEET NO. 19 OF 25	

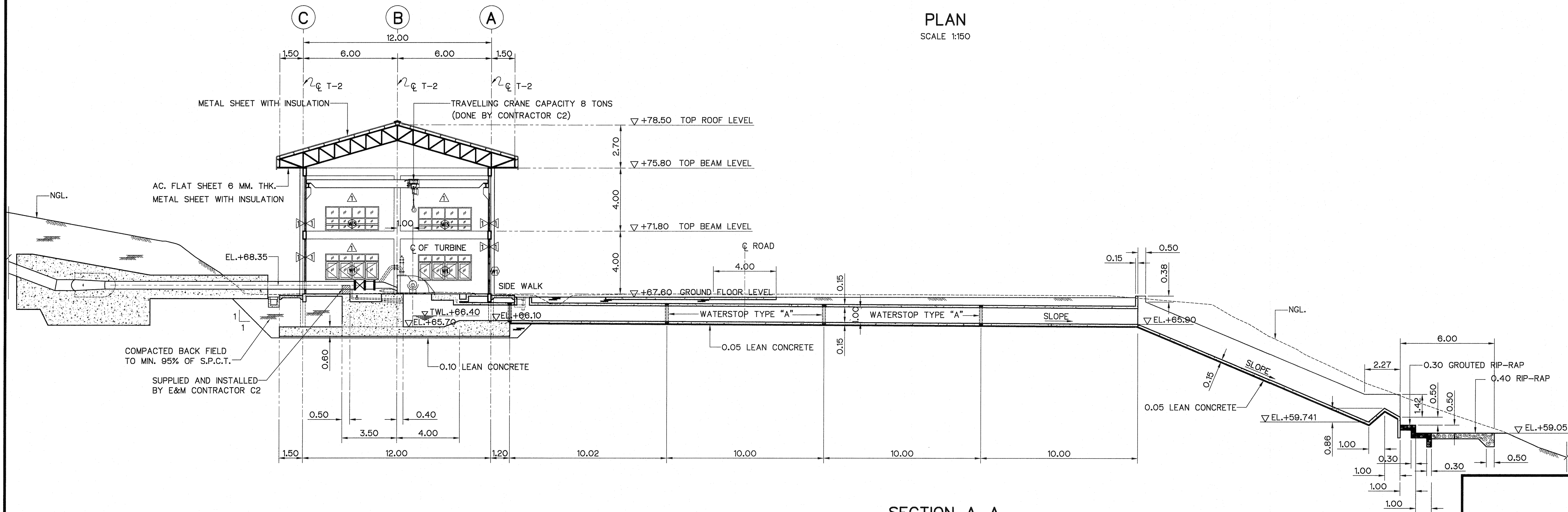
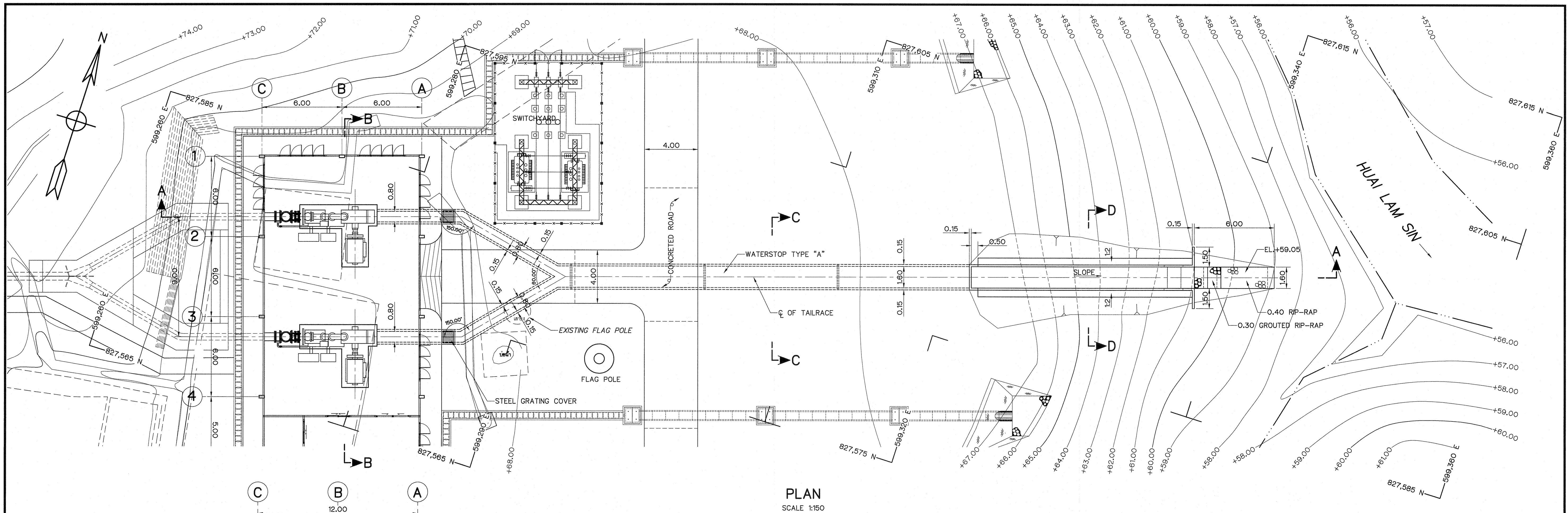
KINGDOM OF THAILAND
Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

