GOVERNMENT OF TELANGANA
TELANGANA DRINKIMG WATER SUPPLY PROJECT
Rural Water Supply & Sanitation Department

TELANGANA WATER GRID

L&T Construction - Water, Smart World & Communication
CHENNAI

CLIENT:	CONSULTANT :
RURAL WATER SUPPLY AND SANITATION DEPARTMENT (WATER GRID), TELUNGANA.	WAPCOS LIMITED

PROJECT :	PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR:	L&T Construction, Water, Smart World and Communication

JOB Ref. No. : LE150883

	NAME	SIGN	DATE
DSGN			
CHKD			
APPD			

TITLE :

DESIGN OF SUMP - 20KL CAPACITY DABBAGUDA AT INDERVELLY MANDAL

DOC./DRG. No.

LE150883-C-WS-RW-DC-1422

SIZE: A4

REV.: A

RELEASED FOR

- ☐ PRELIMINARY
- ☐ INFORMATION
- ☑ APPROVAL
- ☐ CONSTRUCTION

Submitted sir,

Sub:RWS&S-TDWSP- Dabbaguda 20KL clear water sump in Indervelly Mandal– Komarambheem Asifabad Segment-Adilabad District-Designs -Approval-Reg.

*****

Kindly puruse the Designs of the following 20KL Clear Water sump at Dabbaguda(V) ,Indervelly (M), submitted by the Executive Engineer TDWSP Asifabad Division ,Adilabad district for approval.

1. **20 KL Clear Water Sump.**

The Executive Engineer TDWSP Asifabad Division has submitted Structural Designs & Drawings of 20KL Clear Water sump based on the field conditions and as per the estimate provisions , the structural designs & drawings for the above structure is verified with RWS&S standard Type Designs and submitted for approval.

The following design parameters were considered:

- Capacity : 20kL
- Net SBC of Soil : 10.0 t/sqm
- Grade of concrete & Steel : M 30 & Fe 500
- Dia of sump Inner to Inner : 4.00m
- Sidewall Height : 2.2mts
- Sidewall Thickness:150mm
- Top Slab thickness: 150 mm
- Raft Slab thickness: 250mm

As per the above parameters the structural design and drawings of the clear water sump is verified, as per similar Type designs available and approved by the RWS&S Department considering the SBC and type of soil , duly following IS codes, IS: 456-2000, SP:16, 34, IS:3370 and IS 1893-2002 (seismic codes).The sizes and steel proposed in the designs and drawings of all components are safe and sufficient.

The additional points noted after checking the designs are:

- Detailed Estimate of the Structure with these specifications has to be prepared and compared with the provision made in sanctioned estimate. Such that deviation if any is within authorized limits. If any deviations noticed, the Estimate should be submitted for obtaining approval from the Competent Authority.

Subject to approval a draft memo addressed to the EE, TDWSP Asifabad Division , for communicating approved Structure is put up for kind perusal and approval.

AEE (Designs)	DEE (Designs)	30/6/16 Superintending Engineer,
TDWSP,Nirmal Circle	TDWSP,Nirmal Circle	TDWSP,Nirmal Circle

Design Of 20 KL Capacity Sump at

(WITH FLAT TOP SLAB)

Data Not more than 5m Span

Location						
Safe bearing Capacity	sbc	safe for sbc		100	Kn/m^2	
Capacity	v			20	KL	
Free Board	fb			0.30	m	
Dead Storage	ds			0.30	m	
Dia of sump	d			4.00	m	
Projection of Bottom slab from side wall			ps = d/16 to d/8	0.25	m	OK
Depth of tank above GL	dgl	No uplift check required		1.00	m	
Depth of Water table below GL,	wl		Safe Against Uplift	0.90	m	
Depth of the tank	h			2.20	m	1.20
Thickness of Slab	td	Min 150mm thick	OK	0.150	m	0.097 m
Th. Of Side wall	sth	Min 150mm thick	OK	0.150	m	0.069 m
Th. Of Bottom Slab	bsth	Min 150mm thick	thick is Sufficient OK	0.25	m	0.000 m

