

1.4. Layer 3a: Very loose, blackish grey CLAYEY SAND (SC)

Was found only at borehole SP-03. Thickness is 1.8m and the layer bottom is 4.8m. Standard penetration resistance N from 0 to 3. With 1 sample was taken from this layer, the obtained physico-mechanical properties of the sample have shown that, natural moisture is 47.34%, wet density is 1.618g/cm^3 , liquid limit is 47.1%, plasticity index is 20.0%.

1.5 . Layer 4: Stiff, low plasticity, yellowish grey CLAY (CL)

Was found at boreholes DSC-03, SC-06, SC-07, SC-08 and SC-09. The thickness is from 2.2m (DSC-03) to 7.3m (DST(1)-1) and the depth of the layer bottom is from 6.0m (SC-06) to 31.5m (DST(1)-2) deep. Standard penetration resistance $N = 4$. With 01 samples was taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is 16.00%, wet density 2.086g/cm^3 , liquid limit 26.9%, plasticity index is 10.7% (see average value of the physico-mechanical properties - table 2).

1.6 . Layer 4a: Very stiff, high plasticity, yellowish grey CLAY (CH)

Was found at the boreholes DSC-05 and SC-09. The thickness is from 3.5m (DSC-05) to more 10m (SC-09) and the depth of the layer bottom is from 23.5m (DSC-05) to more than 30m (SC-09). Standard penetration resistance N from 15 to 20. One sample was taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is 32.77%, wet density is 1.899g/cm^3 , liquid limit is 55.5%, plasticity index is 26.1%, (see average value of the physico-mechanical properties - table 3).

1.7 . Layer 4b: Medium dense, yellowish whitish grey CLAYEY SAND (SC)

Was found at most of the boreholes. The thickness is from 1.0m (DSC-05) to 8.4m (DSS-05) and the depth of the layer bottom is from 8.0m (SP-03 and SC-06) to 22.0m(DSC-04). Standard penetration resistance N from 10 to 14. In total, 11 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 13.96% to 21.53%, wet density from 1.992 to 2.193g/cm^3 , liquid limit from 14.6% to 28.0%, plasticity index is from 4.0% to 10.7% (see average value of the physico-mechanical properties - table 4). The main characteristics of the layer are as follows :

Wet density	γ_w	=	$2,098 \text{ g/cm}^3$
Unconfined compressive strength	q_u	=	0.542 Kg/cm^2
Compression index	C_c	=	$0.097 \text{ cm}^2/\text{kg}$
Coefficient of consolidation	C_v	=	$7.65 \times 10^{-4} \text{ cm}^2/\text{s}$
Coefficient of volume compressibility	m_v	=	$1.29 \times 10^{-4} \text{ cm}^2/\text{g}$

1.8. Layer 4c: Medium dense, yellowish brownish grey SILTY SAND (SM).

Was found at all the boreholes. The thickness is from 9.5m (DST(1)-2) to 33.7m (DSP-01) and the depth of the layer bottom is from 42.2m (DSP-01) to 44.4m (DST(1)-01). Standard penetration resistance N from 10 to 21. In total, 35 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 10.58% to 21.81%, wet density is from 1.771 to 2.168g/cm^3 , liquid limit from 16.3 to 33.1%, plasticity index from 2.5 to 15.6% (see average value of the physico-mechanical properties - table 5). The main characteristics of the layer are as follows :

Wet density	γ_w	=	$2,031 \text{ g/cm}^3$
Compression index	C_c	=	$0.091 \text{ cm}^2/\text{kg}$
Coefficient of consolidation	C_v	=	$6.51 \times 10^{-4} \text{ cm}^2/\text{s}$
Coefficient of volume compressibility	m_v	=	$2.86 \times 10^{-5} \text{ cm}^2/\text{g}$

1.9. Layer 4d: Dense, white POORLY GRADED SAND (SP)

It was found at the borehole DST (1)-02. Thickness is 2.5m and the depth of the layer bottom is 34.0m. Standard penetration resistance N is from 25 to 30. In total, 2 samples were taken from this layer. The obtained physical, mechanical properties of the samples have shown that natural moisture is from 15.00% to 16.71%, wet density from 1.56 to 1.65g/cm^3

1.10 . Layer 5: Hard, high plasticity, yellowish grey SANDY CLAY (CH)

Was found at boreholes DSP-01, DST(1)-1 and DST(1)-2. The thickness is more than 11.5m (DST(1)-02) and the depth of the layer bottom is more than 55.0m (DST(1)-02. Standard penetration resistance N from 31 to 50.

