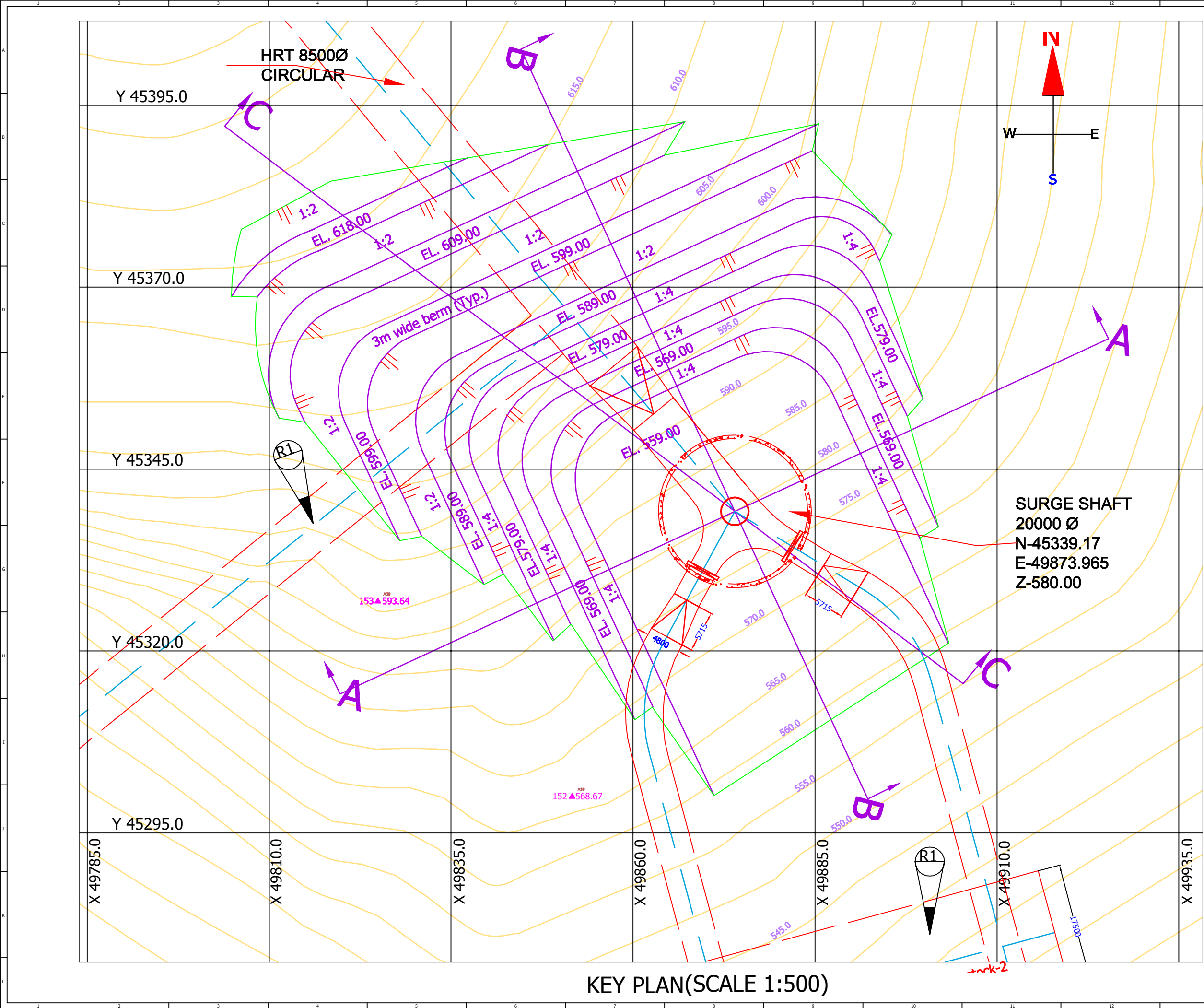




NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS.& ELEVATIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.

2. NO DIMENSSIONS SHALL BE SCALED OUT ONLY WRITTEN DIMENSSIONS ARE TO BE TAKEN AS CORRECT.

FOR DETAILED PROJECT REPORT ONLY

CONNECTED DRAWING

DRG. NO.

TITLE

DRG.NO.PL-WP-DPR03/00

PROJECT LAYOUT PLAN

REVISION HISTORY

R1

Dec-2012

1

Add to Surge Shaft bottom moved by 35.12m towards u/s of HRT

2

Butterfly Valve House moved by 20m towards d/s of surge shaft

SCALE 1:500

0

500

1000

1500

2000

SHEET 1 OF 3

एसजेवीएन लिमिटेड
SJVN Limited

वांग्चू जलविद्युत परियोजना मूटान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

WATER CONDUCTOR SYSTEM
SURGE SHAFT
OPEN EXCAVATION PLAN & SECTIONS

अभिवादन
DSGN. ER. KULDIP GARG

अनुमोदित
CHKD. ER. ASHOK KAPIL

अनुमोदित
APPD. ER. L.M. VERMA

अभिवादन
DSGN. ER. KULDIP GARG

अनुमोदित
CHKD. ER. M.S. THAKUR

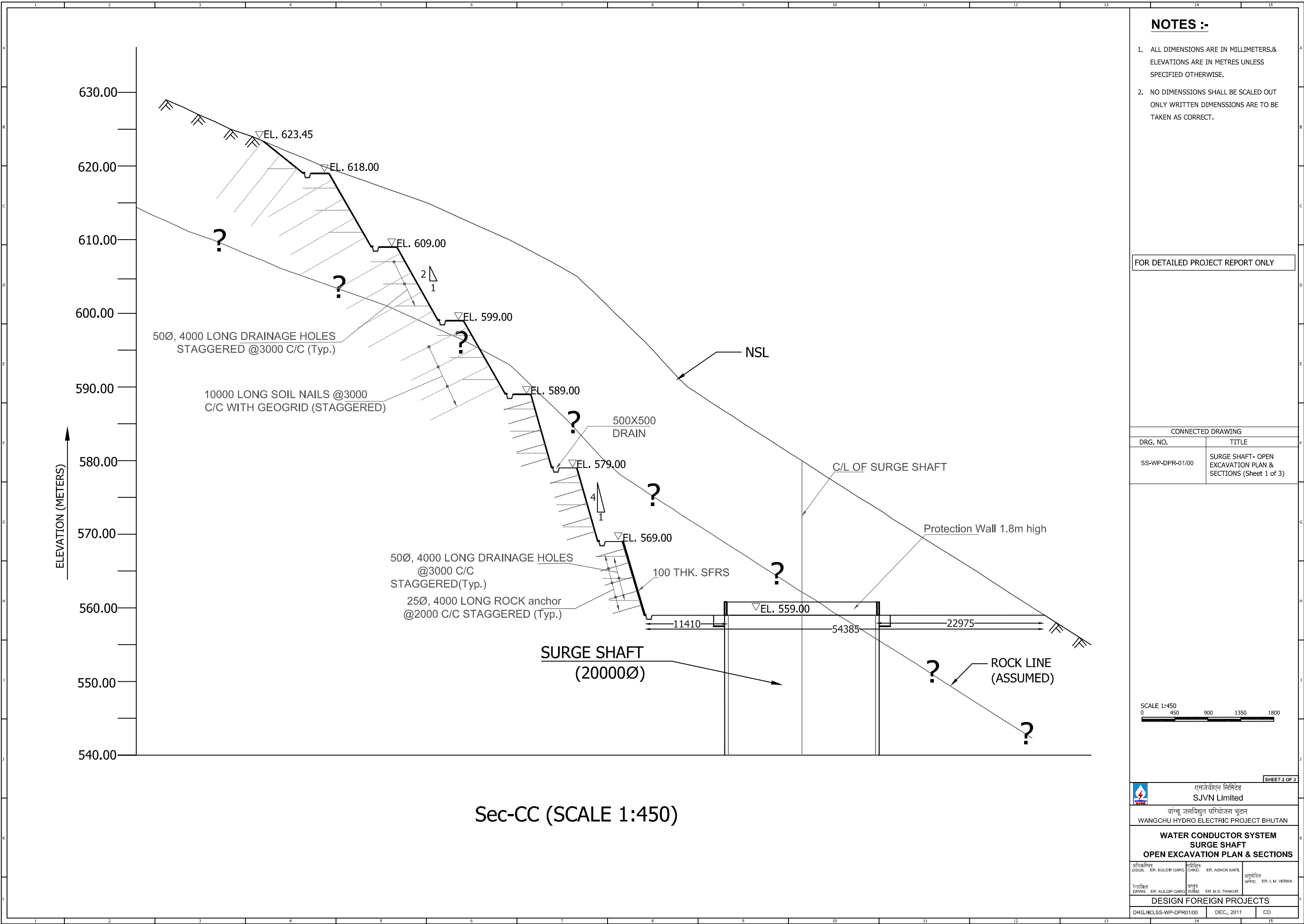
अनुमोदित
APPD. ER. L.M. VERMA

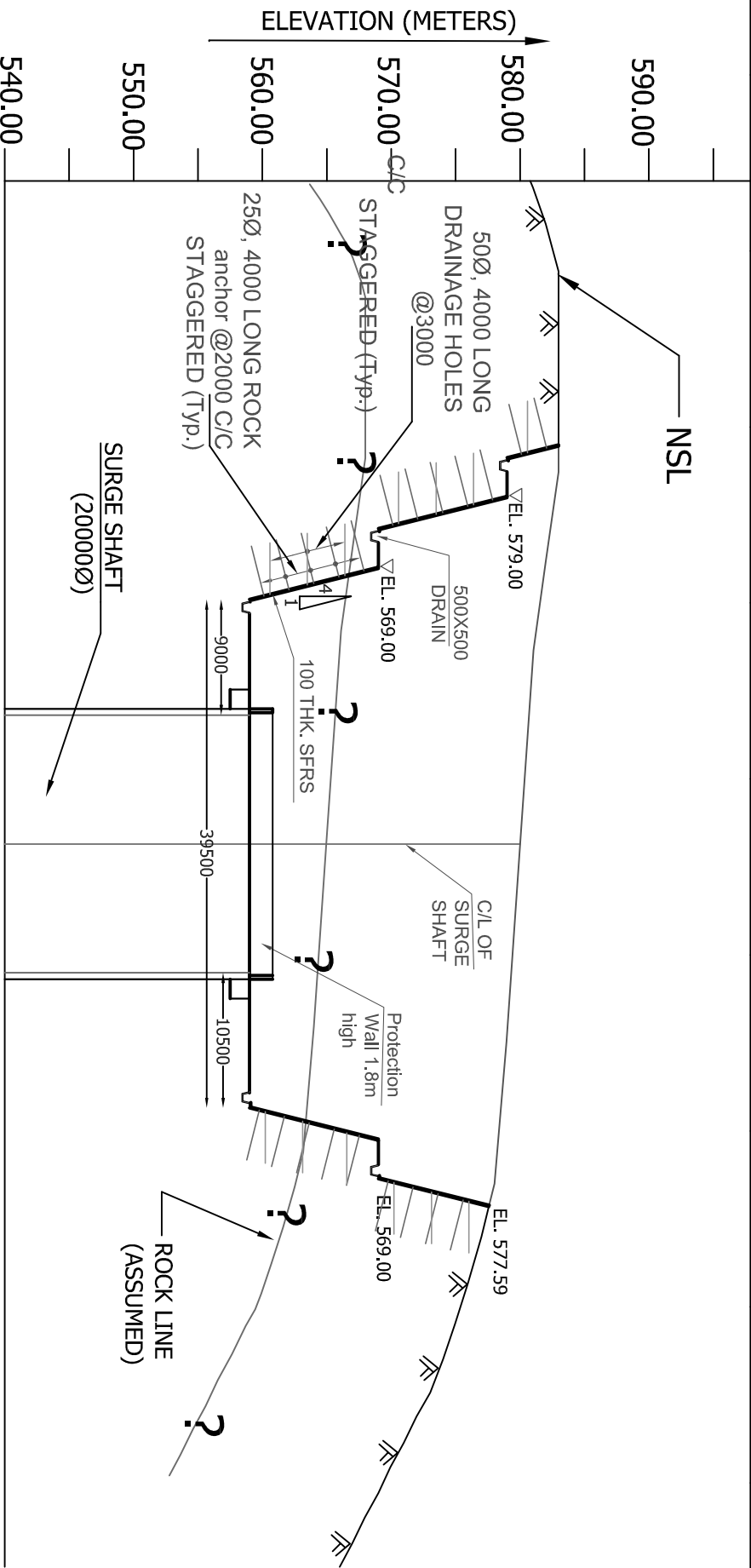
DESIGN FOREIGN PROJECTS

DRG.NO.SS-WP-DPR01/R-1

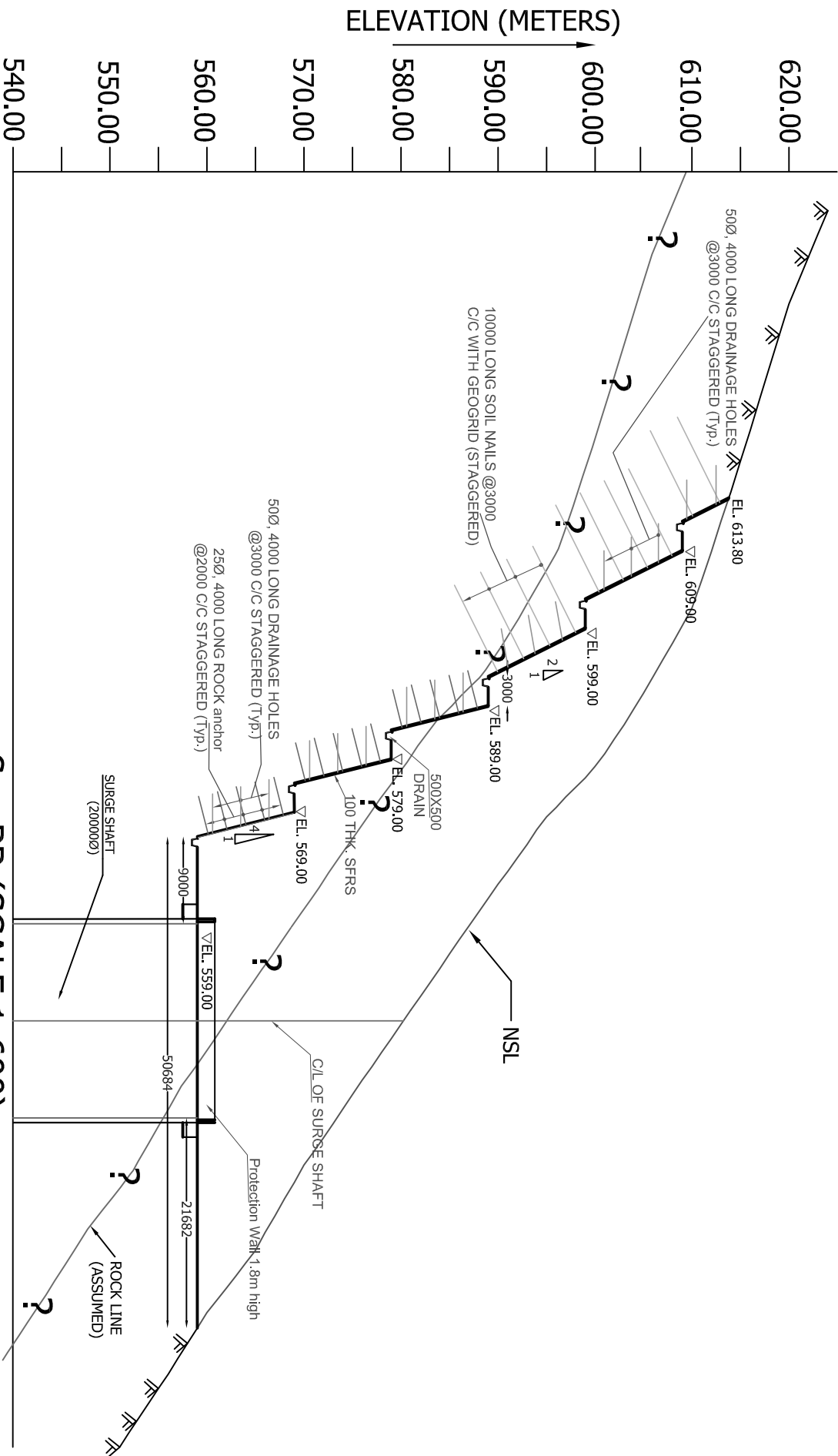
DEC., 2012

CD





Sec-AA (SCALE 1:500)

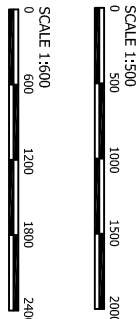


Sec-BB (SCALE 1:600)

- NOTES :-**
- ALL DIMENSIONS ARE IN MILLIMETERS,& ELEVATIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.
 - NO DIMENSIONS SHALL BE SCALED OUT ONLY WRITTEN DIMENSIONS ARE TO BE TAKEN AS CORRECT.