HUAI LAM SIN HYDROPOWER PROJECT

ELECTRO - MECHANICAL EQUIPMENT

POWERHOUSE

TRANSFORMER AND SWITCHYARD, DETAILS

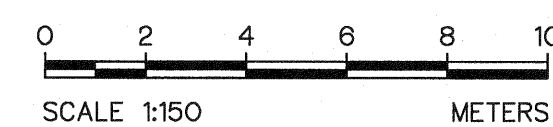


NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
- TURBINE & GENERATOR FOUNDATIONS, TRENCH AND BLOCKOUT SIZES AND LOCATIONS ARE ONLY APPROXIMATE. THE ELECTRO-MECHANICAL CONTRACTOR IS REQUIRED TO SUBMIT THE SHOP DRAWINGS INDICATED ALL FINAL SIZES AND LOCATIONS TO FIELD ENGINEER

REFERENCE DRAWINGS :

- TAILRACE, SECTIONS B-B, C-C AND D-D HLS-TR-02



KINGDOM OF THAILAND
Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

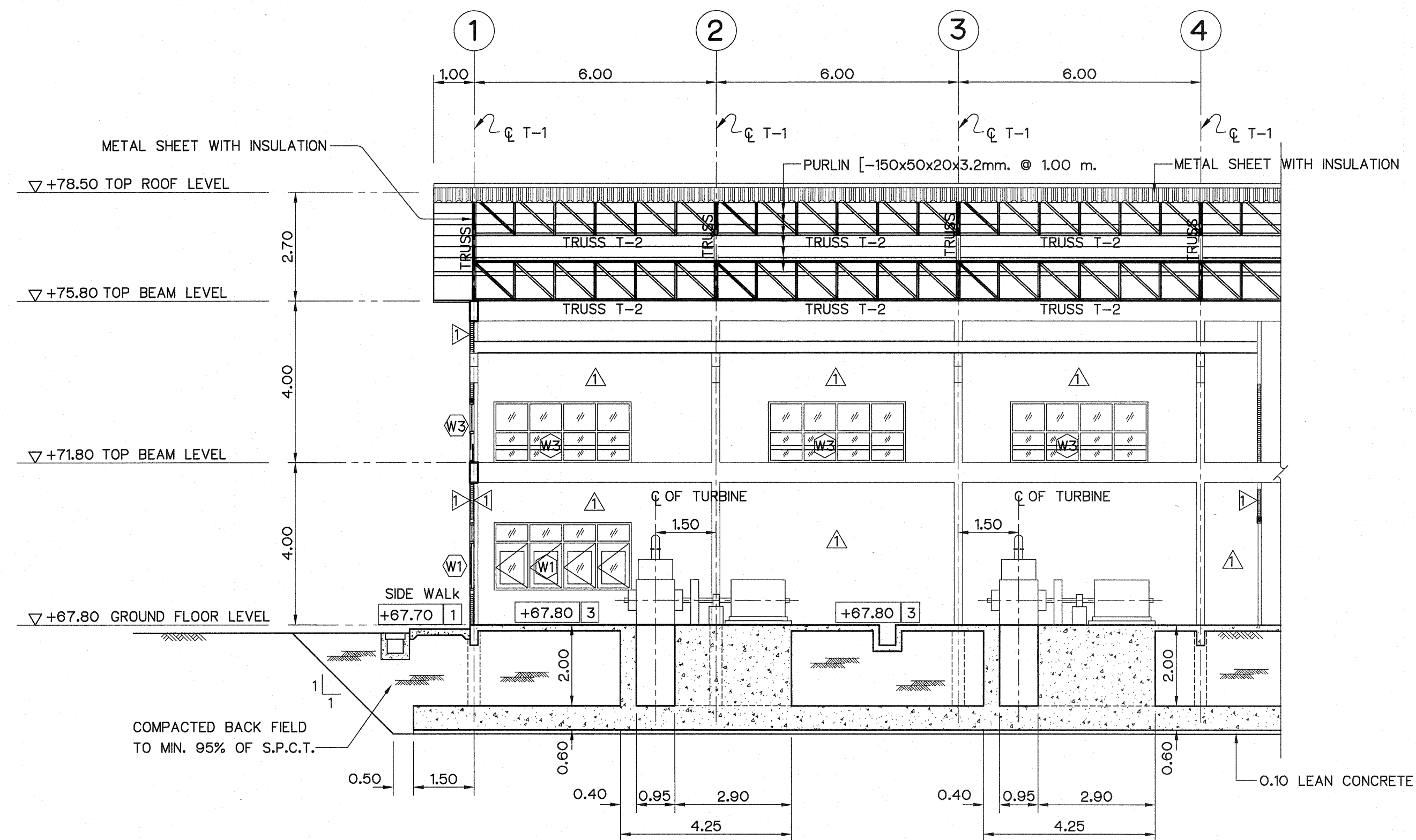
HUAI LAM SIN HYDROPOWER PROJECT

ELECTRO - MECHANICAL EQUIPMENT

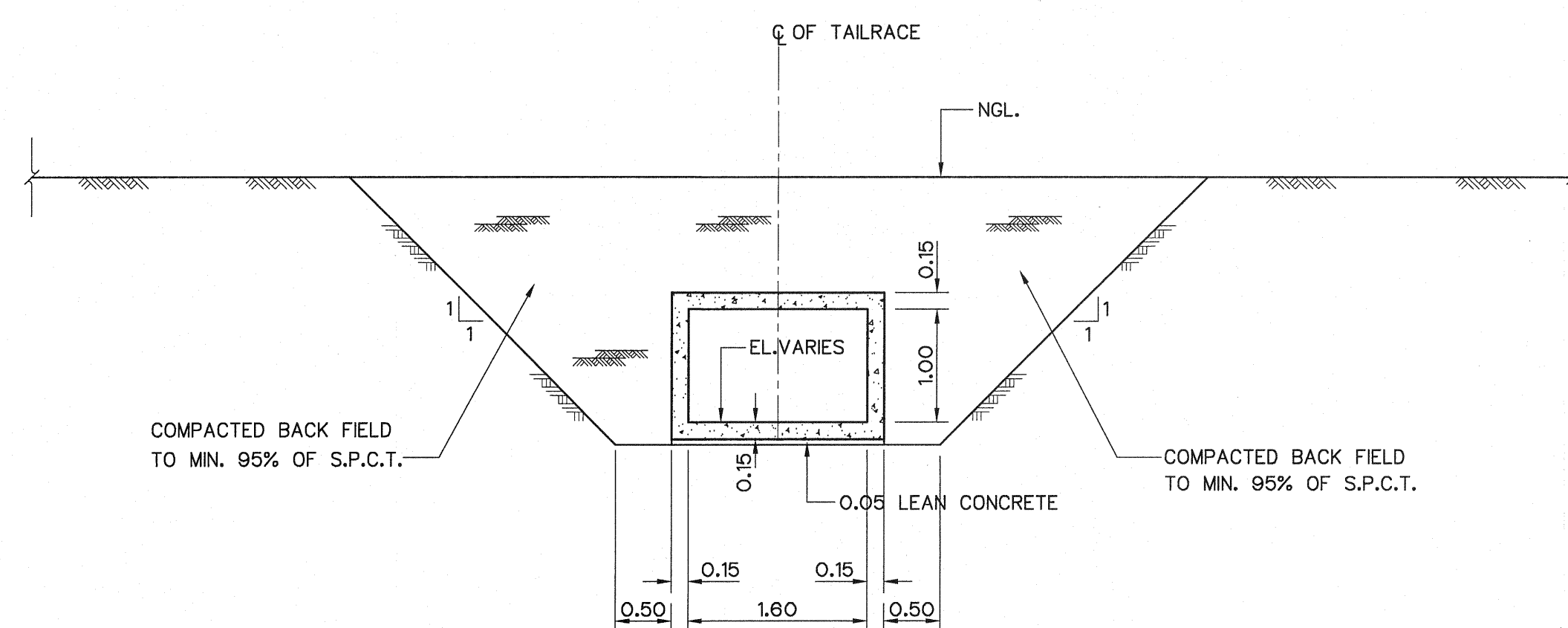
TAILRACE

PLAN AND SECTION A-A

