



Department of Alternative
Energy Development Efficiency
MINISTRY OF ENERGY

HUAI MAE SOT HYDROPOWER PROJECT

TAK PROVINCE

CONTRACT C1/2

CIVIL WORKS

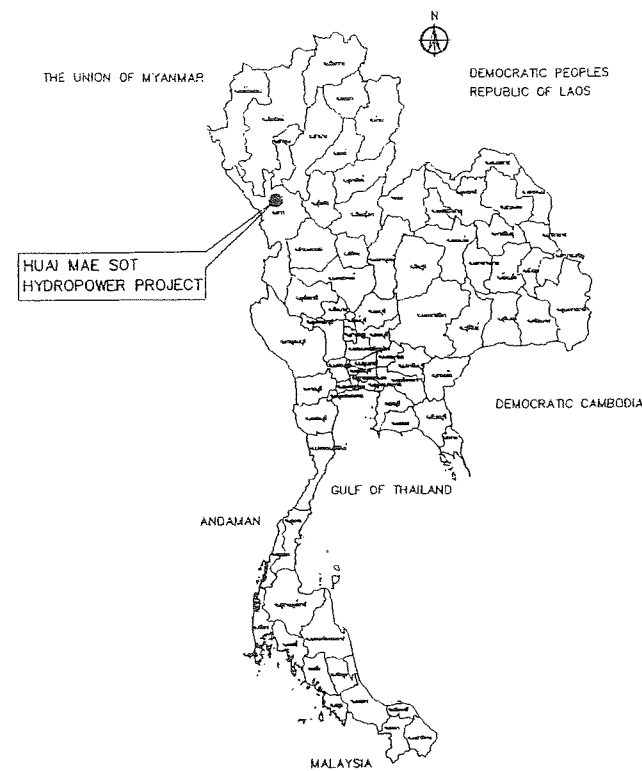
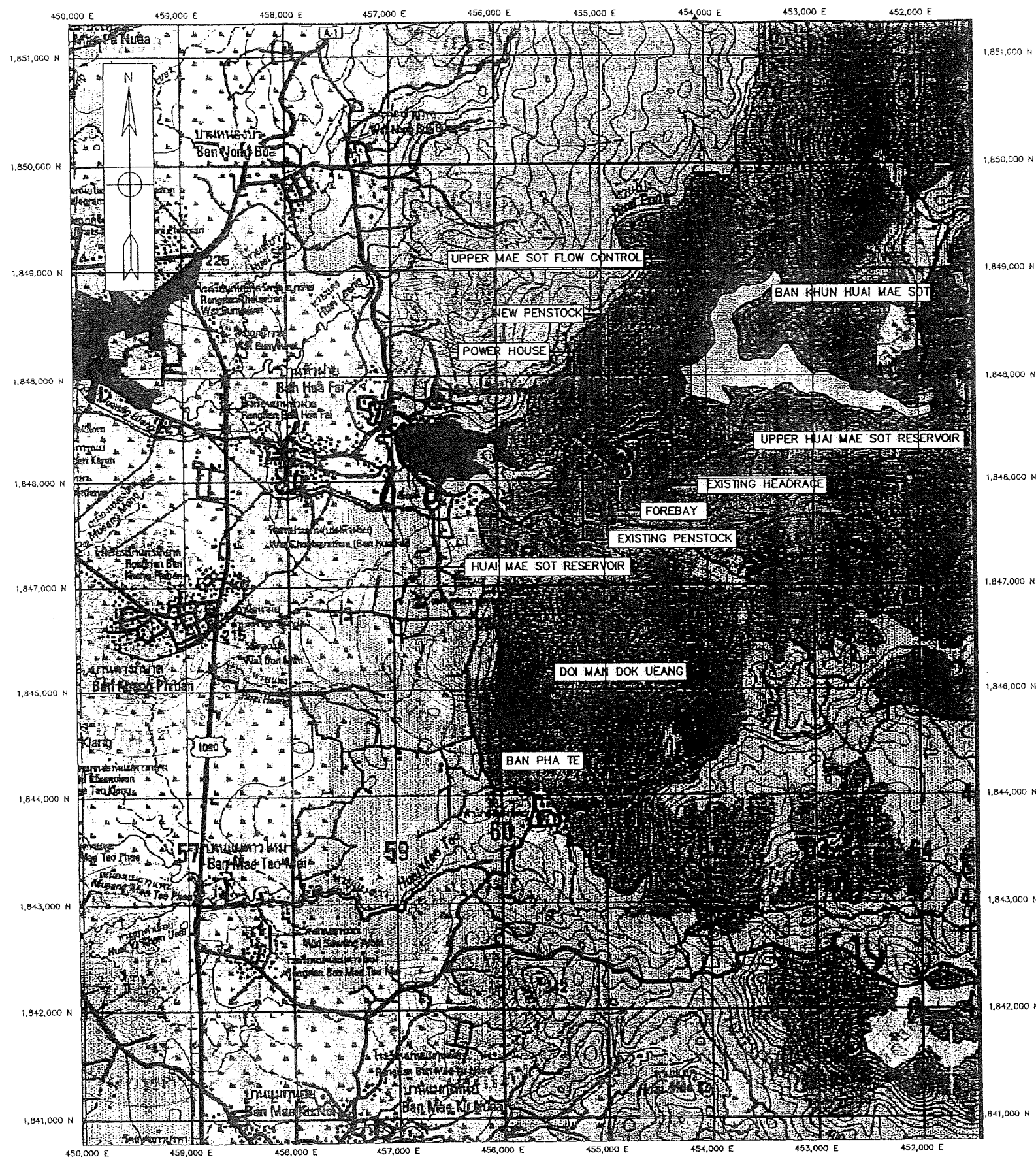
VOLUME 4

DRAWINGS

MAHA NAKORN CONSULTANTS CO.,LTD.

LIST OF DRAWINGS
HUI MAE SOT HYDROPOWER PROJECT
CONTRACT C1/2 : CIVIL WORKS

PAGE NO.	DRAWING NO.	DRAWING DETAILS
GENERAL		
1	HMS-GN-01	LOCATION MAP
2	HMS-GN-02	SITE PLAN
3	HMS-GN-03	SYMBOLS, ABBREVIATIONS AND GENERAL NOTES
PENSTOCK		
4	HMS-PS-01(S)	NO.1 PLAN AND PROFILE, STA.0+000.000 TO STA.0+500.000
5	HMS-PS-02(S)	NO.1 PLAN AND PROFILE, STA.0+500.000 TO STA.1+000.000
6	HMS-PS-03(S)	NO.1 PLAN AND PROFILE, STA.1+000.000 TO STA.1+460.825
7	HMS-PS-04	ANCHOR BLOCK NO. 1,2,3 PLAN AND SECTION
8	HMS-PS-05	ANCHOR BLOCK NO. 4,5,6,7 PLAN AND SECTION
9	HMS-PS-06	ANCHOR BLOCK NO. 8,9,10 PLAN AND SECTION
10	HMS-PS-07	ANCHOR BLOCK NO. 11,12,13,14 PLAN AND SECTION
11	HMS-PS-08(S)	BEND DETAILS
12	HMS-PS-09	WYE, PLAN SECTIONS AND DETAILS
13	HMS-PS-10	WELDING DETAILS
14	HMS-PS-11	EXPANSION JOINT, PLAN, SECTIONS AND DETAILS
15	HMS-PS-12	PIPE SUPPORT, PLAN, SECTIONS AND DETAILS
16	HMS-PS-13	R.C. PIPE CULVERT
POWER HOUSE		
17	HMS-PH-22	DETAIL GATE AND FENCE



LOCATION MAP
NOT TO SCALE

LEGENDS :

- HIGHWAY
- STREAM
- DAM
- HEADRACE
- FOREBAY
- PENSTOCK
- POWERHOUSE
- EXISTING ROAD
- ACCESS ROAD
- BRIDGE

0 500 1,000 1,500
SCALE 1:20,000 METERS

KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUAI MAE SOT HYDROPOWER PROJECT			
CIVIL WORKS GENERAL LOCATION MAP			
MAHA NAKORN CONSULTANTS CO., LTD.		DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
DESIGNED	DATE 18.10.04	REVIEWED	DATE 18.10.04
DRAWN	DATE 18.10.04	SUBMITTED	DATE 18.10.04
CHECKED	DATE 18.10.04	RECOMMENDED	DATE 18.10.04
APPROVED	DATE 18.10.04	APPROVED	DATE 18.10.04
CONSULTANTS		DEDE	
PROJECT MANAGER		DATE	
HMS-GN-01		SHEET NO. 1 OF 39	

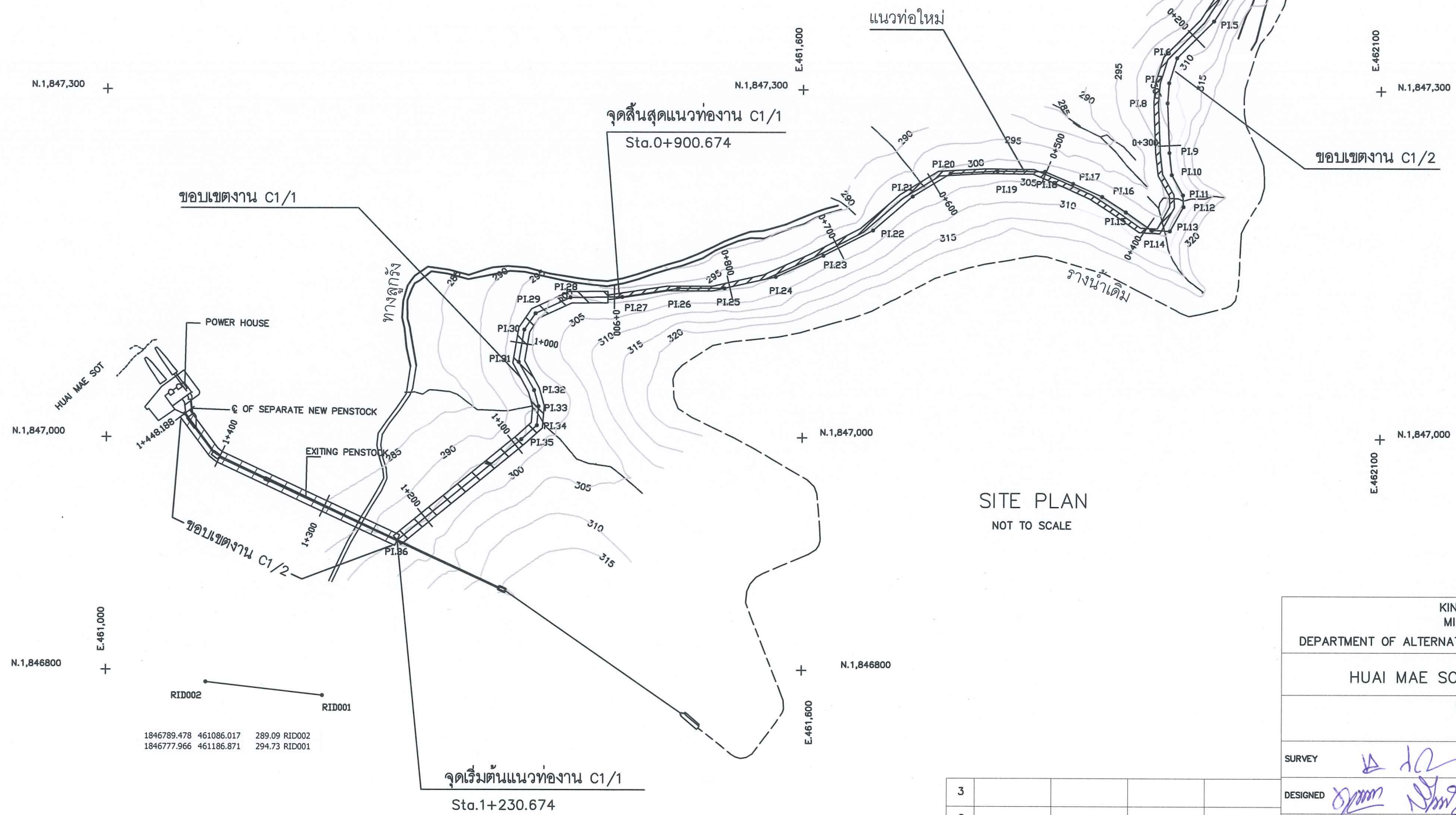


NOTES :

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

REFERENCE DRAWING

- 1. PENSTOCK NO. 1. PLAN AND PROFILE, STA. 0+000.000 TO STA.0+500.000
- 2. PENSTOCK NO. 2. PLAN AND PROFILE, STA. 0+500.000 TO STA.1+000.000
- 3. PENSTOCK NO. 3. PLAN AND PROFILE, STA. 1+000.000 TO STA.1+460.825



KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUA MAE SOT HYDROPOWER PROJECT			
CIVIL WORKS GENERAL SITE PLAN			
SURVEY	DESIGNED	DRAWN	CHECKED
REVIEWED	SUBMITTED	RECOMMENDED	APPROVED
DRAWING NO. HMS-GN-02(S)	SHEET NO. 2 OF 39		

ABBREVIATIONS :

