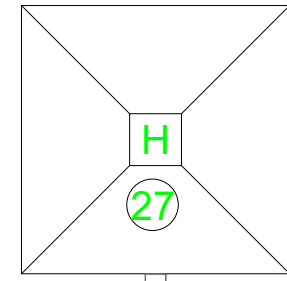
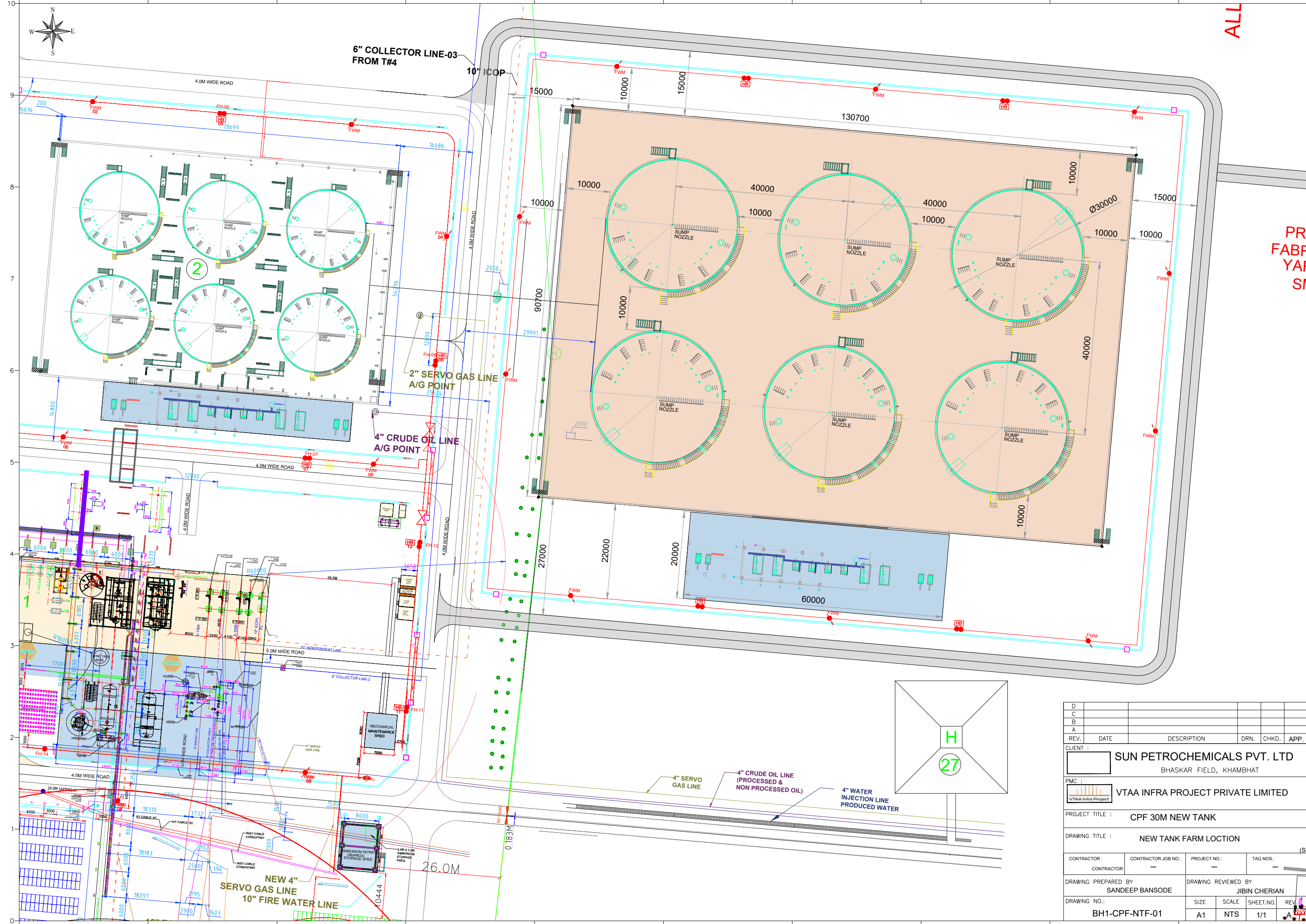
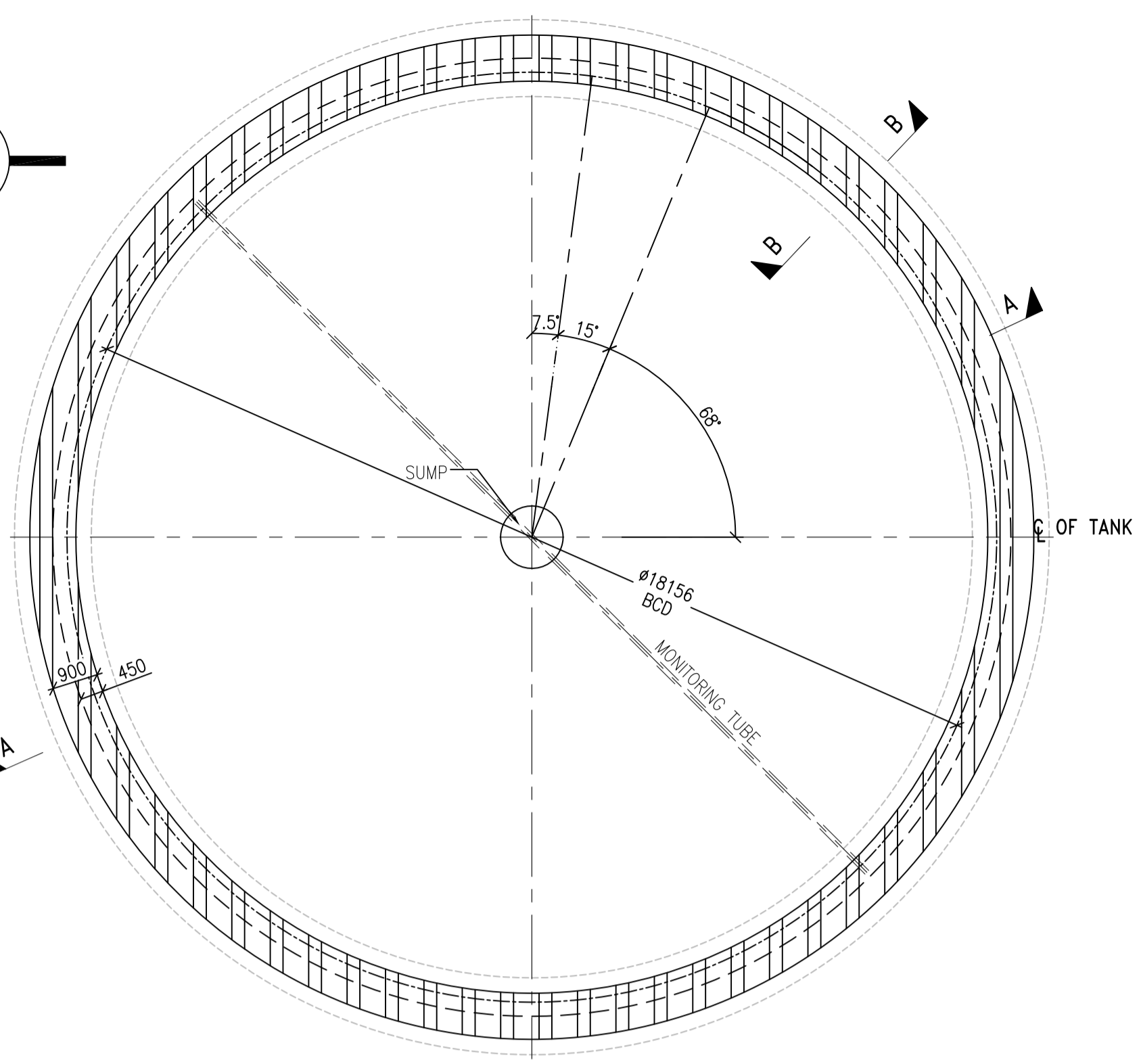
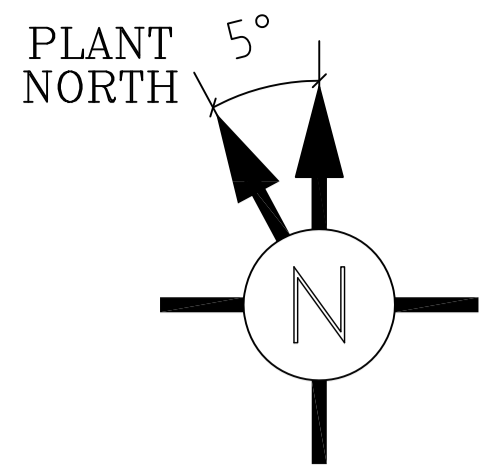