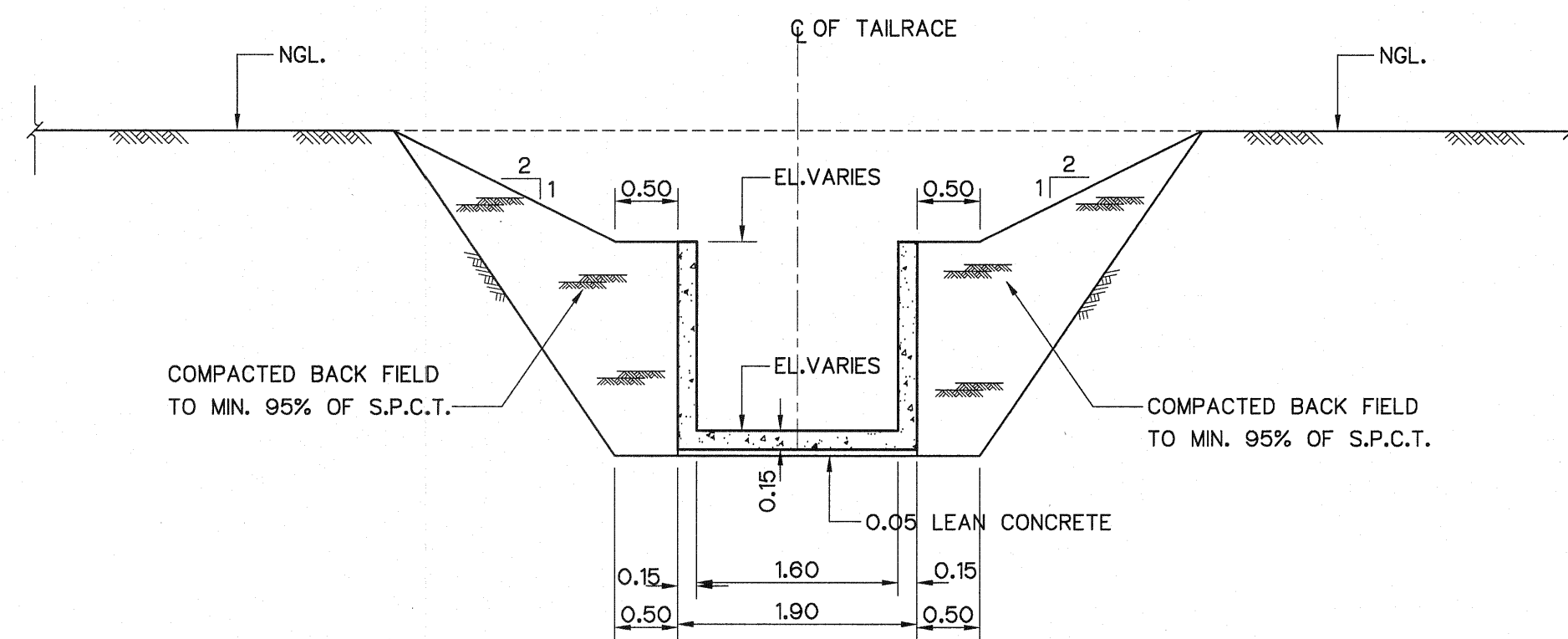
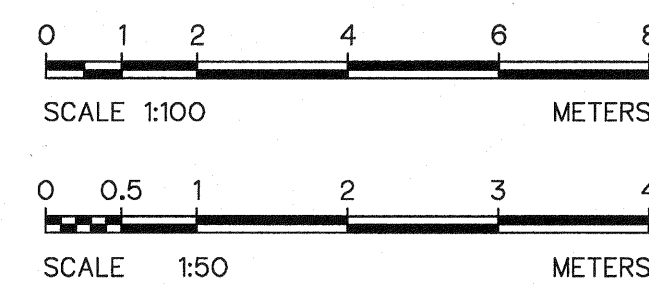
FRONTIER ENGINEERING CONSULTANTS CO., LTD.				REVIEWED <i>S. Kitchan</i>	
DESIGNED	<i>S. Kitchan</i>	821.6851	SUBMITTED	<i>S. Kitchan</i>	
DRAWN	<i>S. Kitchan</i>		RECOMMENDED	<i>S. Kitchan</i>	
CHECKED	<i>S. Kitchan</i>	821.7324	APPROVED	<i>S. Kitchan</i>	
CONSULTANTS		DEDE		DRAWING NO.	SHEET NO.
				HLS-TR-01	20 OF 25