Top Slab

						slab projection
Radius of Top slab	rs			2.00		0.15 m
Thickness of Slab	td	Min 150mm thick	OK	0.15	m	0.097 mm is required
Effective depth of slab	d			100	mm	
Total Load on slab		Self wt		3.75	kN/sqm	
		Live load		1.5	kN/sqm	
		Finishings		1	kN/sqm	
	w	Total load		6.25	kN/sqm	
Bending Moment	bm	(2/16*w*rs^2)		3.13	kN-m/m	
Area of Steel required	ast	(bm/(σstjd)		279	sqmm/m	
		σst	N/mm2	130.00	N/sqmm	
		j=1-k/3		0.86		
		k=1/1+σst/mσcbc		0.42		
		m=280/3σcbc		9.33		
		σcbc		10	N/sqmm	
		Grade of steel	Fe 415 , σst=	130	N/sqmm	
		Grade of Concrete	M 30			

Dia of Reinforcement	db	10mm				
Spacing required	min of	150 mm	280 mm	floor to	10mm	
Spacing provided			OK	150 mm	c/c	

Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings

Side Wall

Depth of the tank	h		2.2	m	
Th. Of Side wall	sth	Min 150mm thick	0.15	m	0.069 mm
Depth of tank above GL	dgl		1.00	m	
Moments					
	Inner Side		1.55	Kn-m	
	Outer Side		1.1	Kn-m	
Hoop force					
	Inner Side		30.72	Kn	(Tension)
	Outer Side		18.11	Kn	(Compression)

Reinforcement				Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	50
Outer face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	

Bottom slab Min 150mm thick

Safe bearing Capacity	sbc		100	Kn/m^2	
Th. Of Bottom Slab	bsth	thick is Sufficient	0.250	m	0.000 m
Dia of Bottom Slab	dbs		4.80	m	
Size of Haunch	bh		0.25	m	
effective cover to reinforcement for raft slab		covraft	65	mm	
Moments Radial			2.49	Kn-m	
Circumferential			2.39	Kn-m	

			Ast (Min 10mm dia)	Dia	Spacing Provided	floor to	
Reinforcemer	Top	mesh	300 mm^2	10 mm	225 mm	25	150
	Bottom	mesh	300 mm^2	10 mm	200 mm	50	200

Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion

Design Of Bottom Slab

CASE-1

Projection from side wall	ps			0.25	m
Dia of Bottom Slab	dbs	d+2*sth+2*ps		4.80	m
Size of Haunch	bh			0.25	m
Dia of Bar top	dbbs			10	mm
bottom	dbbsb			10	mm

Net Load on Bottom Slab

Wt of Top Slab		pi/4*(d+sth+topproj)^2*td*25		62.32	Kn	
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25		97.78	Kn	
Wt of Haunch		pi*(d-bh)*bh^2/2*25		9.21	Kn	
Total Load	wbs			169.31	Kn	
LL on TOP slab		pi/4*(d+sth+topproj)^2*LL		36.30	Kn	
				2.056	sq m	0.158
Effective foundation width of sidewall load on bottom slab, ewf			ps+sth+bh+bsth=	0.900	m	
Max Pr on Soil	prb	Wbs/(pi*(d+sth)*ewf)		14.43	Kn/m^2	

Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges

		r		2.075		1.95
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2*l		-2.49	mrb	-2.38 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2		-2.39	mtb	-2.38 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/16,0.01))		2.49	Kn-m	
Max Circumferential mon	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16,0.01))		2.39	Kn-m	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mr=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))^		0.087	m
				Provided th is Sufficient	
Eff Depth	de	bsth*1000-covraft		185	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%
				300	mm^2
Area of Steel	Astr	mr*10^6/(130*.87*de)		121	mm^2
Spacing					
Top Steel	Asttp	pi*(dbbs^2/4)*1000/max(Astmn,astr)		262	mm
Provide 10 mm dia TOR @ 225 mm c/c in the form of mesh at top					
Bottom Steel	Astb	pi*(dbbsb^2/4)*1000/(Astmin)		262	mm
Provide 10 mm dia TOR @ 200 mm c/c in the form of mesh at bottom					

Check For SBC

APPROVED
SE, NIRMAL
20/4/16

Load from tank Portion	wbs			169.31	Kn
Weight of Bottom Slab	wbsi	pi*(dbs^2/4)*bsth*25		113.1	Kn
Weight of water	ww	pi*(d^2/4)*h*10		276.46	Kn
Total	W	wbs+wbsi+ww		558.87	Kn
Pr on Soil	pr s	w/(pi*dbs^/4)	safe for sbc	30.89	Kn/m^2

CASE-2

Bottom Slab is designed as circular Slab loaded with Uplift and continuous Supported on edges

Load on Bottom Slab (Uplift)