ALL

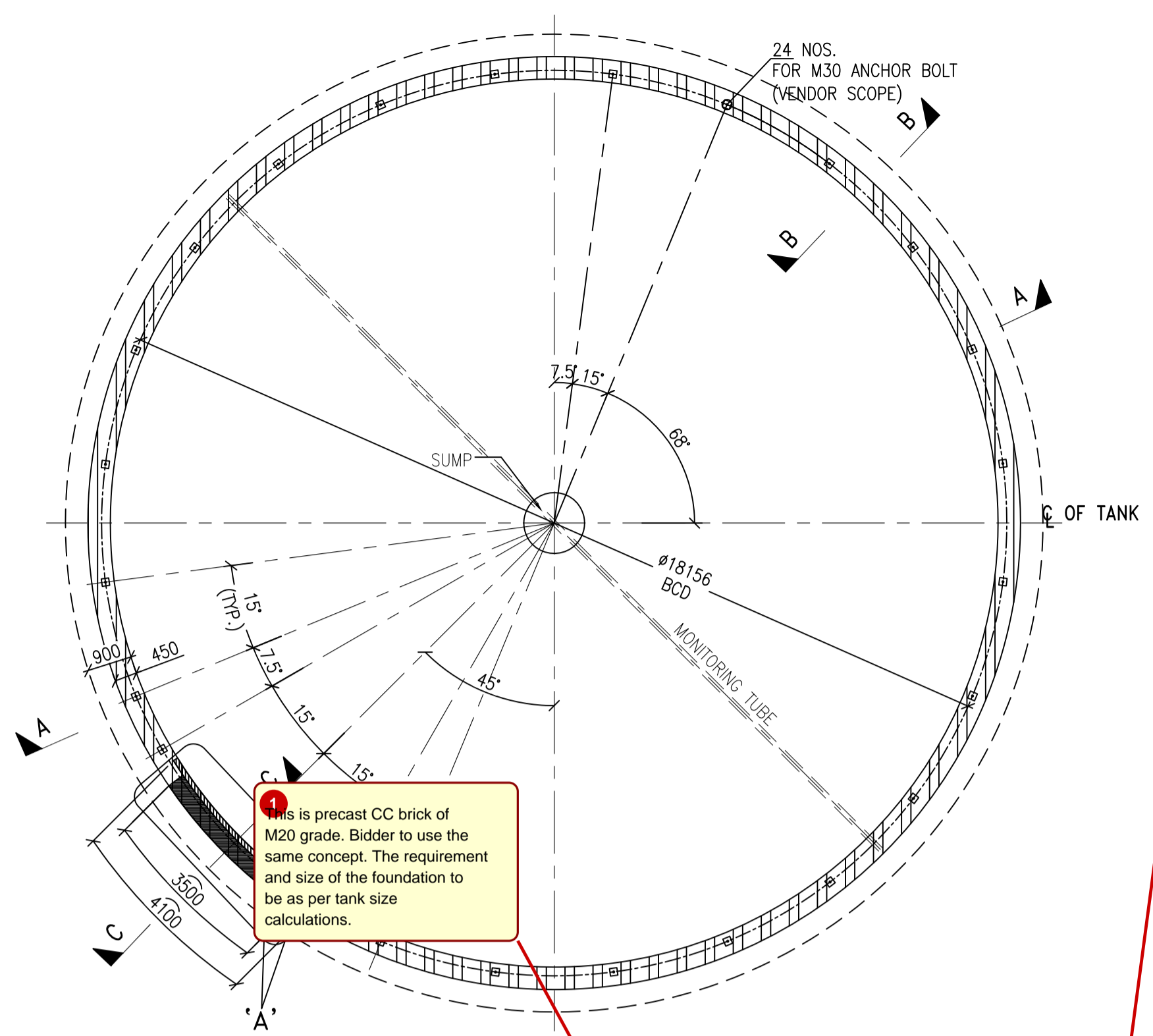
PR  
FABR  
YAF  
SM



D					
C					
B					
A					
REV.	DATE	DESCRIPTION	DRN.	CHKD.	APP.
CLIENT : SUN PETROCHEMICALS PVT. LTD BHASKAR FIELD, KHAMBHAT					
PMC : VTAA INFRA PROJECT PRIVATE LIMITED					
PROJECT TITLE : CPF 30M NEW TANK					
DRAWING TITLE : NEW TANK FARM LOCTION					
CONTRACTOR :	CONTRACTOR JOB NO. :	PROJECT NO. :	TAG NOS. :		
CONTRACTOR	-	-	-		
DRAWING PREPARED BY SANDEEP BANSODE			DRAWING REVIEWED BY JIBIN CHERIAN		
DRAWING NO. : BH1-CPF-NTF-01			SIZE : A1	SCALE : NTS	SHEET.NO. : 1/1



**BOTTOM PLAN OF FOUNDATION FOR STORAGE TANK**  
(SCALE 1:100)



**TOP PLAN OF FOUNDATION FOR STORAGE TANK**  
(SCALE 1:100)

**LEGENDS:**

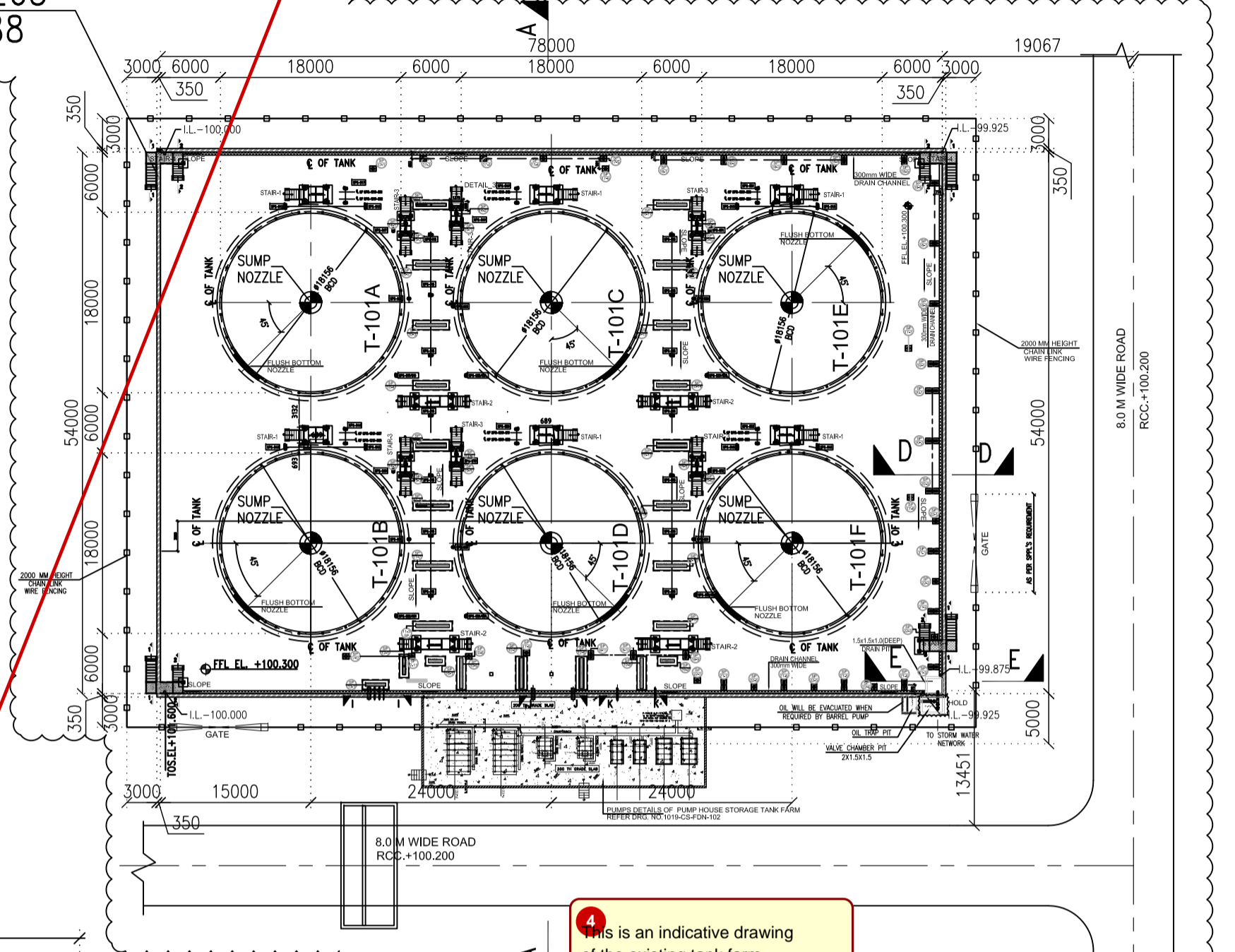
F.G.L : FINISHED GRADE LEVEL  
F.F.L : FINISHED FLOOR LEVEL  
B.O.P : BOTTOM OF PIPE LEVEL

**REFERENCE DRAWINGS**

DRG. NO.	DESCRIPTION
1019-PI-PPN-001-R16	PLOT PLAN
1019-PI-ELP-101	EQUIPMENT LAYOUT FOR CLASS "C" CRUDE OIL STORAGE TANK FARM
1019-PI-ELP-101	EQUIPMENT LAYOUT FOR CLASS "C" CRUDE OIL STORAGE TANK FARM

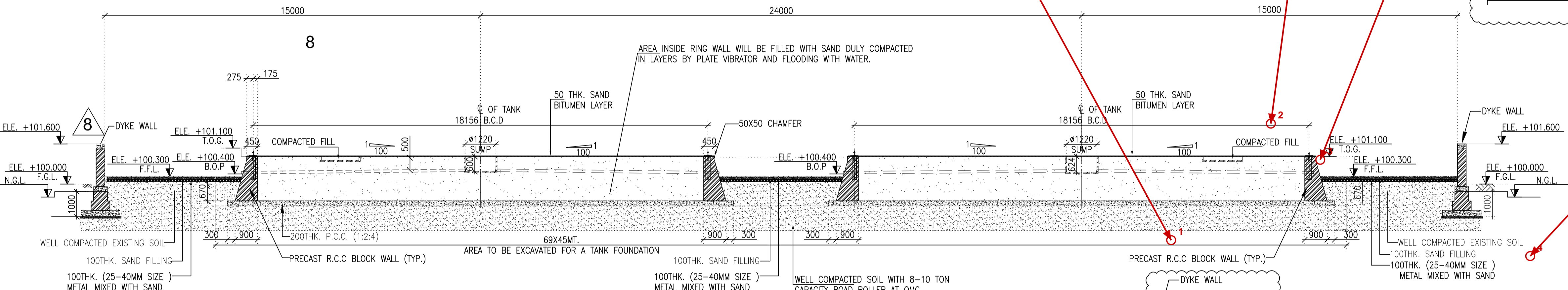
- 3 inch dia PVC pipe weep holes to be placed in CC block masonry as per requirement.
- 2 TANKS SHOULD BE LEFT LOADED FOR 3 WEEKS MINIMUM DURING HYDRO TEST BEFORE PIPING IS CONNECTED.
3. DIMENSION OF BLOCK WALL MAY VARY AS PER AVAILABLE BLOCK SIZE AT SITE, HOWEVER MINIMUM DIMENSION AS MARKED IN THE DRAWING SHALL BE FOLLOWED.