Hydrogeological conditions

At the surveying area, the groundwater level is affected by the tide and changeable according to seasons. The depth of the groundwater level in the boreholes during the investigation time is from 0.4 to 1.5m. See follow table.

STT	Borehole ID	Groundwater level (m)	Measure date (dd/mm/yy)	Remark
1	DSC-01	-1.0	01/8/2000	From surface
2	DSC-02	-0.5	03/8/2000	From surface
3	DSC-03	-0.7	31/5/2000	From surface
4	DSC-04	-1.3	2/6/2000	From surface
5	DSC-05	-0.8	29/7/2000	From surface

Note: The underground water measured from ground surface.

From every borehole DSC 01 and DSC 02 gaseous samples were taken at depth intervals 2÷8m; 8÷14m; 10÷30m by special tool.

Required parameters to be analysed are: CH₄, H₂S, CO₂, CO.

Analysing method: ASTM 1945

Instrument: GCHP/AC 6890.

Samples were analysed at Laboratory "Physical Department" belonging "Research & Development Centre for Petroleum Processing" - Petro Vietnam.

Analysed results are as follows:

#	Borehole	Sample ID	Depth (m)	CH ₄ (Pmm)	H ₂ S (Pmm)	CO ₂ (%mol)	CO (pmm)
	DSC-01	G01-1	2-8	<1	<1	0.4817	0.0
		G01-2	8-14	12	<1	0.3692	0.0
		G01-3	10-30	<1	<1	0.3187	0.0
	DSC-02	G02-1	2-8	<1	<1	0.6569	0.0
		G02-2	8-14	<1	<1	0.3979	0.0
		G02-3	10-30	<1	<1	0.1574	0.0

AVERAGE VALUE OF PHYSICA - MECHANICAL PROPERTIES
Layer 2 : Very soft, high plasticity blackish grey ORGANIC CLAY (OH)

Table : 1

No	Properties	Sign	Average value.	Maximum value	Minimum value	Number of test
1	Sieve Analysis, % Passing					
	3/4" (19 mm)					
	1/2" (12.5 mm)					
	3/8" (9.5 mm)					
	#4 (4.75 mm)					
	#8 (2.36 mm)		100.0	100.0	100.0	18
	#16 (1.18 mm)		99.3	100.0	97.5	18
	#30 (0.6 mm)		99.1	100.0	96.9	18
	#50 (0.3 mm)		98.6	100.0	96.0	18
	#100 (0.15 mm)		97.1	100.0	82.4	18
	#200 (0.075 mm)		92.5	98.2	54.8	18
	< 0.005 mm		59.2	77.3	29.3	18
2	Natural moisture content (%)	w	82.48	115.86	47.55	18
3	Natural unit weight (g/cm ³)	γ	1.489	1.651	1.356	18
4	Dry unit weight (g/cm ³)	γ _d	0.825	1.119	0.631	18
5	Specific gravity	G _s	2.571	2.602	2.526	18
6	Porosity	n	0.680	0.760	0.560	18
7	Void ratio	e _o	2.170	3.088	1.282	18
8	Degree saturation (%)	S	97.70	100.00	92.30	18
9	Liquid limit (%)	LL	86.3	98.1	70.8	18
10	Plastic limit (%)	LP	42.8	51.2	26.9	18
11	Plastic index (%)	PI	41.2	51.8	17.9	18
12	Water plasticity ratio (%)	B	0.96	1.48	0.64	18
13	Unconfined compression (Kg/cm ²)	qu	0.118	0.189	0.070	9
14	Compression index (cm ² /kg)	C _c	0.8070	1.5060	0.2950	8
15	Coefficient of consolidation (cm ² /s)	C _v	3.16E-04	6.84E-04	1.99E-04	8
16	Preconsolidation pressure (kg/cm ²)	P _c	0.445	0.563	0.351	8
17	Coefficient of volumm compressibility (cm ² /g)	M _v	1.21E-04	1.43E-04	8.08E-05	8
18	Permeability (cm/sec)	k ₂₀	3.47E-08	5.16E-08	2.09E-08	8