Max Pr on Soil	pru	10*(h-dgl-wl)-bsth*25	No uplift check rec	0.00	Kn/m^2
		r		2.075	
Radial moment	mru	2/16*pru*(r)^2		0	
Circuferential Moment	mtu	1/16*pru*(r)^2		0	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mru=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))		0	m
				thick is Sufficient	
Eff Depth	de	bsth*1000-covraft		185	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%

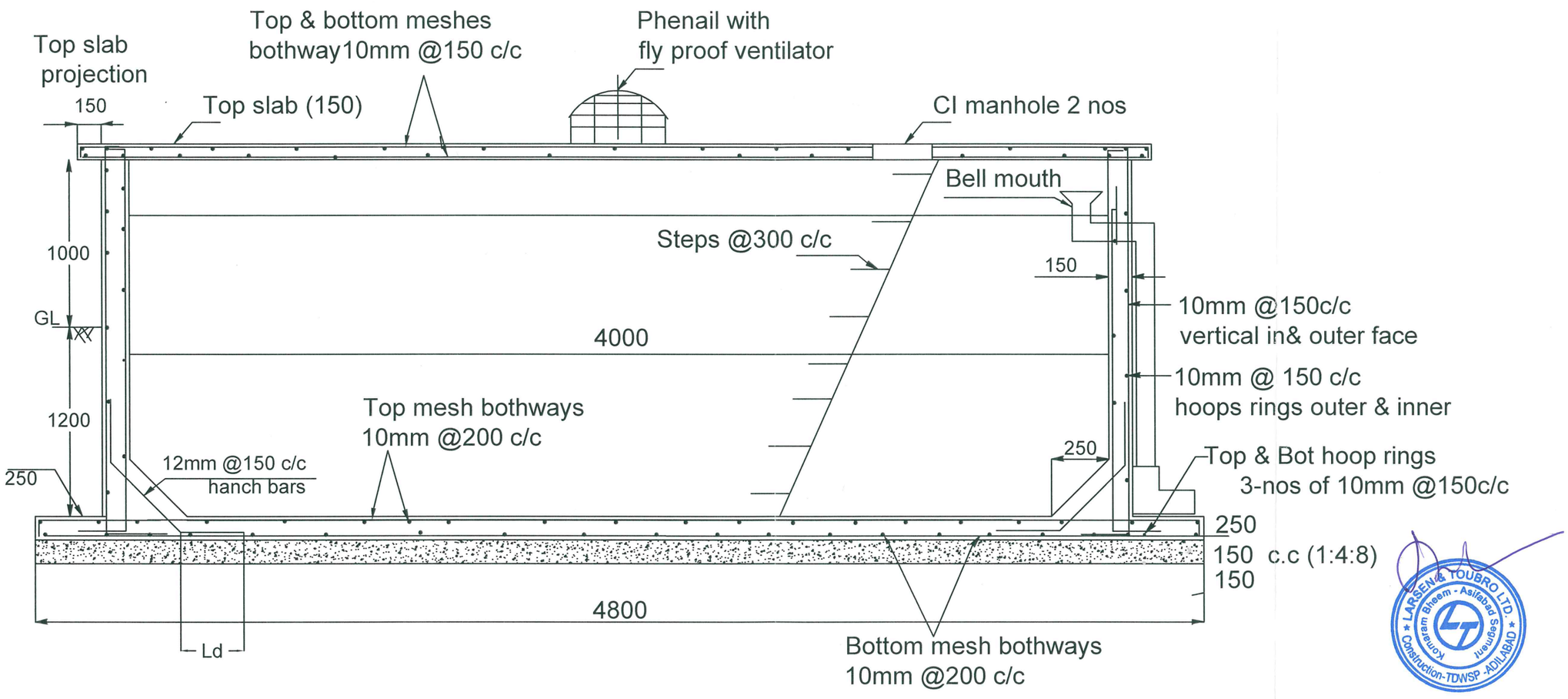
LARSEN & TOUBRO LTD. Komaram Bheem - Asifabad Segment Construction-TDWSP -ADILABAD

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

20KL SUMP



All dimenstions are in 'mm'
Concrete mix V.R.C.C M30
Steel Fe-415
Reinforcement details shall be as per IS-SP34

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

APPROVED
SE, NIRMAL
30/4/16

LARSEN & TOUBRO LTD. Komaram Bheem - Asifabad Segment Construction-TDWSP -ADILABAD

REV.NO.	DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR INFORMATION				

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT :

PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT (PRIMARY GRID)