FOR DETAILED PROJECT REPORT ONLY

CONNECTED DRAWING	
DRG. NO.	TITLE
SS-WP-DPR-01/00	SURGE SHAFT - OPEN EXCAVATION PLAN & SECTIONS (Sheet 1 of 3)



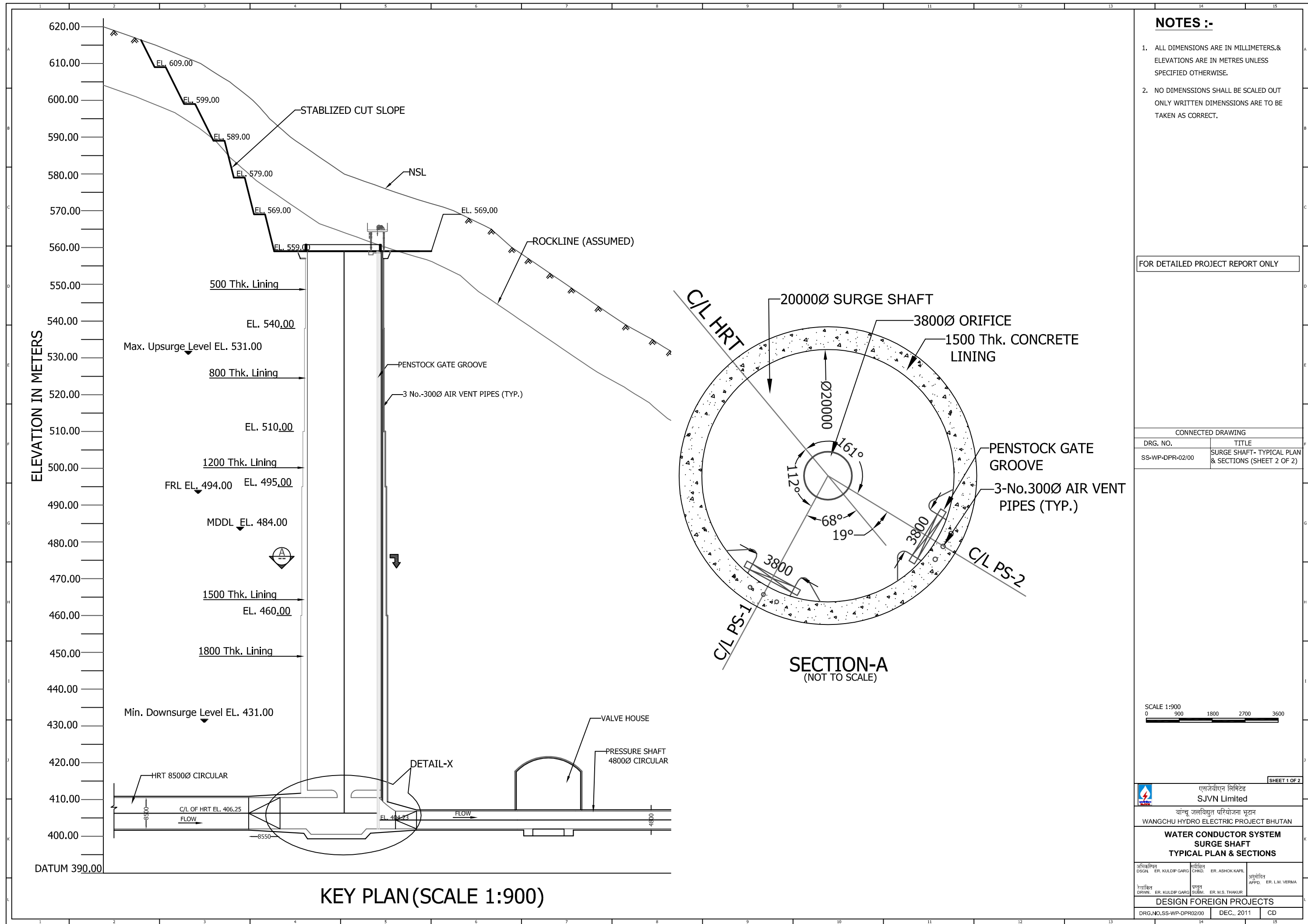
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

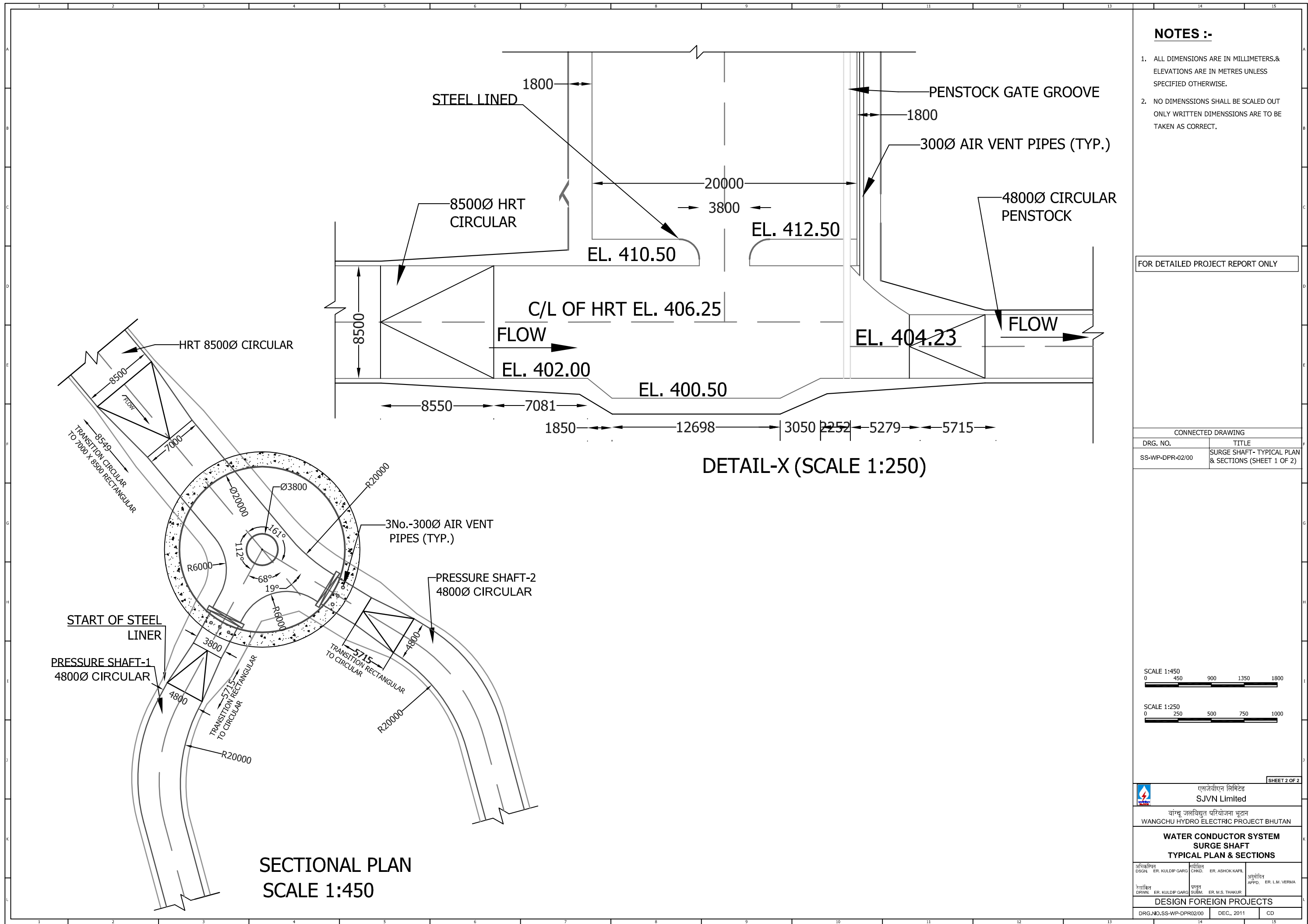
SUN Limited

WATER CONDUCTOR SYSTEM

OPEN EXCAVATION PLAN & SECTIONS

DESIGN	ER. KULDEP GANGI CHAKI	ER. ASHOK KUMAR	ER. LAKSHMI KUMAR
APPROVED	ER. KULDEP GANGI CHAKI	ER. ASHOK KUMAR	ER. LAKSHMI KUMAR
DATE	DEC. 2011	CD	





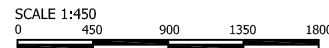
NOTES :-

- ALL DIMENSIONS ARE IN MILLIMETERS,& ELEVATIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.
- NO DIMENSSIONS SHALL BE SCALED OUT ONLY WRITTEN DIMENSSIONS ARE TO BE TAKEN AS CORRECT.

FOR DETAILED PROJECT REPORT ONLY

CONNECTED DRAWING

DRG. NO.	TITLE
SS-WP-DPR-02/00	SURGE SHAFT- TYPICAL PLAN & SECTIONS (SHEET 1 OF 2)



SHEET 2 OF 2



एसजेवीएन लिमिटेड
SJVN Limited

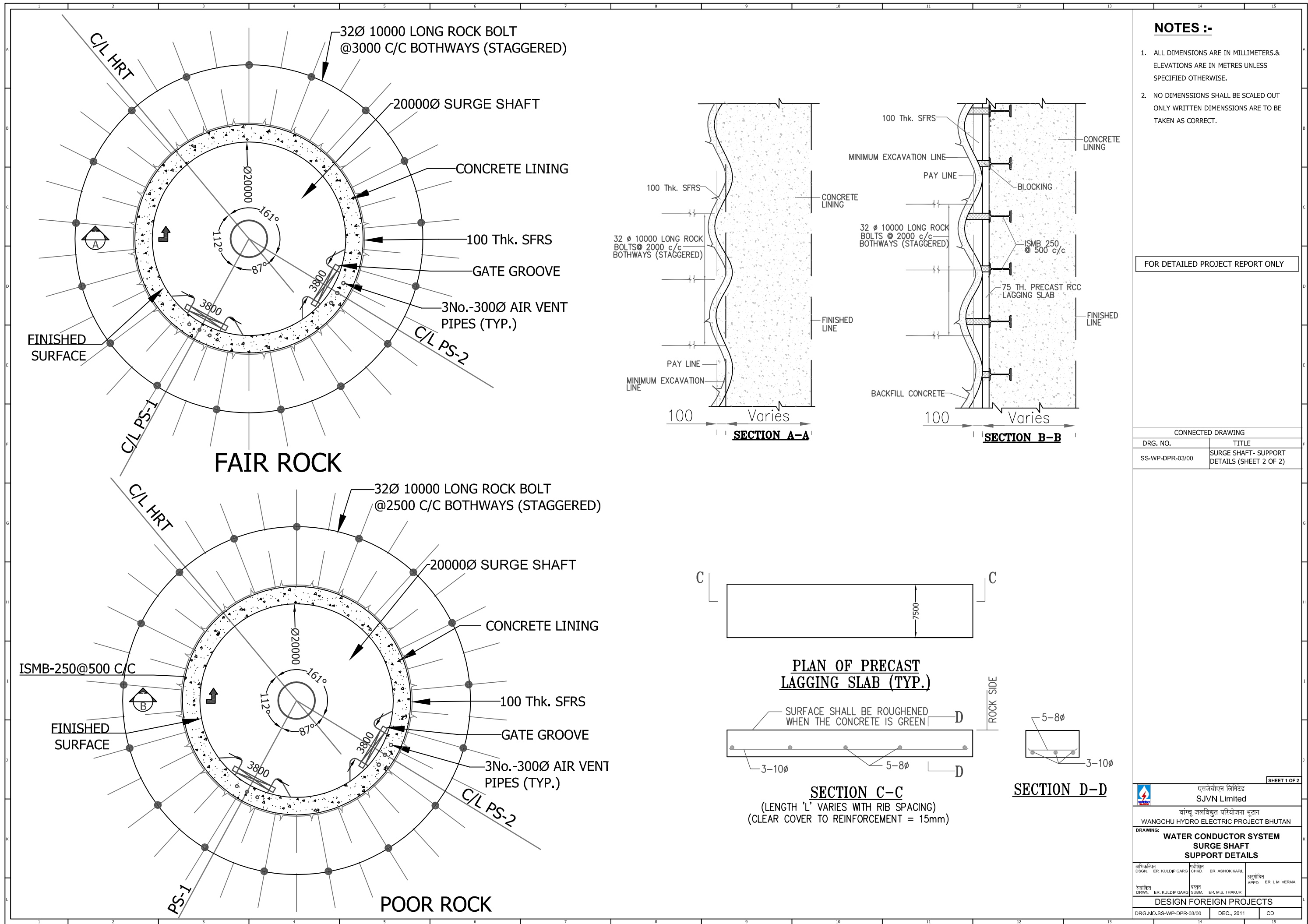
वांग्चू जलविद्युत परियोजना मूटान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

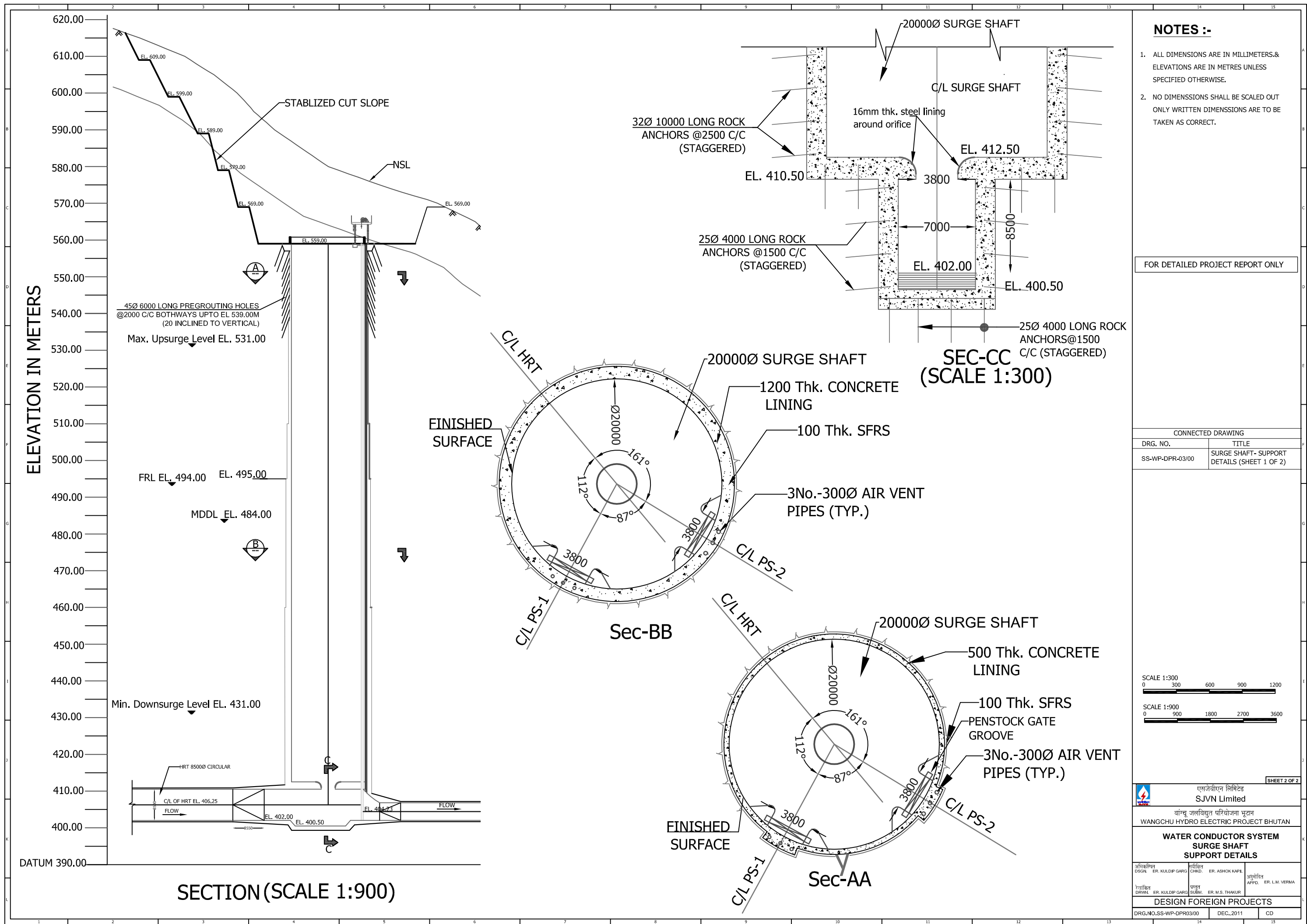
WATER CONDUCTOR SYSTEM
SURGE SHAFT
TYPICAL PLAN & SECTIONS

अभिस्वीकृत DSGN. ER. KULDIP GARG	अनुमोदित CHKD. ER. ASHOK KAPIL
ड्राफ्ट DRWN. ER. KULDIP GARG	सुबम SUBM. ER. M.S. THAKUR
अनुमोदित APPD. ER. L.M. VERMA	

DESIGN FOREIGN PROJECTS

DRG.NO.SS-WP-DPR02/00	DEC., 2011	CD
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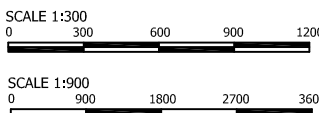


NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS.& ELEVATIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.
2. NO DIMENSSIONS SHALL BE SCALED OUT ONLY WRITTEN DIMENSSIONS ARE TO BE TAKEN AS CORRECT.