N: 512464.5265  
E: 101933.688

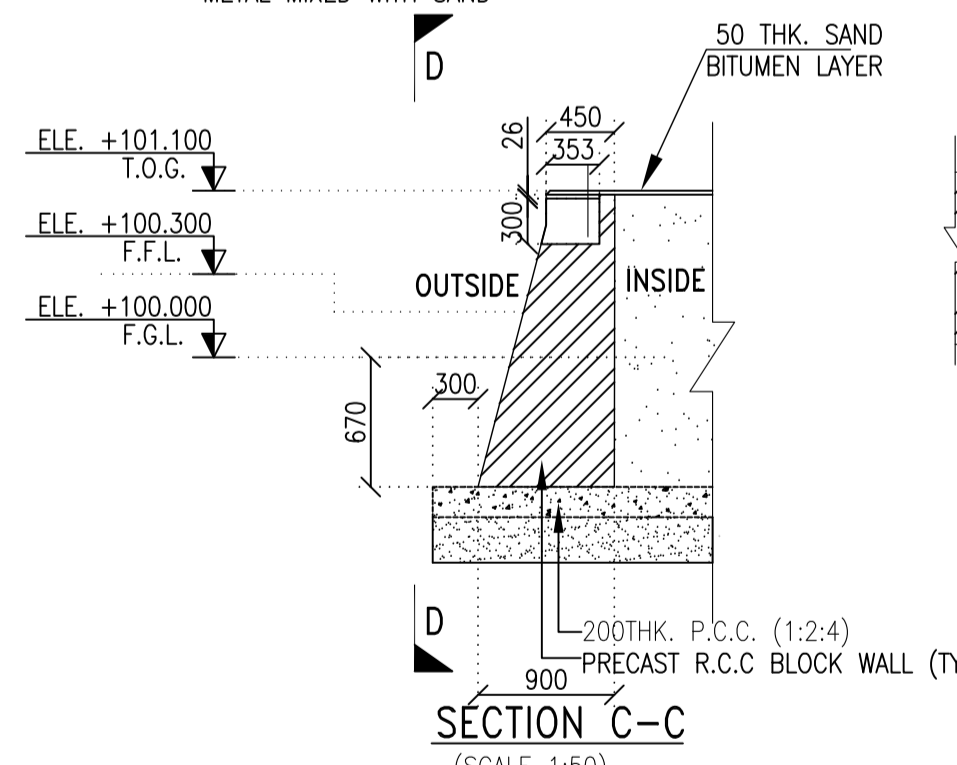


**TANK LOCATION PLAN**

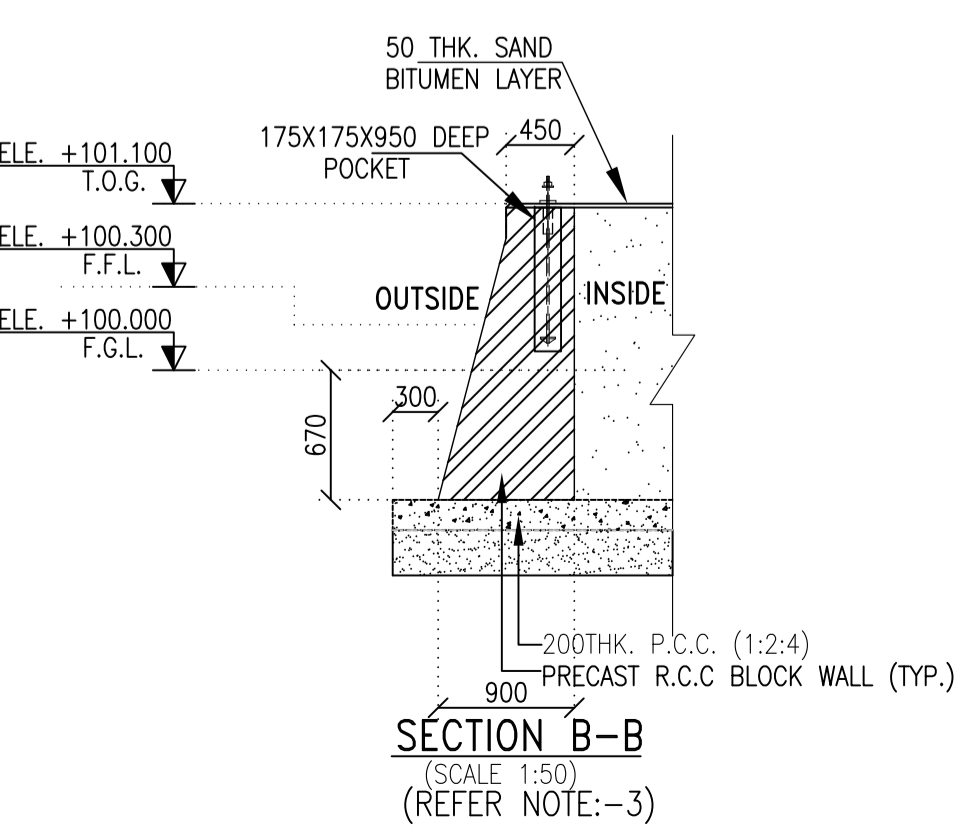
This is an indicative drawing of the existing tank farm foundation (to be used as concept). All the level / dimensions to be firm up during detailed design after award of work.



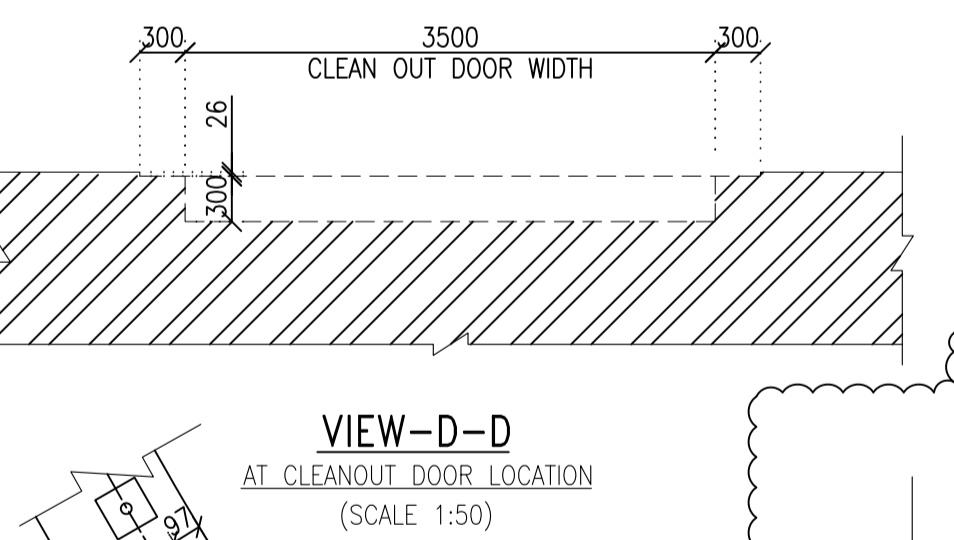
**SECTION A-A**  
(SCALE 1:100)



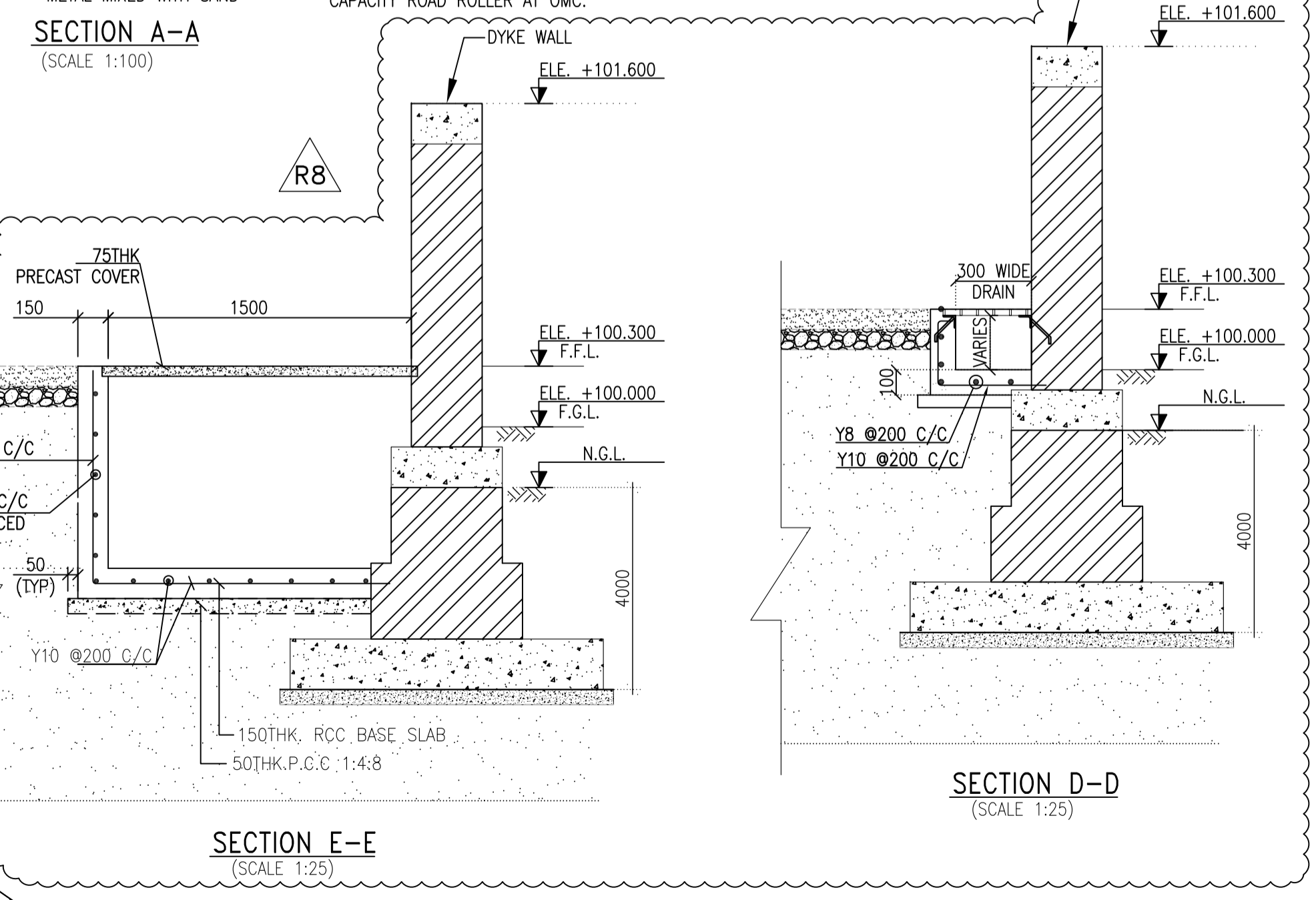
**SECTION B-B**  
(SCALE 1:50)