A	CROSS-SECTION AREA OF FLOW	MAX.	MAXIMUM
AC.	ASBESTOS CEMENT PIPE	M.S.L.	MEAN SEA LEVEL
AGG.	AGGREGATE	MISC.	MISCELLANEOUS
ALT.	ALTERNATIVE	N.	NORTH
APPROX.	APPROXIMATE	n.	MANNING'S ROUGHNESS COEFFICIENT
AZ.	AZIMUTH	N.F.	NEAR FACE
B.	BEGINNING OF SURVEY	NGL.	NATURAL GROUND LEVEL
BC.	BEGINNING OF CURVE	NO. OR #	NUMBER
BF.	BOTTOM FACE	N.W.L.	NORMAL WATER LEVEL
B.	BEAM	OD.	OUTSIDE DIAMETER
B.M.	BENCH MARK	O.F.	OUTSIDE FACE
BOTT.	BOTTOM	O&M	OPERATION & MAINTENANCE
BRG.	BEARING	PC.	POINT OF HORIZONTAL CURVATURE
C.B.R.	CALIFORNIA BEARING RATIO	PI.	POINT OF HORIZONTAL INTERSECTION
C/C	CENTER TO CENTER	PL.	PLATE
CL.	CENTER LINE	P.O.C.	POINT ON CURVE
CL.	CLEARANCE	P.O.T.	POINT ON TANGENT
CM. OR cm.	CENTIMETER	P.O.S.T.	POINT ON SUB-TANGENT
CM./S OR cm./s	CENTIMETER PER SECOND	PRC.	POINT OF HORIZONTAL REVERSE CURVE
CCL.	COLUMN	PT.	POINT OF TANGENT
CONC.	CONCRETE	PVC.	POLYVINYL CHLORIDE
D.	DEGREE OF CURVE	PVC.	POINT OF VERTICAL CURVATURE
DB.	DEFORM BAR	PVI.	POINT OF VERTICAL INTERSECTION
d.	DEPTH OF WATER	PVRC.	POINT OF VERTICAL REVERSE CURVE
DIA. OR Ø	DIAMETER	PVT.	POINT OF VERTICAL TANGENT
DOH.	DEPARTMENT OF HIGHWAY	Q.	DISCHARGE
DWG.	DRAWING	QTY. QUAN.	QUANTITY
DEDE.	DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	R	RADIUS OF CURVATURE
E	EAST	r	HYDRAULIC RADIUS
E	END OF SURVEY	RØ, Ø	ROUND BAR
EA.	EACH	RC.	REINFORCED CONCRETE
E.C.	END OF CURVE	RD.	ROAD
E.F.	END OF FACE	REF.	REFERENCE
EL. OR ELEV.	ELEVATION	REINF.	REINFORCEMENT
EXIST.	EXISTING	REQ'D	REQUIRED
EXP.	EXPANSION	RID.	ROYAL IRRIGATION DEPARTMENT
EXT.	EXTERIOR	SCH.	SCHEDULE
EX.	EXTERNAL DISTANCE OF CURVE	SE.	SUPERELEVATION
f	FREE BOARD, FINISH	SETC.	SECTION
F.F.	FAR FACE	S.P.C.T.	STANDARD PROCTOR COMPACTION TEST
F.S.L.	FULL SUPPLY LEVEL	S.S.	SIDE SLOPE
FTG.	FOOTING	STR.	STRUT
HD.	HEAD	STA.	STATION
HEX.	HEXAGONAL	STD.	STANDARD
HOR.	HORIZONTAL	STR.	STRUCTURE
I.D.	INSIDE DIAMETER	SYMM.	SYMMETRICAL
I.F.	INSIDE FACE	T.	TANGENT LENGTH, THICKNESS
IN. OR "	INCH	T	TON
INT.	INTERIOR	THK.	THICKNESS
INV.	INVERT	T.F.	TOP FACE
Kg.	KILOGRAM	T.I.S.	THAI INDUSTRIAL STANDARD
Km.	KILOMETER	Ts	SUPERELEVATION TRANSITION LENGTH
KPH.	KILOMETER PER HOUR	TYP.	TYPICAL
KSC.	KILOGRAM PER SQUARE CENTIMETER	V.	VELOCITY OF FLOW
L	LENGTH OF CURVE	V.C.	VERTICAL CURVE
LC.	LENGTH OF HORIZONTAL CURVE	Vc.	LENGTH OF VERTICAL CURVE
LONG.	LONGITUDINAL	VER.	VERTICAL
LT.	LEFT	VOL.	VOLUME
L.W.L.	LOW WATER LEVEL	W/	WITH
M. OR m.	METER	W.C.	WATER CLOSET
M ² OR m ²	SQUARE METER	Ø	ANGLE
M ³ OR m ³	CUBIC METER	Δ	DEFLECTION ANGLE
MM. OR mm.	MILLIMETER		
M./S OR m./s	METER PER SECOND		
MIN.	MINIMUM		

SYMBOLS :

	TYPICAL NORTH ARROW
	CENTER LINE
	PAVED ROAD
	DIRT ROAD, LATITE 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 CONSTRUCTION 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 AMBIGUITY BETWEEN OR IN ANY OF THE DRAWINGS, IT IS THE CONTRACTOR'S RESPONSIBILITY TO CORRECT AND/OR ADJUST THE RELEVANT 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 CHAMFERED 2 cm. UNLESS OTHERWISE SHOWN.
- SLOPE IN CUT AND FILL SECTIONS, UNLESS OTHERWISE SHOWN, SHALL BE CONFORM TO THE FOLLOWING TABLE OR AS DIRECTED BY FIELD ENGINEER.

EXISTING GROUND SLOPE	EARTH		HARD ROCK	
	1:5	1:5	1:5	1:5
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

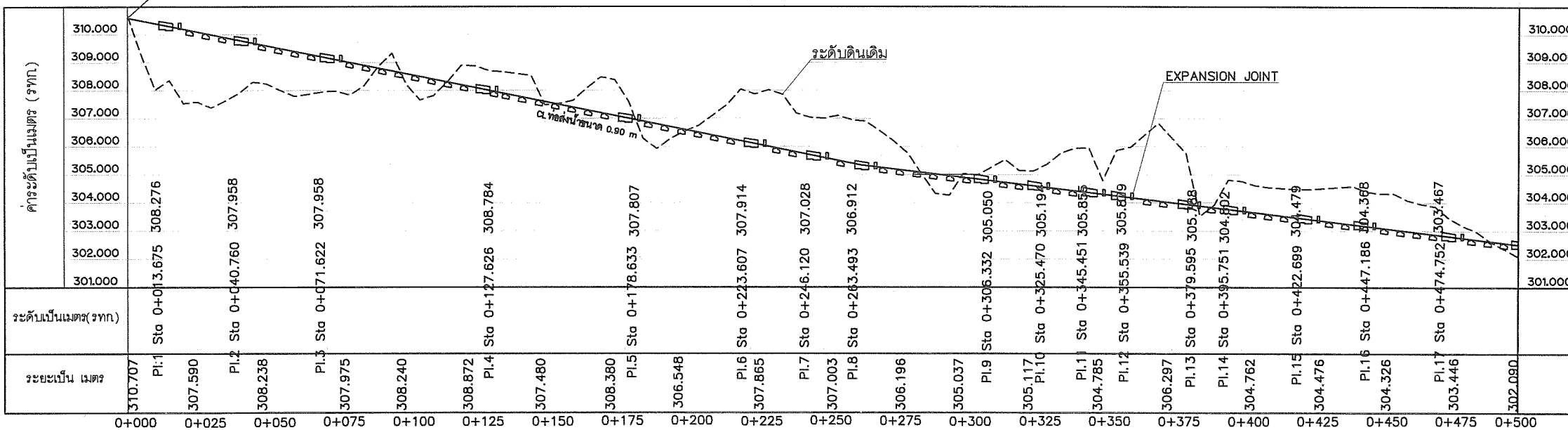
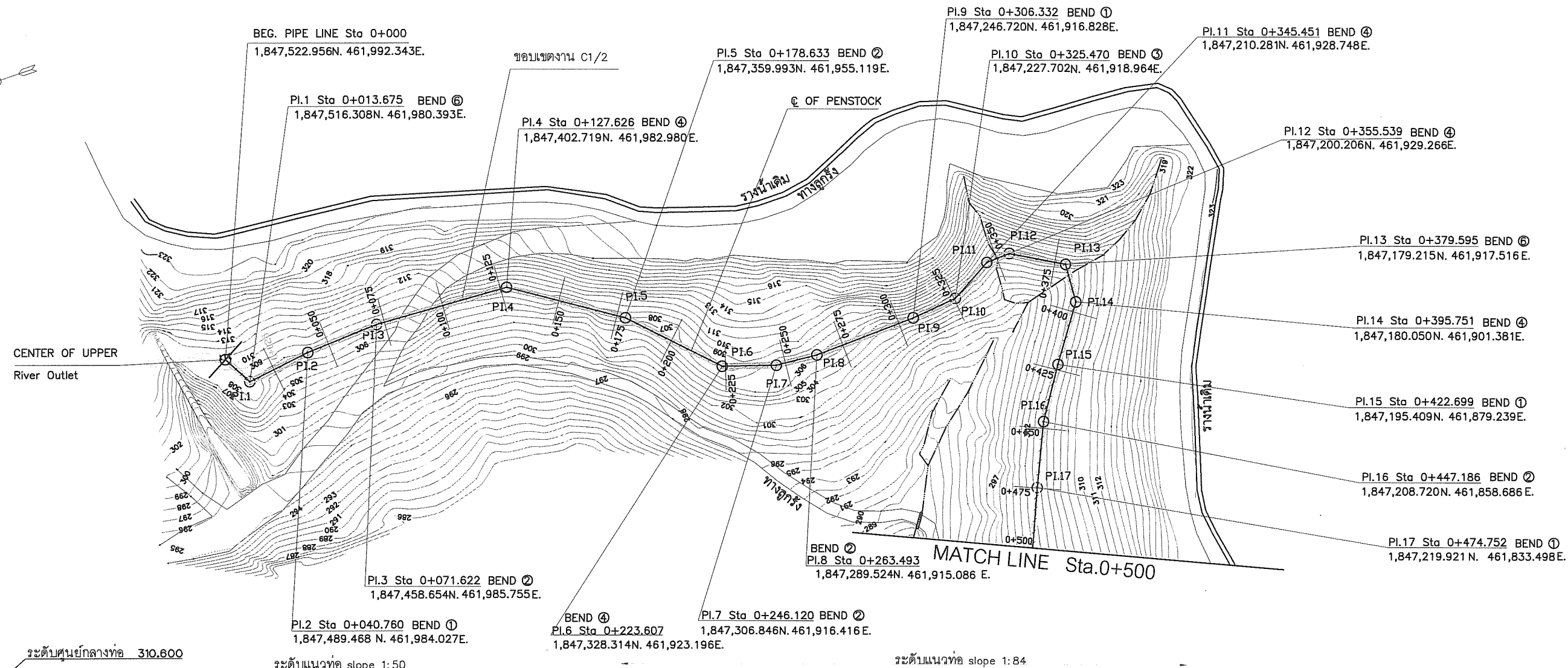
STRUCTURAL DESIGN NOTES :

- THE ULTIMATE COMPRESSIVE STRENGTH OF CONCRETE OF STANDARD CYLINDER (Ø150x300 mm) TEST AT AGE 28 DAYS SHALL BE AS THE FOLLOWING, UNLESS OTHERWISE SHOWN.

fc' (ksc)	DESCRIPTION
350	PRESTRESS CONCRETE
210	1. POWER HOUSE
	2. TAILRACE
175	1. ANCHOR
140	1. 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 SPICES 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. 24-2548
 - ROUND BARS (SR24) - T.I.S. 20-2543
- ALLOWABLE BEARING CAPACITY OF FOUNDATION SHALL NOT BE LESS THAN AS FOLLOW :
 - POWERHOUSE $Q_u = 15 \text{ T/M}^2$
 - PENSTOCK $Q_u = 20 \text{ T/M}^2$

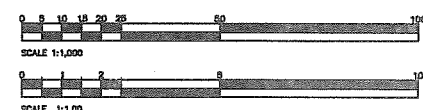
KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUA MAE SOT HYDROPOWER PROJECT			
CIVIL WORKS GENERAL SYMBOLS, ABBREVIATIONS AND GENERAL NOTES			
MAHA NAKORN CONSULTANTS CO., LTD.		DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
DESIGNED <i>Shin</i> REL10804	REVIEWED <i>Shin</i> REL10803	SUBMITTED <i>Shin</i> REL10803	RECOMMENDED <i>Shin</i> REL10803
DRAWN <i>Shin</i> REL10804	CHECKED <i>Shin</i> REL10804	APPROVED <i>Shin</i> REL10804	DATE <i>Shin</i> REL10804
NO.	DATE	REVISIONS	CHECKED
1			
2			
3			
CONSULTANTS	DEDE	PROJECT MANAGER	DATE
		HMS-GN-03	SHEET NO. 3 OF 39



หมายเหตุ
การวางท่อทั้งหมดจะต้องสำรวจกำหนดแนวก่อสร้างเพื่อพิจารณาการวางท่อบนดิน (pipe support) หรือวางท่อใต้ดิน (Encased steel pipe) โดยอยู่ในดุลยพินิจของผู้ควบคุมงาน