FOR DETAILED PROJECT REPORT ONLY

CONNECTED DRAWING	
DRG. NO.	TITLE
SS-WP-DPR-03/00	SURGE SHAFT- SUPPORT DETAILS (SHEET 1 OF 2)



SHEET 2 OF 2

एसजेवीएन लिमिटेड
SJVN Limited

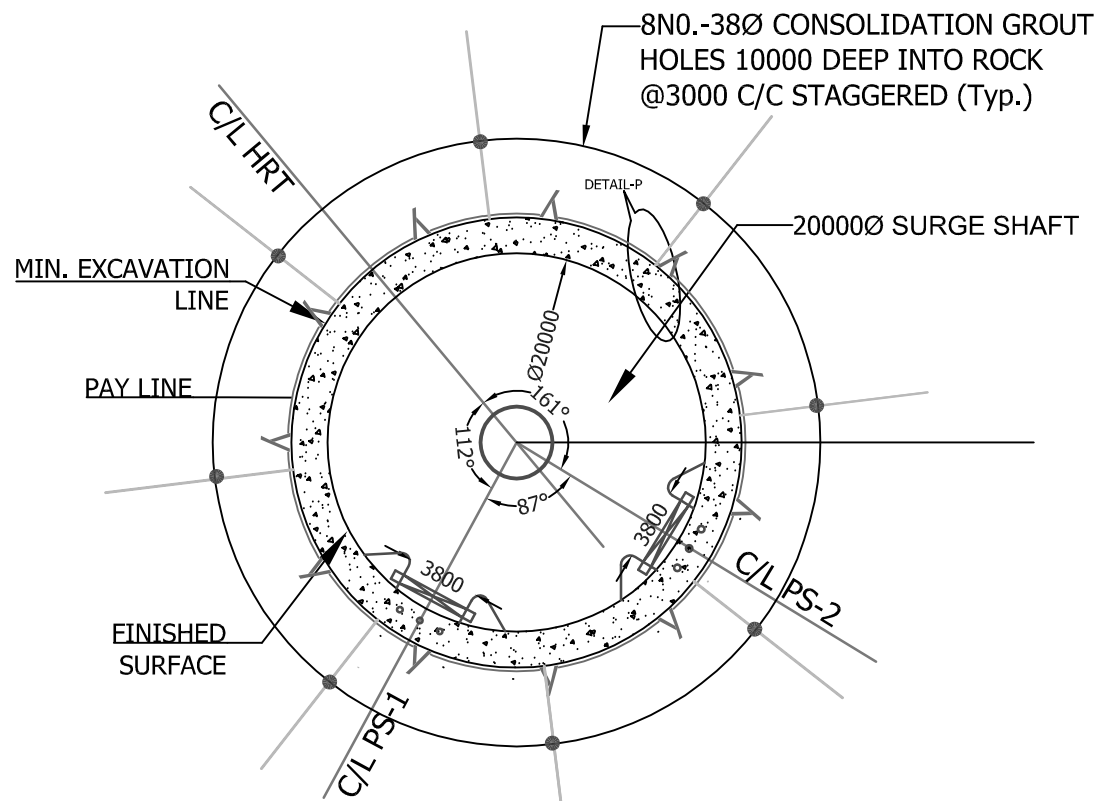
वांचू जलविद्युत परियोजना भूदान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

**WATER CONDUCTOR SYSTEM
SURGE SHAFT
SUPPORT DETAILS**

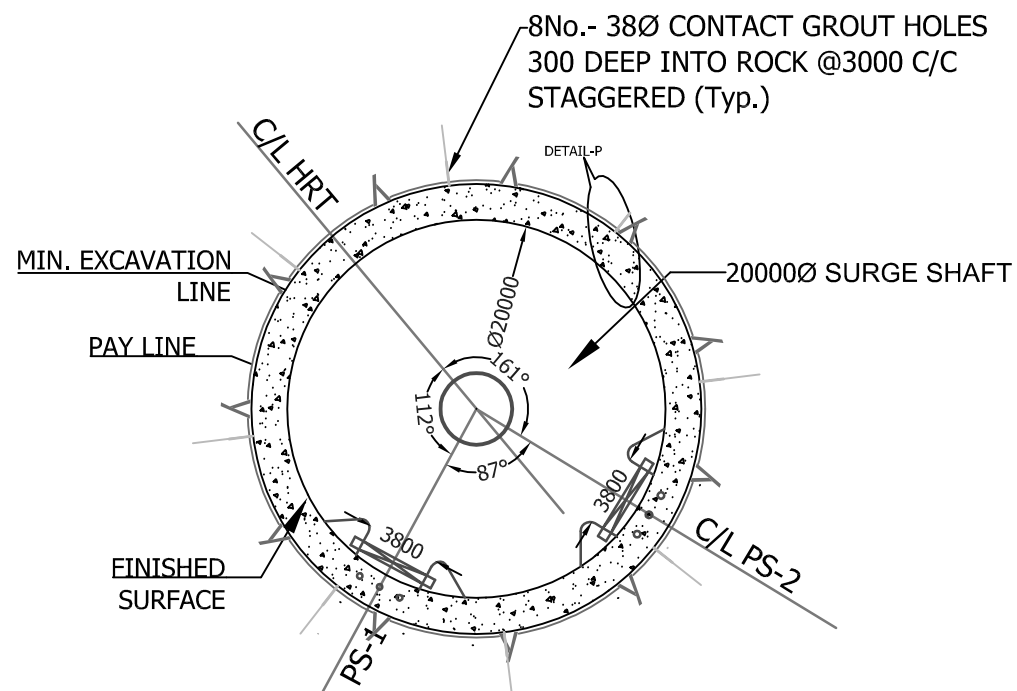
अभिवादन DSGN. ER. KULDIP GARG	अनुमोदित APPD. ER. L.M. VERMA
अभिवादन DSGN. ER. KULDIP GARG	अनुमोदित APPD. ER. M.S. THAKUR

DESIGN FOREIGN PROJECTS

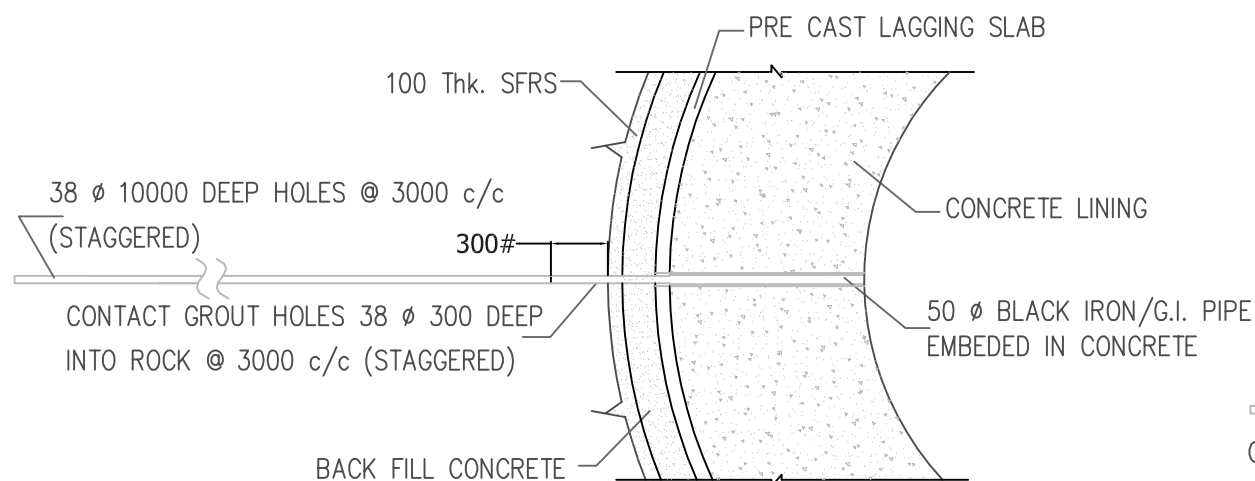
DRG.NO.SS-WP-DPR03/00	DEC.,2011	CD
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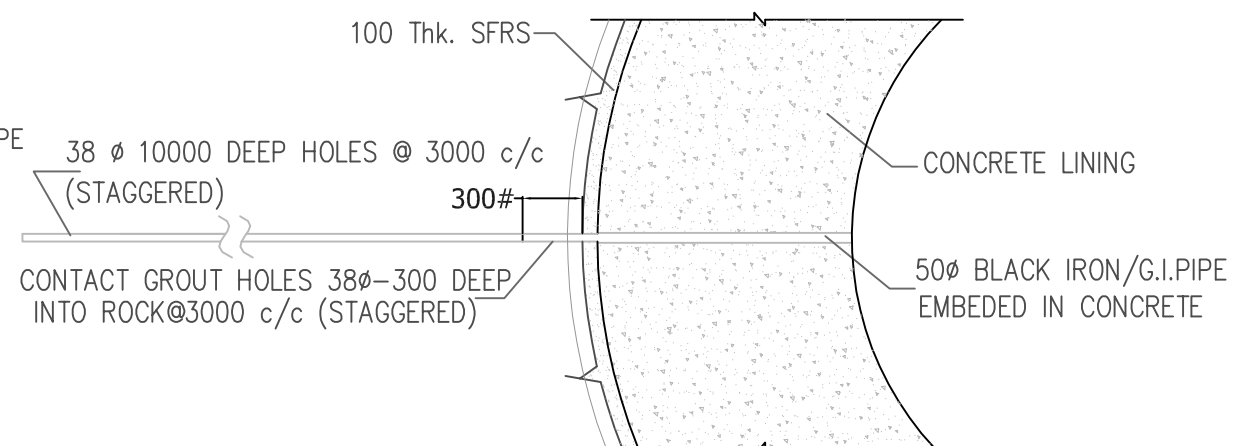
CONSOLIDATION GROUTING DETAILS



CURTAIN GROUTING DETAILS



DETAIL 'P'
CONSOLIDATION GROUTING (TYP.) (WITH RIB)
#FOR CONTACT GROUTING



DETAIL 'P'
CONSOLIDATION GROUTING (TYP.) (WITHOUT RIB)
#FOR CONTACT GROUTING

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS.& ELEVATIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.
2. NO DIMENSSIONS SHALL BE SCALED OUT ONLY WRITTEN DIMENSSIONS ARE TO BE TAKEN AS CORRECT.

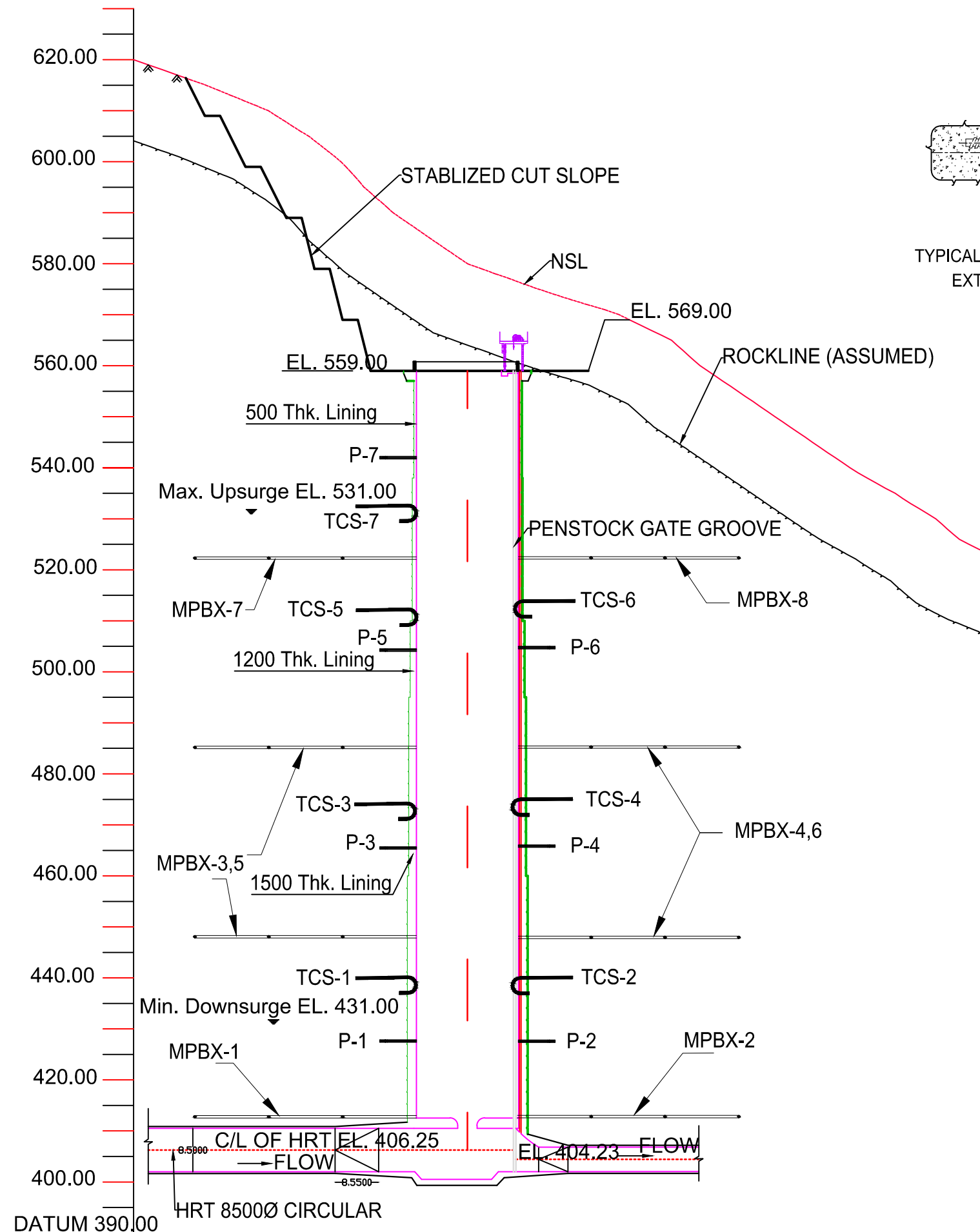
FOR DETAILED PROJECT REPORT ONLY

CONNECTED DRAWING

DRG. NO.	TITLE
SS-WP-DPR-02/00	SURGE SHAFT- TYPICAL PLAN & SECTIONS (SHEET 1 and 2 of 2)

 एसजेवीएन लिमिटेड SJVN Limited	
वांग्चू जलविद्युत परियोजना भूटान WANGCHU HYDRO ELECTRIC PROJECT BHUTAN	
WATER CONDUCTOR SYSTEM SURGE SHAFT TYPICAL GROUTING DETAILS	
अभिकल्पित DSGN. ER. KULDIP GARG	प्रमाणित CHKD. ER. ASHOK KAPIL
प्रमाणित DROWN. ER. KULDIP GARG	अनुमोदित APPD. ER. L.M. VERMA
DESIGN FOREIGN PROJECTS	
DRG.NO.SS-WP-DPR04/00	DEC., 2011
	CD

