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வ.உ.சிதம்பரனார் துறைமுக ஆணையம்
वी.ओ. चिदम्बरनारपत्तनप्राधिकरण
V.O.C Port Authority

V.O.CHIDAMBARANAR PORT AUTHORITY
पत्तन, पोतपरिवहनऔरजलमार्गमंत्रालय
CIVIL ENGINEERING DEPARTMENT
MINISTRY OF PORTS, SHIPPING AND WATERWAYS
भारतसरकार GOVERNMENT OF INDIA
ADMINISTRATIVE OFFICE, HARBOUR ESTATE,
TUTICORIN 628 004, TAMIL NADU



SAGARMALA
PORT-LED PROSPERITY

No.CIV-OFCEV-PLC-ESTAB-V1-23/D. 1312

Date: 28.04.2025

CORRIGENDUM - II

Name of work: "Establishment of 3 MLD Desalination Plant based on sea water reverse osmosis at V.O.Chidambaranar Port and Operation and Maintenance for 5 Years on DBO Mode"


Ref: NIT No.01 CE/RCM&BMR/2025-26/D.886 Dated: 02.04.2025


With reference to the clarification sought by the Tenderers through E-mail for the tender NIT No.01 CE/RCM&BMR/2025-26/D.886 Dated: 02.04.2025, the reply to the is attached herewith.

This Corrigendum along with annexures will form part of the Tender document.

Encl: As above

Yours Faithfully,

 28.04.2025
CHIEFENGINEER


21/4/25

Sr.No.	Clause No	Clause	Query	Reply
KALPATARU PROJECTS INTERNATIONAL LIMITED				
1	Section-I, VOLUME I	Clause 2.6.3 Scope of Works	Coordinates of Intake pipe and Outfall are not mentioned in tender documents. Please provide the same.	The CRZ clearance for the establishment of 5 MLD Desalination plant at VOC Port and Coordinates of Intake and Outfall is enclosed as Annexure I
2	Section-I, VOLUME I	Clause 2.6.3 Scope of Works	There is no design criteria and material of construction given in tender documents for units mentioned under Scope of work. We presume design criteria and material of construction for units mentioned under Scope of work will be as respective bidder's proposal considering good engineering practice as per Indian and or International standards for 3 MLD output capacity desalination plant.please confirm the same.	Design criteria for 3 MLD desalination plant as per our PFD and material as per Good engineering practice as per Indian and or International standards and also it should be proved in any one desalination plant with minimim period of 2 years running conditions.
3	Section-I, VOLUME I	Clause 2.6.3 Scope of Works	Product water pumping main to nearby VOC Port sump. Please provide the length of Product water pumping main from WTP plant to nearby VOC Port sump.	The land enmarked for the establishment of desalination plant is 200 m from the VOC Port Water tank. During the Bid Stage, Bidders are invited to examine the Project in greater detail, and to carry out, at their cost, such studies as may be required for submitting their respective Bid. Also since it is DBO model so bidders follow good engineering practice as per Indian and or International standards.
4	Section-I, VOLUME I	Clause 2.6.3 Scope of Works	It is mentioned as under scope of works "Transformer- Outdoor Switchyard". Shall we considered Outdoor type Transformer? Please confirm.	The bidder has to Design the 3 MLD desalination plant inline with the Scope of work as mentioned in the revised tender document.

Sr.No.	Clause No	Clause	Query	Reply
5	Section-I, VOLUME I	Clause 2.6.3 Scope of Works	It is mentioned as under scope of works "Transformer- Outdoor Switchyard". Qty. of transformer is not mentioned. Shall we considered 1 no. working transformer along with 1 no. emergency Diesel Generator? Please confirm.	Confirmed.
6	Section-I, VOLUME I	Clause 2.6.3 Scope of Works	It is mentioned as under scope of works "Transformer- Outdoor Switchyard". We presume 11 KVA incoming power supply will be provided by the Employer at Switchyard of 3 MLD Desalination plant. Kindly confirm the same.	The nearest Port power supply point is 22 KVA Sub Station by supply & installation of necessary equipment's, cables, switches, etc as directed by engineer.
7	Section-I, VOLUME I	Clause 2.6.3 Scope of Works	It is mentioned as under scope of works "dressing of site and raising / levelling the existing ground level to the proposed formation level". Please provide the Finished Ground Level / formation level to be considered for the Site.	Please refer Sl.No.03
8	VOLUME I	Tender Notice Period of completion	Considering quantum of project works as well as monsoon period, we request please considered the Period of completion as - 18 Months (Construction period) + 6 Months (Trial Commissioning period) and 60 Months (O&M period)	Please refer Sl.No.03
9	General	Land Acquisition	Kindly please clarify the Land acquisition status for the project 1> Total Land required for the project 2> Extent of government and private land to be acquired 3> Land already acquired by the employer 4> Balance land yet to be acquired by employer and its present status	The land earmarked for the establishment of desalination plant is Port own land. There is no requirement of land acquisition.
10	VOLUME I- Page No 84 of 227	Price Adjustment-During Construction Period	As prices of materials are dependent on volatile global markets it is not possible for the contractor to predict their affect at this stage on the bid price. This will result in unbalanced bids and hence it is requested that applicability of Price Variation Clause should be considered.	Tender Condition prevails.
11		Advance Payment	we request you to kindly please consider Advance Payment equal to 10% of the Accepted Contract Value to ease cash flow.	Tender Condition prevails.