SUPPLIER/CONTRACTOR : L&T Construction Water & Effluent Treatment SBG

JOB No : LE150883

NAME	SIGN	DATE

TITLE : DABBAGUDA AT INDERVELLY MANDAL
SUMP - 20KL

SCALE
PROJECTION

CHECKED BY	SIGN	DATE
CIVIL & STRUCTURAL		
MECHANICAL		
ELECTRICAL		
INSTRUMENTATION		

DRAWING No. LE150883-C-WS-RW-DC-1422 | SIZE A3 | REV. A

RELEASED FOR ☐PRELIMINARY ☐ TENDER ☐INFORMATION ☑APPROVAL ☐CONSTRUCTION

TELANGANA DRINKING WATER SUPPLY PROJECT

20 KL SUMP AT DABBAGUDA, INDERVELLY (M) IN ADILABAD DIST

1. INTRODUCTION

M/s. L &T Construction, Water & Effluent Treatment is proposing to construct 20 KL Sump at Wadoni (V), Utnoor (M). The work is taken up under Segment 22 , Komaram Bheem Project , TDWSP, Asifabad in Adilabad Dt.

The present Report presents the results of (3) Bore hole.

M/S Anji Drilling & Grouting works; Anantapur has carried out the drilling of bore holes, collection of soil and rock samples and conduct of Standard Penetration Tests at different levels in the respective bore holes at the proposed site.

Analysis of borehole data , Laboratory tests and geotechnical investigation report have been made by Prof. D Babu Rao, ME (IIT,R) , Ph.D. (USA), MIGS, Empanelled Consulting Geo technical Engineer &,Director, Geo technologies, Former Professor of Civil Engineering, Osmania University.

2. SCOPE OF WORK

The following is the scope of work of M/s. Anji Drilling and Grouting Works:

- Drilling Borehole at (1) location for 20 KL Sump in Wadoni , Adilabad Dt.
- Conducting SPT at regular intervals, where feasible
- Collection of undisturbed / disturbed samples from the Bore holes
- Preparation of Technical Report recommending suitable foundations and safe bearing capacity

Dr. D. BABU ...
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

Following is the scope of work of Prof. D Babu Rao ,

Testing of soil samples in the Laboratory

Preparation of Technical Report

3. SUB SOIL INVESTIGATION

The sub soil investigation was carried out to determine:

Nature of sub stratum and engineering properties of sub strata which may affect the mode of construction of the proposed work.

FIELD INVESTIGATION PROCEDURE:

The following technique is adopted for sub soil investigations.

a) BORINGS:

Rotary Drilling was done using TC / Diamond bits. The size of the casing used was 125 to 75 mm, yielding samples of NX size.

TC bits were employed for the overburden, and Impregnated Diamond Core bits were used for rock formation.

Drilling was performed on 7-8 Jan ,2016.

The following relevant data was recorded during Rotary drilling operations.

- Nature of strata
- Details of samples
- Core Recovery (CR)
- Rock Quality Designation (RQD)

GEO TECHNOLOGIES

M.E., Ph.D.(USA)

Consulting Geotechnical Engineer

b) STANDARD PENETRATION TEST (SPT):

SPT split spoon sampler of standard dimensions was driven into the soil from the borehole bottom using 63.5 kg hammer with a fall of 75 cm height. The SPT weight was lifted to the specified height and allowed to fall freely on the anvil with the use of cat-head winch with one to one and half turn of the drum. Blow counts for the penetration of every 15 cm were recorded and the 'N' value is reported as the blow counts for 30 cm penetration of the sampler excluding the first 15 cm penetration as seating drive.

When the number of blows exceeded 50 to penetrate the first or second 15 cm length of the sampler, the SPT 'N' is regarded as more than 100 as described in IS 2131 - 1981. The test is terminated in such case and a record of the penetration of the sampler under 50 blows is made. SPT refusal is recorded when there is no penetration of the sampler at any stage and also when a rebound of the sounding system is recorded. These tests were conducted at close intervals of 1.0m so that a continuous SPT 'N' profile is available.

Disturbed soil collected in the SPT sampler was preserved in polythene covers and transported to the laboratory. Additional polythene cover was used to prevent the loss of moisture during the transit period.

c) DEPTH OF BORING: The depth of the Bore hole was as follows:

BH No	R L	Drilled depth
1	417.780	6 m

Dr. B. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

d) LOG OF BORE HOLE:

All the results obtained from the field operations are presented in Log of Bore hole in Fig. 1 .