ELEVATION IN METERS



TYPICAL MULTI-POINT BOREHOLE
EXTENSOMETER (MPBX)
(NOT TO SCALE)

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES & ELEVATIONS IN METRES UNLESS OTHERWISE SPECIFIED.
2. NO DIMENSION SHALL BE SCALED OUT, ONLY WRITTEN DIMENSIONS ARE TO BE TAKEN AS CORRECT.
3. INSTRUMENTS SHOWN IN THIS DRAWING ARE INDICATIVE ONLY.
4. MPBX SHALL BE PROVIDED IN THE REACHES WHERE SIGNIFICANT DEFORMATIONS ARE NOTICED, ONE OR TWO LOCATIONS CAN BE CHOSEN FOR MEASUREMENT THROUGH MPBX IN CONSULTATION WITH RESIDENT GEOLOGIST,

LEGENDS:

	TCS-TAPE CONVERGENCE STUD
	MULTI-POINT BORE HOLE EXTENSOMETER
	V-W PIEZOMETER (P)



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SJVN Limited

वांग्चू जल विद्युत परियोजना भूटान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

SURGE SHAFT INSTRUMENTATION DETAILS

अभिज्ञित DSGN. Er. ASHOK KUMAR	समीक्षित CHKD. Er. PRIYANKA	अनुमोदित APPD. Er. L.M. VERMA
रचयिता DRWN. B.S. BANYAL	सुबम SUBM. Er. M.S. THAKUR	

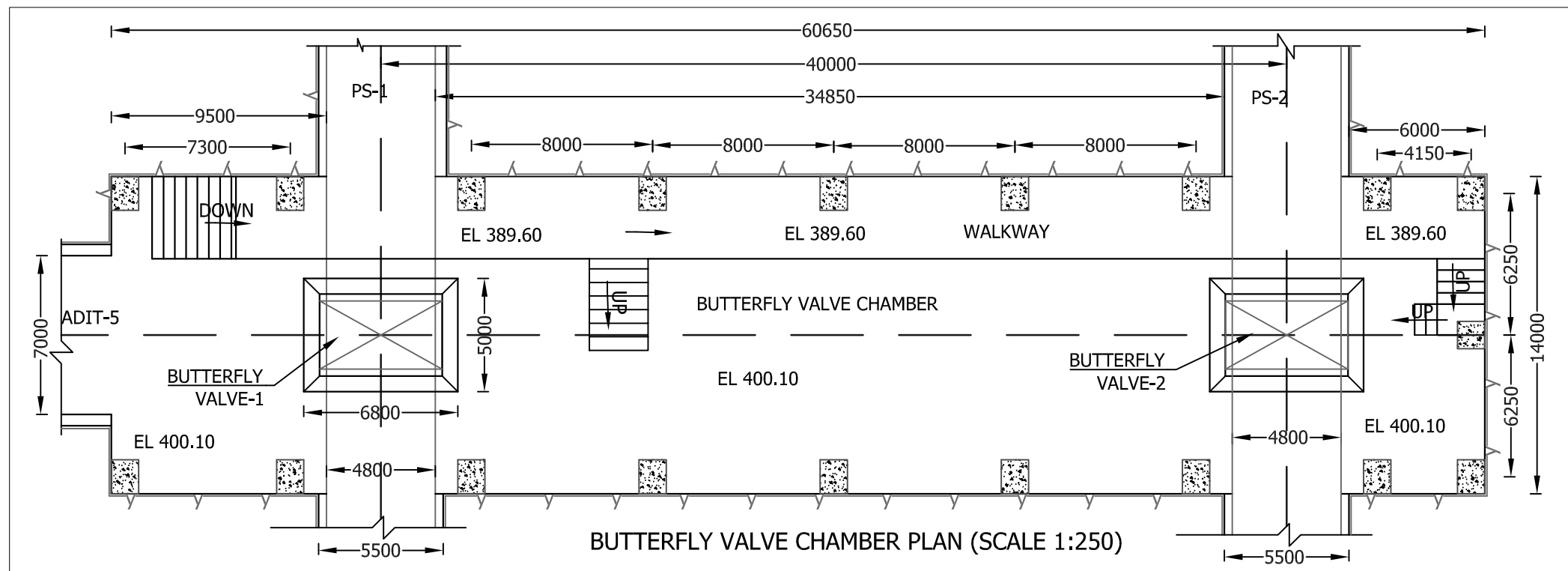
DESIGN FOREIGN PROJECTS

DRG.NO. SS-WP-DPR-05/00	FEB,2014
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TYPICAL SECTION OF SURGE SHAFT
SHOWING INSTRUMENTATION



KEY PLAN (SCALE 1:700)



BUTTERFLY VALVE CHAMBER PLAN (SCALE 1:250)

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS,& ELEVATIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.
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FOR DETAILED PROJECT REPORT ONLY

R1

CONNECTED DRAWING

DRG. NO.	TITLE
	PROJECT LAYOUT PLAN

REVISION HISTORY

NO.	REVISION	DATE
1	Butterfly Valve House moved by 20m towards d/s of surge shaft	DEC-2012
2	Ferrule Erection Chamber provided at the top vertical bend of penstock	

SCALE 1:600
0 600 1200 1800 2400

SCALE 1:250
0 250 500 750 1000

SHEET 1 OF 2

एसजेवीएन लिमिटेड
SJVN Limited

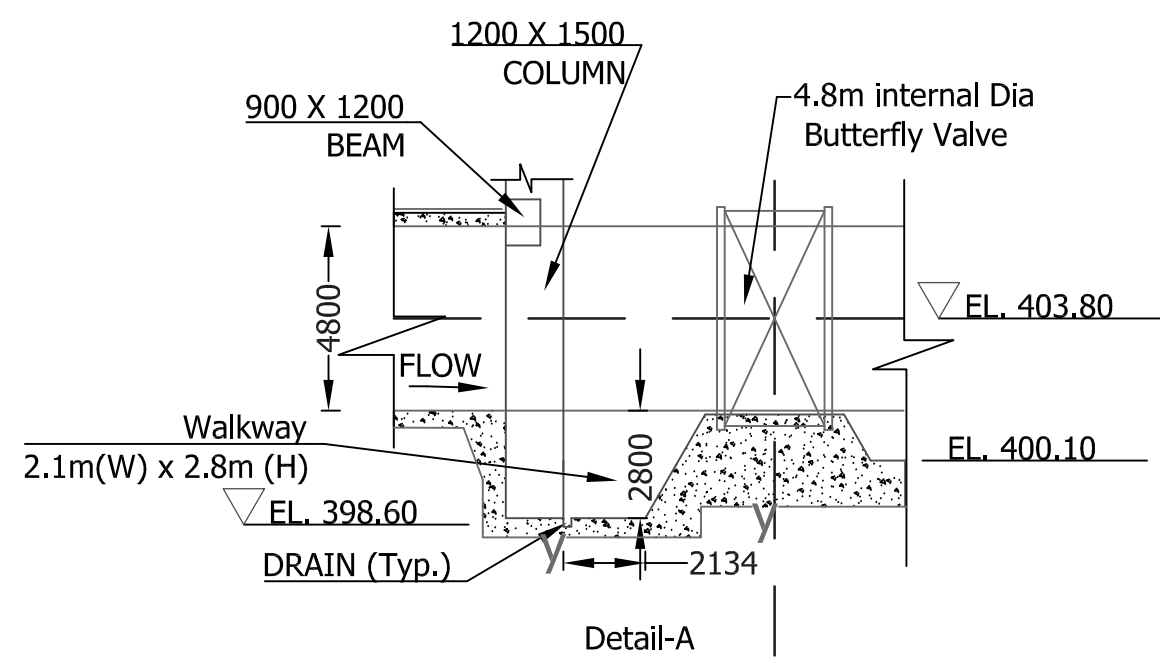
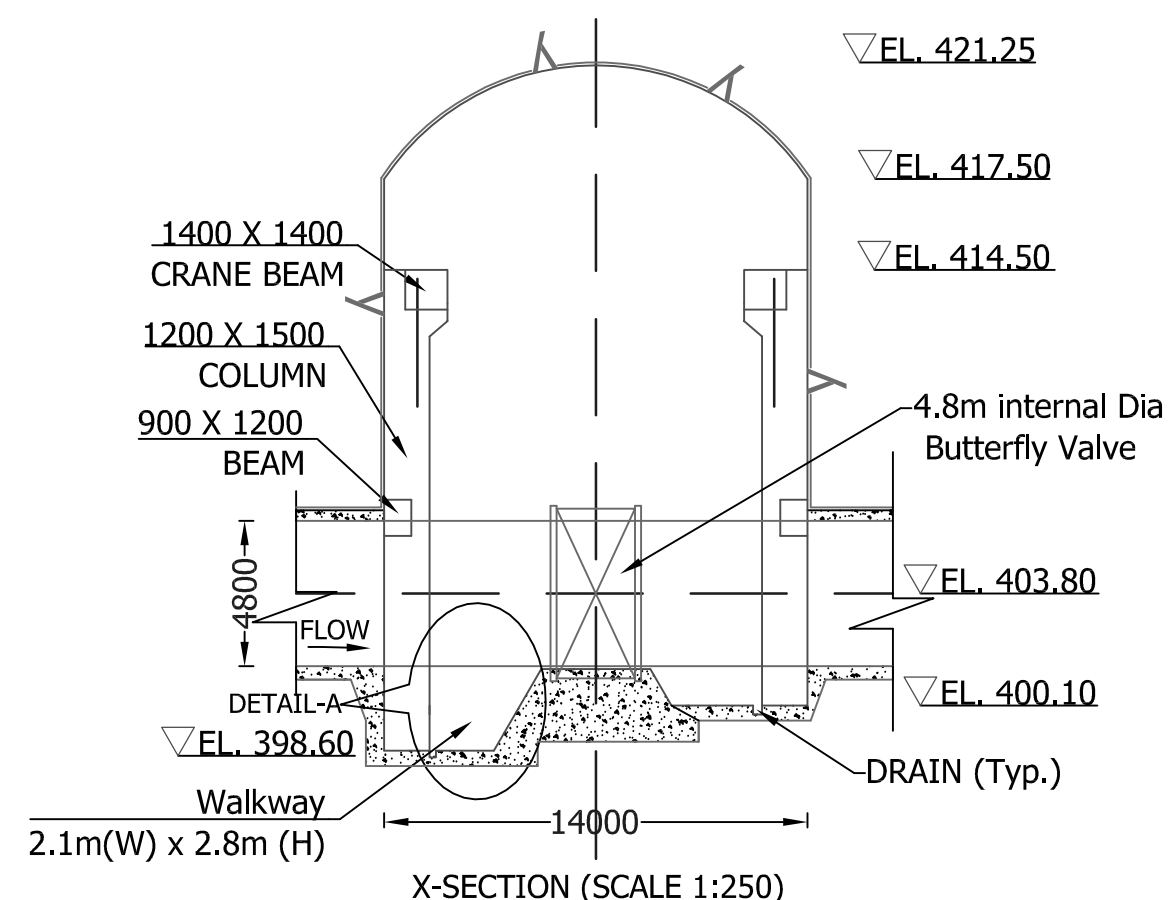
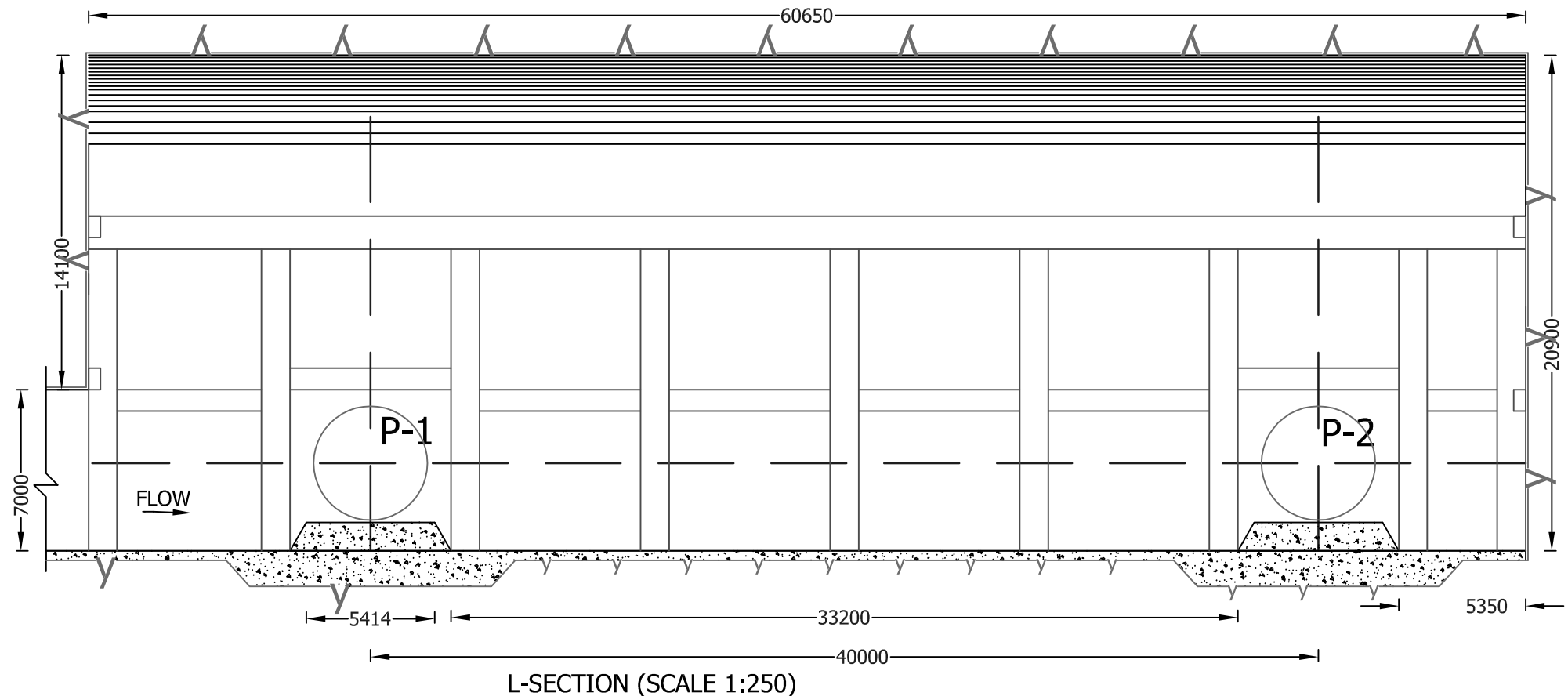
बॉम्बू जलविद्युत परियोजना भूटान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

BUTTERFLY VALVE CHAMBER KEY PLAN & LAYOUT PLAN

डिजाइन DSGN	ER. KULDIP GARIB	अनुमोदित APPD.	ER. L.M. VERMA
ड्राफ्ट DRAWN	K.K. SHARMA	सुबम SUBM.	ER. M.S. THAKUR

DESIGN FOREIGN PROJECTS

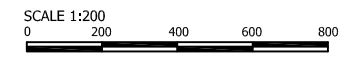
DRG.NO.BVC-WP-DPR-01/R1 DEC., 2012 CD



- NOTES :-**
1. ALL DIMENSIONS ARE IN MILLIMETERS.& ELEVATIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.
 2. NO DIMENSIONS SHALL BE SCALED OUT ONLY WRITTEN DIMENSIONS ARE TO BE TAKEN AS CORRECT.