**SECTION C-C**  
(SCALE 1:50)

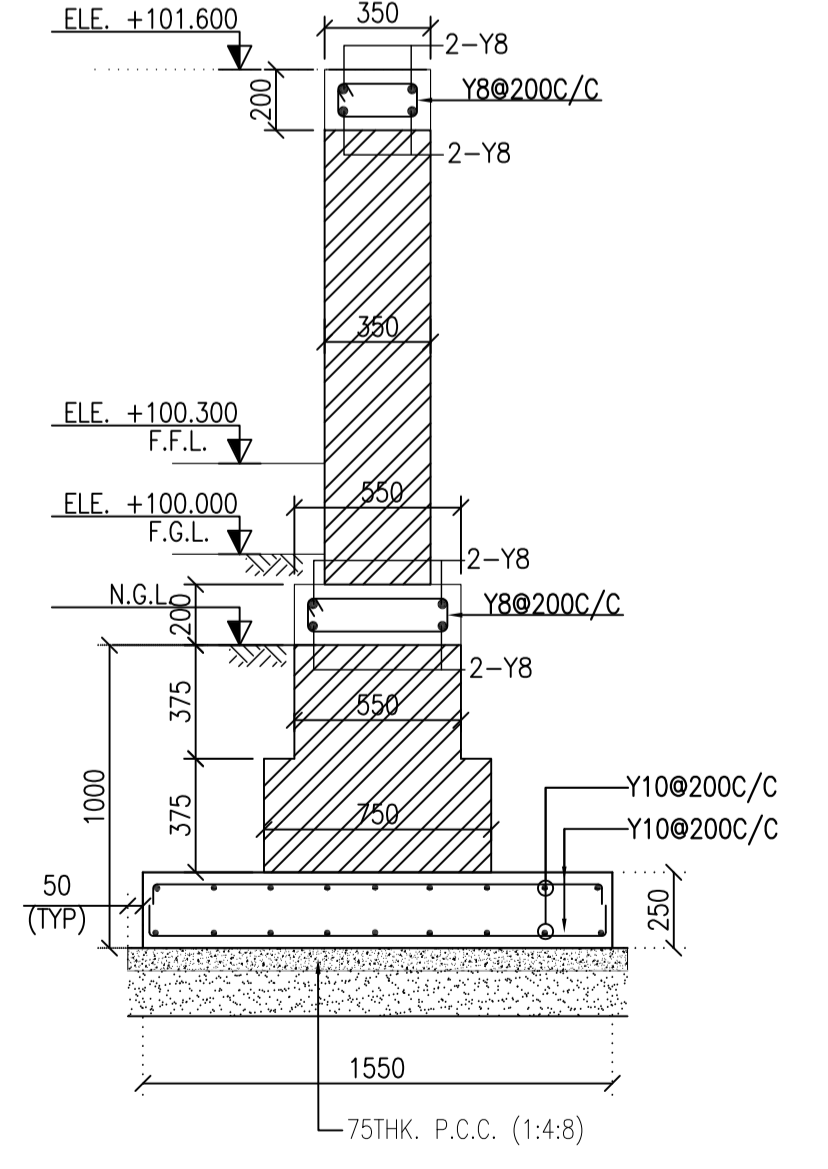


**VIEW-D-D**  
AT CLEANOUT DOOR LOCATION  
(SCALE 1:50)

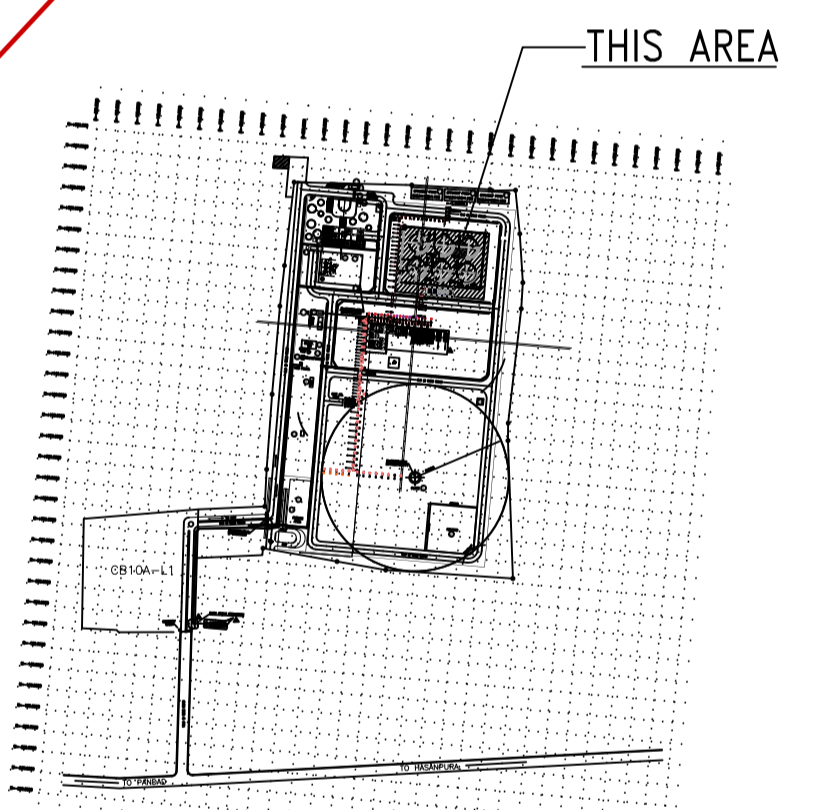


**SECTION D-D**  
(SCALE 1:25)

**SECTION E-E**  
(SCALE 1:25)



**TYPICAL DETAILS OF DYKE WALL**  
SCALE 1:25  
(REFER NOTE:-3)



**KEYPLAN**

REV	DATE	DESCRIPTION	DRAWN	CHKD	REVD	APPD
8	12.01.2020	REVISED AS MARKED & IFC	SNS	JYK	NVB	NVB
7	21.07.2020	REVISED AS MARKED & IFC	SNS	JYK	NVB	NVB
6	23.06.2020	REVISED AS MARKED & IFC	SNS	PCP	NVB	BKJ
5	08.06.2020	REVISED AS MARKED & IFC	SNS	PCP	NVB	BKJ
4	04.06.2020	REVISED AS MARKED & IFC	SNS	PCP	NVB	BKJ
3	25.05.2020	REVISED AS MARKED & IFC	SNS	PCP	NVB	BKJ
2	14.04.2020	REVISED AS MARKED & IFC	SNS	PCP	NVB	BKJ
1	07.01.2020	REVISED AS PER CLIENTS COMMENT & IFC	SNS	PCP	NVB	BKJ
0	03.01.2020	ISSUED FOR APPROVAL	SNS	PCP	NVB	BKJ