4. LABORATORY TESTING:

The laboratory tests are conducted in the laboratory of Geotechnolgies, Hyderabad, an ISO- 9000 approved Laboratory.

Weathered rock from 0 – 2 m depthl was followed by Hard rock to 6 m depth.

The following tests were conducted on cores from hard rock :

- Unconfined compressive strength (as per IS: 9143)

Table 1 gives the rock properties of Cores.

5. SUB SOIL PROFILE

Based on Field and Laboratory tests, the following idealized sub soil profile is evolved.

Depth	Strata	N value
0 – 2 m	Weathered rock	>100-
2 - 6 m	Hard rock	Cores

In Hard rock, no SPT could be conducted. However, in weathered strata, SPT was conducted with N values tending to be 'refusal'. This is the criterion for distinguishing between SDR/Weathered rock and Hard rock.

Dr. D. BABU M.E., Ph.D. (USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

6.0 SHALLOW FOUNDATIONS

In general, the following pertains to foundations resting in soils.

. A properly designed foundation has to satisfy the following two limit states.

1) Limit state of collapse (i.e. Shear strength)

2) Limit state of serviceability (i.e. Settlement)

SHEAR CRITERIA:

The first criterion is depends on shear strength. The calculations are based on "TERZAGHI" bearing capacity equation as recommended by IS: 6403 (with factor of Safety) which takes care of L/B ratio (shape), foundation depth etc., along with other parameters.

SETTLEMENT CRITERIA:

The intensity of loading that will cause a permissible settlement or specified settlement of the structure is termed as allowable bearing pressure. The settlement in this type of layer will be elastic settlement.

These foundation settlements are evaluated using elastic theory. The pressure distribution below the footing is assumed as 2 V: 1 H for estimating the settlement. Since rock formation is available at shallow depth. The settlement will be within the permissible limit. Hence open foundation is suitable.

ALLOWABLE BEARING CAPACITY:

Allowable Bearing capacity (ABC) is the net intensity of the loading which the foundation will carry without undergoing settlement in excess of the permissible value for the structure under consideration but not exceeding the net safe bearing capacity (SBC).

7.0 DISCUSSION ON FOUNDATION OPTIONS

From sub soil profile and laboratory test data, it can be seen that hard rock exists

Dr. B. BABU R.....
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

from 2 m .Hence shallow foundation is feasible and same is recommended.

8.0 RECOMMENDATIONS

Based on Field Investigations and laboratory testing, the following Recommendations are made for construction of 20 KL Sump at Dabbaguda Adilabad Dt..

a) Open foundations resting in hard rock at 2 m below GL ,are recommended. The structure is likely to result in saturation and inundation of the sub soil during long – time operation,

b) SBC is recommended as follows :

Location		BH 4,5,6
S. No.	Depth (m)	Recommended SBC t/ sq m
1	2.0	10
2	3.0	12
3	4.0	13

c) The actual size of foundations will be based on loads from the superstructure.

For ANJI DRILLING AND GROUTING WORKS

(DR. D. BABU RAO)

M. E(IIT,R), Ph. D. (USA), MIGS

Former Professor of Civil Engineering

Consulting Geotechnical Engineer

MCH Panelist No. 2490/TP/2000-2

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

TELANGANA DRINKING WATER SUPPLY PROJECT

FIG 1 : Record of Boring, *Bore Hole No : 1*

20 KL SUMP AT DABBAGUDA IN ADILABAD DT.

Type of Boring: Core drilling — Dia of Boring: NX

Date : 7 – 8 Jan 2016 — GL : 417.780 — Drilled depth = 6 m

Depth, m	Profile	Soil	Sample Depth m	N value	CR, %	RQD%
0		Weathered rock	0	>100	Small pieces	
1.0			1,5			
2.0		Hard rock	2.0		79	73
3.0			3.5		77	77
4.0						
5.0			5.0		79	70
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						
16.0						

DR. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

TABLE 1 : RESULTS OF TESTS ON ROCK SAMPLES

20 KL SUMP AT DABBAGUDA IN ADILABAD DT.

BH No.	Depth, m	Specific gravity	Porosity %	Water absorption %	UCS Kg / sq cm
1	2.2	2.70	3.9	2.9	410
	3.6	2.70	4.1	3.0	412
	5,4	2.71	4.0	2.9	467

NOTES : Where core Samples are less than 100 mm long, UCC tests are not conducted.