Pipe Support
Provide Pipe Support Spacing <6 m.,length

HORIZONTAL SCALE 1:1,000
VERTICAL SCALE 1:100



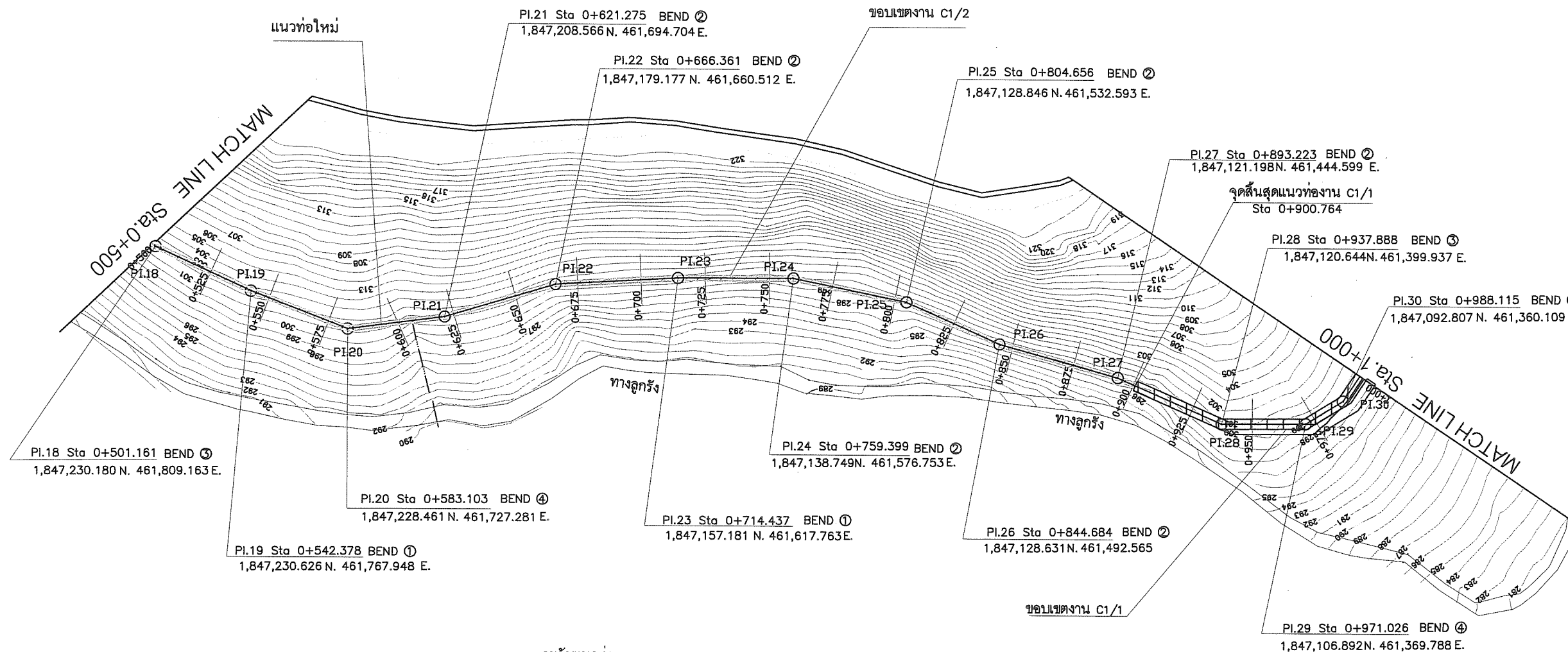
REFERENCE DRAWINGS :

1. ABBREVIATION SYMBOLS AND GENERAL NOTES
2. PENSTOCK NO.1 PLAN AND PROFILE, STA.0+000.000 TO STA.0+500.000
3. PENSTOCK NO.2 PLAN AND PROFILE, STA.0+500.000 TO STA.1+000.000
4. PENSTOCK NO.3 PLAN AND PROFILE, STA.1+000.000 TO STA.1+460.825

HMS-GN-03
HMS-PS-01
HMS-PS-02
HMS-PS-03

04

KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
HUA MAE SOT HYDROPOWER PROJECT	
PENSTOCK CIVIL WORKS	
NO.1, PLAN AND PROFILE, STA.0+000.000 TO STA.0+500.000	
SURVEY	REVIEWED
DESIGNED	SUBMITTED
DRAWN	RECOMMENDED
CHECKED	APPROVED
PROJECT MANAGER	DATE
DRAWING NO. HMS-PS-01(S)	
SHEET NO. 4 OF 39	

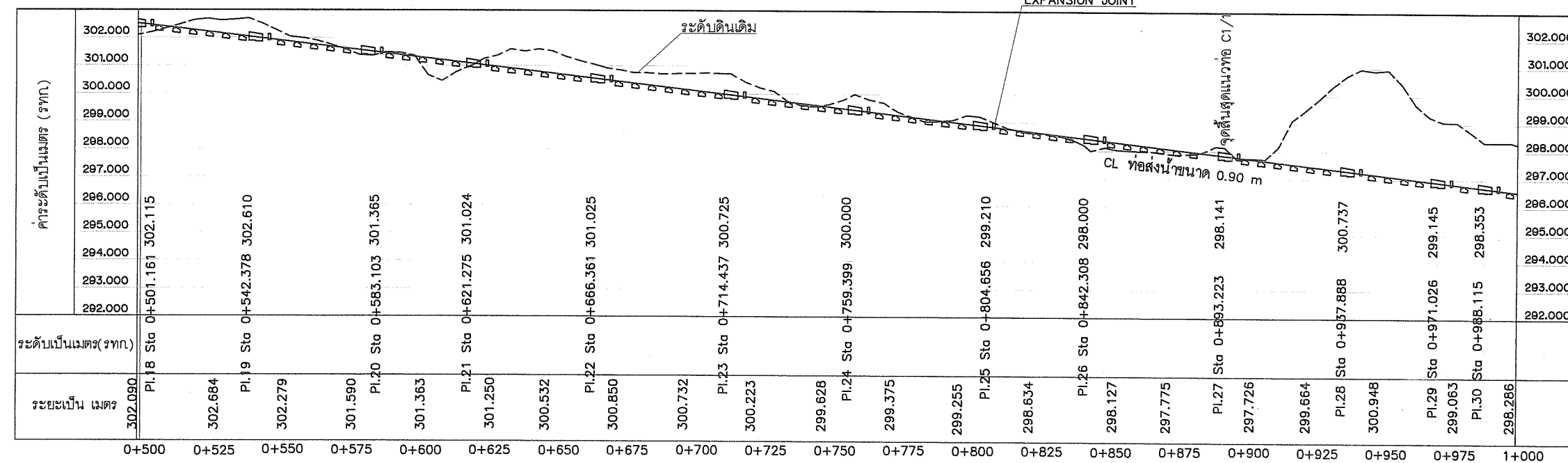


ระดับแนวท่อ slope 1:84

EXPANSION JOINT

ระดับดินเดิม

จุดสิ้นสุดแนวท่อ C1/1
CL ท่อส่งน้ำขนาด 0.90 m



หมายเหตุ

การวางท่อทั้งหมดจะต้องสำรวจกำหนดแนวก่อสร้างเพื่อพิจารณาการวางท่อนดิน (pipe support)

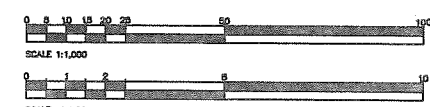
หรือวางท่อใต้ดิน (Encased steel pipe) โดยอยู่ในดุลยพินิจของผู้ควบคุมงาน

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4. PENSTOCK NO.3 PLAN AND PROFILE, STA. 1+000.000 TO STA. 1+460.825

HMS-GN-03
HMS-PS-01
HMS-PS-02
HMS-PS-03

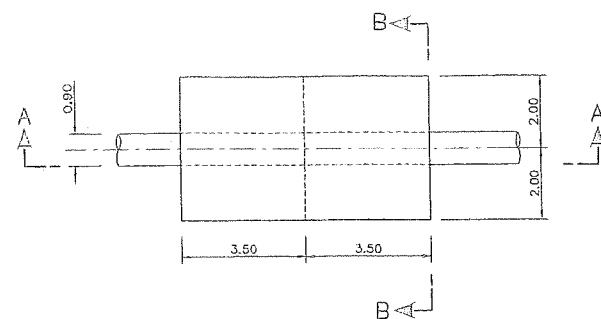
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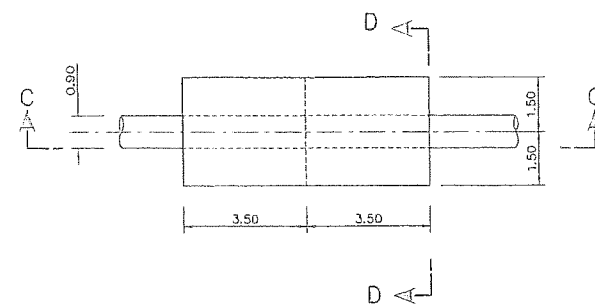
05

3				
2				
1				
NO.	DATE	REVISIONS	CHECK	APPROVE
		CONSULTANTS		DEDE

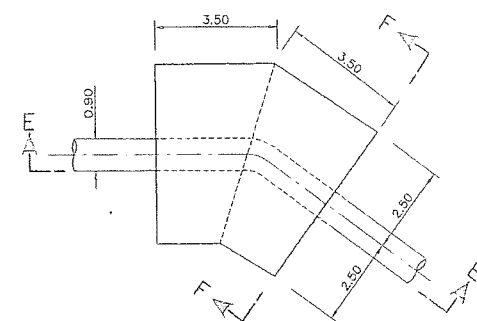
KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
HUA MAE SOT HYDROPOWER PROJECT	
PENSTOCK CIVIL WORKS NO.2, PLAN AND PROFILE, STA. 0+500.000 TO STA. 1+000.000	
SURVEY	REVIEWED
DESIGNED	SUBMITTED
DRAWN	RECOMMENDED
CHECKED	APPROVED
PROJECT MANAGER	DATE
DRAWING NO. HMS-PS-02(S)	SHEET NO. 5 OF 39



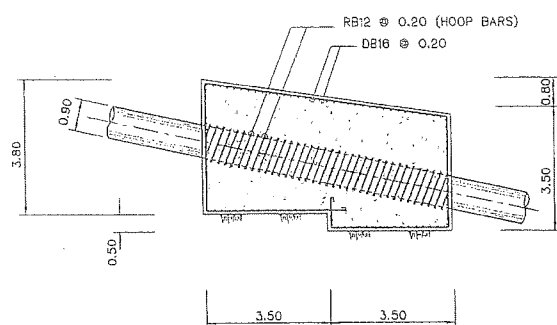
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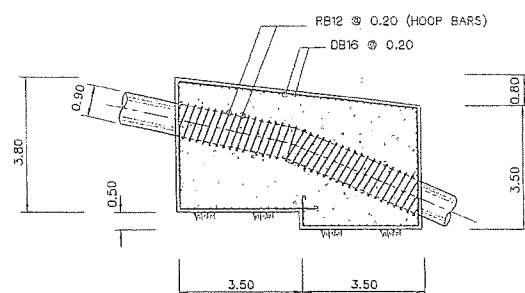
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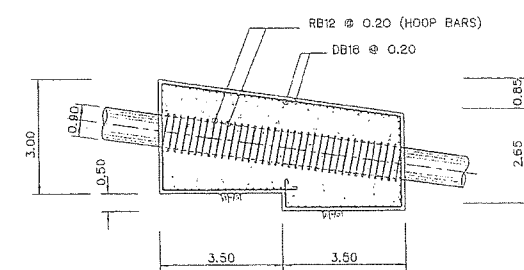
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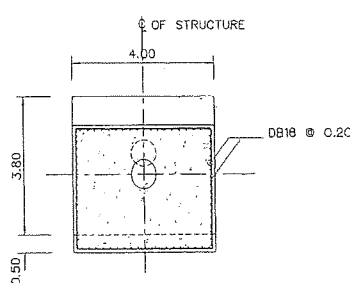
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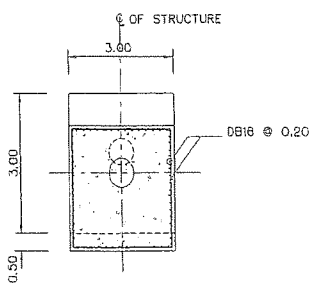
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SCALE 1:100