Sr.No.	Clause No	Clause	Query	Reply
12	VOLUME I- Page No 32 of 227	Retention Money	kindly please allow the contractor to submit upfront BG instead of Cash retention (5%) for the amount of retention money to ease the cashflow	Tender Condition prevails.
13	VOLUME I	Tender Notice Last date and time for submission of bids	We have been putting in every effort to compile the Bid Proposal & quote our best price for this tendering project. We are awaiting quotes from some of our vendors for equipment's mentioned under scope of works. And it is taking some time, We therefore request you to kindly postpone bid submission date by at least TWO weeks from the current bid due date i.e., up to 7th May 2025.	Refer Corrigendum I .

F.No.11-20/2020-IA-III
Government of India
Ministry of Environment, Forest and Climate Change
(IA.III Section)

Indira Paryavaran Bhawan,
Jor Bagh Road, New Delhi-3
Dated: 20th May, 2020

To,

✓ M/s V.O. Chidambaranar Port Trust,
Administrative Office,
Harbour Estate, Tuticorin - 628004

***Sub: CRZ Clearance for setting Sea Water Reverse Osmosis Plant of 5
MLD capacity at Thoothukudi, Tamil Nadu - reg.***

Sir,

This has reference to your online proposal No. IA/TN/CRZ/136080/2020 received in this Ministry on the above mentioned project, for CRZ Clearance in accordance with the provisions of the Coastal Regulation Zone (CRZ) Notification, 2011 issued under the Environment (Protection) Act, 1986.

2. The proposal was considered by the Expert Appraisal Committee (EAC) for Infrastructure Development, Coastal Regulation Zone, Building/ Construction and Miscellaneous projects, in its 233rd meeting held on 28.04.2020. The details of the project as per the documents submitted and presented during the aforesaid meeting are as under:

- (i) The V.O.Chidambaranar Port Trust was declared as a Major Port by the Government of India in July, 1974. The Port has two operational wings viz. Zone 'A' comprising the new port and Zone 'B' constituting the old anchorage port, situated about 9 km away from the new port.
- (ii) Presently required water supply is received from Valavallan and Mangalakurichi plants through TWAD Board. Expected quantity of water received from both the plant is 2 MLD. During the water scarcity period, V.O.C Port Trust could not supply the water requirement in the township as well as for other user of the port.
- (iii) Port has planted about 6,000 trees in and around Port Township in the past few years. Added to this port also proposed sprinkling system in the harbour area around the coal stock yard. In addition to that additional container terminals and modification to the existing berths are proposed.
- (iv) With the above activities the requirement of the potable water is more than 2 MLD. In addition, Coast Guard has proposed new residential complex with sports amenities for which additional water requirements of 0.3 MLD is to be supplied. Navy has also proposed to develop officers residential complex with all indoor facilities and this would require 1.5 MLD of water supply.



Considering the water demand for potable usage, VOC Port Trust proposes to set up 5 MLD desalination plant.

- (v) The proposed project involves laying of seawater intake pipeline (1.25 kms) with intake head (passing through CRZ-IV, CRZ-IB and CRZ-II), Marine outfall pipeline (1.05 kms) with diffuser ports (will also pass through CRZ-IV, CRZ-IB and CRZ-II) and construction of desalination plant and associated facilities (CRZ II)
- (vi) The location of intake and outfall are at 78°10' 48.34" E, 8°44' 27.86" N and 78°10' 45.57" E, 8°44' 37.23" N respectively.
- (vii) The total sea water drawn will be 14.14 MLD and that the brine discharge will be 9.14 MLD.
- (viii) The total project area is about 1.26 ha and the project site is about 7.5 km away from Gulf of Mannar Marine National Park.
- (ix) An STP of 1000 KLD capacity with biological treatment shall be used and treated water of 200 KLD shall be reused for gardening.
- (x) Solid waste of about 1000 kg will be generated and shall be disposed by co-composting.
- (xi) The total cost of the project will be Rs. 88.11 crores.
- (xii) The Tamil Nadu Coastal Zone Management Authority has recommended the above proposal for clearance vide their letter No. 20975/EC.3/2019-1, dated 6th December, 2019