FOR DETAILED PROJECT REPORT ONLY

CONNECTED DRAWING	
DRG. NO.	TITLE
BVC-WP-DPR-01/00	BUTTERFLY VALVE CHAMBER KEY PLAN & LAYOUT PLAN



SHEET 1 OF 2

 एसजेवीएन लिमिटेड
SJVN Limited

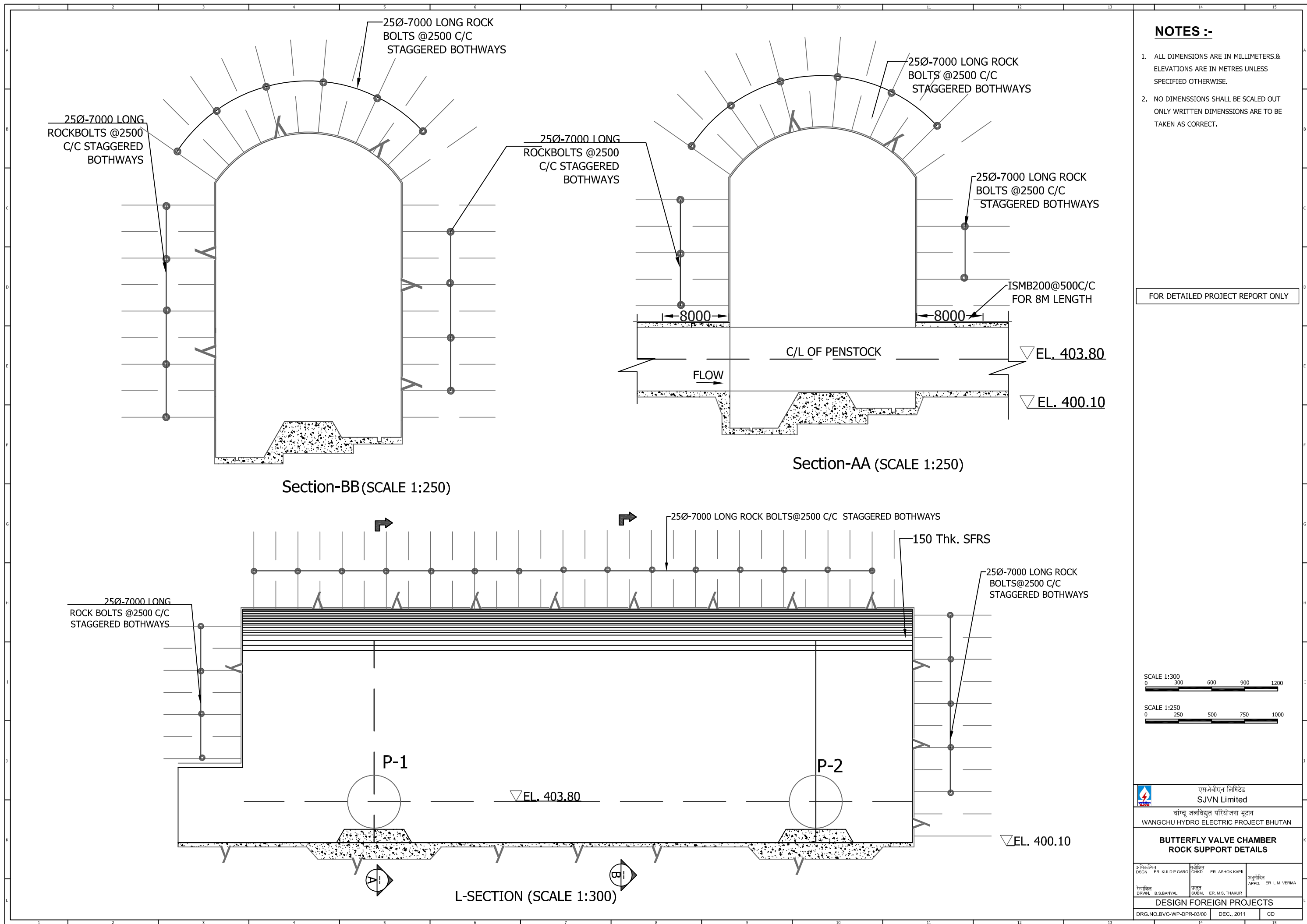
वांग्चू जलविद्युत परियोजना भूटान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

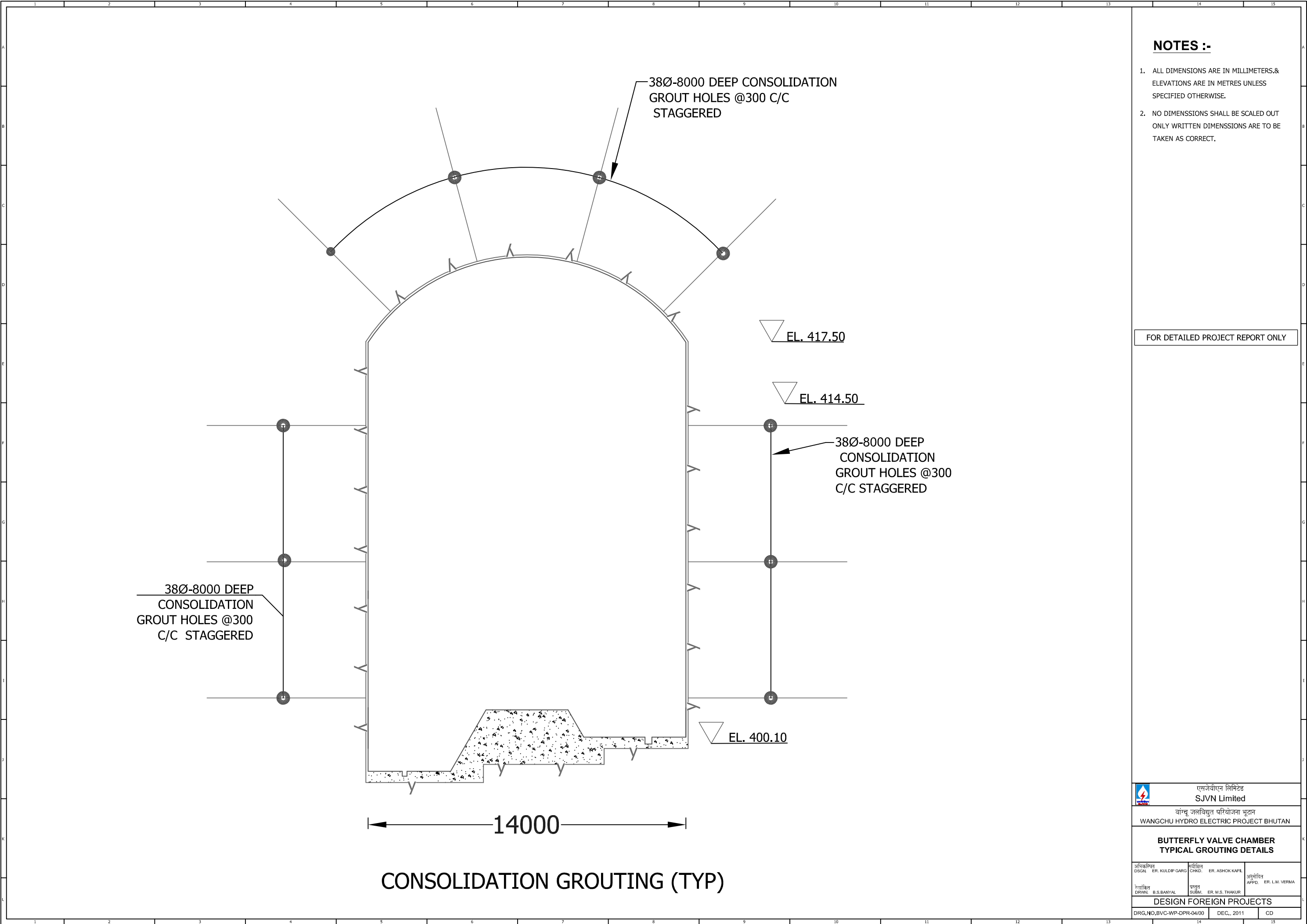
**BUTTERFLY VALVE CHAMBER
TYPICAL SECTIONS**

अभिवादन DSGN. ER. KULDIP GARIB	अभिवादन CHKD. ER. ASHOK KAPIL	अभिवादन APPD. ER. L.M. VERMA
अभिवादन DRWN. DEVI CHAND	अभिवादन SUBM. ER. M.S. THAKUR	

DESIGN FOREIGN PROJECTS

DRG.NO,BVC-WP-DPR-02/00	DEC., 2011	CD
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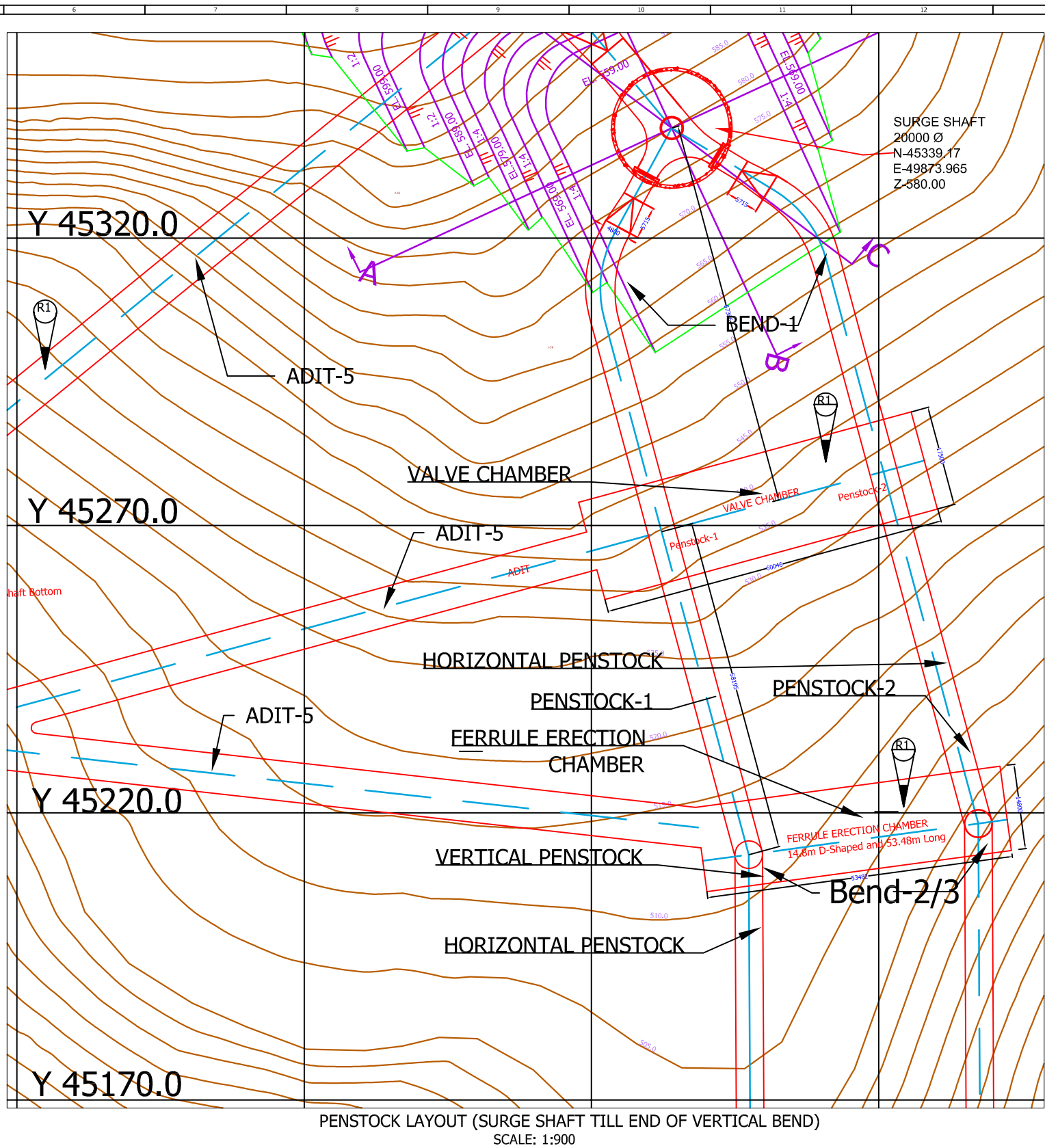
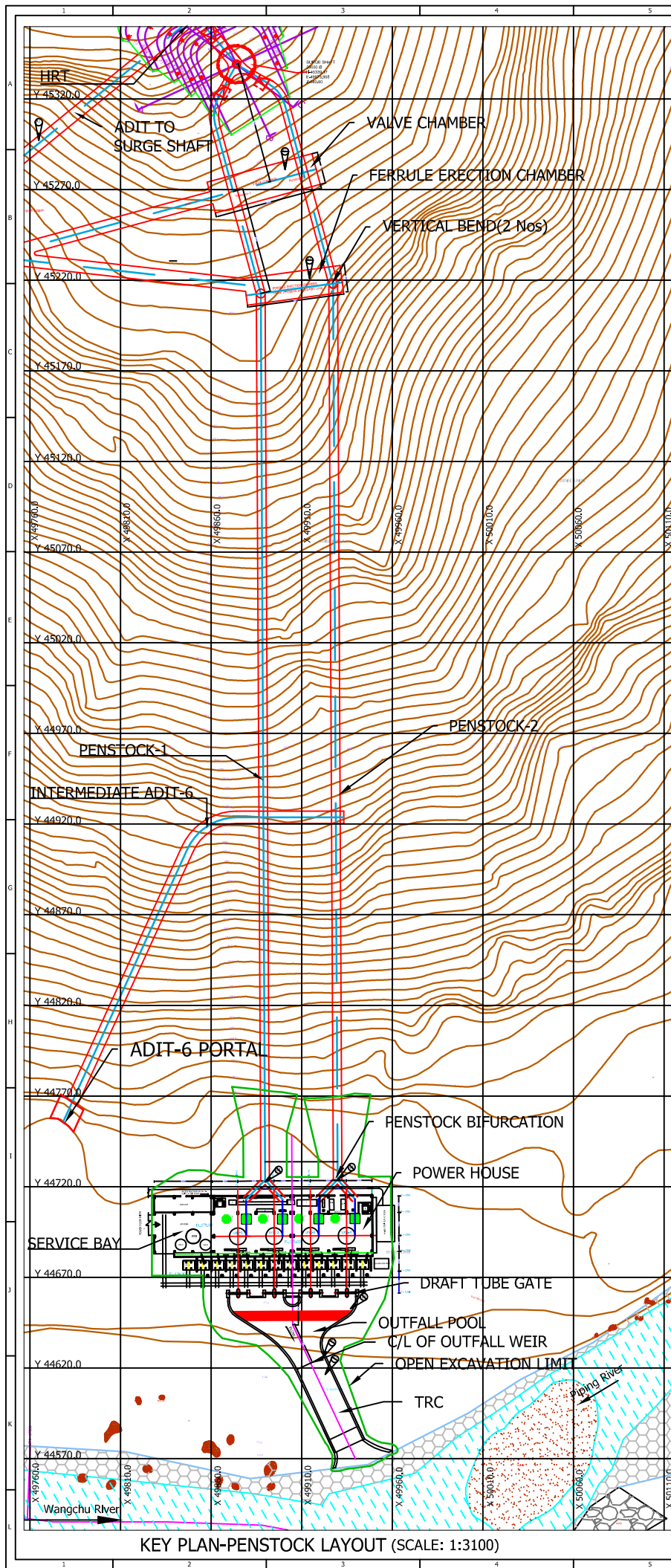
NOTES :-

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FOR DETAILED PROJECT REPORT ONLY

 एसजेवीएन लिमिटेड SJVN Limited		
वांग्चू जलविद्युत परियोजना भूटान WANGCHU HYDRO ELECTRIC PROJECT BHUTAN		
BUTTERFLY VALVE CHAMBER TYPICAL GROUTING DETAILS		
अभिवाचित DSGN. ER. KULDIP GARIB	अनुमोदित CHKD. ER. ASHOK KAPIL	अनुमोदित APPD. ER. L.M. VERMA
ड्राफ्ट B.S.BANYAL	सुबम SUBM. ER. M.S. THAKUR	
DESIGN FOREIGN PROJECTS		
DRG.NO,BVC-WP-DPR-04/00	DEC., 2011	CD

CONSOLIDATION GROUTING (TYP)



S.No.	Description	Bearing
1.	HRT at C/L of Surge Shaft	N 39° 50' W
2.	C/L of Surge Shaft to Bend-1	S 28° 31' W
3.	Bend-1 to Bend-2	S 15° 06' E
4.	Bend-3 to Bend-4	S 0° 17' E

NOTES :-

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FOR DETAILED PROJECT REPORT ONLY

CONNECTED DRAWING	
DRG. NO.	TITLE
DRG.NO.PL-WP-DPR-03/00	PROJECT LAYOUT PLAN

REVISION HISTORY	
R1	DEC-2012
1	Adit to Surge shaft bottom moved to u/s of surge shaft by 35.12m
2	Butterfly Valve House moved by 20m towards d/s of surge shaft
3	Ferrule Erection chamber provided at top vertical bend of penstock
4	penstock bifurcation point moved by 10m towards PH
5	Outfall pool modified
6	outfall gates moved towards PH by 42.72m