SECTION B-B
SCALE 1:100



SECTION C-C
SCALE 1:50



SECTION D-D
SCALE 1:50

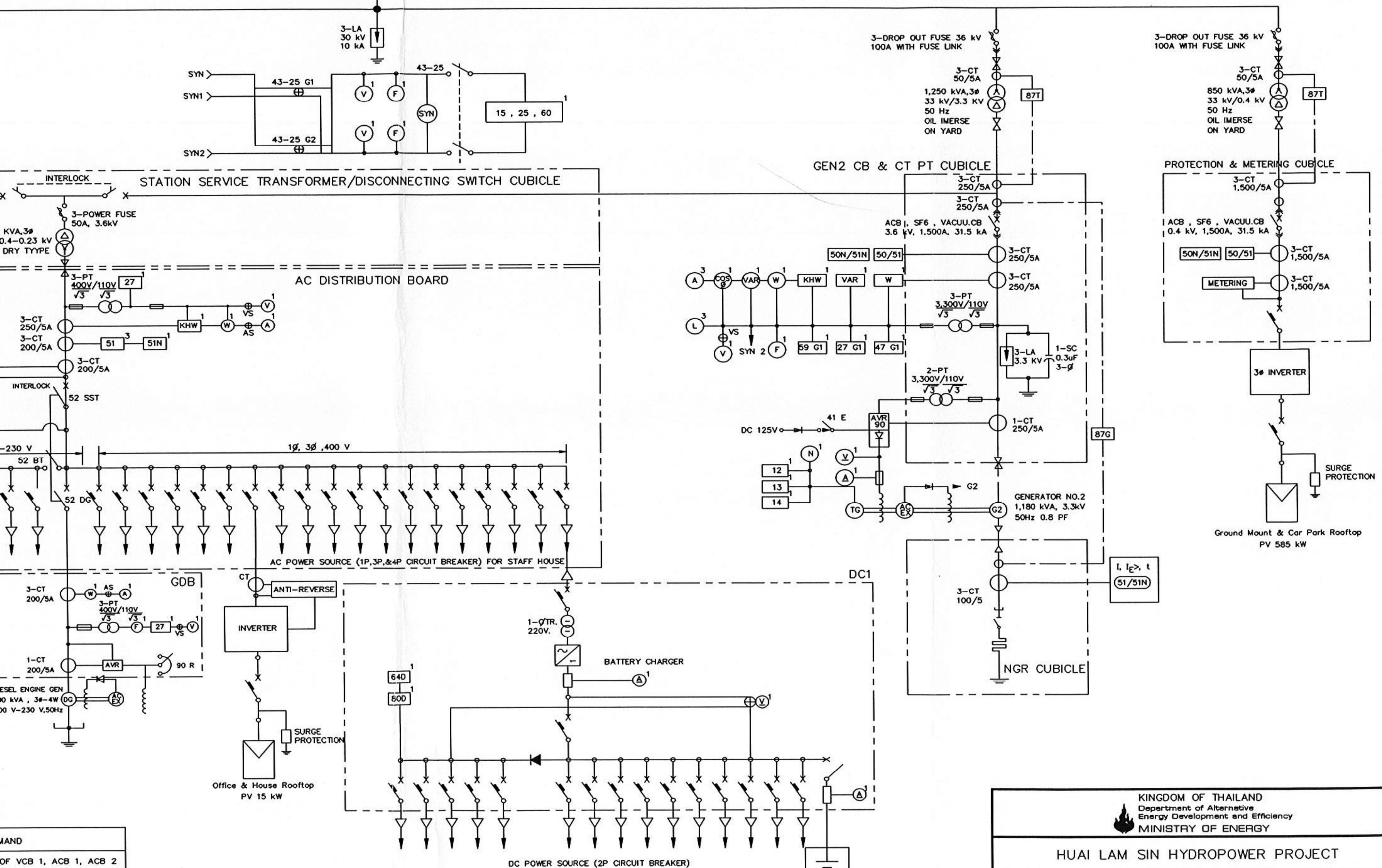
NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HLS-GN-03
3. TURBINE & GENERATOR FOUNDATIONS, TRENCH AND BLOCKOUT SIZES AND LOCATIONS ARE ONLY APPROXIMATE. THE ELECTRO-MECHANICAL CONTRACTOR IS REQUIRED TO SUBMIT THE SHOP DRAWINGS INDICATED ALL FINAL SIZES AND LOCATIONS TO FIELD ENGINEER