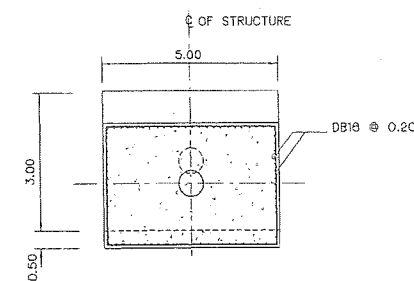
SECTION E-E
ANCHOR ③
SCALE 1:100



SECTION B-B
ANCHOR ①
SCALE 1:100



SECTION D-D
ANCHOR ②
SCALE 1:100

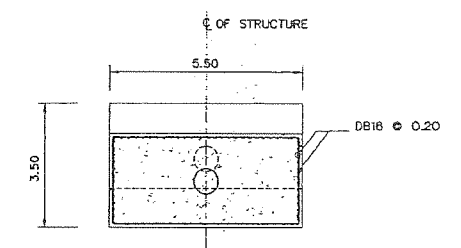
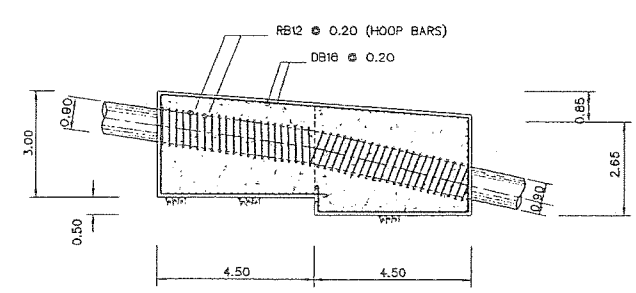
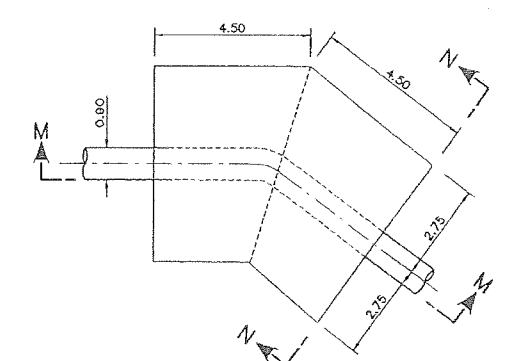
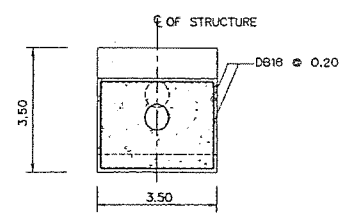
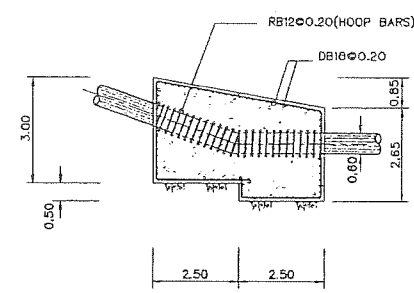
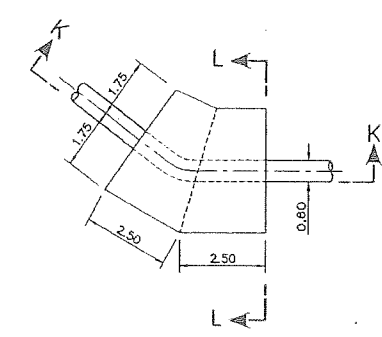
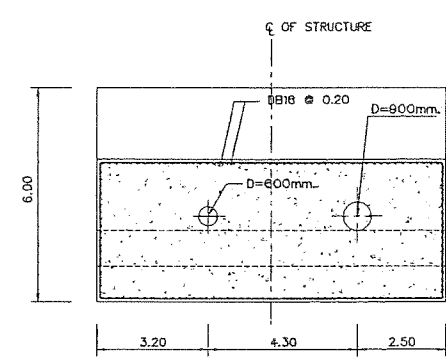
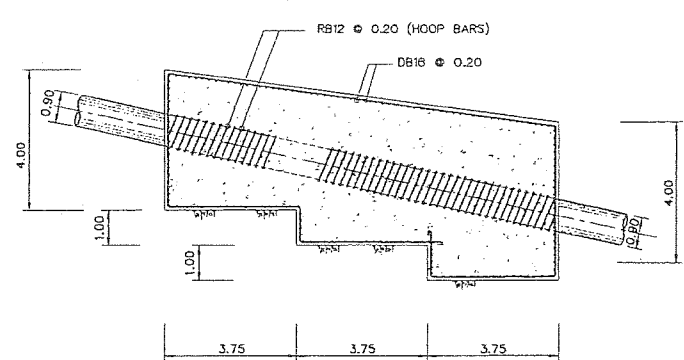
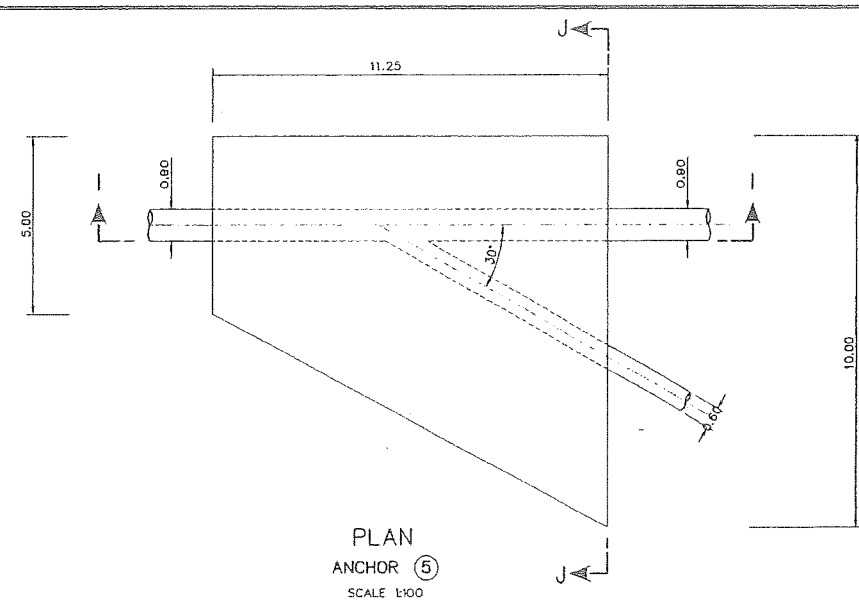
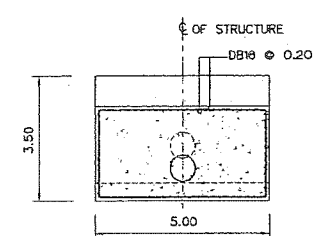
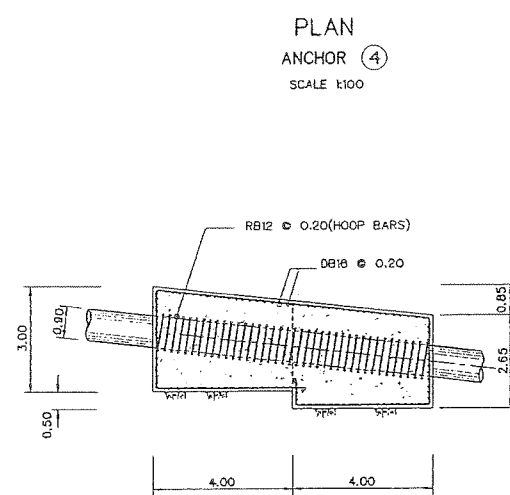
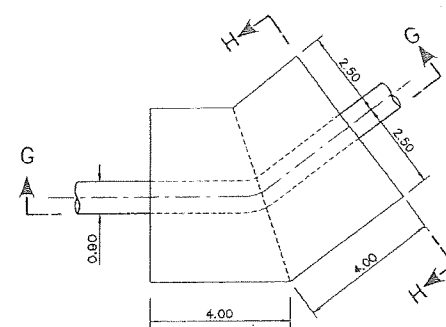


SECTION F-F
ANCHOR ③
SCALE 1:100

- NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
 2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HMS-GN-03
 3. CORROSIVE PROTECTION IS WARNED TO STRICTLY FOLLOW PAINTING SPECIFICATION

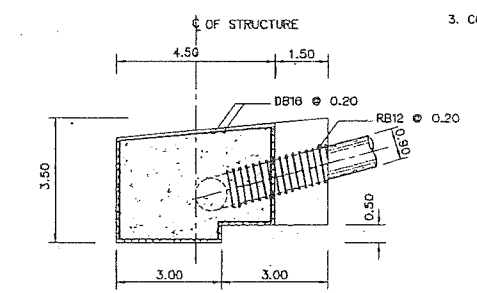
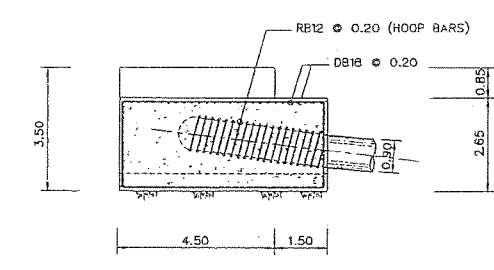
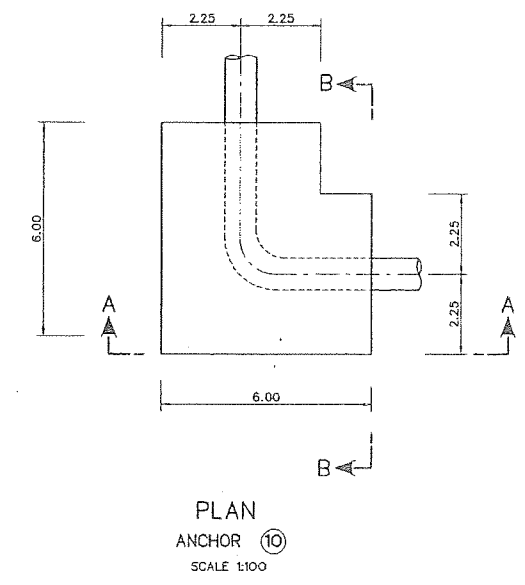
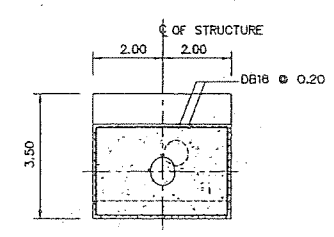
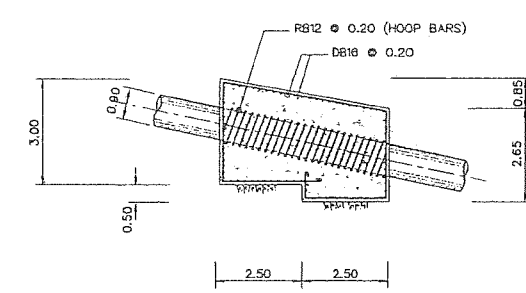
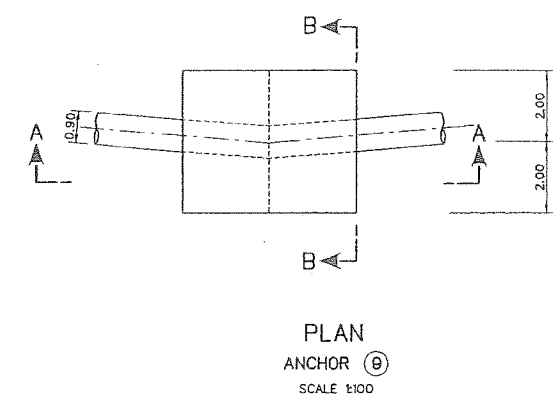
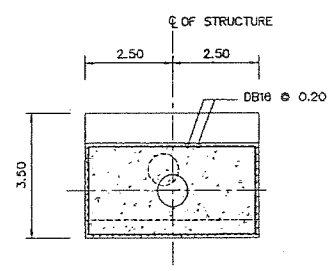
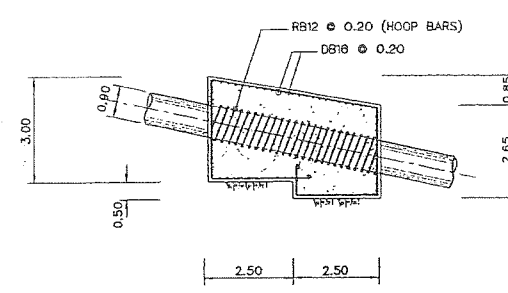
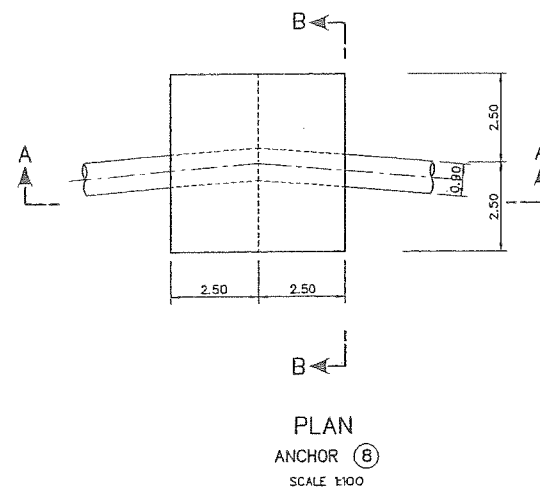
CONSULTANTS					DEDE				
3					3				
2					2				
1					1				
NO.	DATE	REVISIONS	CHECKED	APPROVED	NO.	DATE	REVISIONS	CHECKED	APPROVED
CONSULTANTS					DEDE				
PROJECT MANAGER					DATE				

KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
HUA MAE SOT HYDROPOWER PROJECT	
CIVIL WORKS PENSTOCK ANCHOR BLOCK NO. 1,2,3 PLAN AND SECTION	
DESIGNED BY: 011.49528	REVIEWED BY: 011.5063
DRAWN BY: 011.5220	RECOMMENDED BY: 011.5220
CHECKED BY: 011.5220	APPROVED BY: 011.5220
PROJECT MANAGER	SHEET NO. 7 OF 39



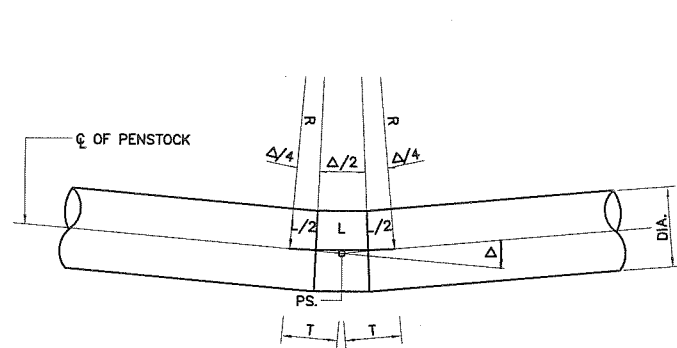
- NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
 2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HMS-GN-03
 3. CORROSIVE PROTECTION IS WARNED TO STRICTLY FOLLOW PAINTING SPECIFICATION

					Maha Nakorn Consultants Co.Ltd.		DEVELOPMENT AND EFFICIENCY	
3					DESIGNED	2014.05.20	REVIEWED	2014.05.20
2					DRAWN	2014.05.20	SUBMITTED	2014.05.20
1					CHECKED	2014.05.20	RECOMMENDED	2014.05.20
NO.	DATE	REVISIONS	CHECKED	APPROVED	CHECKED	DATE	APPROVED	DATE
CONSULTANTS					DEDE		PROJECT MANAGER	
							DRAWING NO. HMS-PS-05	
							SHEET NO. 8 OF 39	



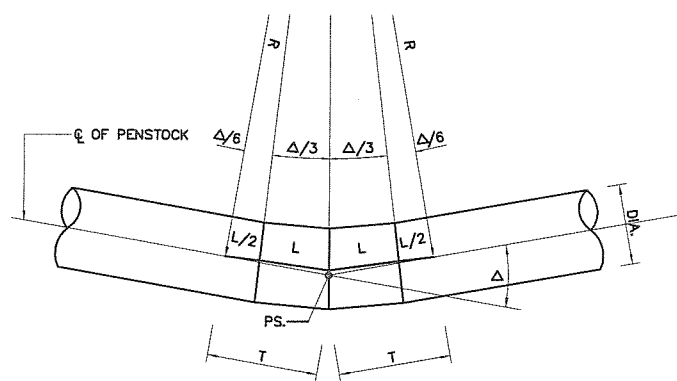
- NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
 2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HMS-GN-03
 3. CORROSIVE PROTECTION IS WARNED TO STRICTLY FOLLOW PAINTING SPECIFICATION

KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUAI MAE SOT HYDROPOWER PROJECT			
CIVIL WORKS PENSTOCK ANCHOR BLOCK NO. 8,9,10 PLAN AND SECTION			
MAHA NAKORN CONSULTANTS CO., LTD.		DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
DESIGNED	21.46520	21.5083	REVIEWED
DRAWN	21.5220	21.5220	SUBMITTED
CHECKED	21.5220	21.5220	RECOMMENDED
DATE	25.12.12	25.12.12	APPROVED
CONSULTANTS	DEDE	PROJECT MANAGER	SHEET NO. 8 OF 30



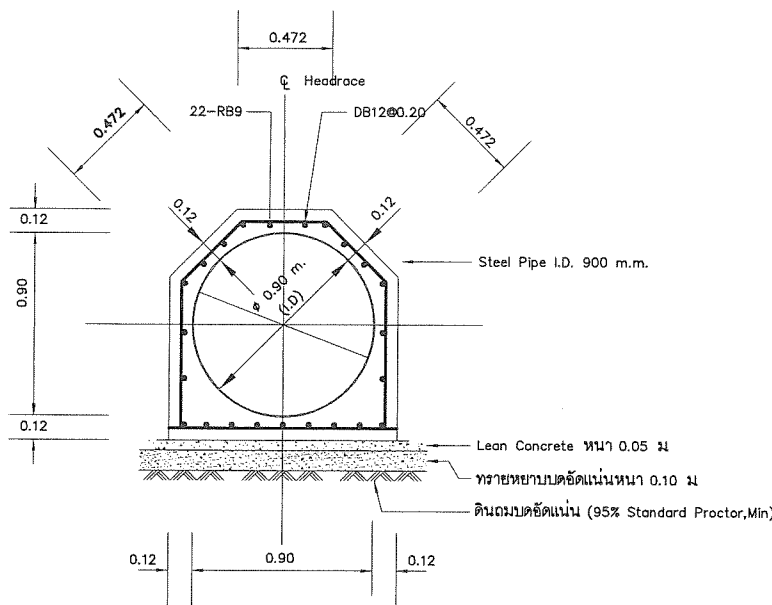
BEND TYPE "2"

DELTA(Δ) 5'-15'
SCALE 1:20

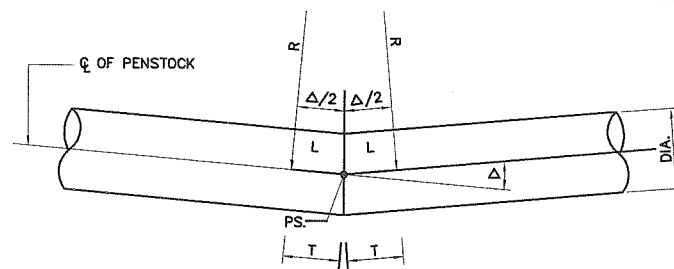


BEND TYPE "3"

DELTA(Δ) 15'-25'
SCALE 1:20

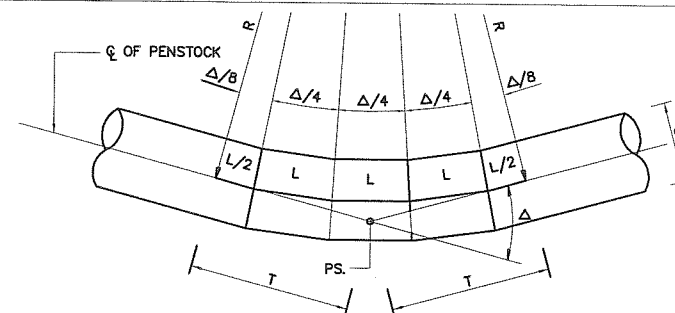


TYPICAL SECTION OF ENCASED STEEL PIPE
(แบบขยายท่อวางใต้ดิน)



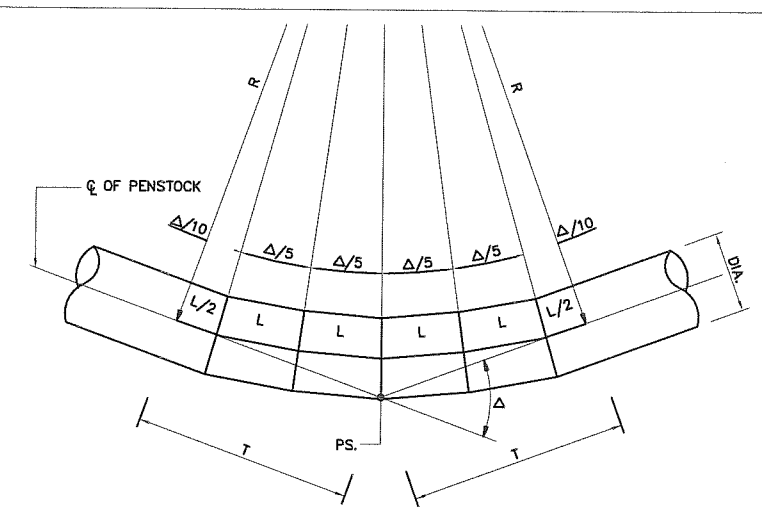
BEND TYPE "1"

DELTA(Δ) 0'-5'
SCALE 1:20



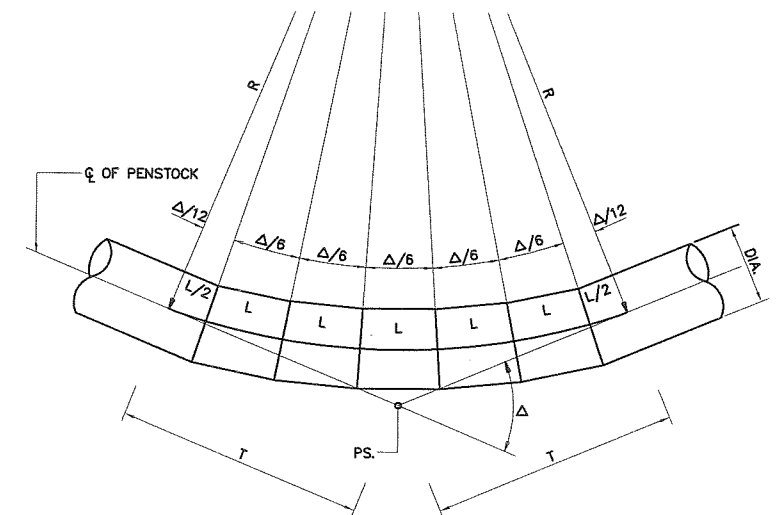
BEND TYPE "4"

DELTA(Δ) 25'-35'
SCALE 1:20



BEND TYPE "5"

DELTA(Δ) 35'-45'
SCALE 1:20



BEND TYPE "6"