R2	JAN-2013
1	OUTFALL GATES REMOVED AS PER SUGGESTION OF HCD, Dte, CWC

SCALE 1:900
0 900 1800 2700 3600



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SJVN Limited

वांग्चू जलविद्युत परियोजना भूटान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

WATER CONDUCTOR SYSTEM
PRESSURE SHAFT
KEY LAYOUT PLAN

आपिकारित
DSGN. ER. KULDIP GARG

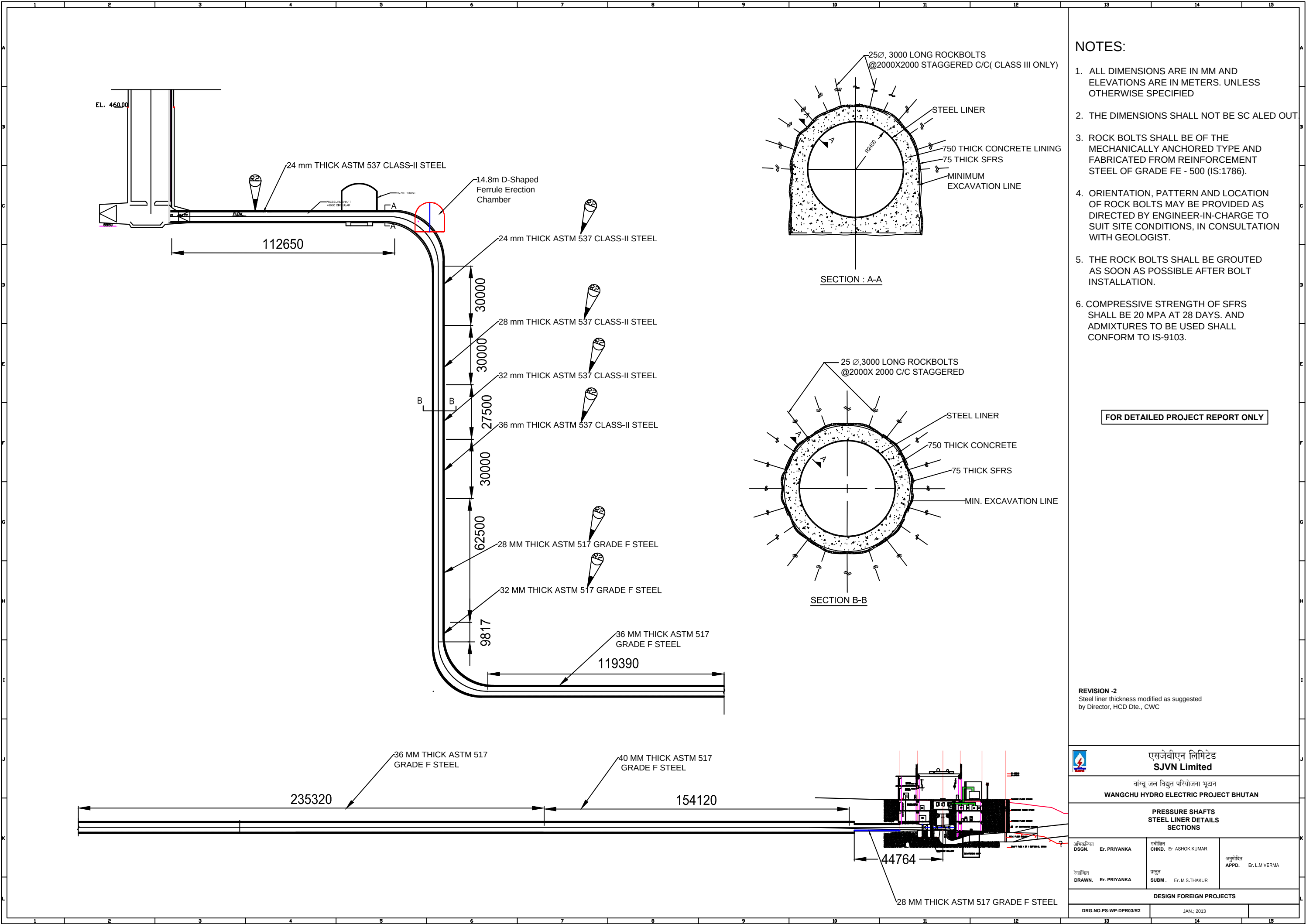
अनुमोदित
APPD. ER. L.M. VERMA

अनुमोदित
ER. ASHOK KAPIL

अनुमोदित
ER. M.S. THAKUR

DESIGN FOREIGN PROJECTS

DRG.NO.PS-WP-DPR-01/R2 JAN., 2013



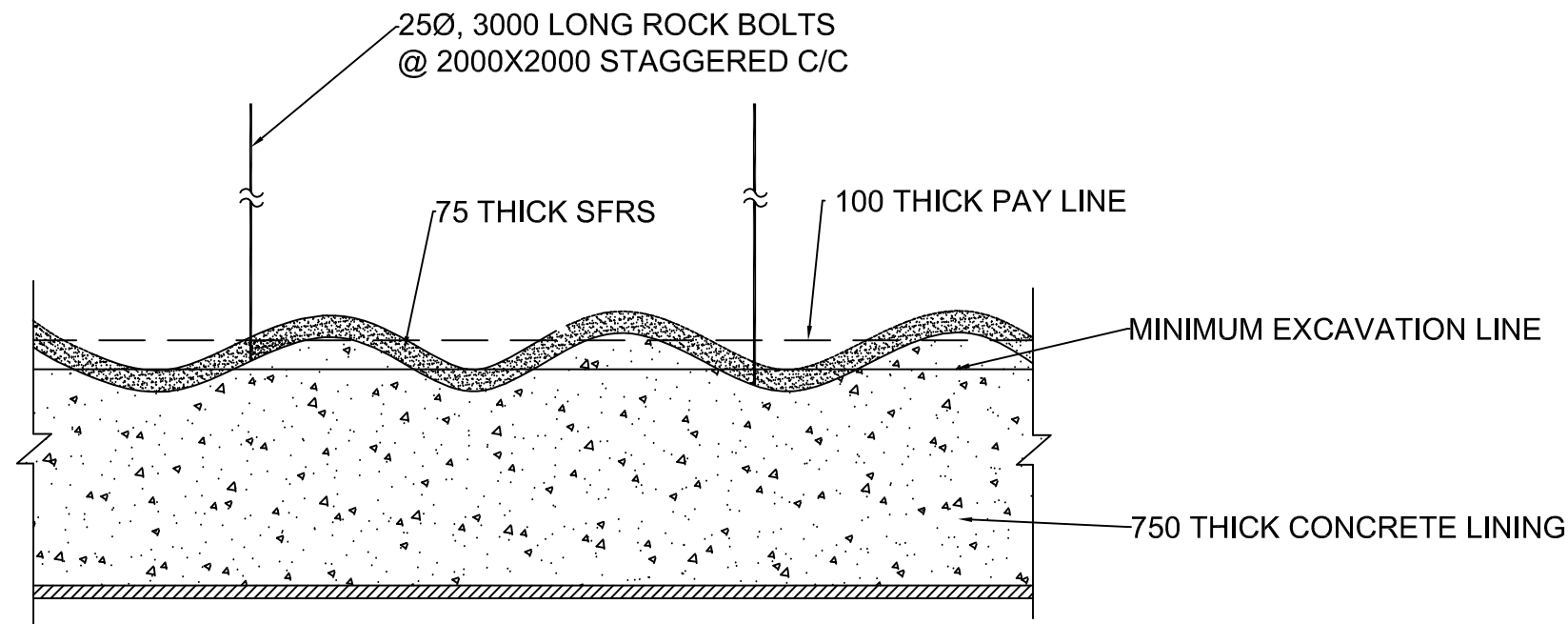
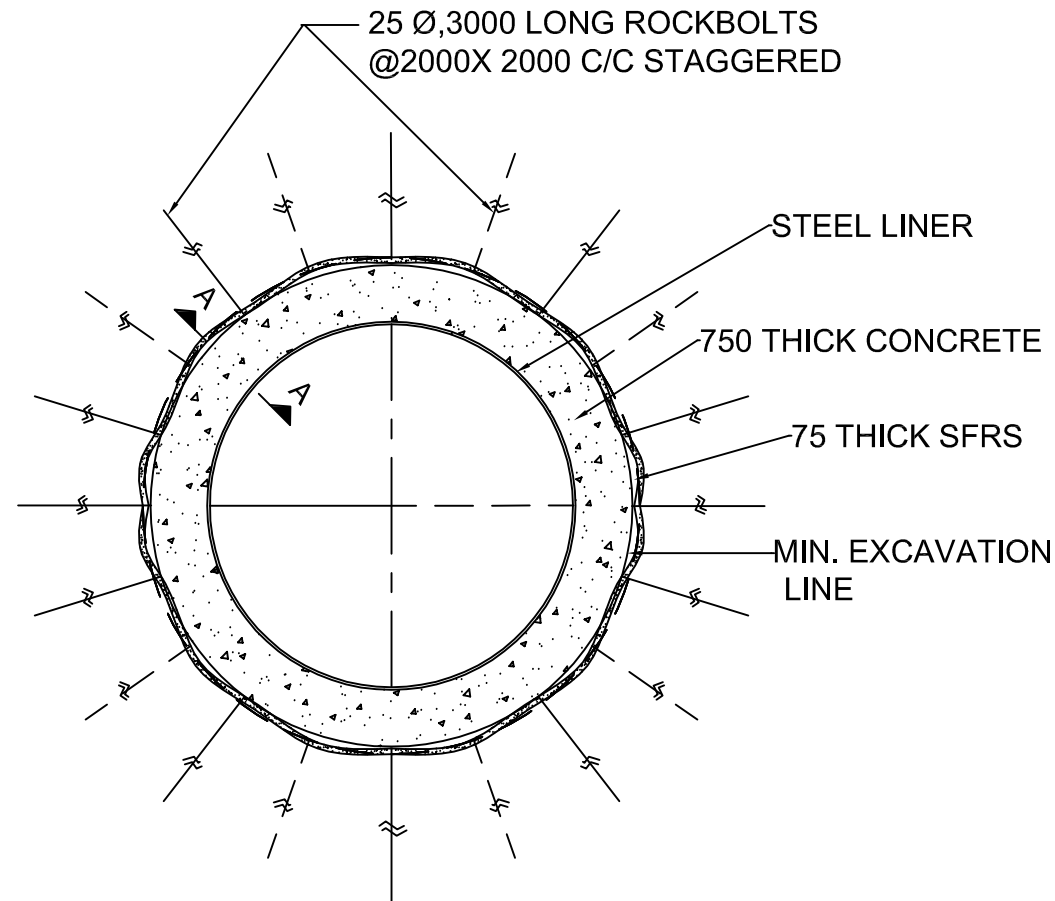
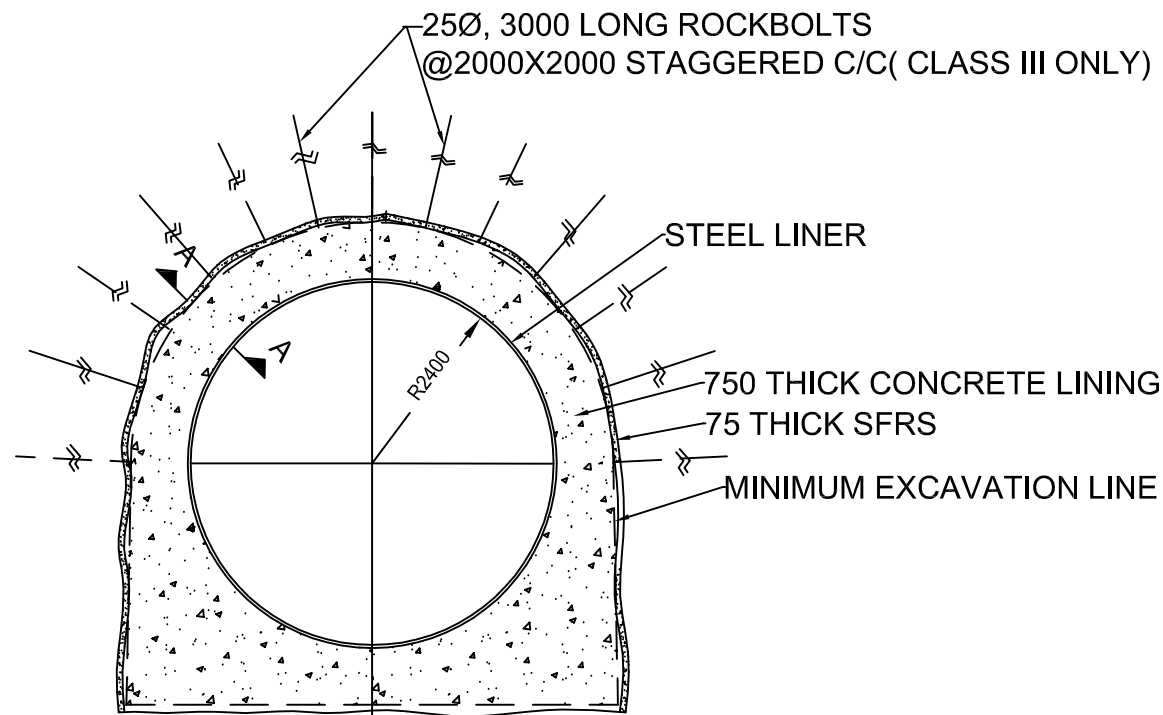
NOTES:

1. ALL DIMENSIONS ARE IN MM AND ELEVATIONS ARE IN METERS. UNLESS OTHERWISE SPECIFIED
2. THE DIMENSIONS SHALL NOT BE SC ALED OUT
3. ROCK BOLTS SHALL BE OF THE MECHANICALLY ANCHORED TYPE AND FABRICATED FROM REINFORCEMENT STEEL OF GRADE FE - 500 (IS:1786).
4. ORIENTATION, PATTERN AND LOCATION OF ROCK BOLTS MAY BE PROVIDED AS DIRECTED BY ENGINEER-IN-CHARGE TO SUIT SITE CONDITIONS, IN CONSULTATION WITH GEOLOGIST.
5. THE ROCK BOLTS SHALL BE GROUTED AS SOON AS POSSIBLE AFTER BOLT INSTALLATION.
6. COMPRESSIVE STRENGTH OF SFRS SHALL BE 20 MPA AT 28 DAYS. AND ADMIXTURES TO BE USED SHALL CONFORM TO IS-9103.

FOR DETAILED PROJECT REPORT ONLY

REVISION -2
Steel liner thickness modified as suggested
by Director, HCD Dte., CWC

 एसजेवीएन लिमिटेड SJVN Limited		
वांग्चू जल विद्युत परियोजना भूटान WANGCHU HYDRO ELECTRIC PROJECT BHUTAN		
PRESSURE SHAFTS STEEL LINER DETAILS SECTIONS		
अभिष्क्रियित DSGN. Er. PRIYANKA	मनीषि CHKD. Er. ASHOK KUMAR	अनुमोदित APPD. Er. L.M.VERMA
रेखांकित DRAWN. Er. PRIYANKA	प्रस्तुत SUBM. Er. M.S.THAKUR	
DESIGN FOREIGN PROJECTS		
DRG.NO.PS-WP-DPR03/R2	JAN., 2013	



NOTES:

- ALL DIMENSIONS ARE IN MM AND ELEVATIONS ARE IN METERS. UNLESS OTHERWISE SPECIFIED
- THE DIMENSIONS SHALL NOT BE SCALED.
- ROCK BOLTS SHALL BE OF THE MECHANICALLY ANCHORED TYPE AND FABRICATED FROM REINFORCEMENT STEEL OF GRADE FE - 500 (IS:1786).
- ORIENTATION, PATTERN AND LOCATION OF ROCK BOLTS MAY BE PROVIDED AS DIRECTED BY ENGINEER-IN-CHARGE TO SUIT SITE CONDITIONS, IN CONSULTATION WITH GEOLOGIST.
- THE ROCK BOLTS SHALL BE GROUTED AS SOON AS POSSIBLE AFTER BOLT INSTALLATION.
- COMPRESSIVE STRENGTH OF SFRS SHALL BE 20 MPA AT 28 DAYS. AND ADMIXTURES TO BE USED SHALL CONFORM TO IS-9103.