3. Based on the recommendation of the Tamil Nadu Coastal Zone Management Authority issued vide its letter No. 20975/EC.3/2019-1, dated 6th December, 2019, and information submitted as at para no. 2 above and information provided during the presentation before the Expert Appraisal Committee and others, the Ministry of Environment, Forest and Climate Change, in acceptance of the recommendation of the Expert Appraisal Committee (CRZ), hereby accords CRZ Clearance to the above project viz '*Setting up a Sea Water Reverse Osmosis Plant of 5 MLD capacity at Thoothukudi, Tamil Nadu TamilNadu*', under the provision of CRZ Notification, 2011 and amendments thereto and circulars issued thereon, and subject to compliance of the following specific and general conditions as under:

PART A – SPECIFIC CONDITIONS:

- (i) The project proponent shall explore the feasibility of supplying brine water to authorized salt pan agencies instead of discharging into sea or arrange to facilitate setting up of a salt manufacturing unit in the area. Accordingly, setting up of salt pans as habitats for feeding and roosting for migratory birds shall be explored and submit a report to this effect to concerned State Coastal Zone Management Authority or Regional Office of the Ministry within six months. While doing so, assistance of organizations like Bombay Natural History Society (BNHS), Wildlife Institute of India (WII), etc. in developing the suitable bird habitat, may be sought. In the event, setting up of salt pan is not feasible, the project proponent shall inform in writing to the concerned

State Coastal Zone Management Authority or Regional Office of the Ministry with sound justification thereof.

- (ii) No storage reservoir for sea water shall be permitted and only pipelines conveyance system shall be installed.
- (iii) No groundwater shall be extracted in the CRZ areas to meet with the water requirements during the construction and/or operation phase of the project.
- (iv) The project proponent shall ensure that the temporary structures installed for laying of pipe lines are removed within one months of accomplishment of the work.
- (v) As committed, drinking water for nearby villages shall be supplied free of cost as part of its CSR activities.
- (vi) As per the Ministry's Office Memorandum F. No. 22-65/2017-IA.III dated 1st May, 2018, and proposed by the project proponent, an amount of Rs.1.76 crores i.e @2% of project Cost shall be earmarked under Corporate Environment Responsibility (CER) for the activities such as support to local government, schools, sanitation and health including construction of public toilets in the surrounding villages, as per need based assessment carried out. The activities proposed under CER shall be restricted to the affected area around the project. The monitoring report shall be submitted to the regional office as a part of half yearly compliance report, and to the District Collector. It should be posted on the website of the project proponent.
- (vii) All conditions/recommendations stipulated by the Tamil Nadu Coastal Zone Management Authority (TNCZMA) vide their letter No. 20975/EC.3/2019-1, dated 6th December, 2019, shall strictly be complied with.
- (viii) 'Consent to Establish' and /or 'Consent to Operate' shall be obtained from State Pollution Control Board under the provisions of Air (Prevention and Control of Pollution) Act, 1981 and / or the Water (Prevention and Control of Pollution) Act, 1974, as may be applicable.

PART B - GENERAL CONDITIONS:

- (i) No excavated material during the construction shall be dumped in water bodies or adjacent areas.
- (ii) Management of solid waste in accordance with the Solid Waste Management Rules, 2016 shall be strictly implemented.
- (iii) There shall be no dressing or alteration of the sand dunes, if any, present in the vicinity and the same shall be kept undisturbed. No alteration of natural features



including landscape changes shall be undertaken for beautification, recreation and other such purpose.


- (iv) Disposal of muck during construction phase should not create any adverse effect on the neighbouring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.
- (v) All liquid waste arising from the proposed development will be disposed of as per the norms prescribed by Central/State Pollution Control Board. There shall not be any disposal of untreated effluent into the sea/coastal water bodies. It shall be ensured that the wastewater generated is treated in the STP as committed by the project proponent. The treated waste water shall be reused for landscaping, flushing and/or HVAC cooling purposes etc. within the development. The project proponent should also make alternate arrangement for situation arising due to malfunctioning of STP. There shall be regular monitoring of standard parameters of the effluent discharge from STP under intimation to the SPCB.
- (vi) Any hazardous waste generated during construction phase, shall be disposed off as per applicable rules and norms with necessary approvals of the State Pollution Control Board.
- (vii) A copy of the clearance letter shall be uploaded on the website of the concerned State Coastal Zone Management Authority/State Pollution Control Board. The Clearance letter shall also be displayed at the Regional Office, District Industries centre and Collector's Office/ Tehsildar's office for 30 days.
- (viii) A six-monthly monitoring report shall need to be submitted by the project proponent to the concerned regional Office of this Ministry regarding the implementation of the stipulated conditions.
- (ix) The Ministry of Environment, Forest & Climate Change or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.
- (x) Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.
- (xi) The above stipulations would be enforced among others under the provisions of the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991, the EIA Notification, 2006 and the extant CRZ regulations.