DELTA(Δ) 45'-OVER
SCALE 1:20

DIMENSIONS OF BENDS

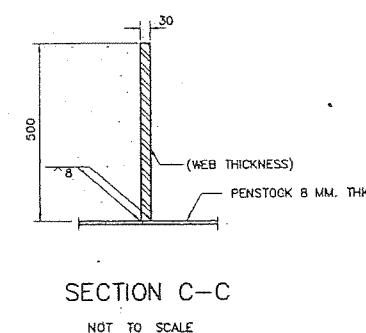
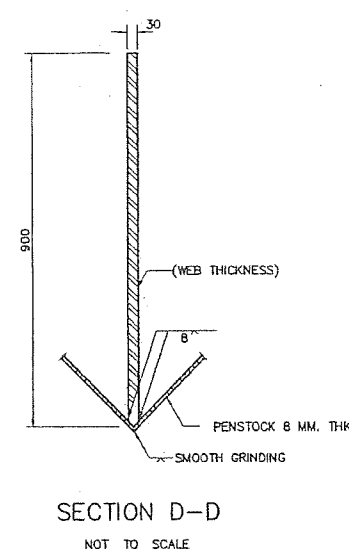
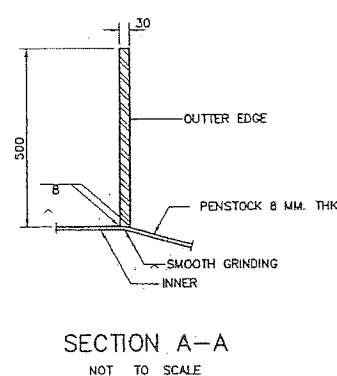
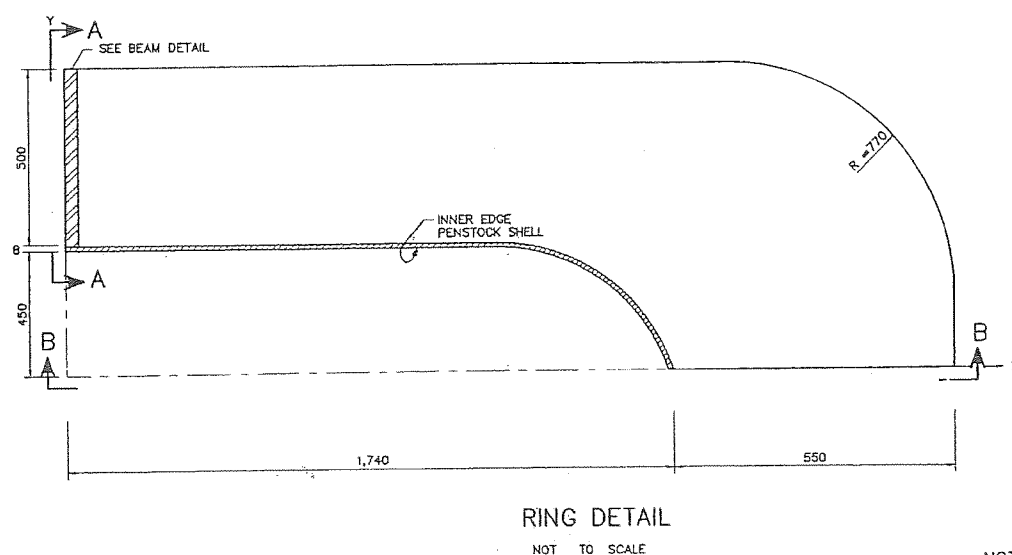
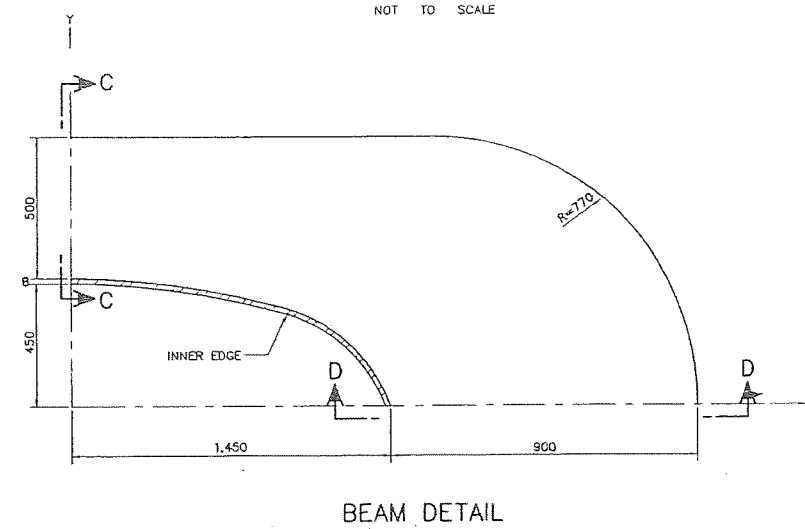
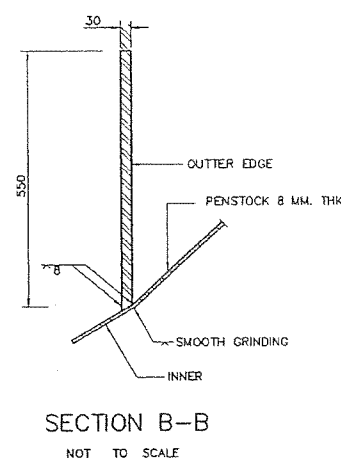
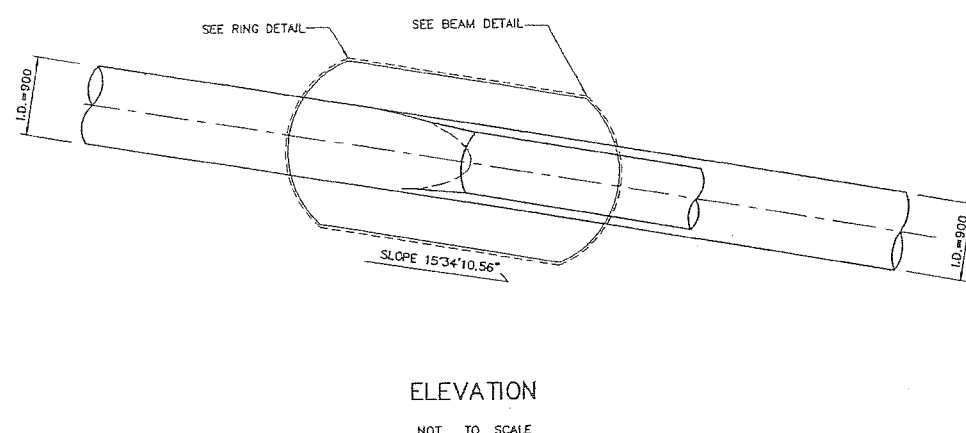
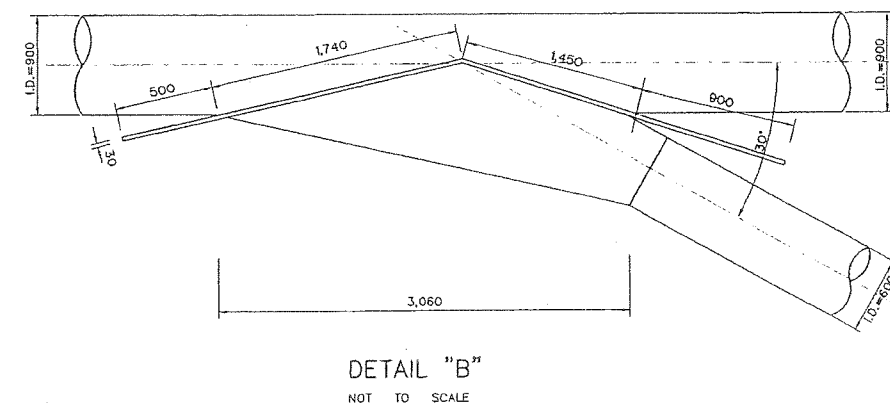
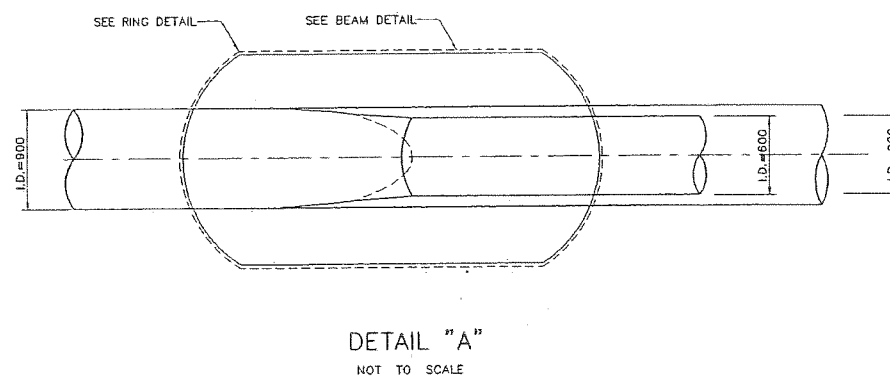
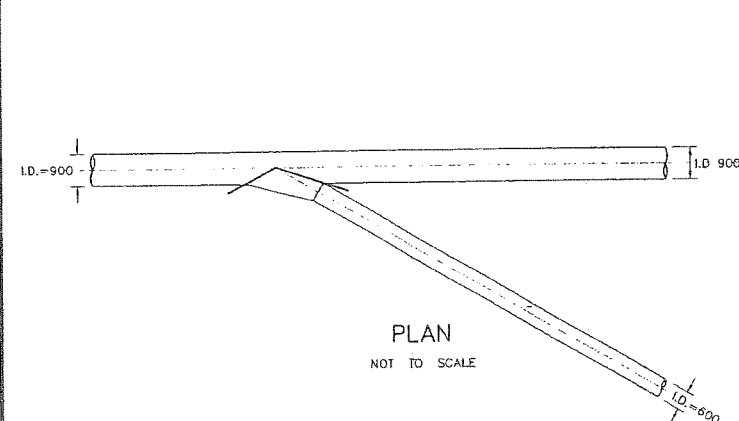
BEND NO.	PI NO.	KM. OF PI - PS	COORDINATE		Δ (DEGREE)	BEND TYPE	T (m.)	R (m.)	DIA. (m.)	Length Of Curve (m.)	THICKNESS (mm.)
			N	E							
BEG. PIPELINE	PI.0	0+000.000	1,847,522.956	461,992.343	-	-	-	-	0.90	-	7.9
1	PI.1	0+013.675	1,847,516.308	461,980.393	68°-37'-21.7"	6	0.450	0.659	0.90	0.759	7.9
2	PI.2	0+040.760	1,847,489.468	461,984.027	4°-30'-03.5"	1	0.100	2.545	0.90	0.200	7.9
3	PI.3	0+071.622	1,847,458.654	461,985.755	06°-02'-00.0"	2	0.450	8.539	0.90	0.899	7.9
4	PI.4	0+127.626	1,847,402.719	461,982.980	30°-16'-03.4"	4	0.450	1.664	0.90	0.879	7.9
5	PI.5	0+178.633	1,847,359.993	461,955.119	12°-06'-43.3"	2	0.450	4.242	0.90	0.897	7.9
6	PI.6	0+223.607	1,847,328.314	461,923.196	27°-41'-33.7"	4	0.450	1.826	0.90	0.882	7.9
7	PI.7	0+246.120	1,847,306.846	461,916.416	13°-08'-11.4"	2	0.450	3.908	0.90	0.896	7.9
8	PI.8	0+263.493	1,847,289.524	461,915.086	06°-43'-16.0"	2	0.450	7.663	0.90	0.899	7.9
9	PI.9	0+306.332	1,847,246.720	461,916.828	04°-04'-40.1"	1	0.100	2.809	0.90	0.200	7.9
10	PI.10	0+325.470	1,847,227.702	461,918.964	22°-54'-40.3"	3	0.450	2.221	0.90	0.888	7.9
11	PI.11	0+345.451	1,847,210.281	461,928.748	26°-22'-34.5"	4	0.450	1.920	0.90	0.884	7.9
12	PI.12	0+355.539	1,847,200.206	461,929.266	32°-10'-54.3"	4	0.450	1.560	0.90	0.876	7.9
13	PI.13	0+379.595	1,847,179.215	461,917.516	63°-43'-26.2"	6	0.450	0.724	0.90	0.805	7.9
14	PI.14	0+395.751	1,847,180.050	461,901.381	31°-47'-06.0"	4	0.450	1.581	0.90	0.877	7.9
15	PI.15	0+422.699	1,847,195.409	461,879.239	01°-49'-07.1"	1	0.100	6.300	0.90	0.200	7.9
16	PI.16	0+447.186	1,847,208.720	461,858.686	08°-57'-15.5"	2	0.450	5.747	0.90	0.898	7.9
17	PI.17	0+474.752	1,847,219.921	461,833.498	01°-06'-55.8"	1	0.100	10.272	0.90	0.200	7.9
18	PI.18	0+501.161	1,847,230.180	461,809.163	22°-14'-20.5"	3	0.450	2.290	0.90	0.889	7.9
19	PI.19	0+542.378	1,847,230.626	461,767.948	03°-40'-03.0"	1	0.100	3.124	0.90	0.200	7.9
20	PI.20	0+583.103	1,847,228.461	461,727.281	28°-21'-55.1"	4	0.450	1.781	0.90	0.882	7.9
21	PI.21	0+621.275	1,847,208.566	461,694.704	09°-16'-02.3"	2	0.450	5.552	0.90	0.898	7.9
22	PI.22	0+666.361	1,847,179.177	461,660.512	13°-27'-08.8"	2	0.450	3.816	0.90	0.896	7.9
23	PI.23	0+714.437	1,847,157.181	461,617.763	03°-01'-33.5"	1	0.100	3.786	0.90	0.200	7.9
24	PI.24	0+759.399	1,847,138.749	461,576.753	11°-33'-43.1"	2	0.450	4.445	0.90	0.897	7.9
25	PI.25	0+804.656	1,847,128.846	461,532.593	12°-19'-54.8"	2	0.450	4.165	0.90	0.897	7.9
26	PI.26	0+844.684	1,847,128.631	461,492.565	08°-30'-03.5"	2	0.450	6.055	0.90	0.898	7.9
27	PI.27	0+893.223	1,847,121.198	461,444.599	08°-05'-52.9"	2	0.450	6.357	0.90	0.899	7.9
28	PI.28	0+937.888	1,847,120.644	461,399.937	23°-48'-31.3"	3	0.450	2.135	0.90	0.887	7.9
29	PI.29	0+971.026	1,847,106.892	461,369.788	30°-59'-07.7"	4	0.450	1.623	0.90	0.878	7.9
30	PI.30	0+988.115	1,847,092.807	461,360.109	24°-56'-22.2"	3	0.450	2.035	0.90	0.886	7.9
31	PI.31	1+016.373	1,847,064.941	461,355.418	38°-13'-23.3"	5	0.450	1.299	0.90	0.866	7.9
32	PI.32	1+044.170	1,847,040.552	461,368.753	12°-58'-46.9"	2	0.450	3.956	0.90	0.896	7.9
33	PI.33	1+058.560	1,847,026.698	461,372.644	20°-24'-49.7"	3	0.450	2.499	0.90	0.890	7.9
34	PI.34	1+074.994	1,847,010.320	461,371.290	43°-20'-56.6"	5	0.450	1.132	0.90	0.857	7.9
35	PI.35	1+093.052	1,846,998.254	461,357.854	02°-43'-43.5"	1	0.100	4.199	0.90	0.200	7.9
36	PI.36	1+230.764	1,846,911.223	461,251.129	64°-24'-22.6"	6	0.450	0.715	0.90	0.803	7.9
37	PI.37	1+403.247	1,846,984.690	461,095.075	15°-11'-22.4"	3	0.450	3.375	0.90	0.895	7.9
38	PI.38	1+406.791	1,846,986.987	461,092.376	12°-43'-23.8"	2	0.450	4.036	0.90	0.896	7.9
39	PI.39	1+448.188	1,847,020.101	461,067.534	33°-17'-47.4"	4	0.450	1.505	0.90	0.875	7.9
40	END OF PIPELINE	1+460.825	1,847,032.500	461,065.149			0.450		0.90		7.9

0.5 1.0 1.5
SCALE 1:20 METERS

NOTES :

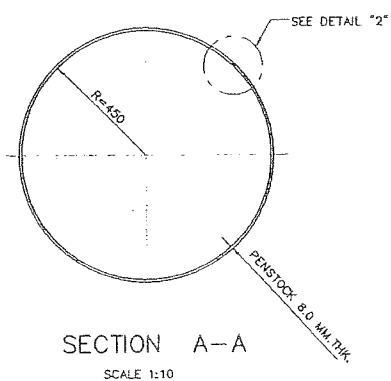
1. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HMS-GN-03

KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUA MAE SOT HYDROPOWER PROJECT			
PENSTOCK CIVIL WORKS BEND DETAILS			
SURVEY	DESIGNED	DRAWN	CHECKED
REVIEWED	SUBMITTED	RECOMMENDED	APPROVED
PROJECT MANAGER	DATE	DRAWING NO. HMS-PS-08 (S)	SHEET NO. 11 OF 39

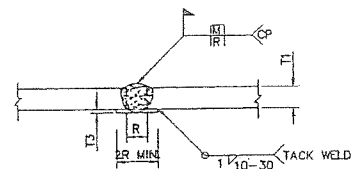


- NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
 2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HMS-GN-03

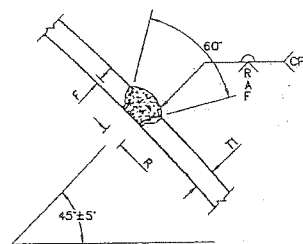
					KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
					HUAI MAE SOT HYDROPOWER PROJECT			
					CIVIL WORKS PENSTOCK WYE, PLAN, SECTIONS AND DETAILS			
					MAHA NAKORN CONSULTANTS CO., LTD.			
					DESIGNED BY N18.10804			
					DRAWN BY N18.10804			
					CHECKED BY N18.10804			
					APPROVED BY N18.10804			
					PROJECT MANAGER			
					DATE			
					HMS-PS-09			
					SHEET NO.			
					12 OF 39			



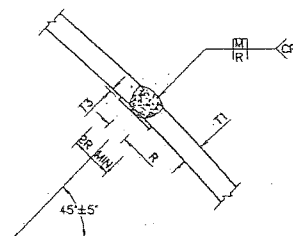
ELEVATION
SCALE 1:10



CIRCULAR BUTT JOINT
DETAIL "1"



LONGITUDINAL BUTT JOINT
TYPE "A"



LONGITUDINAL BUTT JOINT (ALTERNATIVE)
TYPE "B"

DETAIL "2"

WELDING SYMBOLS

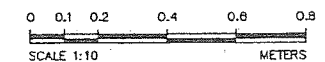
WELDING SYMBOLS										
FIELD WELD SYMBOL	WELD - ALL - AROUND SYMBOL	SQUARE GROOVE WELDING SYMBOL R=ROOT OPENING	V-GROOVE WELDING SYMBOL R=ROOT OPENING A=GROOVE ANGLE F=ROOT FACE	BACKING SYMBOL (MATERIAL OF BACKING THE SAME AS OF PIPE)	COMPLETE JOINT PENETRATION WELD	FILLET WELD S=WELDING SIZE L=LENGTH OF WELD P=PITCH (CENTER TO CENTER OF WELD)	BACK OR BACKING WELD SYMBOL	COMBINED WELDS. BACKING WELD ON FAR SIDE AND V-GROOVE WELD ON NEAR SIDE	BEVEL GROOVE WELDING SYMBOL	FLARE-BEVEL GROOVE WELDING SYMBOL

[illegible]

SMAW = SHIELD METAL ARC WELDING
 GMAW = GAS METAL ARC WELDING
 FCAW = FLUX CORED ARC WELDING

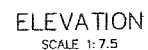
TYPE	WELDING PROCESS	DESIGNATION	BASE METAL THICKNESS		GROOVE PREPARATION			TOLERANCES			REMARKS
			T1	T3	ROOT OPENING	GROOVE ANGLE	ROOT FACE	R	A	F	
A	SMAW	B-U2	8.0	-	R = 2.0	A = 60°	F = 1.5	+1.0,-0	+5°,-0°	+1.5,-0	SINGLE-PASS WELD
	SMAW	B-U2	8.0	-	R = 2.0	A = 60°	F = 2.0	+1.0,-0	+5°,-0°	+1.5,-0	SINGLE-PASS WELD
B	SMAW	B-L1a-GF	8.0	1.0	R = 6.0	-	-	+1.0,-0	-	-	SINGLE-PASS WELD
	GMAW FCAW	B-L1a-GF	8.0	1.0	R = 9.0	-	-	+1.0,-0	-	-	SINGLE-PASS WELD