FOR DETAILED PROJECT REPORT ONLY

SCALE:

0 100 200 300 400 500

SCALE:

0 25 50 75 100 125

SHEET 1 OF 2



एसजेवीएन लिमिटेड
SJVN Limited

वांग्चू जल विद्युत परियोजना प्रकल्प
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

PRESSURE SHAFTS-
ROCK SUPPORT DETAILS
CLASS I, II & III

अभिप्रेत
DSGN. Er. PRIYANKA

समीक्षा
CHKD. Er. SUMIT KUMAR

अनुमोदित
APPD. Er. L.M.VERMA

रेखांकित
DRAWN. Er. PRIYANKA

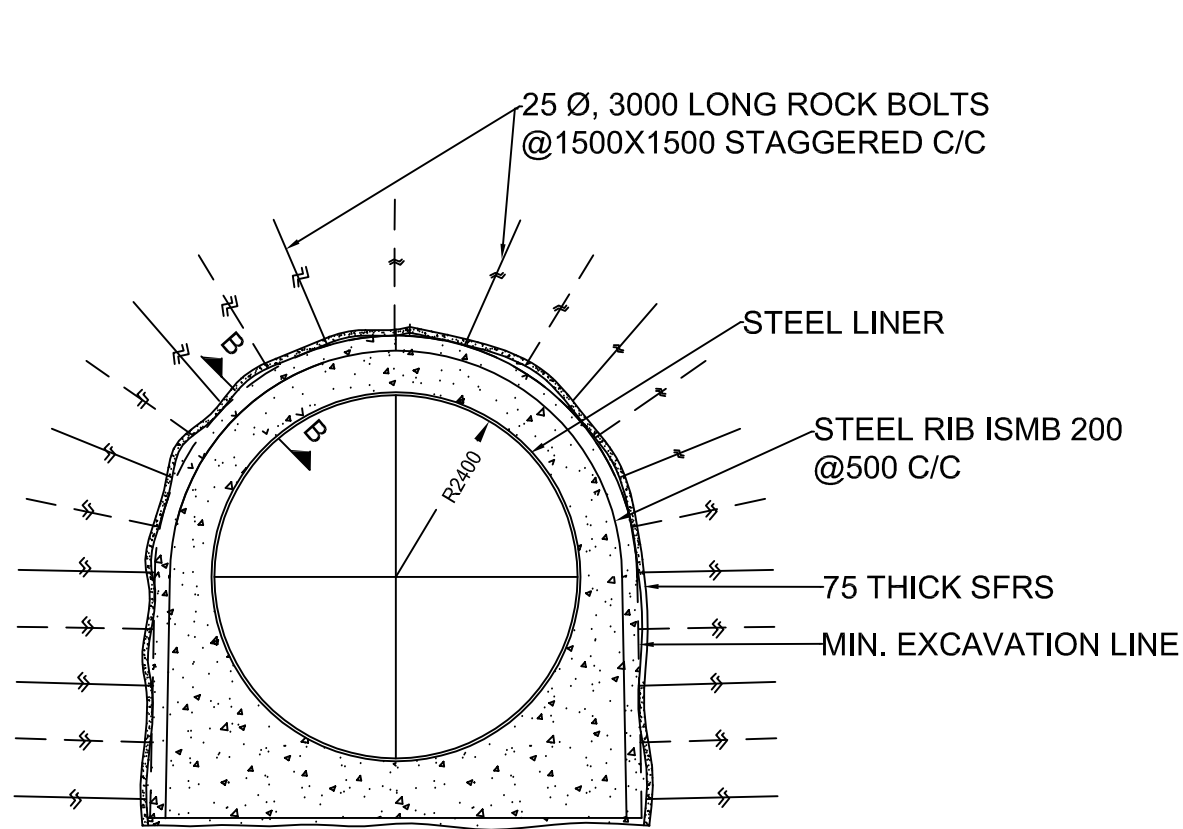
प्रस्तुत
SUBM. Er. M.S.THAKUR

DESIGN FOREIGN PROJECTS

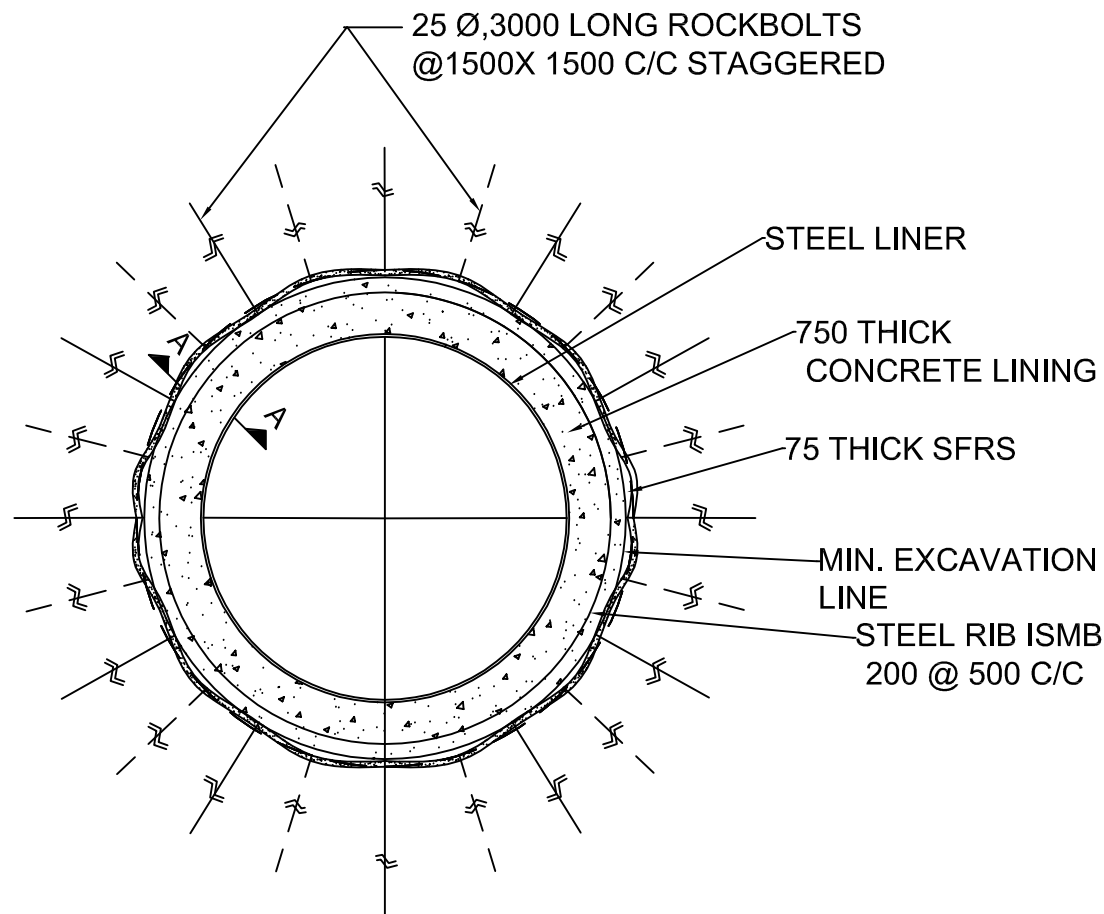
DRG.NO.PS-WP-DPR04/00

DEC., 2011

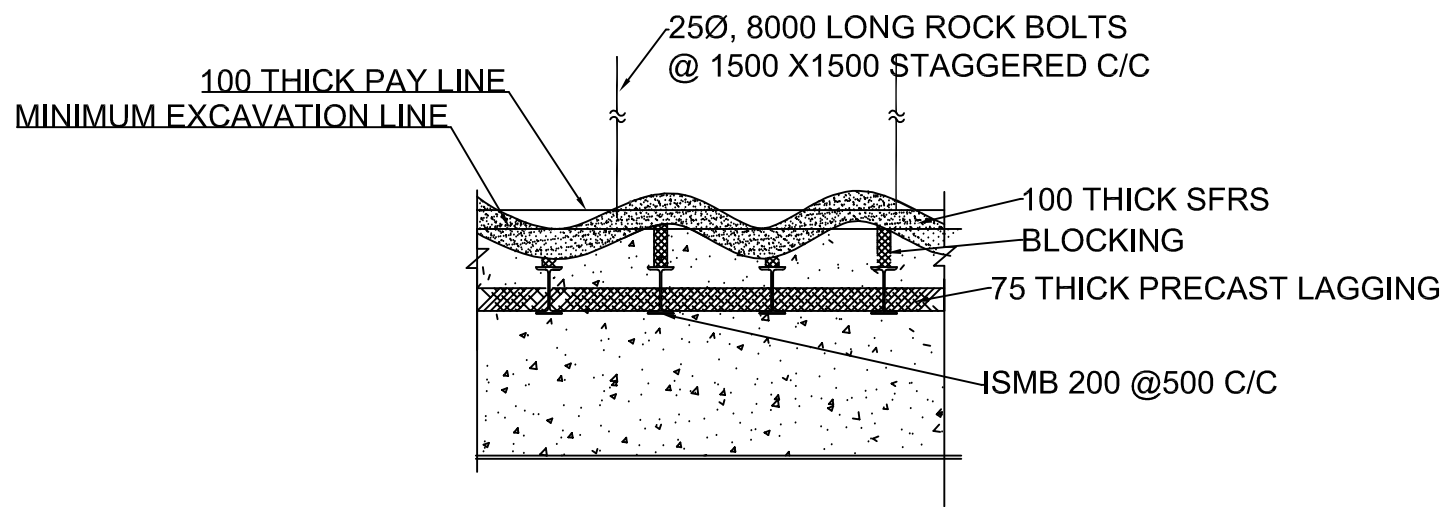
CD



CLASS IV AND V
(HORIZONTAL SHAFT)
SCALE: 1:100



CLASS IV AND V
(VERTICAL SHAFT)
SCALE: 1:100



SECTION B-B
SCALE: 1:25

NOTES:

1. ALL DIMENSIONS ARE IN MM AND ELEVATIONS ARE IN METERS. UNLESS OTHERWISE SPECIFIED
2. THE DIMENSIONS SHALL NOT BE SCALED.
3. ROCK BOLTS SHALL BE OF THE MECHANICALLY ANCHORED TYPE AND FABRICATED FROM REINFORCEMENT STEEL OF GRADE FE - 500 (IS:1786).
4. ORIENTATION, PATTERN AND LOCATION OF ROCK BOLTS MAY BE PROVIDED AS DIRECTED BY ENGINEER-IN-CHARGE TO SUIT SITE CONDITIONS, IN CONSULTATION WITH GEOLOGIST.
5. THE ROCK BOLTS SHALL BE GROUTED AS SOON AS POSSIBLE AFTER BOLT INSTALLATION.
6. COMPRESSIVE STRENGTH OF SFRS SHALL BE 20 MPA AT 28 DAYS. AND ADMIXTURES TO BE USED SHALL CONFORM TO IS-9103.

FOR DETAILED PROJECT REPORT ONLY

SCALE:

0 100 200 300 400 500

SCALE:

0 25 50 75 100 125

SHEET 2 OF 2



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SJVN Limited

वांग्चू जल विद्युत परियोजना मूटान
WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

DRAWING: **PRESSURE SHAFTS
ROCK SUPPORT DETAILS
CLASS IV & V**

अभिस्मिता
DSGN. Er. PRIYANKA

समीक्षित
CHKD. Er. SUMIT KUMAR

अनुमोदित
APPD. Er. L.M.VERMA

रचयिता
DRAWN. Er. PRIYANKA

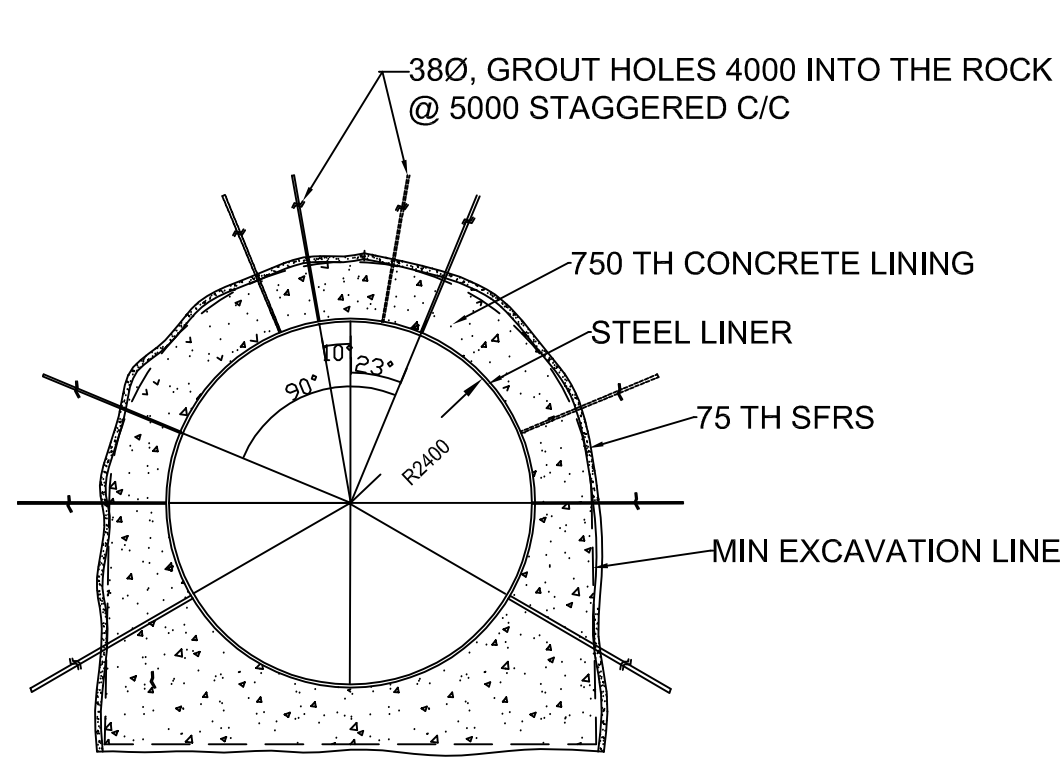
प्रस्तुत
SUBM. Er. M.S.THAKUR

DESIGN FOREIGN PROJECTS

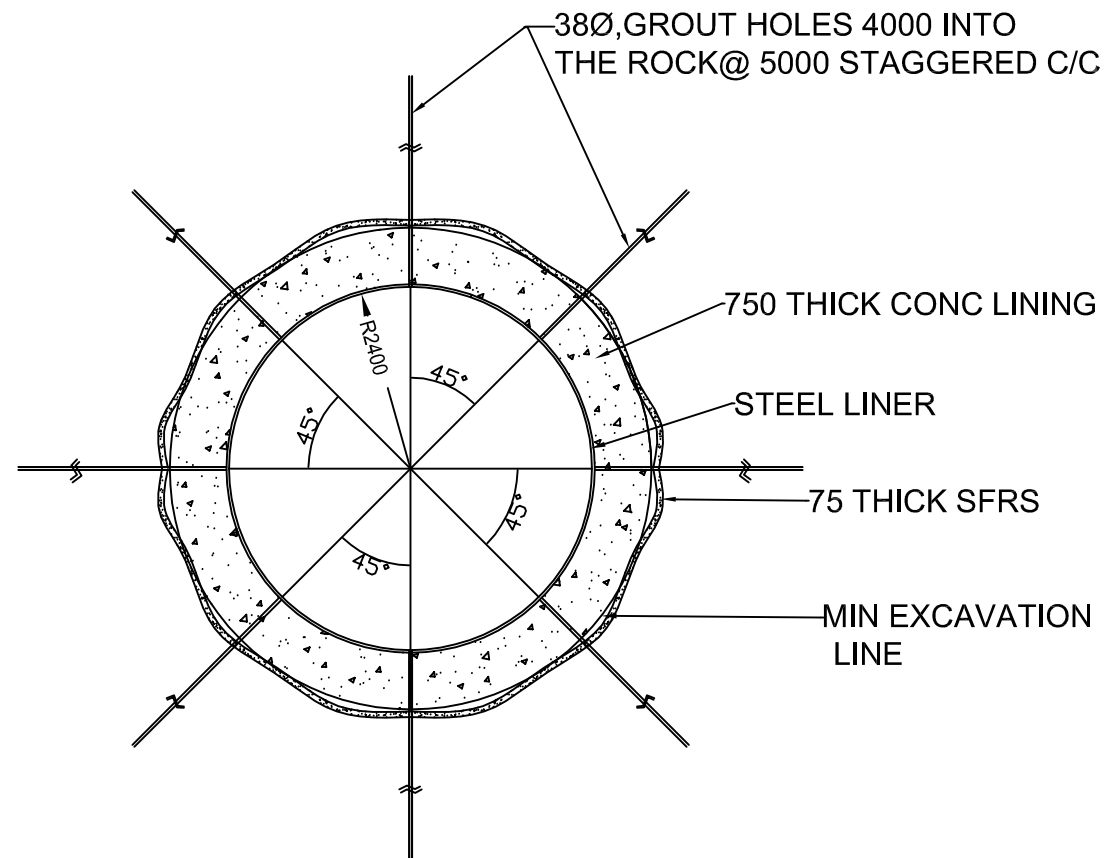
DRG.NO.PS-WP-DPR04/00

DEC: 2011

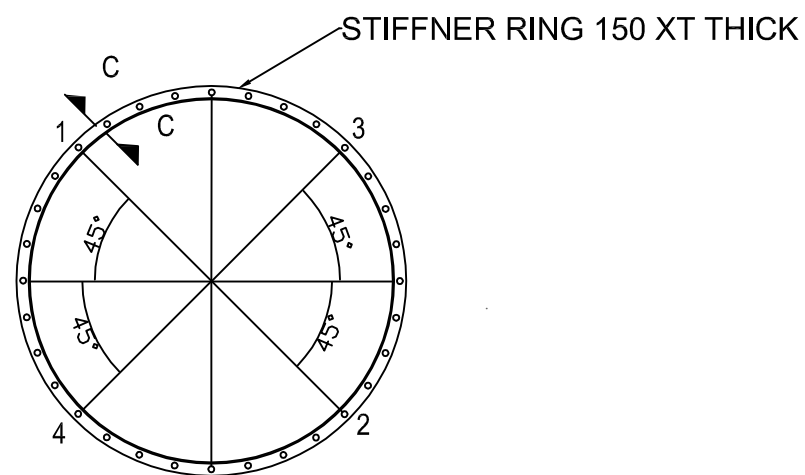
CD



GROUTING DETAILS
(HORIZONTAL SHAFT)