- (xii) Full co-operation shall be extended to the officials from the Regional Office of MoEF&CC, during monitoring of implementation of environmental safeguards stipulated. It shall be ensured that documents/data sought pertinent is made available to the monitoring team. A complete set of all the documents submitted to MoEF&CC shall be forwarded to the concerned Regional Office of MoEF&CC.
 - (xiii) In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by this Ministry.
 - (xiv) The Ministry reserves the right to add additional safeguard measures subsequently, if considered necessary, and to take action to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner, including revoking of the environment clearance under the provisions of the Environmental (Protection) Act, 1986, for non compliance.
 - (xv) All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponent from the respective competent authorities.
 - (xvi) The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded CRZ Clearance and copies of clearance letters are available with the State Pollution Control Board (SPCB) and may also be seen on the website of the Ministry of Environment, Forest and Climate Change at <http://www.envfor.nic.in>. The advertisement should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the concerned Regional Office of this Ministry.
4. This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.
5. Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.
6. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parishad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal.



7. The proponent shall upload the status of compliance of the stipulated conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF&CC, the respective Zonal Office of CPCB and the SPCB.

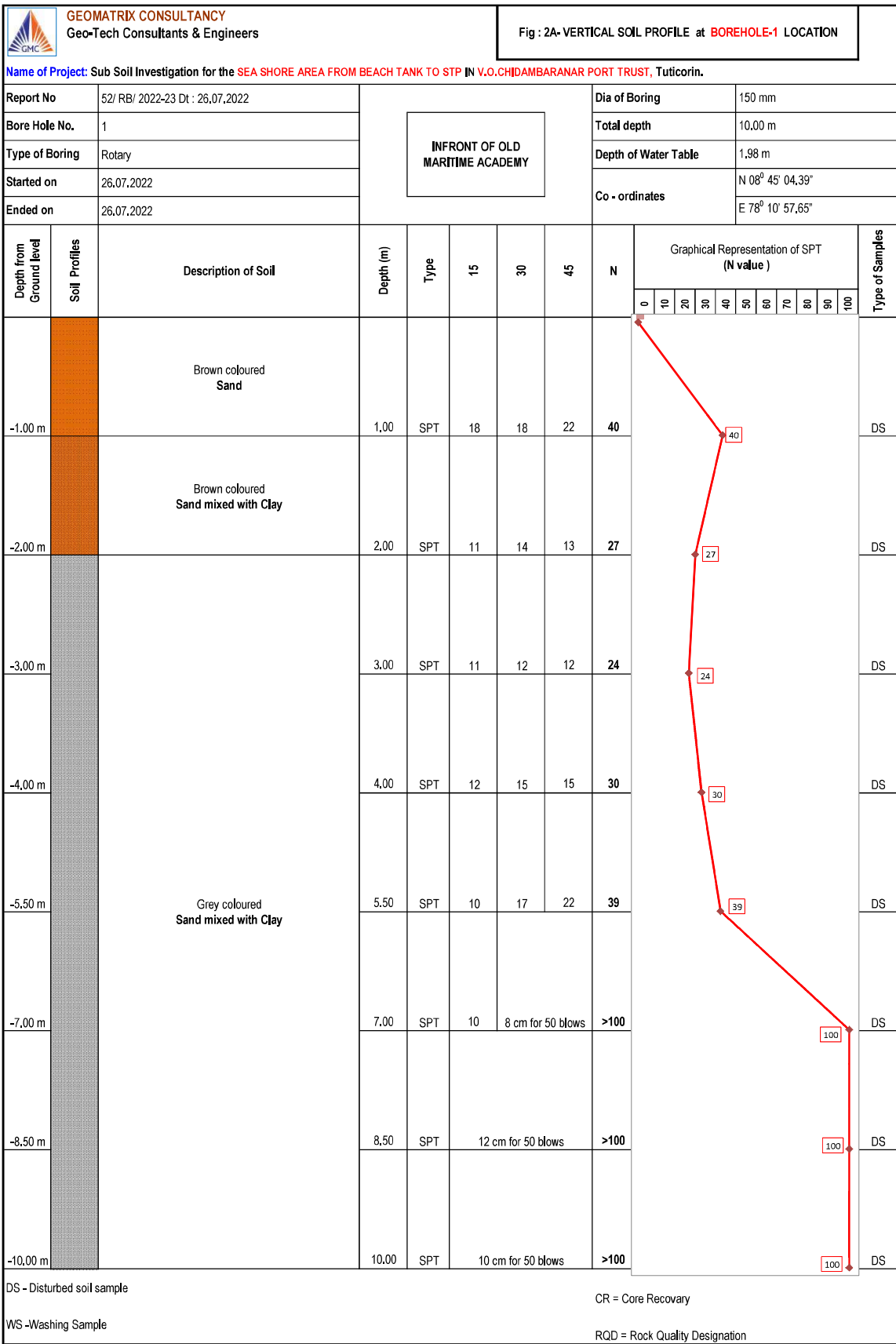
8. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of clearance conditions and shall also be sent to the respective Regional Office of the Ministry by e-mail.