REFERENCE DRAWINGS :

1. TAILRACE, PLAN AND SECTION HLS-TR-01

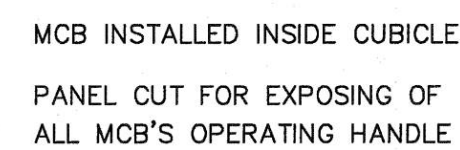
KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI LAM SIN HYDROPOWER PROJECT			
ELECTRO - MECHANICAL EQUIPMENT TAILRACE SECTIONS B-B, C-C AND D-D			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED <i>[Signature]</i> 22.6651		REVIEWED <i>[Signature]</i> 22.6651	
DRAWN <i>[Signature]</i>		RECOMMENDED <i>[Signature]</i>	
CHECKED <i>[Signature]</i> 22.7324		APPROVED <i>[Signature]</i>	
PROJECT MANAGER		DATE 14/01/62	
CONSULTANTS		DEDE	
DRAWING NO. HLS-TR-02		SHEET NO. 21 OF 25	



NOTES

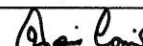
1. 33 AND 0.4 KV CIRCUIT BREAKER MUST BE VACUUM TYPE OR AIR TYPE OR SF6 RESPECTIVELY
2. 0.4 KV CURRENT TRANSFORMER AND POTENTIAL TRANSFORMER MUST BE DRY TYPE
3. 33 KV CURRENT TRANSFORMER AND POTENTIAL TRANSFORMER MUST BE EPOXY RESIN MOLD
4. ALL POTENTIAL TRANSFORMER : ACCURACY CLASS 0.5
5. ALL CURRENT TRANSFORMER : FOR METERING ACCURACY CLASS 0.5
: FOR RELAY ACCURACY CLASS 5P20
6. THIS DRAWING IS DESIGNED FOR GUIDELINE ONLY, IT SHALL BE DESIGNED AND SPECIFIED BY CONTRACTOR FOR SUBMITTED TO FIELD ENGINEER APPROVAL LATER
7. ACCORDING TO PEA'S REGULATION ON THE POWER NETWORK SYSTEM INTERCONNECTION CODE