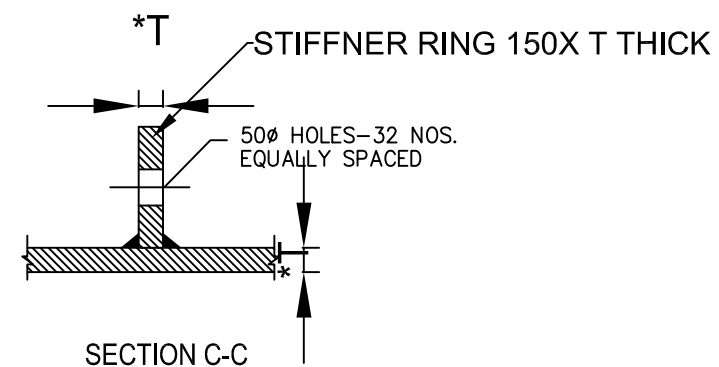


GROUTING DETAILS
(VERTICAL SHAFT)



TYPICAL SECTION FERRULE

* T= SHELL PLATE THICKNESS
(VARIES FROM 24mm to 40mm)



* T= SHELL PLATE THICKNESS
(VARIES FROM 24mm to 40mm)

NOTES:

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2. THE DIMENSIONS SHALL NOT BE SCALED OUT
3. ROCK BOLTS SHALL BE OF THE MECHANICALLY ANCHORED TYPE AND FABRICATED FROM REINFORCEMENT STEEL OF GRADE FE - 500 (IS:1786).
4. ORIENTATION, PATTERN AND LOCATION OF ROCK BOLTS MAY BE PROVIDED AS DIRECTED BY ENGINEER-IN-CHARGE TO SUIT SITE CONDITIONS, IN CONSULTATION WITH GEOLOGIST.
5. THE ROCK BOLTS SHALL BE GROUTED AS SOON AS POSSIBLE AFTER BOLT INSTALLATION.
6. COMPRESSIVE STRENGTH OF SFRS SHALL BE 20 MPA AT 28 DAYS. AND ADMIXTURES TO BE USED SHALL CONFORM TO IS-9103.

FOR DETAILED PROJECT REPORT ONLY

NOT TO THE SCALE



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WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

PRESSURE SHAFTS
GROUTING AND FERRULE DETAILS

अभिस्मृत
DSGN. Er. PRIYANKA

समीक्षा
CHKD. Er. SUMIT KUMAR

अनुमोदित
APPD. Er. L.M.VERMA

रेखांकित
DRAWN. Er. PRIYANKA

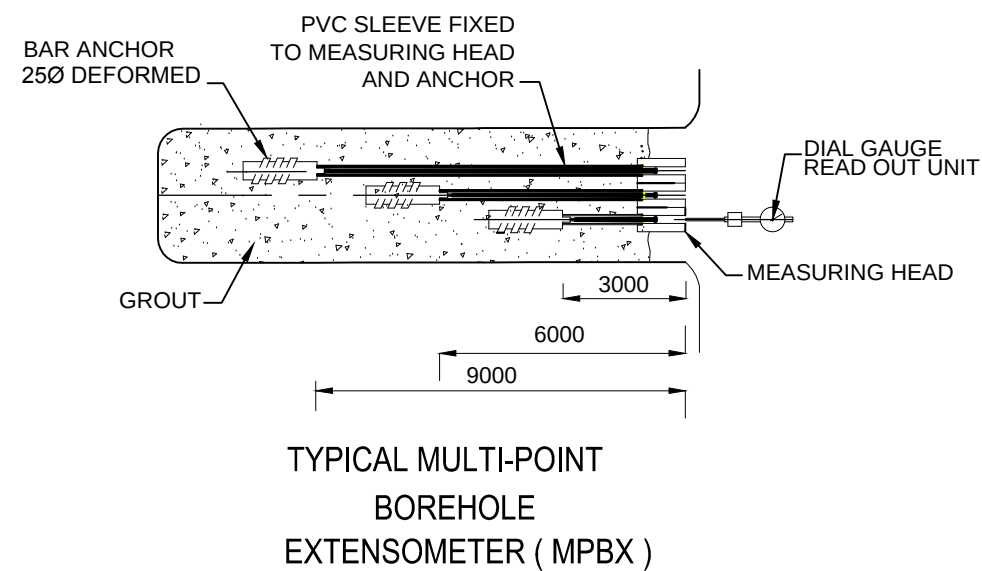
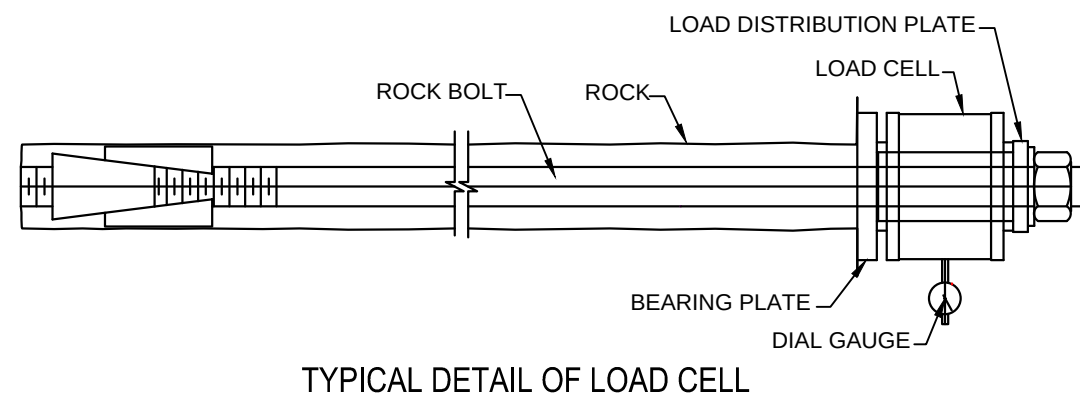
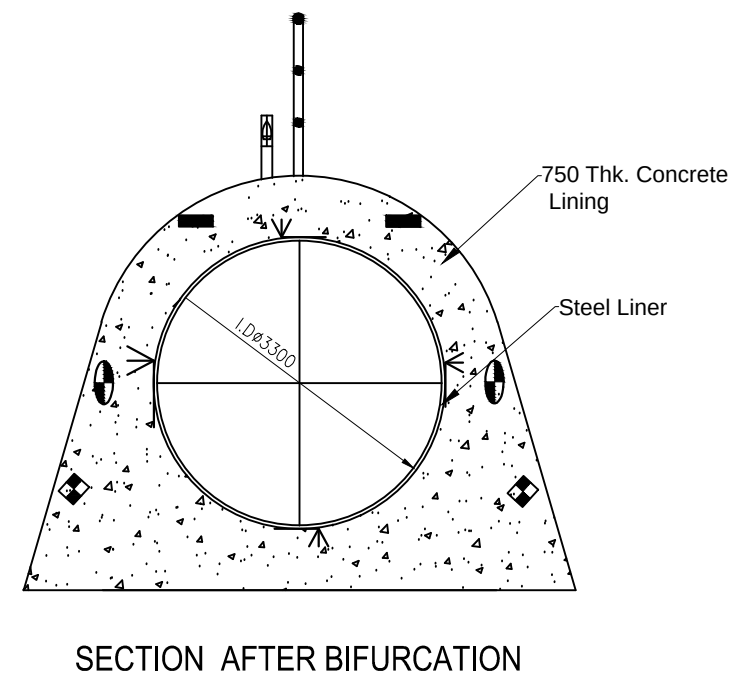
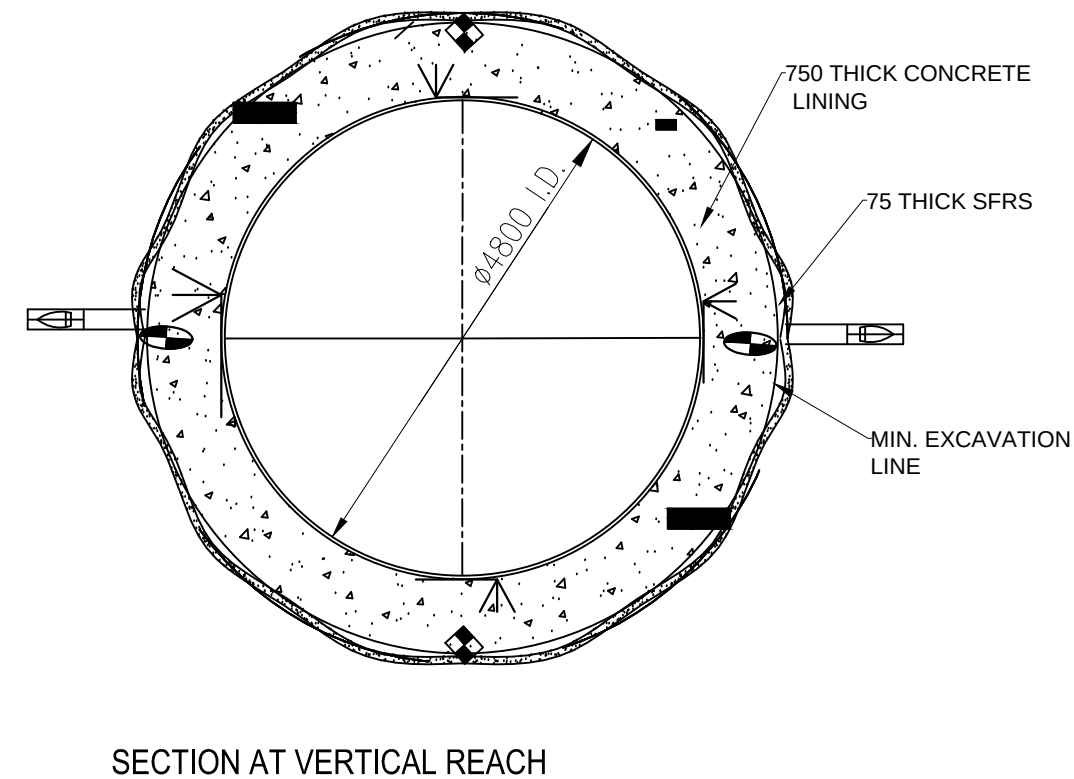
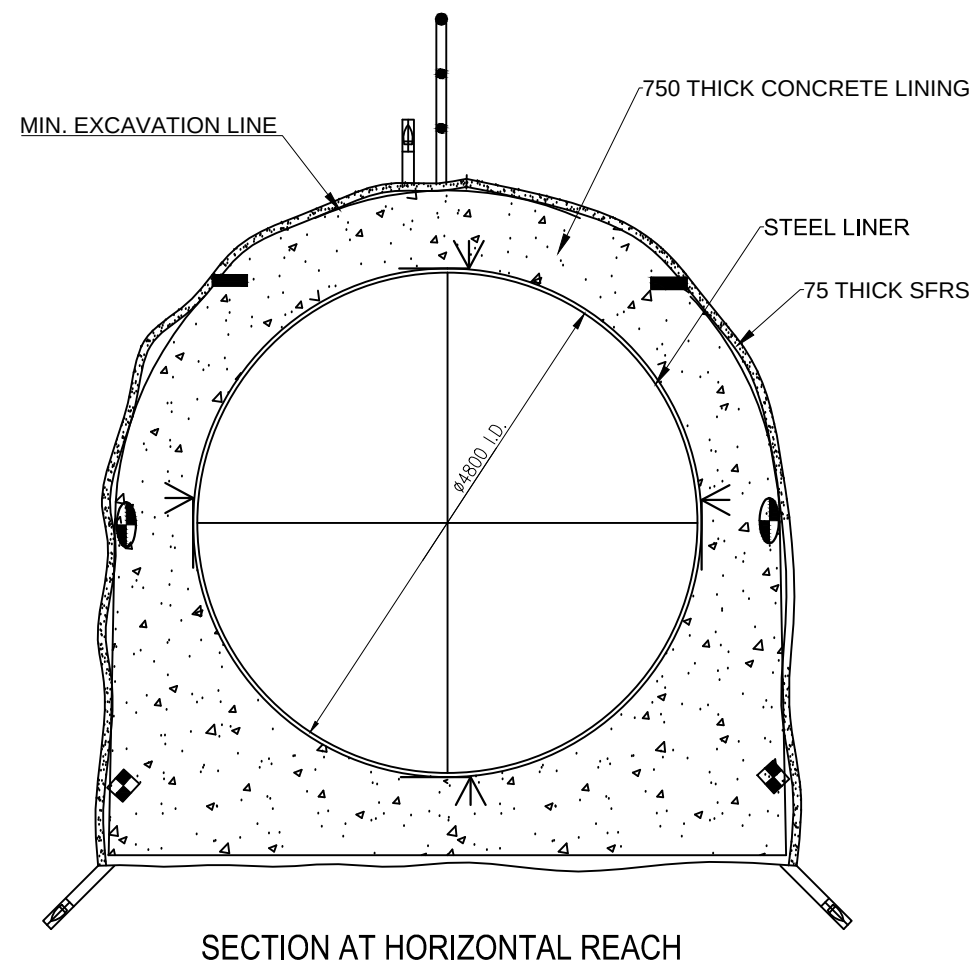
प्रस्तुत
SUBM. Er. M.S.THAKUR

DESIGN FOREIGN PROJECTS

DRG.NO.PS-WP-DPR05/00

DEC., 2011

CD



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS OTHERWISE SPECIFIED.
2. NO DIMENSION SHALL BE SCALED OUT, ONLY WRITTEN DIMENSIONS ARE TO BE TAKEN AS CORRECT.
3. INSTRUMENTS SHOWN IN THIS DRAWING ARE INDICATIVE ONLY.

LEGENDS :-

	MULTI POINT BOREHOLE EXTENSOMETER
	SHOTCRETE STRAIN GAUGE
	LOAD CELL
	SHOTCRETE RADIAL PRESSURE CELL
	PIEZOMETER
	V-W ARC WELDABLE STRAIN METER



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WANGCHU HYDRO ELECTRIC PROJECT BHUTAN

PRESSURE SHAFT SECTIONS INSTRUMENTATION DETAILS

अभिज्ञित DSGN. Er. ASHOK KUMAR	समीक्षित CHKD. Er. PRIYANKA	अनुमोदित APPD. Er. L.M. VERMA
रेखांकित DRWN. B.S. BANYAL	प्रस्तुत SUBM. Er. M.S. THAKUR	

DESIGN FOREIGN PROJECTS

DRG.NO. PS-WP-DPR-06/00

FEB , 2014