

#### 4.3 OBSTACLES DURING DRILLING.

During drilling at some the boreholes caught some rotten woods have not yet completely disintegrated when drill through layer 2 (Very soft, high plasticity blackish grey).

## **B. VISSAN DRAINAGE STATION**

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### 1 . STRUCTURE OF THE BASE SOIL.

Based on in-situ survey, drilling documents and the results obtained from the soil tests, we have noticed that basic soil on the surveying site (up to 30.0m deep) was composed by Holocene deposits of 17.5m thick and Pleistocene deposits, which the thickness has not been determined yet (boreholes of 30.0m depth did not excess these deposits), and on the surface there is made ground on the surface with the thickness 0.5m. From the surface downwards there are the following layers:

**1.1 . Layer 1: Made ground - Reddish brown sandy clay with cobbles of stone and brick.**

This layer lies right on the surface found at all boreholes, with the thickness 0.5m.

**1.2 . Layer 2: Very soft, high plasticity blackish grey ORGANIC CLAY (OH).**

It is covered by layer 1 with thickness from 13.0m (UV-02) to 17.5m (UV-01) and the bottom is from 13.5m (UV-02) to 18.0m (UV-01) deep. Standard penetration resistance N from 0 to 1. In total, 23 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 56.04% to 105.18%, wet density from 1.351 to 1.471g/cm<sup>3</sup>, liquid limit from 52.1 to 96.7%, plasticity index from 19.9 to 47.9%, high compressibility (see average value of the physico-mechanical properties - table 1b). The main characteristics of the layer are as follows :

Wet density	$\gamma_w$	=	1,413 g/cm <sup>3</sup>
Unconfined compressive strength	$q_u$	=	0.136 Kg/cm <sup>2</sup>
Compression index	Cc	=	1.282
Coefficient of consolidation	Cv	=	2.08 x 10 <sup>-4</sup>
Coefficient of volume compressibility	mv	=	1.16 x 10 <sup>-4</sup>

**1.3 . Layer 3: Stiff, high plasticity, brown spot green CLAY (CH).**

Was found only at borehole UV-02. Thickness is 9.0m and the layer bottom is 22.5m deep. Standard penetration resistance N from 10 to 15. In total, 4 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 27.33% to 31.15%, wet density from 1.895 to 1.924g/cm<sup>3</sup>, liquid limit from 50.7 to 51.3%, plasticity index from 25.2 to 25.6% (see average value of the physico-mechanical properties - table 2b). The main characteristics of the layer are as follows :

Wet density	$\gamma_w$	=	1,905 g/cm <sup>3</sup>
Unconfined compressive UVrength	$q_u$	=	1.566 Kg/cm <sup>2</sup>

**1.4 . Layer 3a: Medium dense, light yellowish brown CLAYEY SAND (SC).**

Was found at all the boreholes. The thickness is 4.5m and the depth of the layer bottom is from 22.5m (UV-01) to 27.0m (UV-02) . Standard penetration resistance from 10 to 14. In total, 4 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 18.28% to 22.17%, wet density from 1.850 to 1.938g/cm<sup>3</sup>, liquid limit from 22.9% to 24.0%, plasticity index is from 7.28% to 7.6%, (see average value of the physico-mechanical properties - table 3b).

**1.5 . Layer 3b: Medium dense, yellowish greenish grey SILTY SAND (SM)**

Was found at all the boreholes. The thickness is more 7.5m and the depth of the layer bottom is more 30.0m. At the boreholes with 30.0m depth, its thickness has not been determined yet. Standard penetration resistance from 10 to 15. In total, 6 samples were taken from this layer, the obtained physico-mechanical properties of the samples have shown that, natural moisture is from 21.75% to 24.92%, wet density from 1.851 to 1.934g/cm<sup>3</sup>, (see average value of the physico-mechanical properties - table 4b).

### *Hydrogeological conditions*

At the surveying area, the groundwater level is affected by the tide and changeable according to seasons. The groundwater level in the boreholes during the investigation time is 1.2m depth.