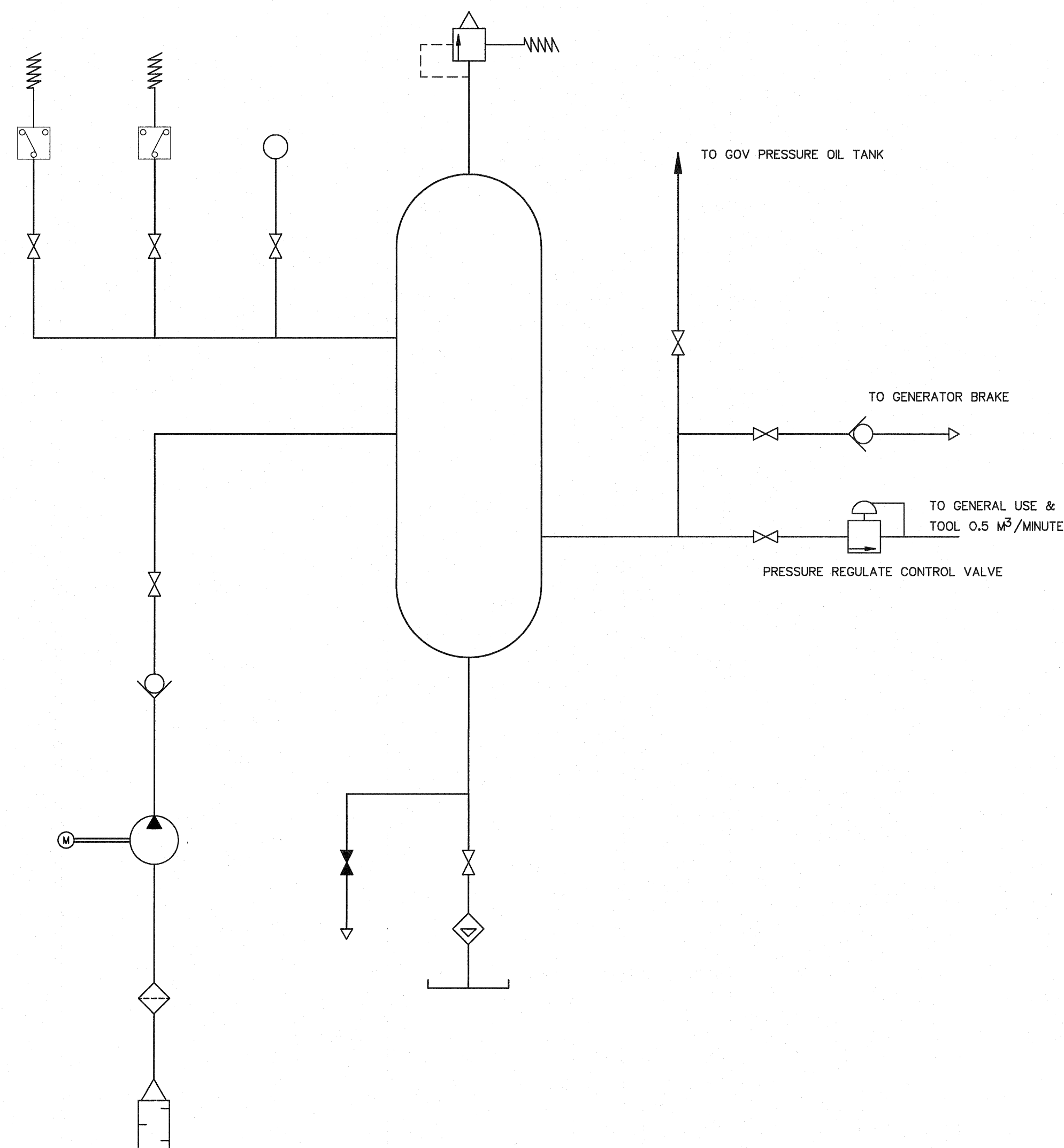
3					REVIEWED	SUBMITTED
2					DESIGNED	RECOMMENDED
1					DRAWN	APPROVED
NO.	DATE	REVISIONS	CHECKED	APPROVED	CHECKED	
	CONSULTANTS		DEDE		DATE	DRAWING NO. HLS-EM-01
						SHEET NO. OF