(W. Bharat Singh)
Director (CRZ)

Copy to:

1. The Principal Secretary, Environment & Forests Department (EC-3), Government of Tamil Nadu, Secretariat, Chennai - 600 009
2. The Chairman, Tamil Nadu Coastal Zone Management Authority, Environment & Forests Department (EC-3), Government of Tamil Nadu, Secretariat, Chennai - 600 009
3. The Member Secretary, Central Pollution Control Board, Parivesh Bhavan, CBD cum Office Complex, East Arjun Nagar, Delhi - 32
4. The Member Secretary, Tamil Nadu Pollution Control Board, No. 76, Anna Salai, Guindy Industrial Estate, Race View Colony, Guindy, Chennai - 600 032
5. The Member Secretary, Tamil Nadu Coastal Zone Management Authority, Department of Environment, No.1, Jeenu Road, Panagal Building, Ground Floor, Saidapet, Chennai - 600 015
6. The Deputy Director General of Forests (C), Ministry of Environment, Forest and Climate Change, Regional Office (SEZ), I and II Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai - 34
7. Guard File/ Record File/ Monitoring Cell.


(W. Bharat Singh)
Director (CRZ)





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Geo-Tech, Consultants & Engineers

SUMMARY OF LAB TEST RESULTS

Report No:52/ RB/ 2022-23 Dt : 26.07.2022

Name of Project: Sub Soil Investigation for the SEA SHORE AREA FROM BEACH TANK TO STP IN V.O.CHIDAMBARANAR PORT TRUST, Tuticorin.

TABLE : 1

BH No : 1

Depth of soil (m)		Soil Description	Type of sample collected	IS Classification	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (K/lin ³) γ_s	Dry Density (K/lin ³) γ_d	Porosity (%) n	Voids ratio (%) e	Specific Gravity	Cohesion "C" in (K/lin ²)	Angle of friction (ϕ)
From	To				Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (W_L)	Plastic Limit (W_p)	Plasticity Index (I_p)							
0,00	1,00	Brown coloured Sand	DS	SP	0,00	0,36	2,07	93,61	3,96	8	NP	NP	NP	17,51	16,21	0,39	0,63	2,64	0,00	33,00
1,00	2,00	Brown coloured Sand mixed with Clay	DS	SC	0,00	0,36	3,54	84,64	11,46	25	NP	NP	NP	17,63	14,10	0,47	0,87	2,64	0,00	33,00
2,00	3,00	Grey coloured Sand mixed with Clay	DS	SC	5,98	1,98	3,53	73,10	15,41	25	NP	NP	NP	17,38	13,90	0,48	0,91	2,65	0,00	33,00
3,00	4,00	Grey coloured Sand mixed with Clay	DS	SC	0,00	0,34	1,31	76,91	21,44	25	NP	NP	NP	17,76	14,21	0,46	0,87	2,65	0,00	33,00
4,00	5,50	Grey coloured Sand mixed with Clay	DS	SC	0,00	0,86	4,99	75,85	18,30	25	NP	NP	NP	17,85	14,28	0,46	0,85	2,64	0,00	34,00
5,50	7,00	Grey coloured Sand mixed with Clay	DS	SC	0,00	0,11	2,19	75,99	21,71	28	NP	NP	NP	17,89	13,98	0,47	0,89	2,64	0,00	36,00
7,00	8,50	Grey coloured Sand mixed with Clay	DS	SC	1,97	4,62	14,28	34,69	44,44	29	43,84	22,57	21,27	18,29	14,18	0,46	0,85	2,62	0,33	18,00
8,50	10,00	Grey coloured Sand mixed with Clay	DS	SC	19,78	6,67	16,96	34,33	22,26	17	NP	NP	NP	18,36	15,69	0,41	0,70	2,66	0,00	38,00

DS = Disturbed Sample

NMC = Natural Moisture Content

NP = Non Plastic



GEOMATRIX CONSULTANCY
Geo-Tech. Consultants & Engineers

Report No: 52/ RB/ 2022-23 Dt : 26.07.2022

ANNEXURE - C

GRAIN SIZE ANALYSIS TEST
(Test method as per IS 2720 (Part 4) - 1985)

Name of Project: Sub Soil Investigation for **SEA SHORE AREA FROM BEACH TANK TO STP IN V.O.CHIDAMBARANAR PORT TRUST, Tuticorin.**

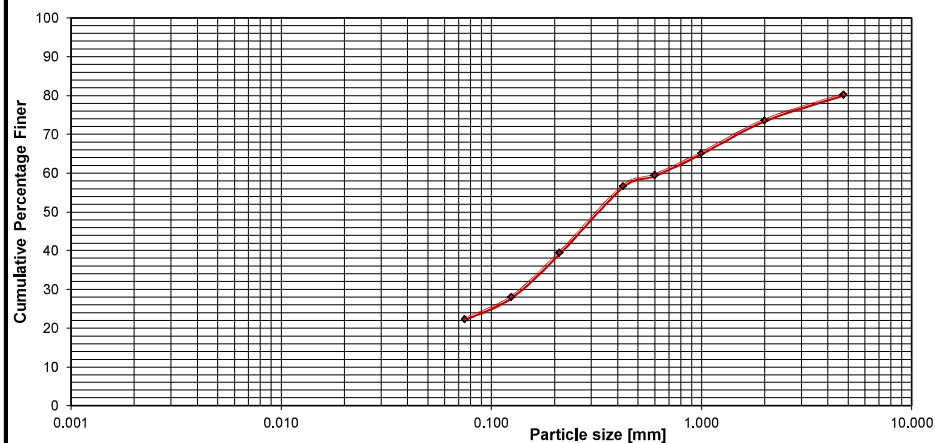
Weight of Soil taken for analysis **Ws** : 100.00 g
Weight of Soil more than 0.075mm IS Sieve : 77.74 g