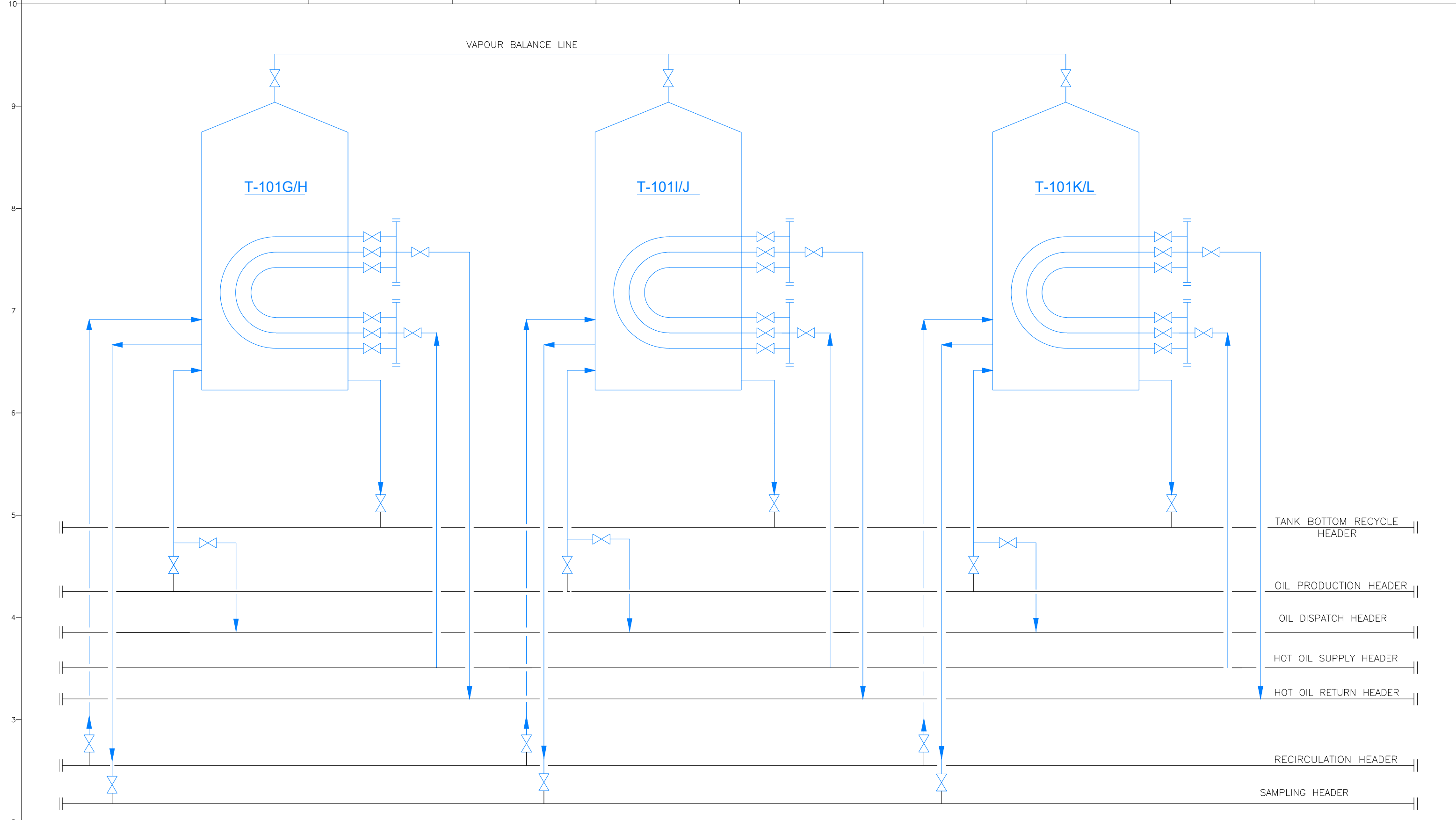
**QUANTA PROCESS SOLUTIONS PVT.LTD.**  
www.quantaprocess.com

CLIENT : SUN PETROCHEMICAL PRIVATE LIMITED

PROJECT : BHASKAR FIELD

TITLE : LAYOUT & DETAILS OF STORAGE TANK FOR TANK FARM AREA

SHEET NO.	REV.
1 OF 1	8

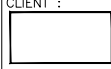



**Notes:-**  
 Scope of work is not limited to storage tank fabrication. It also includes the following:  
 1.Piping, valves, and fittings up to the dyke wall  
 2.Installation of gas equalizer lines interconnecting all six storage tanks  
 3.Fire Water Sprinkler / Foam Fire Protection System for the tanks.  
 4.Piping insulation within the dyke wall

 CONTRACTOR SCOPE  
 SUNPETRO SCOPE

LINE SIZE		
Sr.No	LINE NAME	SIZE
1	TANK BOTTOM RECYCLE HEADER	4 inch
2	OIL PRODUCTION HEADER	16 inch
3	OIL DISPATCH HEADER	16 inch
4	HOT OIL SUPPLY HEADER	6 inch
5	HOT OIL RETURN HEADER	6 inch
6	RECIRCULATION HEADER	4 inch
7	SAMPLING HEADER	2 inch

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APP.
A					
B					
C					
D					

CLIENT :  **SUN\_PETROCHEMICALS\_PVT.LTD**  
 BHASKAR\_FIELD,KHAMBHAT

PMC :  **VTAA\_INFRA\_PROJECT\_PRIVATE\_LIMITED**

PROJECT TITLE : **BHASKAR-I\_TENTATIVE\_PFD**

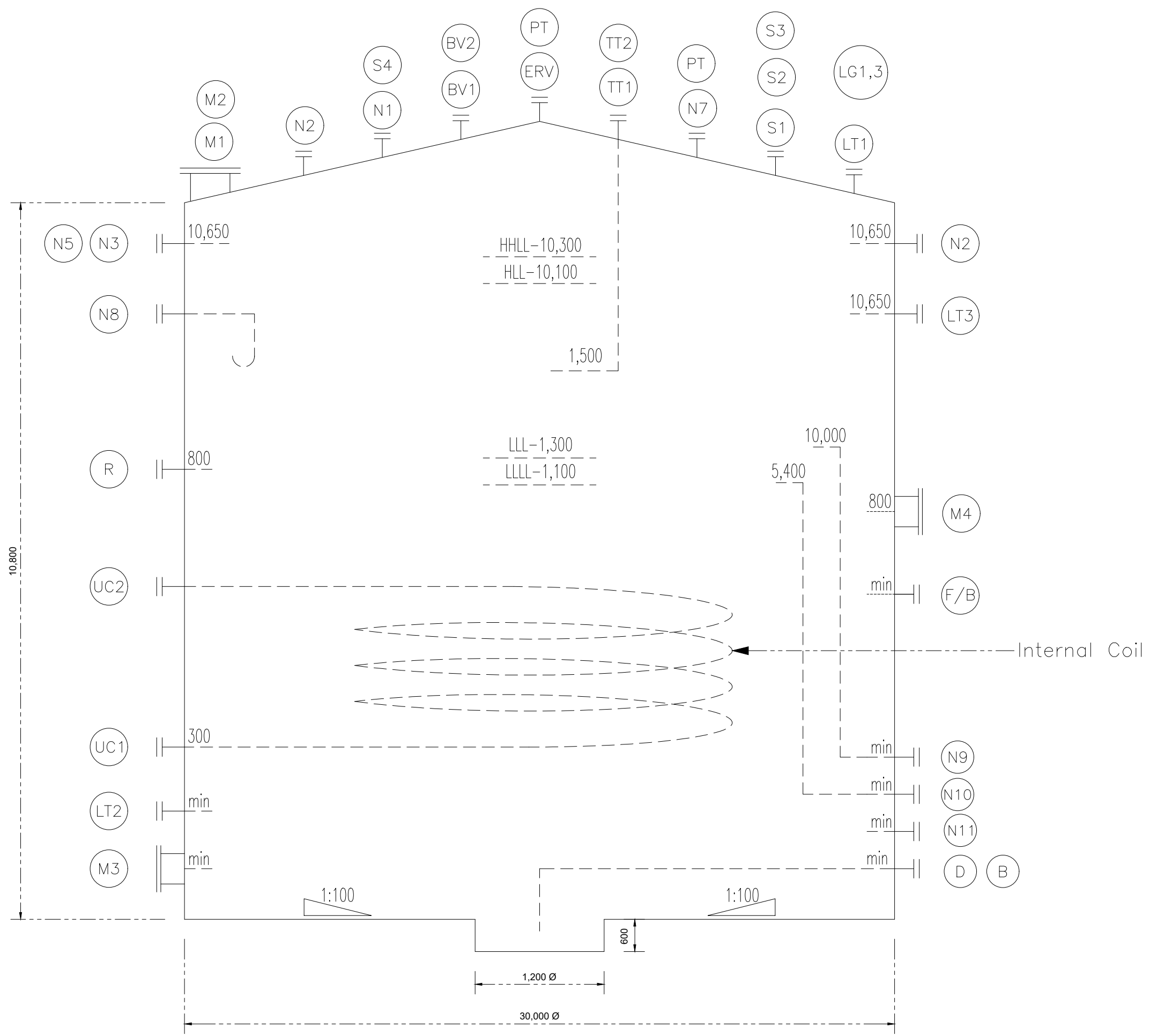
DRAWING TITLE : **PFD\_FOR\_STORAGE\_TANK**

CONTRACTOR : IN_HOUSE	CONTRACTOR JOB NO. : -	PROJECT NO. : -	TAG NOS. : -
--------------------------	---------------------------	--------------------	-----------------

DRAWING PREPARED BY : **SANDEEP\_BANSODE**      DRAWING REVIEWED BY : **JIBIN\_CHERIAN**

DRAWING NO. : **BH1-PFD-**

SIZE	SCALE	SHEET.NO.	REV.
A1	NTS	1/1	A



NOZZLE SCHEDULE		
Sr. No	Ref	Service
<b>Roof/Shell Side</b>		
1	F/P	Liquid inlet
2	B	Bottom outlet (Water) with internal pipe
3	R	Recirculation
4	ERV	Vent
5	D	Drain with internal pipe
6	PT	Pressure transmitter
7	BV 1-2	Breather valve
8	LT 1	Level transmitter (Radar)
9	LT 2-3	Level transmitter (DP Diaphragm type)
10	LG 1-3	Level gauge (Float type)
11	TT 1-2	Temperature transmitter
12	N 1	Dip hatch with B/F
13	N 2	Sampling point with B/F
14	N 3-5	Foam injection
15	N 7	Gas blanketing
16	N 8	PSV discharge with internal J pipe
17	N 9-11	Sampling point
18	M 1-2	Manhole with cover & davit arm
19	M 3	Flush type clean out door
20	M 4	Manhole with cover & davit arm
21	S 1-2	Spare with B/F
22	S 3-4	Spare with B/F
<b>Coil Side</b>		
24	UC 1	Hot oil inlet
25	UC 2	Hot oil outlet

TENTATIVE LINE SIZE		
Sr. No	SIZE	LINE NAME
1	4"	TANK BOTTOM RECYCLE HEADER
2	16"	OIL PRODUCTION HEADER
3	16"	OIL DISPATCH HEADER
4	6"	HOT OIL SUPPLY HEADER
5	6"	HOT OIL RETURN HEADER
6	4"	RECIRCULATION HEADER
7	2"	SAMPLING HEADER

NOTES:  
ALL DIMENSION ON ARE IN MM.