1. ALL DIMENSION ARE IN MILLIMETER, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTE SEE DWG. NO. HMS-GN-03
3. GROOVE WELD MADE AFTER WELDING OTHER SIDE
4. USE WELDING ELECTRODE TYPE "E" 70XX
5. MATERIAL OF BACKING IS THE SAME AS OF PIPE



KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUAI MAE SOT HYDROPOWER PROJECT			
CIVIL WORKS PENSTOCK WELDING DETAILS			
 MAHA NAKORN CONSULTANTS CO., LTD.		DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
DESIGNED <i>aw</i> NE19804 <i>aw</i> NE15083		REVISED <i>aw</i> <i>aw</i>	
DRAWN <i>aw</i>		SUBMITTED <i>aw</i> <i>aw</i>	
CHECKED <i>aw</i>		RECOMMENDED	
PROJECT MANAGER <i>aw</i> 25 Feb 58		APPROVED <i>aw</i>	
DATE		DRAWING NO. HMS-PS-10	
		SHEET NO. 13 OF 39	

3						DESIGNED <i>gaw</i> <i>21.10.04</i> <i>gaw</i> <i>21.10.05</i>	REVIEWED <i>gaw</i> <i>21.10.05</i>	
2						DRAWN <i>gaw</i> <i>21.10.05</i>	SUBMITTED <i>gaw</i> <i>21.10.05</i>	
1						CHECKED <i>gaw</i> <i>21.10.05</i>	RECOMMENDED <i>gaw</i> <i>21.10.05</i>	
NO.	DATE	REVISIONS	CHECKED	APPROVED		CHECKED <i>gaw</i> <i>21.10.05</i>	APPROVED <i>gaw</i> <i>21.10.05</i>	
		CONSULTANTS		DEDE		PROJECT MANAGER	HMS-PS-10	SHEET NO. 13 OF 39

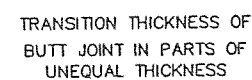


NOTES :

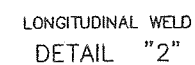
1. LONGITUDINAL SEAMS HAVE TO BE COMPLETE JOINT PENETRATION
WELDS BY COMBINING SINGLE-V-GROOVE WITH BACKING WELDS AND
GROUND FLUSH WELDING WITH BASE METAL AS REQUIRED (SEE DETAIL "2")
2. GALVANIZED ALL SURFACES WITH 0.10 mm. THK.
3. NICKEL CLADDING ON OUTER SURFACE WITH 0.50 mm. THK.
AND GALVANIZED INNER SURFACE WITH 0.10 mm. THK.
4. EACH JOINT OF EACH PACKING RING SHALL BE MIN. 25 cm. APART
DO NOT LINE UP JOINTS
5. ALL DIMENSION ARE IN MILLIMETER UNLESS OTHERWISE SHOWN
6. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. HMS-GN-03
7. MATERIAL GRADE CAN BE CHANGE AS SHOWN IN CHAP 8 OF CONTRACT C1 VOL.2

WELDING NOTATION :

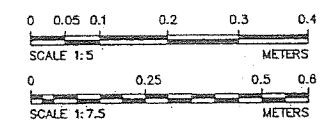
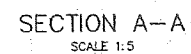
CP = COMPLETE JOINT PENETRATION GROOVE WELD
G = GRINDING WELD DEPOSITE FLUSH WITH BASE METAL
• = BACKING PLATE SIZE 0.10x1.50 mm. AND SAME MATERIAL AS PENSTOCK
⊙ = BEVEL PLATE 9 mm. BEFORE ROLLING CHIP SQUARE AFTER WELDING
Δ = ROOT OPENING R = 2.0 mm.
ROOT FACE t = 3.0 mm.
GROOVE ANGLE = 45°
⊞ = ROOT OPENING R = 2.0 mm.
ROOT FACE t = 2.0 mm.
GROOVE ANGLE = 60°



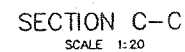
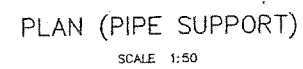
DETAIL "1"
NOT TO SCALE



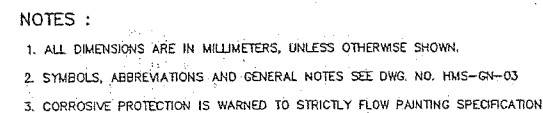
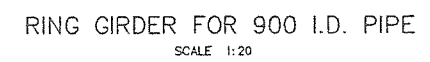
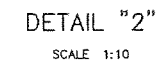
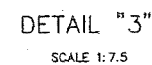
NOT TO SCALE

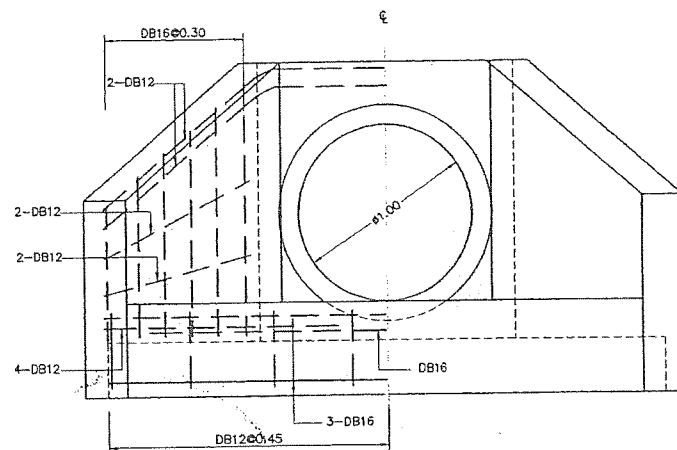
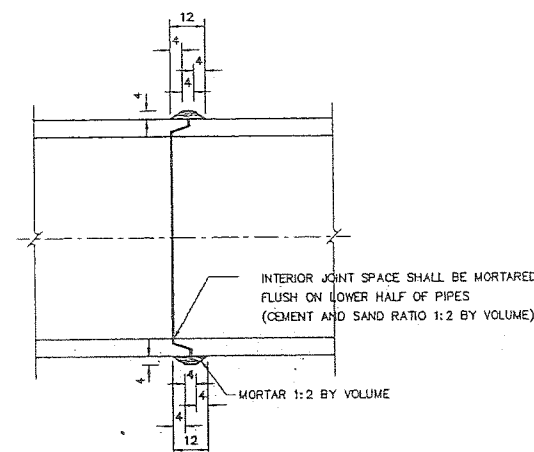
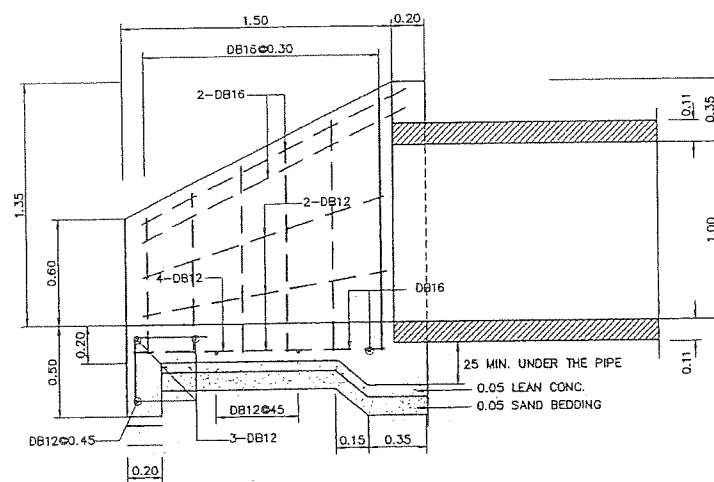
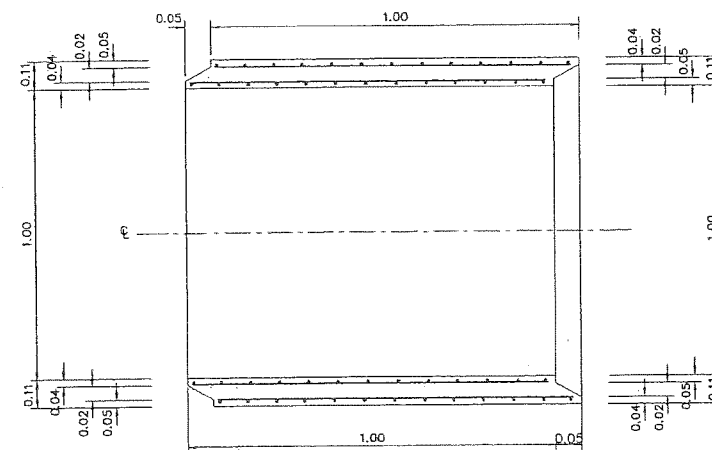
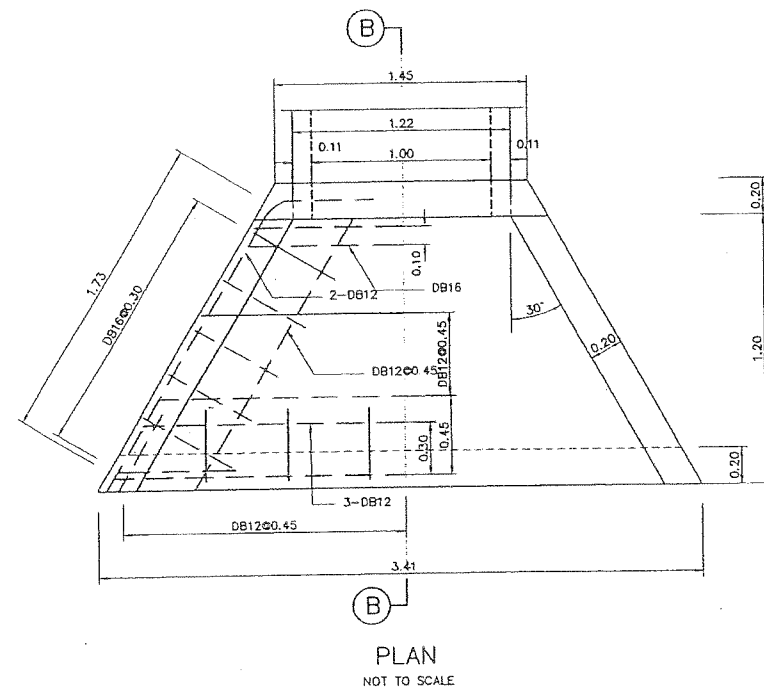


KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
HUAL MAE SOT HYDROPOWER PROJECT	
CIVIL WORKS PENSTOCK EXPANSION JOINT, PLAN, SECTIONS AND DETAILS	
 MAHA NAKORN CONSULTANTS CO., LTD.	DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY
DESIGNED & DRAWN <i>101.10804</i> <i>101.10803</i>	REVIEWED <i>101.10804</i>
DRAWN <i>101.10804</i>	SUBMITTED <i>101.10804</i>
CHECKED <i>101.10804</i> <i>101.10804</i>	RECOMMENDED <i>101.10804</i>
PROJECT MANAGER <i>101.10804</i> <i>101.10804</i>	APPROVED <i>101.10804</i>
DATE <i>101.10804</i>	DRAWING NO. <i>101.10804</i>
	SHEET NO. <i>101.10804</i>



TYPICAL OF PENSTOCK TRENCH





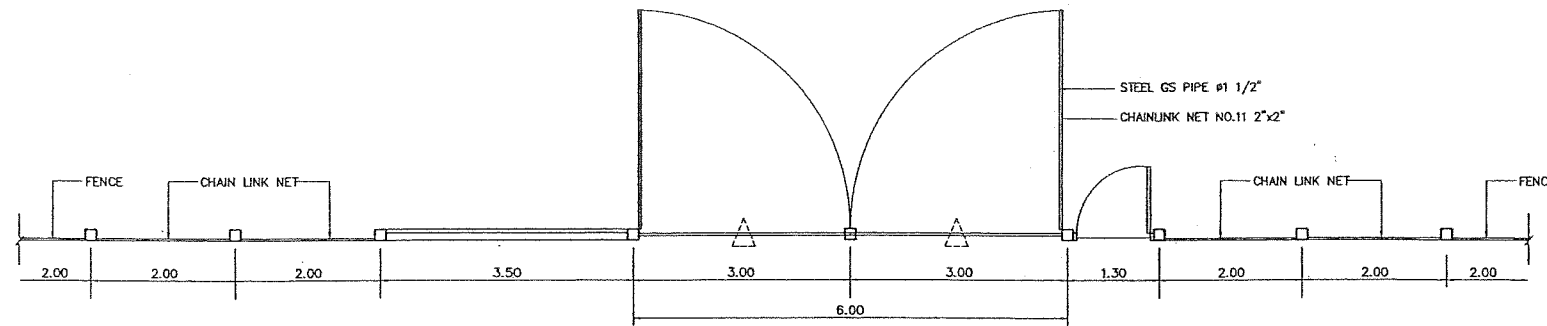
NOTES :

- ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED.
- REINFORCED CONCRETE PIPE CULVERT CLASSES 2 AND 3 SHALL CONFORM TO TIS.128 OR EQUIVALENT.
- CEMENT, STEEL REINFORCEMENT, AGGREGATES AND TEST METHODS USED FOR R.C. PIPE CULVERT SHALL CONFORM TO THE REQUIREMENT OF TIS.128 OR EQUIVALENT.
 - CEMENT CONTENT USED FOR CONCRETE MIX SHALL NOT BE LESS THAN 335 KILOGRAM PER CUBIC METER OF CONCRETE.
 - CONCRETE COVER FOR SINGLE LAYER CIRCULAR REINFORCEMENT SHALL BE 0.35 TO 0.5 TIME OF WALL THICKNESS (MEASURED FROM INNER WALL).
 - CONCRETE COVER FOR DOUBLE LAYERS CIRCULAR REINFORCEMENT SHALL BE 2.5 CM. IN AVERAGE BUT NOT LESS THAN 1.5 CM.
 - LONGITUDINAL REINFORCEMENT SPACING SHALL BE A MINIMUM OF 8-64 MM. BARS.
 - CIRCULAR REINFORCEMENT SPACING SHALL BE 15 CM. OR LESS BUT NOT MORE THAN WALL THICKNESS.
- THE CULVERT WHICH HAVING TRANSVERSE REINFORCEMENT IN ELLIPTICAL CAGE AS SPECIFIED IN THE TIS. 128 SHALL NOT BE USED.
- CULVERT JOINTS SHALL BE MORTARED AS SHOWN ON THE DRAWING WITH CEMENT MORTAR (1:2 BY VOLUME)
- FOR R.C. HEADWALL
 - CONCRETE SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 210 KSC. FOR 15x15x15 CM. CUBE AT 28 DAY AN APPROXIMATE MIX DESIGN PER CUBIC METER IS SUGGESTED AS FOLLOWS:

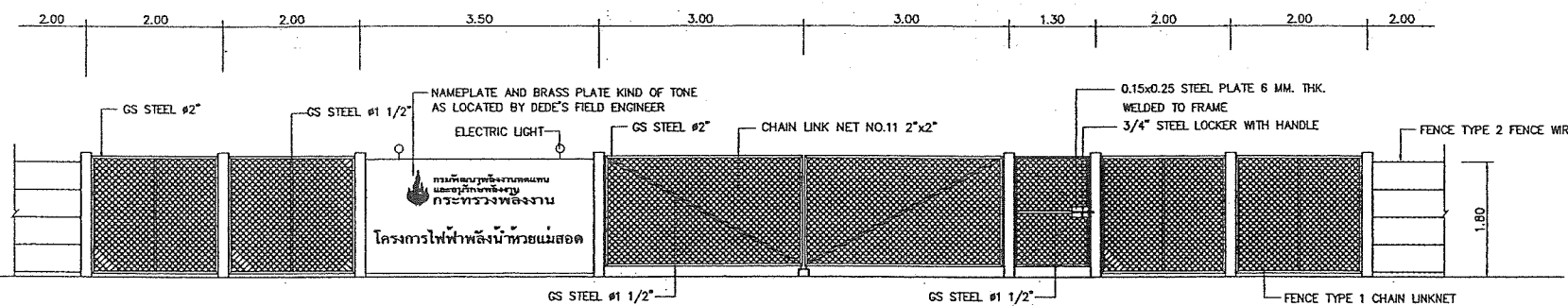
PORTLAND CEMENT TYPE 1	350	KG. (MIN)
SAND	0.43	M ³
CRUSHED ROCK OR GRAVEL	0.86	M ³
CONCRETE SLUMP	10	CM. (MAC.)
 - REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO TIS.24 GRADE SD 30
 - DESIGN WORKING STRESSES :-
 - CONCRETE, $f_c = 70$ KSC.
 - STEEL, $f_s = 1400$ KSC. $n = 10$
- THIS DRAWING IS ADAPTED FROM DOH DWG NO.DS-101,DS-104

DETAILS FOR RC. PIPE CULVERT NOT TO SCALE

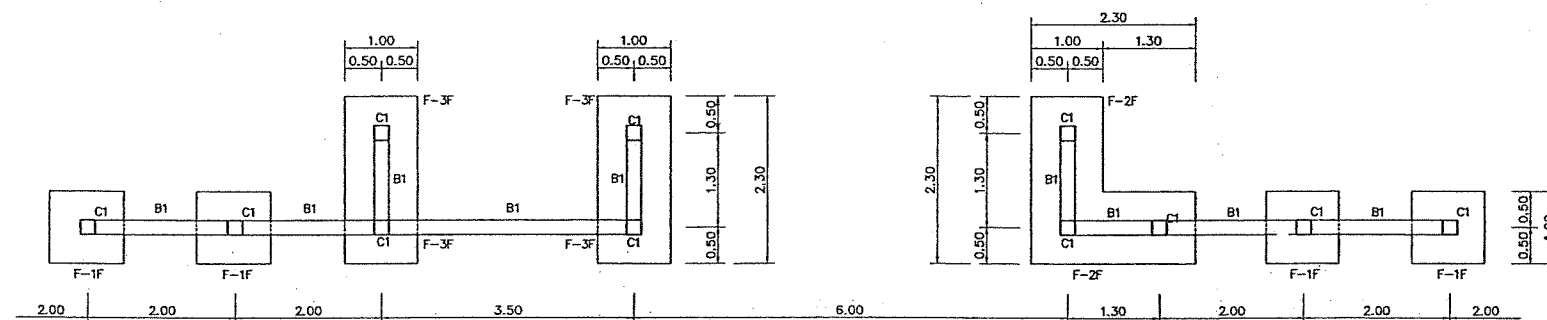
KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUA MAE SOT HYDROPOWER PROJECT			
CIVIL WORKS PENSTOCK R.C. PIPE CULVERT			
MAHA NAKORN CONSULTANTS CO.,LTD.		DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
DESIGNED	25.16804	25.15083	REVIEWED
DRAWN	25.15083	25.15083	SUBMITTED
CHECKED	25.15083	25.15083	RECOMMENDED
APPROVED	25.15083	25.15083	APPROVED
PROJECT MANAGER	DATE	HMS-PS-13	SHEET NO.



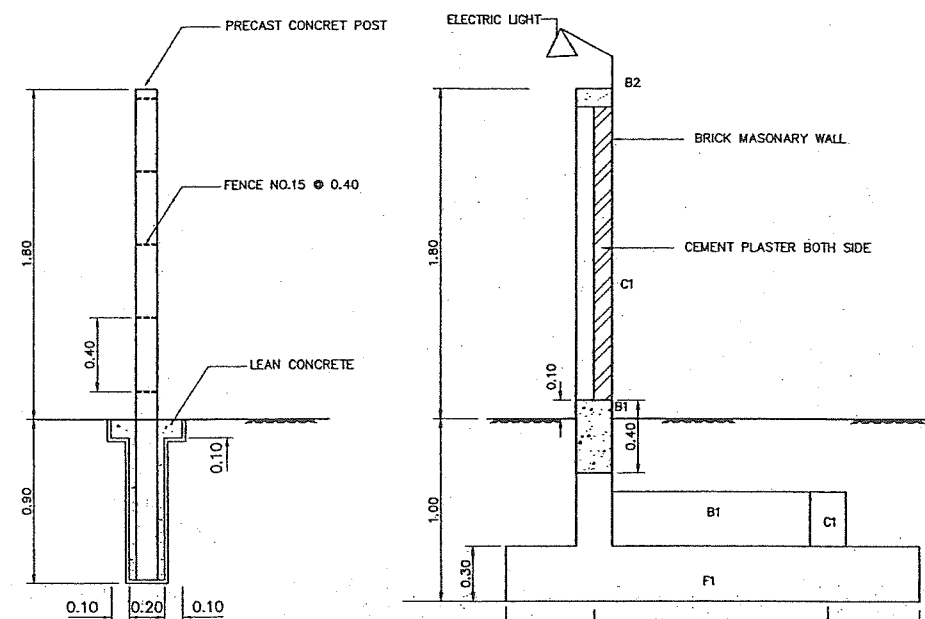
PLAN
SCALE 1:50



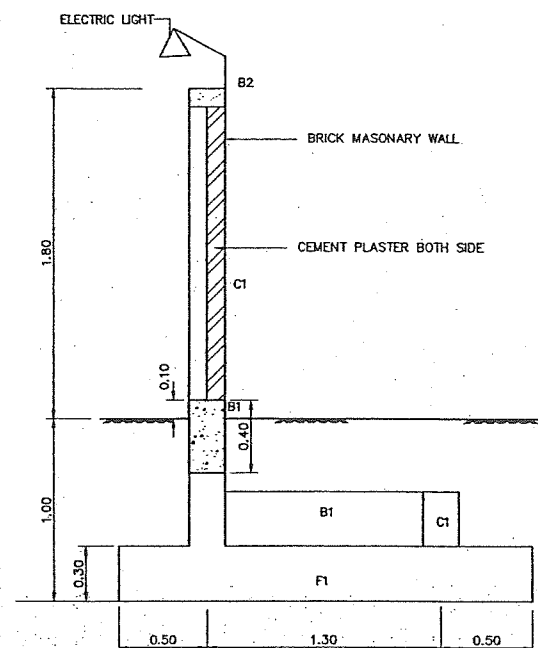
FRONT ELEVATION GATE AND FENCE FOR ENTRANCE
SCALE 1:50



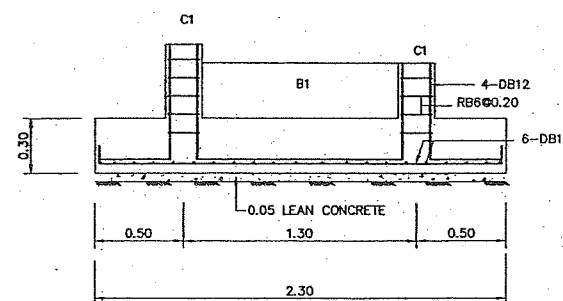
PLAN R.C. BEAM & COLUMN
SCALE 1:50



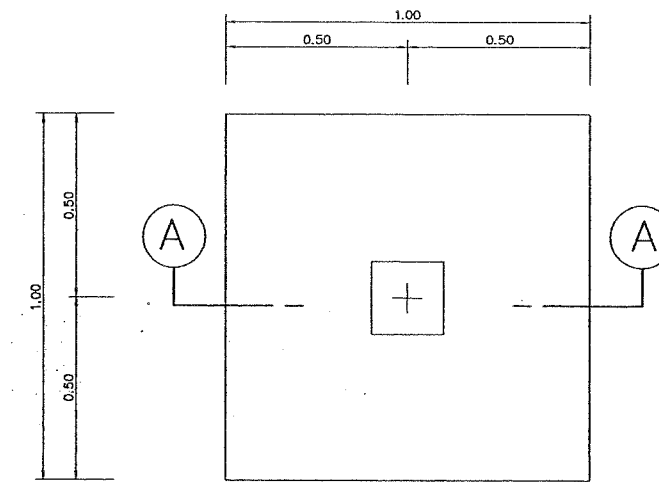
SECTION FENCE & PRECAST CONCRETE POST
SCALE 1:20



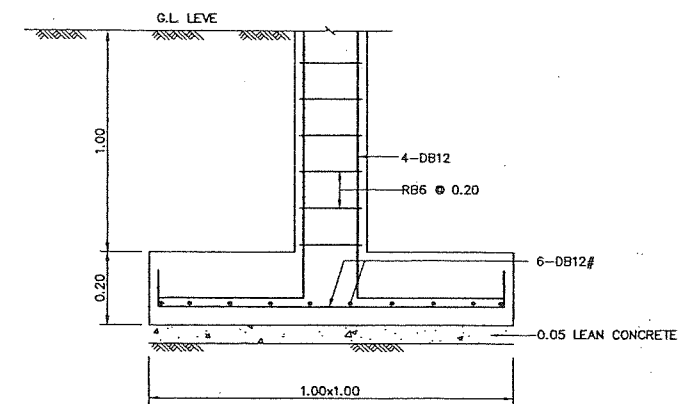
SECTION
SCALE 1:20



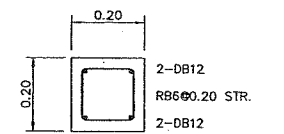
SECTION F-2F, F-3F
SCALE 1:20



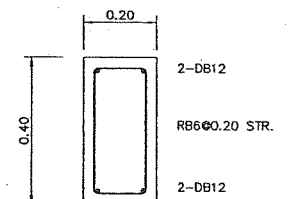
F-1F
SCALE 1:10



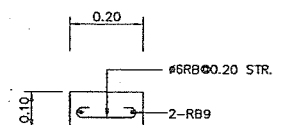
SECTION A-A
SCALE 1:10



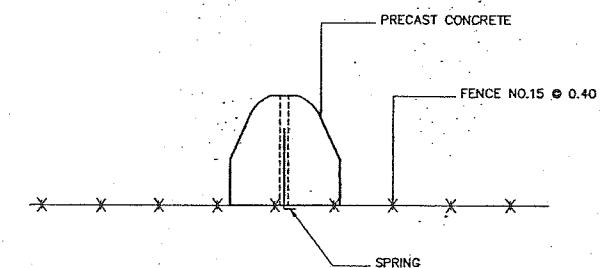
C1
SCALE 1:10



B1
SCALE 1:10



B2
SCALE 1:10



FENCE POST
SCALE 1:10

KINGDOM OF THAILAND MINISTRY OF ENERGY DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY			
HUA MAE SOT HYDROPOWER PROJECT			
CIVIL WORKS POWER HOUSE DETAIL GATE AND FENCE			
MAHA NAKORN CONSULTANTS CO., LTD.		DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY	
DESIGNED	2512533	REVIEWED	2515063
DRAWN	2515220	SUBMITTED	2515063
CHECKED	2515220	RECOMMENDED	2515063
APPROVED	2515220	APPROVED	2515063
PROJECT MANAGER	DATE	DRAWING NO.	SHEET NO.
		HMS-PH-22	38 OF 39