Bore Hole No	1
Depth (m)	8.50 m

S.No.	Size of sieves	% Soil PSR % (1)	Cumulative % F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	19.78	80.22	4.750	93.96
2	2.000	6.67	73.55	3.375	22.51
3	1.000	8.48	65.07	1.500	12.72
4	0.600	5.65	59.42	0.800	4.52
5	0.425	2.83	56.59	0.513	1.45
6	0.212	17.17	39.42	0.319	5.47
7	0.125	11.44	27.98	0.181	2.07
8	0.075	5.72	22.26	0.113	0.64
9	passing 0.075				143.339

Average Particle Diameter = 1.4931

Clay	Fine	Silt Medium	Coarse	Fine	Sand Medium	Coarse	Gravel Fine
------	------	----------------	--------	------	----------------	--------	----------------



Soil description : Sand mixed with Clay

Based on Gradation Curve, the following sizes of Material (as per IS 1498 - 1970) are obtained

Classification of soil	%
Gravel	19.78
Course Sand	6.67
Medium Sand	16.96
Fine Sand	34.33
Silt & Clay	22.26

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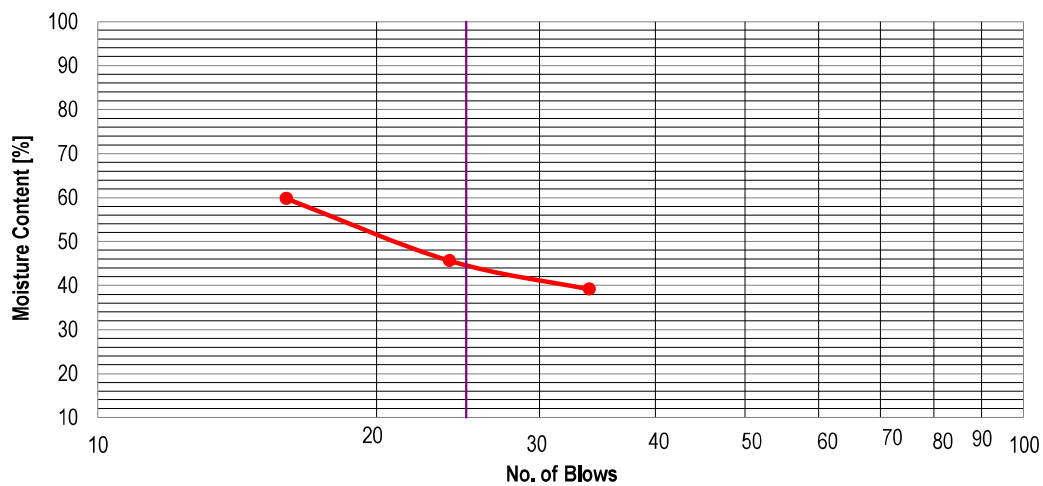
ANNEXURE - D**LIQUID LIMIT & PLASTIC LIMIT TEST**

(Test method As per IS 2720 (Part 5) - 1985)

Name of Project: Sub Soil Investigation for **SEA SHORE AREA FROM BEACH TANK TO STP IN V.O.CHIDAMBARANAR PORT TRUST, Tuticorin.**

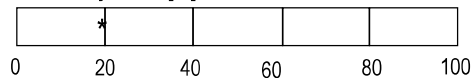
Report No	52/ RB/ 2022-23 Dt : 26.07.2022
Borehole No	1
Depth	7.00 m

Description		Liquid Limit			Plastic Limit	
No. of Blows	N	16	24	34		
Weight of Wet Specimen + Container	WSC g	79.42	79.31	75.53	81.46	68.34
Weight of Dry Specimen + Container	WDC g	76.19	75.99	72.33	79.86	66.32
Weight of Container	WC g	70.78	68.71	64.15	72.80	57.33
Weight of Water	WW g	3.23	3.32	3.20	1.60	2.02
Weight of Dry Specimen	WD g	5.41	7.28	8.18	7.06	8.99
Moisture Content	W %	59.70	45.60	39.12	22.66	22.47



Liquid Limit	W_L :	43.84 %
Plastic Limit	W_P :	22.57 %
Plasticity Index	I_P :	21.27 %

Plasticity Index [%]





DIRECT SHEAR TEST

(Test method As per IS 2720 (Part 13) - 1986)