REV.	DATE	DESCRIPTION	DRN.	CHKD.	APP.
A	04-06-2026	ISSUE FOR APPROVAL	S.B.	J.C	

CLIENT : **SUN PETROCHEMICALS PVT. LTD**  
BHASKAR FIELD, KHAMBHAT

PMC : **VTAA INFRA PROJECT PRIVATE LIMITED**

PROJECT TITLE : **BHASKAR-I / CPF**

DRAWING TITLE : **STORAGE TANK MODEL DRAWING WITH NOZZLE SCHEDULE**

CONTRACTOR : <b>IN HOUSE</b>	CONTRACTOR JOB NO. : -	PROJECT NO. : -	TAG NOS. : -
---------------------------------	---------------------------	--------------------	-----------------

DRAWING PREPARED BY **SANDEEP BANSODE** DRAWING REVIEWED BY **JIBIN CHERIAN**

DRAWING NO. : <b>BH1-CPF-ST-NS-01</b>	SIZE <b>A1</b>	SCALE <b>1</b>	SHEET.NO. <b>1</b>	REV. <b>A</b>
--	-------------------	-------------------	-----------------------	------------------

<b>SERVICE FLUID</b>	CRUDE OIL				
<b>DESIGN / FABRICATION CODE</b>	API-650 12TH EDITION, MARCH 2013, ADDENDUM 2, JANUARY 2016				
<b>TANK SIZE</b>	ID 30m X HT 10.8m	<b>No. OF UNITS</b>	6	<b>TYPE</b>	FLAT BOTTOM + CONICAL ROOF/CYLINDRICAL+ VERTICAL + INTERNAL COIL
<b>DESCRIPTION</b>		<b>UNIT</b>		<b>DESIGN DATA</b>	
				<b>SHELL</b>	<b>INTERNAL COIL</b>
SHELL CAPACITY (OPERATING / GROSS)		m3			
OPERATING PRESSURE		mmWC (g)		+65 / -10	7 (kg/cm2(g))
OPERATING TEMPERATURE		°C		9-50	120
DESIGN PRESSURE (INT/ EXT)		mmWC (g)		150 @ top / -75	15 (kg/cm2(g))
DESIGN TEMPERATURE		°C		60	150
HYDROSTATIC TEST PRESSURE		mmWC (g)		FULL OF WATER	19.5 kg/cm2(g)
TEST PRESSURE POSITION				VERTICAL	VERTICAL
CONTENTS OF FLUID				CRUDE OIL	HOT OIL
DENSITY OF FLUID		kg/m3		812	823
CORROSION ALLOWANCE(SHELL/ROOF/BOTTOM)		mm		3 / 1.0 / 3 (INT.)	0 / 3 (INT. / EXT.)
RADIOGRAPHY				SPOT + ALL "T" JOINTS	NIL
JOINT EFFICIENCY				0.85	0.7
DP TEST				YES	YES

<b>GENERAL NOTES:</b>
1. WIND ANALYSIS - API-650 CL. 5.11
2. BASIC WIND SPEED 44 m/sec. IS 875 PART-3
3. SEISMIC ANALYSIS - API 650 - APPENDIX E & IS 1893 PART-4

<b>ITEMS</b>	<b>MATERIAL</b>	<b>ITEMS</b>	<b>MATERIAL</b>
SHELL / ROOF / BOTTOM PLATE	IS:2062 Gr.B	NAME PLATE	SS304
CURB ANGLE	IS:2062 Gr.B	NAME PLATE BRACKET	IS:2062
NOZZLE FLANGE	SA 105	ANCHOR CHAIRS	IS:2062
NOZZLE PIPE UP TO 250NB	SA 106 Gr. B	RAFTER ASSEMBLY	IS:2062
NOZZLE PIPE ABOVE 250NB	IS:2062 Gr.B	INTERNAL COIL	SA 106 Gr. B
PIPE FITTINGS	SA 234 Gr. WPB	COIL NOZZLE	SA 106 Gr.B
R.F. PAD	IS:2062 Gr.B	COIL FLANGE	SA 105
FASTENERS	A 193 Gr. B7 / A 194 Gr. 2H (HDG)	INSULATION CLEAT	NA
GASKET (FINISH 125 - 250 AARH)	STYLE-54 NON ETALLIC(3mm)	SUMP	IS:2062 Gr.B
PLATFORM & HAND RAILS	IS:2062 (HDG) + IS:1239(GI)		

RINGS & STIFFENERS	IS:2062	ANCHOR BOLTS	SA 36
PAD FOR EXTERNAL ATTACHMENT	IS:2062		
LIFTING LUGS	NA		
EARTHING LUGS (2 Nos.)	SA 36		

<b>GENERAL NOTES: -</b>
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.
2. ALL FLANGES (EXCEPT MANHOLES AS PER API 650) SHALL BE AS PER ASME B16.5 FOR SIZE UP TO NPS 24.
3. CONTRACTOR TO PROVIDE INTERNAL COIL SIZING AFTER DETAILED ENGINEERING FOR COMPANY APPROVAL.
4. ALL NOZZLE $\leq$ 50 NB SHALL BE STIFFENED WITH 2 GUSSETS 6t x 40WIDE @ 90 DEG. APART AND NOZZLE $>$ 50 NB SHALL BE PROVIDED WITH REINFORCEMENT PAD (2 X O.D OF PIPE) & PNEUMATIC TEST ON RF PAD AT 1.5 KG/CM <sup>2</sup> .
5. ALL C.S. EXTERNAL UNMACHINED SURFACES SHALL BE PREPARED & CAMOUFLAGE PAINTED AS PER SPECIFICATION NO. 1019-PI-SPC-103. & THE INTERNAL SURFACE COATING SHALL INCLUDE THE TOTAL TANK FLOOR, SHELL, ROOF WITH STRUCTURE AND INTERNAL PIPING (EXCEPT HEATING COILS. THE COATING SHALL BE APPLIED TO A MIN. DEPTH OF 15MILs (150micron) UTILIZING A HIGH BUILT EPOXY COATING MATERIAL SUCH AS DEVOE-253 OR EQUIVALENT.
6. SPARES- (A) 400% GASKET PER FLANGED JOINT (B) 10% OF BOLTS & NUTS (EACH SIZE) OR MIN. 4 NOS.
7. NO PRICE ESCALATION WILL BE ALLOWED FOR ADDITION OF 2 NOZZLES EQUIVALENT TO SIZE 250 NB.
8. PROJECTION OF NOZZLE SHALL BE MEASURED FROM OUTER SURFACE OF SHELL/ROOF UPTO FLANGE CONTACT FACE.
9.VENDOR TO PROVIDE HAND RAILINGS, STAIRCASE, PLATFORMS, ROOFWALK WAY ETC. HOT DIP GALVANISED & AS PER QPS STD.
10.VENDOR TO PROVIDE SHELL DEVELOPMENT DRAWING.
11. VENDOR TO FOLLOW MECHANICAL STANDARD FOR STORAGE TANK AS APPLICABLE.
12.CLEATS/SUPPORTS FOR FIRE WATER SPRINKLER SYSTEM SHALL BE PROVIDED ON ROOF & SHELL.
13. DIP HATCH SHALL BE NON-SPARKING AND SELF CLOSING TYPE. IT SHALL BE AWAY FROM ROOF WALKWAY.
14. BREATHER VALVE WITH FLAME ARRESTER SHALL BE NON FLAMEBLE & IN VENDOR SCOPE OF SUPPLY.
15. ARRANGEMENT FOR MONITORING OF INTERNAL CP TO BE PROVIDED BY CONTRACTOR.

REPORT OF GEOTECHNICAL INVESTIGATION FOR PROPOSED  
PROJECT INSTALLATION OF WELL FLUID PROCESSING TRAIN-B  
& ASSOCIATED EQUIPMENT AT CPF BHASKAR FIELD, PANDAD –  
TAMSA ROAD, TAL. KHAMBHAT, DIST. ANAND, GUJARAT

(GETS/2024/REPORTS/2389, DATE: 20.06.2024)

CLIENT:

**GOURAV TRADING COMPANY**

AHMEDABAD

Prepared By:

**Geostruct Engineering & Testing Services**

8-sahajanand co-op industrial estate, Munjmahuda, Baroda-390020

Mo.No. 9099012025 / 0265-2341590, 2358415

Email: info@geostruct.co.in // [www.geostruct.co.in](http://www.geostruct.co.in)

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7	RECOMMEDATIONS	5 – 6
	<b>FIELD AND LABORATORY TEST DATA</b>	<b>PLATES</b>
8	LOCATION PLAN	1
9	BORELOG	2
10	RESULT SHEET	3

# GEOSTRUCT

## ENGINEERING AND TESTING SERVICES

8, Sahajanand Ind. Estate, Munjmahuda, Padra road, Vadodara – 390020. Phone: 9099012025, 9099050338  
Email: info@geostruct.co.in, geostruct.engg@gmail.com, Website: www.geostruct.co.in

PAN: AABFG5352N • GSTIN: 24AABFG5352N1ZB

GETS/2024/REPORTS/2389

Date: 20.06.2024

### REPORT OF GEOTECHNICAL INVESTIGATION FOR PROPOSED PROJECT INSTALLATION OF WELL FLUID PROCESSING TRAIN-B & ASSOCIATED EQUIPMENT AT CPF BHASKAR FIELD, PANDAD – TAMSA ROAD, TAL. KHAMBHAT, DIST. ANAND, GUJARAT

#### 1.0 INTRODUCTION

SUN PETROCHEMICALS PRIVATE LIMITED is planning to Installation of well Fluid processing train-B & Associated equipment @ CPF Bhaskar field, Pandad-Tamsa road, Tal. Khambhat, Dist. Anand. They have awarded work of geotechnical investigation of proposed project site to us.

#### 2.0 SCOPE OF WORK

1. Drilling two bore holes up to 10m depth and collection of UDS and conducting SPT at regular interval.
2. Carry out laboratory testing on soil samples to evaluate engineering properties
3. Analyzing all field and laboratory data in order to develop engineering recommendations for foundation design and construction.