1. AC AMMETER
2. AC VOLTMETER
3. AC WATTMETER
4. WATT HOUR METER
5. UNDER VOLTAGE RELAY
6. AMMETER SELECTOR SWITCH
7. VOLTMETER SELECTOR SWITCH
8. DC AMMETER
9. DC VOLTMETER
10. DC AMMETER
11. DC UNDER VOLTAGE RELAY
12. DC GROUND FAULT RELAY
13. DC VOLTMETER SELECTOR SWITCH
14. TEST TERMINAL
15. MS1 } 3 PHASE MOTOR STARTER , TWO DIRECTIONS , FORWARD AND REVERSE
16. MS2 } WITH FORWARD AND REVERSE PUSH BUTTON , SUITABLE FOR
3 0 , 380 V. GATE MOTORS.

1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE	SHOWN
2. THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY, IT	SHALL BE
BE DESIGNED AND SPECIFIED LATER BY CONTRACTOR	C2
AND SUBMITTED TO FIELD ENGINEER FOR APPROVAL	

 KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI LAM SIN HYDROPOWER PROJECT	
ELECTRO — MECHANICAL EQUIPMENT	
MAIN CONTROL SWITCH BOARD	
 FRONTIER ENGINEERING CONSULTANTS co., LTD.	 Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY
DESIGNED 	REVIEWED SWITCH 
DRAWN 	SUBMITTED 
CHECKED 	RECOMMENDED 
	APPROVED 
PROJECT MANAGER	DRAWING NO.
DATE	DATE
14/01/62	HLS-EM-02
	SHEET NO.
	23 OF 25



COMPRESSED AIR SYSTEM SCHEMATIC

LEGENDS :

	AUTOMATIC CONDENSATE TRAP		VALVE-NON RETURN
	FILTER OR STRAINER - MANUAL - AUTOMATIC HAS ADDITIONAL DRAIN LINE AND VALVE		PRESSURE SWITCH
	VALVE-NORMALLY OPEN		AIR VENT
	VALVE-NORMALLY CLOSED		HEAD EXCHANGER
	NEEDLE VALVE		FLOW RELAY
	ORIFICE		FLOW METER
	VALVE-THERMOSTATICALLY CONTROLLED		PRESSURE GAUGE
	VALVE-PRESSURE REGULATING		RECEIVER
	VALVE-PRESSURE RELIEF (WATER)		PUMP OR COMPRESSOR
	VALVE-SOLENOID OPERATED PRESSURE REDUCING		SILENCER
	VALVE-PRESSURE RELIEF (AIR)		DIRECTION OF FLOW
	VALVE-SOLENOID OPERATED OIL PRESSURE ACTUATED		MOTORIZED VALVE

NOTES :

1. PIPING & FITTING TO WORK SHOP ROOM AND MACHINE
HALL FOR UNIT 1 & UNIT 2 SHALL BE PROVIDED BY
THE CONTRACTOR
2. THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY, IT SHALL BE DESIGNED AND SPECIFIED LATER
BY CONTRACTOR C2 AND SUBMITTED TO FIELD ENGINEER FOR APPROVAL

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI LAM SIN HYDROPOWER PROJECT	
ELECTRO - MECHANICAL EQUIPMENT COMPRESS AIR SYSTEM SCHEMATIC DIAGRAM	
FRONTIER ENGINEERING CONSULTANTS CO.,LTD. DESIGNED <i>[Signature]</i> 14/01/82 DRAWN <i>[Signature]</i> 14/01/82 CHECKED <i>[Signature]</i> 14/01/82	Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY REVIEWED <i>[Signature]</i> SUBMITTED <i>[Signature]</i> RECOMMENDED <i>[Signature]</i> APPROVED <i>[Signature]</i>
NO. DATE REVISIONS CHECKED APPROVED CONSULTANTS DEDE	DRAWING NO. HLS-EM-04 SHEET NO. 25 OF 25