ANNEXURE: E

Name of Project: Sub Soil Investigation for **SEA SHORE AREA FROM BEACH TANK TO STP IN V.O.CHIDAMBARANAR PORT TRUST, Tuticorin.**

Borehole No	1
Depth (m)	3.00 m
Date of Test	29.07.2022

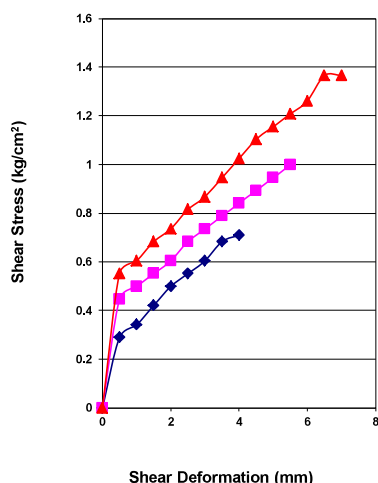
L.C of Dial gauge	:	0.01
Proving Ring Constant	:	0.81421
Area of the Specimen	:	36

Trail-1			
Normal Stress:0.5 kg/cm ²			
Horizontal Gauge Reading	Proving Ring Reading	Shear deformation	Shear Stress (kg/Cm ²)
0	0	0.00	0.000
50	12.799	0.50	0.289
100	15.1261	1.00	0.342
150	18.6167	1.50	0.421
200	22.1074	2.00	0.500
250	24.4345	2.50	0.553
300	26.7615	3.00	0.605
350	30.2522	3.50	0.684
400	31.4157	4.00	0.711

Trail-2			
Normal Stress:1.0 kg/cm ²			
Horizontal Gauge Reading	Proving Ring Reading	Shear deformation	Shear Stress (kg/Cm ²)
0	0	0.00	0.000
50	19.7803	0.50	0.447
100	22.1074	1.00	0.500
150	24.4345	1.50	0.553
200	26.7615	2.00	0.605
250	30.2522	2.50	0.684
300	32.5793	3.00	0.737
350	34.9064	3.50	0.789
400	37.2335	4.00	0.842
450	39.5606	4.50	0.895
500	41.8876	5.00	0.947
550	44.2147	5.50	1.000

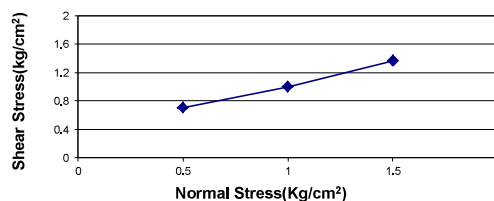
Trail-3			
Normal Stress:1.5 kg/cm ²			
Horizontal Gauge Reading	Proving Ring Reading	Shear deformation	Shear Stress (kg/Cm ²)
0	0	0.00	0.000
50	24.4345	0.50	0.553
100	26.7615	1.00	0.605
150	30.2522	1.50	0.684
200	32.5793	2.00	0.737
250	36.0699	2.50	0.816
300	38.397	3.00	0.868
350	41.8876	3.50	0.947
400	45.3783	4.00	1.026
450	48.8689	4.50	1.105
500	51.196	5.00	1.158
550	53.5231	5.50	1.211
600	55.8502	6.00	1.263
650	60.5044	6.50	1.368
700	60.5044	7.00	1.368

Shear Deformation Vs Shear Stress



Normal Stress (kg/cm ²)	Proving Ring reading at failure	Shear Stress (kg/cm ²)
0.50	31.41573231	0.711
1.00	44.21473437	1.000
1.50	60.50437335	1.368

DIRECT SHEAR TEST



1. Angle of Shearing Resistance (Φ) = 33 Degrees
2. Cohesion (C) = 0.00 Kg/cm²



DENSITY CALCULATIONS

Name of Project: Sub Soil Investigation for **SEA SHORE AREA FROM BEACH TANK TO STP IN V.O.CHIDAMBARANAR PORT TRUST, Tuticorin.**

Bore Hole No	1
Depth (m)	0.50

Sl. No.	Description	Reading
1	Weight of Empty Box (gm)	3,393.00
2	Weight of Box + Soil (gm)	3,550.60
3	Weight of Soil (gm)	157.60
4	Volume of Box (cm ³)	90.00
5	Bulk Density (gm /cm ³)	1.751
6	Weight of Container (gm)	41.98
7	Weight of Container + Wet Soil (gm)	62.77
8	Weight of Container + Dry Soil (gm)	60.55
9	Moisture Content (%)	11.95
10	Dry Density (gm /cm ³)	1.564

RESULT

- 1 WET DENSITY OF SOIL = 1.751 t / m³
- 2 DRY DENSITY OF SOIL = 1.564 t / m³



GEOMATRIX CONSULTANCY

Geo-Tech. Consultants & Engineers

Name of Project: Sub Soil Investigation for **SEA SHORE AREA FROM BEACH TANK TO STP IN V.O.CHIDAMBARANAR PORT TRUST, Tuticorin.**