DR. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

APPENDIX

CALCULATION OF SBC

20 KL SUMP AT DABBAGUDA IN ADILABAD DT.

TYPICAL CALCULATIONS FOR OPEN FOUNDATIONS RESTING IN

HARD ROCK AT 2 M DEPTH

From Lab tests UCC is taken as 400 kg / sq cm

Keeping the heterogeneous nature of rock,

For RQD < 0.50, Field strength = 0.2 x 400 = 80 kg / sq cm

With a F.S. of 10, SBC = 80/10 =8 kg /sq cm

= 80 t / sq m

Recommended SBC is **10** t / sq m.

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

LARSEN & TOUBRO LTD. Construction-TDWSP Segment Adilabad

GEO TECHNOLOGIES

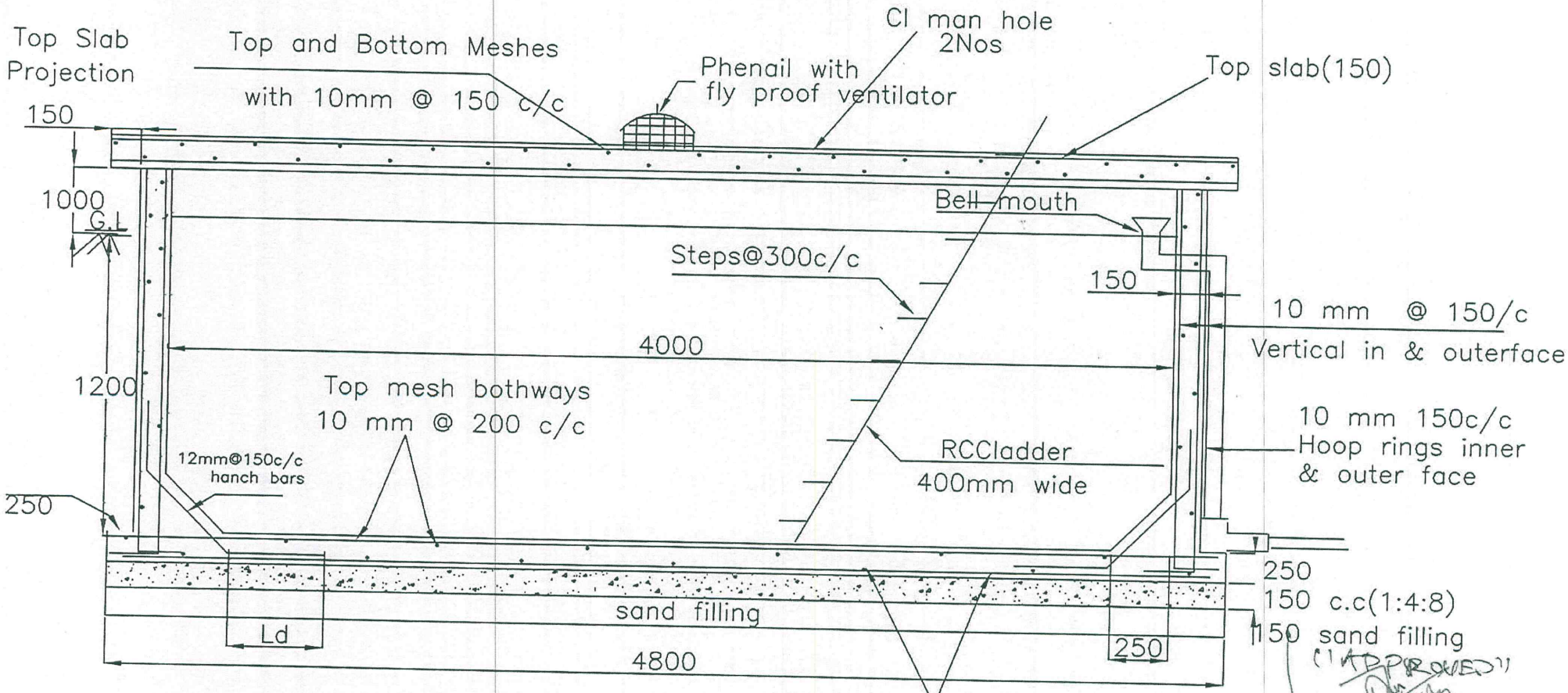
Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

APPROVED

SE, NIRMAL



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

20 KL SUMP

"APPROVED"

EASC-RWS & SH

19/4/14

SCHEME :CPWS Schemes
LOCATION: Adilabad District
DWG.NO.