#### 3.0 FIELD WORK

The field work was commenced on 10.06.2024 and completed on 11.06.2024.

#### 3.1 Exploratory Boreholes and Location

The Summary of boreholes drilled is given in Table 1.

**Table 1: Summary of Bore Holes**

BH No.	Termination Depth of Bore Hole (m)	Ground water table below EGL (m)
BH-1	10.0	3.3
BH-2	10.0	3.0

All the test locations are shown in Plate 1. Bore logs are given as Plate 2 to 3.

#### 3.1.1 Standard penetration test (SPT)

SPT is conducted as per IS 2131 – 1981 at specified intervals. In a SPT test, standard split spoon sampler is driven at the bottom of the borehole. The penetration resistance in terms of blows for 30cm penetration of the split spoon sampler is measured as 'N' Value. The blows are imparted by a standard weight of 63.5 kg falling through a height of 75cm. The resistance is measured for 15cm, 30cm, and 45cm penetrations. The resistance measured for first 15cm is ignored since

those blows are considered as seating blows due to the loosening of the strata. The resistance of next 30cm is recorded as standard penetration value 'N'. If the sampler is driven less than 45cm (total) then the penetration resistance is given for the last 30cm of penetration. The observed SPT – N values for each borehole is given in bore logs attached as Plate 2 to 3.

### 3.1.2 Disturbed samples

Disturbed representative samples are collected, logged, labeled and placed in polythene bags.

### 3.1.3 Undisturbed samples

Undisturbed soil samples are collected in 75mm diameter (ID) thin walled sampler (Shelby tube) from each borehole. The sampler used for the sampling had smooth surface and appropriate area ratio and cutting edge angle thereby minimising disturbance of soil during sampling.

## 4.0 LABORATORY TESTS

The laboratory testing of soil samples is carried out in our own laboratory as per relevant IS standards

	TESTS ON SOIL & ROCK SAMPLES	TEST METHOD
a)	Grain Size Distribution (Sieve Analysis)	IS 2720 (Part 4)
b)	Atterberg's limits (liquid limit and plastic limit)	IS 2720 (Part 5)
c)	Engineering Classification of Soil	IS 1498
d)	Specific Gravity	IS 2720 (Part 3)
e)	Field Dry Density & Field Moisture Content	IS 2720 (Part 2 & 29)
f)	Tri-axial Shear test (for c & $\Phi$ ) - Tuu	IS 2720 (Part 11)
g)	Differential Free swell index test	IS 2720 (Part 40)
h)	Consolidation Test	IS 2720 (Part 15)

## 5.0 SOIL PROPERTIES

### 5.1 Executive summary of soil stratifications

BH No.	Stratum	Depth (m)	Description of Strata	SPT N Value
BH 1 & 2	-	0.0 – 0.5	Filled up soil in BH-2	
	I-a	0.0/0.5 – 3.5/4.0	Brownish silty clay of medium plasticity and of stiff to very stiff consistency	12 – 18
	I-b	3.5/4.0 – 10.0	Grey silty clay of medium plasticity and of very stiff to hard consistency	17 – 36

## 5.2 Ground water table

Water table was encountered at 3.0 – 3.3m depth below existing ground level during the sub soil exploration work carried out in the month of June 2024.

## 5.3 Soil Properties

Laboratory test results for various strata are given in Plate 4.

**Table 2: Range values of Sub-soil Properties**

<b>Stratum →</b>	<b>Brownish / Grey silty clay</b>
<b>Depth, m</b>	<b>0.0 – 10.0</b>
<b>Grain size analysis</b>	
Gravel (%)	00 – 02
Sand (%)	04 – 21
Silt and clay (%)	77 – 94
<b>Atterberg's limit</b>	
Liquid limit (%)	35 – 43
Plastic limit (%)	20 – 22
Plasticity index (%)	14 – 21
<b>Soil classification</b>	
CI	
Field bulk density (g/cc)	1.83 – 1.93
Field dry density (g/cc)	1.45 – 1.52
Field moisture content (%)	25.0 – 28.3
Triaxial shear test - Tuu	
Cohesion (kg/cm <sup>2</sup> )	0.74 – 0.80
Angle of internal friction (deg)	03 - 05
Specific Gravity	2.55 – 2.62
<b>Consolidation Characteristics</b>	
Compression Index, Cc	0.11
Pre-compression Pressure, kg/cm <sup>2</sup>	1.6 – 1.7
Coeff. Of Vol.change.cm <sup>2</sup> /kg (Pressure range of 2 – 4kg/cm <sup>2</sup> )	0.0103 – 0.0114
Free Swell index, %	10 – 40

#### 5.4 Chemical Analysis and Environmental Conditions

Soil and water samples from boreholes are collected and analyzed for pH, sulphate and chloride. The results of chemical analysis of soil and water samples are as shown in Table 3(a) and 3(b) below.

**Table 3(a): Chemical Analysis of Soil Samples**

Bore hole No.	Depth m	pH	Sulphate SO <sub>3</sub> (%)	Chloride (Cl), (%)
BH-2	1.5	8.5	0.010	0.16

**Table 3(b): Chemical Analysis of Water Samples**

Bore hole No.	pH	Sulphate SO <sub>3</sub> mg/l	Chloride (Cl), (mg/l)
BH-2	7.93	10	1700
IS 456 :2000 requirement Table-1	6 to 9	< 400	< 500

## 6.0 FOUNDATION ANALYSIS

### 6.1 OPEN FOUNDATION

The following formula is used for calculating ultimate net bearing capacity in the case of open foundation and raft foundation (Ref: IS: 6403 - 1981):

$$q_{\text{net safe}} = \frac{1}{F} [C N_c S_c d_c + q(N_q - 1) S_q d_q + 0.5B\gamma N_r S_r d_r R_w]$$

Where,

$c$  = cohesion in t/sq m

$\phi$  = angle of internal friction

$\gamma$  = effective unit weight of soil (g/cc)

$N_c, N_q, N_r$  = bearing capacity factors which are a function of  $\phi$

$q_{\text{net safe}}$  = safe net bearing capacity of soil based on the shear failure criterion.

$q$  = overburden pressure,

$R_w$  = water table correction factor

$S_c, S_q, S_r$  = Shape factors,

$d_c, d_q, d_r$  = Depth Factor

Shape Factor	$S_c$	$S_q$	$S_r$
Continuous strip	1.00	1.00	1.00
Rectangular	1+0.2 B/L	1+0.2 B/L	1-0.4 B/L
Square	1.3	1.2	0.8
Circle	1.3	1.2	0.6

$$\text{For } \phi \leq 10, d_c = 1 + 0.2 \frac{D_f}{B} \tan\left(45 + \frac{\phi}{2}\right) \quad d_q = d_r = 1$$

$$\text{For } \phi > 10, d_q = d_r = 1 + 0.1 \frac{D_f}{B} \tan\left(45 + \frac{\phi}{2}\right)$$

Following parameters are adopted for the evaluation of bearing capacity for shallow foundation.

Cohesion (kg/cm <sup>2</sup> ) C	0.74
Angle of Internal Friction (Degree)	0.00
Dry Density (g/cc)	1.45
Bulk Density (g/cc)	1.86
Specific Gravity	2.55
Coefficient of volume change mv (kg/cm <sup>2</sup> )	0.0114
Factor of Safety	2.5
Void ratio (Computed)	0.76
Type of Shear Failure Considered	Local
Water table effect	At NGL

The net safe bearing capacity for various sizes of individual rigid footings having vertical static load intensity is given in Table 4.

**Table 4: Summaries of SBC & SBP for open/shallow foundations**

Type and Size of Footing (m x m)	Depth below EGL (m)	Net Safe Bearing Capacity Based on shear parameters (t/m <sup>2</sup> )	Allowable bearing pressure for 50mm settlement (Sc) (t/m <sup>2</sup> )	Recommended allowable bearing capacity for 50mm settlement (t/m <sup>2</sup> )
1.5 x 1.5	2.0	16.7	25.0+	<b>16.7</b>
2.0 x 2.0	2.0	15.8		<b>15.8</b>
3.0 x 3.0	2.0	15.0		<b>15.0</b>

## 7.0 RECOMMENDATIONS

### 1.0 Shallow/Open foundations:

The net safe bearing capacity and safe bearing pressure considering laboratory shear and settlement parameters for shallow/open foundation is given in Table 4. The recommended value of allowable bearing pressure shall be for static vertical loading only.

For minor / lightly loaded foundations not sensitive to settlements having load intensity 5.0t/sq-m shall be placed at 1.0m below FGL on compacted filled up soil.

Foundation Level Preparation: The exposed foundation bearing surface should be compacted using light manual rammer/compactor so that the founding soils shall not remain disturbed / loosened. The

surface should then be protected from disturbances due to construction activities so that the foundations may bear on the natural undisturbed ground.

2.0 Water table was observed at 3.0 – 3.3m depth below existing ground level, during the sub soil exploration work carried out in the month of June 2024. For SBC analysis, effect of water level is considered at EGL.

3.0 Fill and compaction: Brownish silty clayey are low swelling characteristic hence it is suitable for filling purpose. The fill should be placed in layers not exceeding 20cm in thickness and at a moisture content  $\pm 2$  per cent of the optimum moisture content. It should be compacted to at least 95 per cent of maximum dry density as per Standard Proctor Compaction Test (IS: 2720-Part 7) with suitable compaction method.

4.0 Chemical Analysis and Environmental Conditions:

- a. pH values in soil show alkaline nature of the ground. Sulphate contents in soil show that site falls under Class 1 as per IS 456: 2000.
- b. In ground water sulphate & chloride content are exceed permissible limit as per IS 456:2000. It is suitable for construction purpose.
- c. The site is assigned 'Severe' environmental exposure considering local environment & Chemical Industry. Ordinary portland cement or Portland pozzolana Cement or Portland slag cement shall be used for concrete.  
For Severe exposure condition: Min. cement content 320kg/cum and minimum grade of concrete M30 with maximum free water-cement ratio of 0.45 shall be used or if higher cement content / grade of concrete is specified in contract specifications, it shall be followed.
- d. A clear concrete cover over the reinforcement steel of at least 50mm shall be provided for all foundations or if higher clear cover over reinforcement is specified in contract specifications, it shall be followed.