Report No:52/ RB/ 2022-23

BH NO : 1

CALCULATION - 1

SAFE BEARING CAPACITY CALCULATIONS on SHALLOW FOUNDATIONS

TYPE OF FOOTING : SQUARE FOOTING

Length of footing (Assumed Value)	L =	1.50 m
Breadth of footing (Assumed Value)	B =	1.50 m
Foundation depth	D _f =	3.60 m
Correction Factor for Water Table	W' =	0.50
Unit weight of soil	Y _{soil} =	1.776 T/m ³
Cohension	"C" =	0.00 T/m ²
Angle of shearing resistance(general shear) φ =		33.00°
Angle of shearing resistance(Local shear) φ' =		23.36° (Tan ⁻¹ (2/3 * tanφ)
Safety factor	F =	3.00
Effective Surcharge of Soil above Footing Base	q =	2.79 T/m ²
Type of soil		= Medium Consolidated Sand
Mode of failure		= Combined (GSF & LSF) Shear Failure
Ground Water Table level (Assumed for worst Case - at the Ground level) =		0 m From NGL

The Bearing Capacity Factors are Given by the following equations

For GENERAL SHEAR FAILURE

$$\begin{aligned}
 N_q &= \tan^2 (45^\circ + \phi/2) (e^{\pi \tan \phi}) = 26.09 \\
 N_c &= (N_q - 1) \cot \phi = 38.64 \\
 N_\gamma &= 2 (N_q + 1) \tan \phi = 35.19
 \end{aligned}$$

For LOCAL SHEAR FAILURE

$$\begin{aligned}
 N'_q &= \tan^2 (45^\circ + \phi'/2) (e^{\pi \tan \phi'}) = 8.99 \\
 N'_c &= (N'_q - 1) \cot \phi' = 18.50 \\
 N'_\gamma &= 2 (N'_q + 1) \tan \phi' = 8.63
 \end{aligned}$$

The Shape Factors

Shape of Footing	S_c	S_q	S_γ
CONTINUOUS STRIP FOOTING	1.0	1.0	1.0
SQUARE FOOTING	1.3	1.2	0.8
RECTANGULAR FOOTING	$1+0.2B/L$	$1+0.2B/L$	$1-0.4B/L$

SQUARE FOOTING	
$S_c =$	1.300
$S_q =$	1.200
$S_\gamma =$	0.800

The Depth Factor

$d_c =$	$1 + 0.2 D_f / B \times \tan (45^\circ + \phi'/2) =$	1.884
$d_q = d_\gamma =$	1 for $\phi' < 10^\circ$ =	1.000
$d_q = d_\gamma =$	$1 + 0.1 D_f / B \tan(45^\circ + \phi'/2)$ for $\phi' > 10^\circ =$	1.442

The Inclination Factor

$i_c = i_q =$	$1 - \alpha / 90$	1.00	$i_\gamma =$	$1 - \alpha / \phi'$	1.00
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α = Inclination of the load to the vertical in degrees =

0

$$\begin{aligned} \text{Net Ultimate Bearing Capacity, } q_d = & \frac{(c \times N_c \times S_c \times d_c \times i_c) + (q \times (N_q - 1) \times S_q \times D_q \times I_q) + (0.5 \times B \times \gamma \times N_\gamma \times S_\gamma \times D_\gamma \times I_\gamma \times W')}{(2/3) (c \times N_c \times S_c \times d_c \times i_c) + (q \times (N_q - 1) \times S_q \times D_q \times I_q) + (0.5 \times B \times \gamma \times N_\gamma \times S_\gamma \times D_\gamma \times I_\gamma \times W')} \\ & = 96.79 \quad \text{T/sq.m} \end{aligned}$$

SAFE BEARING CAPACITY :

$$SBC = q_d / F.s = \quad \quad \quad \mathbf{32.26 \text{ T/sq.m}} \quad \quad \quad \text{or} \quad \quad \quad \mathbf{316.49 \text{ kN/m}^2}$$

SETTLEMENT CALCULATIONS AS PER IS-8009-(part-1) 1998

Q_s = Pressure, S_i = Immediate settlement I = Influence factor

B = width of foundation μ = Poisson's ratio E_s = Elastic Modulus

For,

Medium Consolidated Sand

$$E_s = 61250 \text{ kN/m}^2$$

$$(\text{or}) E_s = 6125.00 \text{ t/m}^2$$

S_i = Immediate settlement =

$$= \frac{I \times Q_s \times B(1 - \mu^2) / E_s}{0.95 \times 32.26 \times (1.5 \times (1 - 0.25^2)) / 6125}$$

$$S_i = 0.0070 \text{ m}$$

$$0.0070 \times 1000$$

$$\text{Settlement} = 7 \text{ mm} < 50 \text{ mm}$$

The Max Allowable Differential Settlement for **Sand & Gravel is 50mm** and for **Silt & Clay is 75mm.**

Hence SAFE

BATHYMETRY SURVEY