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

Table : 1b

No	Property	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)		100.0	100.0	100.0	23
	#8 (2.36 mm)		99.9	100.0	97.8	23
	#16 (1.18 mm)		99.5	100.0	94	23
	#30 (0.6 mm)		99.3	100.0	93.5	23
	#50 (0.3 mm)		99.0	100.0	91.4	23
	#100 (0.15 mm)		98.3	100.0	88.7	23
	#200 (0.075 mm)		94.6	99.1	86.2	23
	< 0.005 mm		68.9	90.1	60.2	23
2	Natural moisture content (%)	w	87.62	105.18	56.04	23
3	Natural unit weight (g/cm <sup>3</sup> )	γ	1.413	1.471	1.351	23
4	Dry unit weight (g/cm <sup>3</sup> )	γ <sub>d</sub>	0.757	0.909	0.664	23
5	Specific gravity	G <sub>s</sub>	2.593	2.686	2.567	23
6	Porosity	n	0.71	0.74	0.65	23
7	Void ratio	e <sub>o</sub>	2.448	2.879	1.836	23
8	Degree saturation (%)	S	92.5	99.7	78.7	23
9	Liquid limit (%)	LL	79.2	96.7	52.1	12
10	Plastic limit (%)	LP	42.2	49.8	32.2	12
11	Plastic index (%)	PI	37.0	47.9	19.9	12
12	Water plasticity ratio (%)	B	1.25	1.44	1.10	12
13	Unconfined compression (Kg/cm <sup>2</sup> )	qu	0.136	0.240	0.077	10
14	Compression index	C <sub>c</sub>	1.282	1.376	1.205	7
15	Coefficient of consolidation (cm <sup>2</sup> /Kg)	C <sub>v</sub>	2.08E-04	2.56E-04	1.42E-04	7
16	Preconsolidation pressure (kg/cm <sup>2</sup> )	P <sub>c</sub>	0.876	1.139	0.524	7
17	Coefficient of volumm compressibility (cm <sup>2</sup> /g)	M <sub>v</sub>	1.16E-02	8.02E-02	8.18E-05	7
18	Permeability (cm/sec)	k <sub>20</sub>	2.22E-08	3.01E-08	1.95E-09	7

AVERAGE VALUE OF PHYSICO - MECHANICAL PROPERTIES  
Layer 3 : Stiff, high plasticity brown spot, green CLAY (CH).

Table : 2b

No	Property	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	4
	#16 (1.18 mm)		99.6	100.0	98.2	4
	#30 (0.6 mm)		99.4	100.0	97.5	4
	#50 (0.3 mm)		99.2	100.0	96.7	4
	#100 (0.15 mm)		98.6	100.0	95.0	4
	#200 (0.075 mm)		94.6	96.0	93.0	4
	< 0.005 mm		62.0	68.1	52.1	4
2	Natural moisture content (%)	w	29.78	31.15	27.33	4
3	Natural unit weight (g/cm <sup>3</sup> )	γ	1.905	1.924	1.895	4
4	Dry unit weight (g/cm <sup>3</sup> )	γ <sub>d</sub>	1.468	1.488	1.446	4
5	Specific gravity	G <sub>s</sub>	2.693	2.697	2.689	4
6	Porosity	n	0.45	0.46	0.45	4
7	Void ratio	e <sub>o</sub>	0.835	0.861	0.810	4
8	Degree saturation (%)	S	96.0	99.1	90.9	4
9	Liquid limit (%)	LL	51.0	51.3	50.7	2
10	Plastic limit (%)	LP	25.6	25.7	25.5	2
11	Plastic index (%)	PI	25.4	25.6	25.2	2
12	Water plasticity ratio (%)	B	0.14	0.21	0.07	2
13	Unconfined compression (Kg/cm <sup>2</sup> )	qu	1.566			1
14	Compression index	C <sub>c</sub>	0.0723			1
15	Coefficient of consolidation (cm <sup>2</sup> /Kg)	C <sub>v</sub>	7.91E-04			1
16	Preconsolidation pressure (kg/cm <sup>2</sup> )	P <sub>c</sub>	0.577			1
17	Coefficient of volumm compressibility (cm <sup>2</sup> /g)	M <sub>v</sub>	1.56E-05			1
18	Permeability (cm/sec)	k <sub>20</sub>	1.13E-08			1