5.0 Excavation: Temporary open cut excavations to about 2.0 m depth for foundation construction may be cut using side slopes of 0.5(H):1.0(V). Such excavations are expected to remain stable except during rains. If excessive sloughing or caving is observed or for deep excavations, the slopes may be flattened further to ensure stability. However, local judgment shall be made by engineer in-charge at the time of execution.

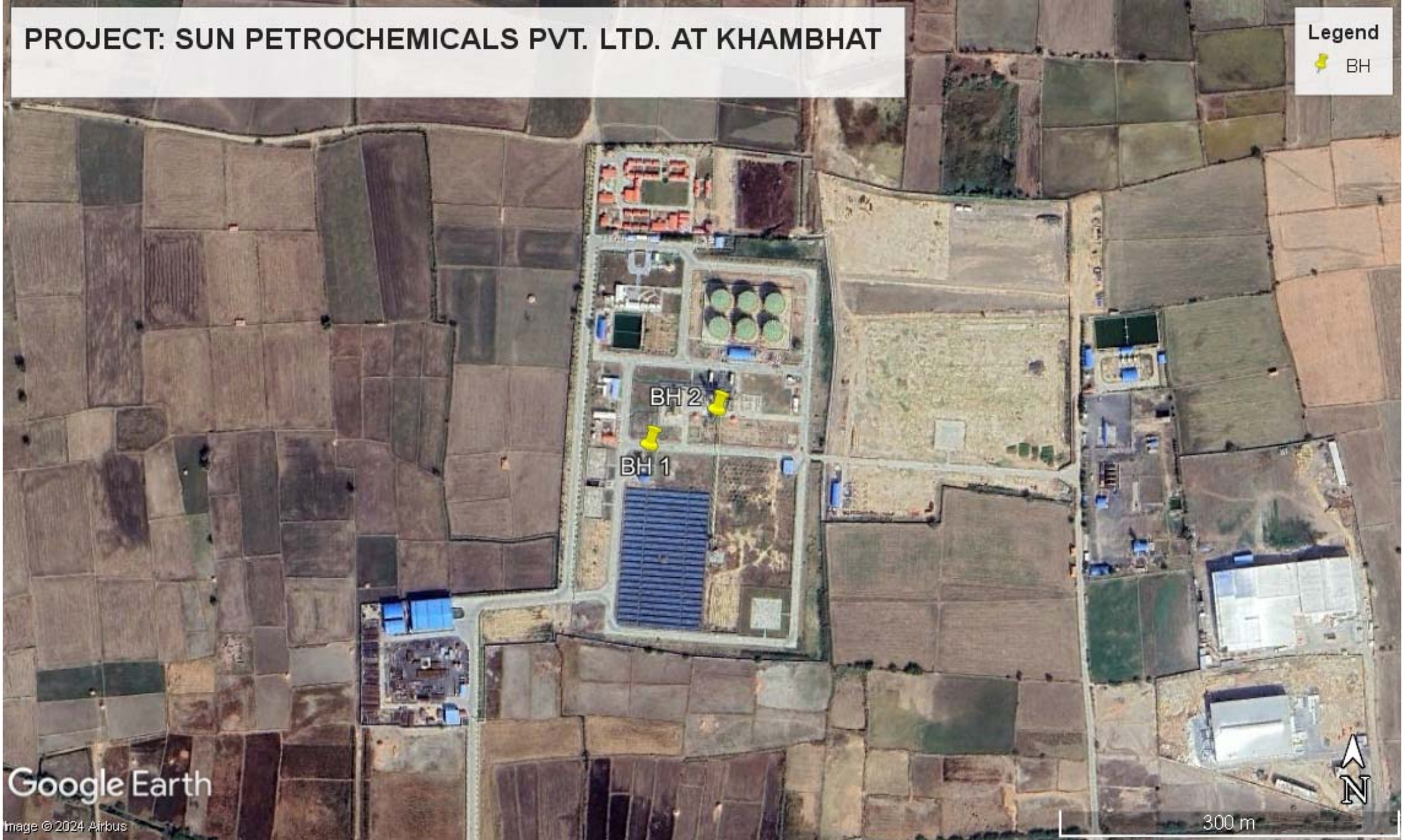
6.0 In case the proposed structures are located away from the test locations and / or the actual sub-soil conditions during excavation for various foundations are found different from what has been reported above, additional investigations would be needed prior to taking up of actual construction work at site.

**Authorized Sign: HIMAKSHI PATEL**

PROJECT: SUN PETROCHEMICALS PVT. LTD. AT KHAMBHAT

Legend

 BH



Google Earth

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300 m

# BORE LOG

PLATE: 2

**PROJECT :** Installation of well fluid processing train-B & Asso. equipment at CPF Bhaskar field At Sun Petrochemicals Pvt. Ltd., Khambhat

Bore hole no: 1	Diameter: 150 mm
Location / Co-ordinate. Hot Oil Train -B	Soil Sampler Used: Tube / SPT
Gr R.L.: -	Type of Boring: Manual Drilling
Ground Water Level : At 3.3 m	Date : 10.06.2024

Depth (m)	Description of Strata	Thk of strata (m)	Symbol	Sampling Details		SPT Value 'N' blows				GRAPHICAL REPRESENTATION										
				Depth		Type	A	B	C	B+C	10	20	30	40	50	60	70			
				From	To															
1	Stiff Brownish silty clay of medium plasticity	3.5		0.00	0.50	DS														
2				1.50	1.95	UDS														
3				3.00	3.40	SPT	5	7	5	12										
4	Hard Grey silty clay of medium plasticity	6.5		4.50	4.95	UDS														
5																				
6																				
7				6.50	6.90	SPT	9	14	22	36										
8				7.50	7.90	UDS														
9				9.00	9.45	SPT	6	11	23	34										
10																				

SPT N - STANDARD PENETRATION TEST VALUE

UDS = UNDISTURBED SOIL SAMPLE

DS = DISTURBED SOIL SAMPLE

REMARK : TERMINATED 10.0 M

**GEOSTRUCT ENGINEERING & TESTING SERVICES**

## BORE LOG

PLATE: **3**

**PROJECT :** Installation of well fluid processing train-B & Asso. equipment at CPF Bhaskar field At Sun Petrochemicals Pvt. Ltd., Khambhat

Bore hole no: 2	Diameter: 150 mm
Location / Co-ordinate: Opp. to Existing Process unit Train -B	Soil Sampler Used: Tube / SPT
Gr R.L.: -	Type of Boring: Manual Drilling
Ground Water Level : At 3.0m	Date : 10.06.2024 to 11.06.2024

Depth (m)	Description of Strata	Thk of strata (m)	Symbol	Sampling Details			SPT Value 'N' blows				GRAPHICAL REPRESENTATION									
				Depth		Type	A	B	C	B+C	REPRESENTATION									
				From	To						10	20	30	40	50	60	70			
	Filed up soil	0.5	[Symbol]	0.00	0.50	DS														
1	Very stiff Brownish silty clay of medium plasticity	3.5		1.50	1.95	UDS														
2																				
3				3.00	3.40	SPT	6	8	10	18										
4																				
	Very stiff Grey silty clay of medium plasticity	6.0		4.50	4.95	UDS														
5																				
6				6.00	6.45	SPT	5	7	10	17										
7																				
8				7.50	7.90	UDS														
9																				
10			9.50	9.95	SPT	7	8	10	18											

SPT N - STANDARD PENETRATION TEST VALUE      UDS = UNDISTURBED SOIL SAMPLE      DS = DISTURBED SOIL SAMPLE  
 REMARK : TERMINATED 10.0 M

**SOIL CHARACTERISTICS**

PLATE : 4

PROJECT : Installation of well fluid processing train-B & Asso. equipment at CPF Bhaskar field At Sun Petrochemicals Pvt. Ltd., Khambhat

Lab No.	Bore Hole No.	Depth In mt.	Natural Density		Natural water content %	Grain Size Analysis				Atterbergs Limits			Soil Group	Shear Parameters			Free Swell Index %	Spec-ific Gravity	Consolidation Test			
			field density g/cc	dry density g/cc		Gravel %	Sand %	Silt & Clay %		LL %	PL %	PI %		Types of tests	Cohesion Kg/cm <sup>2</sup>	Angle of int. friction Deg.			Compre-ssion index Cc	Pre-com. Pressure Pc Kg/cm <sup>2</sup>	Co.efficient of vol.Change mv (cm <sup>2</sup> /kg)	
								%	%													
24/1476/1/																						
1/2		0.5				2	21	---	77	---	37.0	21.5	15.6	CI								
1/1	BH-1	3.0	1.86	1.45	28.32	2	4	---	94	---	38.5	21.0	17.5	CI	Tuu	0.77	5	10.0	2.55	0.11	1.60	0.0103
1/3		4.5				0	8	---	92	---	35.6	20.8	14.9	CI								
1/4		7.5				0	14	---	86	---	36.1	21.3	14.8	CI								
2/1	BH-2	1.5	1.83	1.46	25.08	2	11	---	87	---	42.5	21.9	20.5	CI				40.0				
2/2		4.5	1.90	1.48	28.12	0	10	---	90	---	36.0	21.5	14.5	CI	Tuu	0.74	5		2.62	0.11	1.70	0.0114
2/3		7.5	1.93	1.52	27.15	0	12	---	88	---	35.2	20.9	14.3	CI	Tuu	0.80	3					

\* LL - Liquid limit , PL - Plastic limit , PI - Plasticity index , Tuu - Unconsolidated Undrain Triaxial Shear Test