



4. FIELDWORK

One set of hydraulically powered drilling equipment, complete with crew were mobilized for this project. Actual drilling work was started on September 18, 2015 and was completed on September 21, 2015.

The approximate location of the boreholes is shown in Appendix A entitled “Borehole Location Plan”.

The duration of work and the final depth of boreholes are tabulated as follows:

Table 4-1. Summary of drilling activities

Borehole I.D.	Work Started	Work Completed	Final Depth (meter)
BH-1	Sept. 18, 2015	Sept. 19, 2015	30.45
BH-2	Sept. 20, 2015	Sept. 21, 2015	30.45
TOTAL			60.90

4.1. DRILLING OF BOREHOLES

The drilling work was conducted using rotary, hydraulically-powered TDC-2 drilling machine.

4.1.1. Wash Boring Procedure

Drilling through ordinary soils was advanced using the Wash Boring Procedure. This is accomplished by first driving short pieces of casings into the ground to start the borehole. The casing is normally cleaned out by means of chopping bit attached to the lower end of the drill rods, with water exiting at high pressure at the side holes of the chopping bit, carrying the cuttings or loosened soil particles out of the borehole through the space between the casings and the drill rods.



NW size casings (76 mm inside diameter) were added to prevent the borehole from caving-in.

4.1.2. Standard Penetration Tests (ASTM D1586)

Standard Penetration Tests were conducted at 1.0 meter intervals for the first 3.0 meters and 1.5 meters thereafter.

Standard Penetration Tests (SPT) was performed using the Automatic Trip Hammer Mechanism with the Standard 50 mm outside-diameter split-spoon sampler, coupled to the end of a string of drill rods, and driven by a 63.5-kg hammer with a free-fall of 75 cm. The trip-hammer mechanism minimizes errors due to human intervention during the testing. The number of blows for the three successive 15-cm penetrations was then recorded.

The sum of the two 15-cm penetrations comprises the N value. These results are incorporated in the final logs in a semi-graphical form.

Disturbed and representative soil samples obtained from the split-spoon samplers were visually classified and then carefully sealed in properly labeled water-tight plastic bags. These were brought to AGES Laboratory in Quezon City for testing.

The soil consistency or in-situ relative density mentioned and shown in the attached final boring logs is based on the following:



Table 4-2. SPT N-value blow count and relative density for granular soil

Relative Density of Sands according to the Results of Standard Penetration Test	
No. of Blows	Relative Density
0 – 4	Very Loose
4 – 10	Loose
10 – 30	Medium Dense
30 – 50	Dense
Over 50	Very Dense

Table 4-3. SPT N-value and consistency for cohesive soil

Consistency of Cohesive Soils according to the Results of Standard Penetration Test	
No. of Blows	Consistency
0 – 2	Very Soft
2 – 4	Soft
4 – 8	Medium Stiff
8 – 15	Stiff
15 – 30	Very Stiff
>30	Hard

Disturbed and representative soil samples obtained from the split-spoon samplers were visually classified and then carefully sealed in properly labeled water-tight plastic bags. These were brought to AGES Laboratory in Quezon City for testing.



5. LABORATORY TESTS

Significant characteristics of the representative soil samples taken out from the fieldwork were further investigated by laboratory tests. These soil characteristics provide data used to classify and quantitatively assess the engineering properties needed in the structure's foundation.

In general, all testing procedures conform to the American Society for Testing Materials (ASTM). The Unified Soil Classification System (USCS) was used in the classification of the samples.

The following tests tabulated below were conducted on disturbed samples:

Table 5-1. Summary of laboratory tests conducted

ASTM DESIGNATION	TITLE/ DESCRIPTION
1. D 2487-85	Classification of Soils for Engineering Purposes
2. D 2216-80	Water (moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
3. D 422	Particle size Analysis of Soils
4. D 4318-84	Liquid Limit, Plastic Limit and Plasticity Index of Soils
5. D 512	Chloride Content Test on Soil
6. D 516	Sulfate Content Test on Soil
7. D 2974	Organic Content on Soil



6. RESULTS AND FINDINGS

The Idealized Soil profile shown in Appendix B was drawn to graphically depict the general subsoil condition at the project site.

Based on the results of the two (2) boreholes, it may be generalized that the project site is underlain by practically uniform soil stratification, described as follows:

Layer A

The uppermost layer of about 12.0 meters thick consists of gray, fine to medium Sand (SM), with traces of non-plastic silt and fine gravel. Consistency of this layer is very loose to loose. SPT blow counts ranged between $3 < N < 13$, with an average of 8. It was observed that pockets/lenses of soft, slightly plastic Clay materials were found in this layer, particularly in BH-1. Decayed wood material was also recovered in BH-1 at 2.0m depth. The lone undisturbed sample recovered at BH-1 (12.0-12.45m depth) cannot be tested for unconfined compression test because of the presence of broken corals and traces of fine gravels.

Layer B

This layer underlies layer A, generally described as medium to high plastic Clay (CH) with appreciable amount of limestone fragments. Thickness of this layer is about 3.0 to 4.5 meters, with recorded SPT blow counts of $5 < N < 14$.

Layer C

This is the last layer encountered in the boreholes, generally classified as creamy white, gravel/sand-sized Limestone fragments with some slight to medium plastic clay. SPT blow counts ranged from a low of 9 in the uppermost stretches of the layer and linearly increased towards the bottom of the borehole (as high as 30). The two boreholes were both terminated in this layer at about 30.45 meter depths.



For better appreciation, a plot showing the recorded uncorrected N-values vs. Depth is shown below.

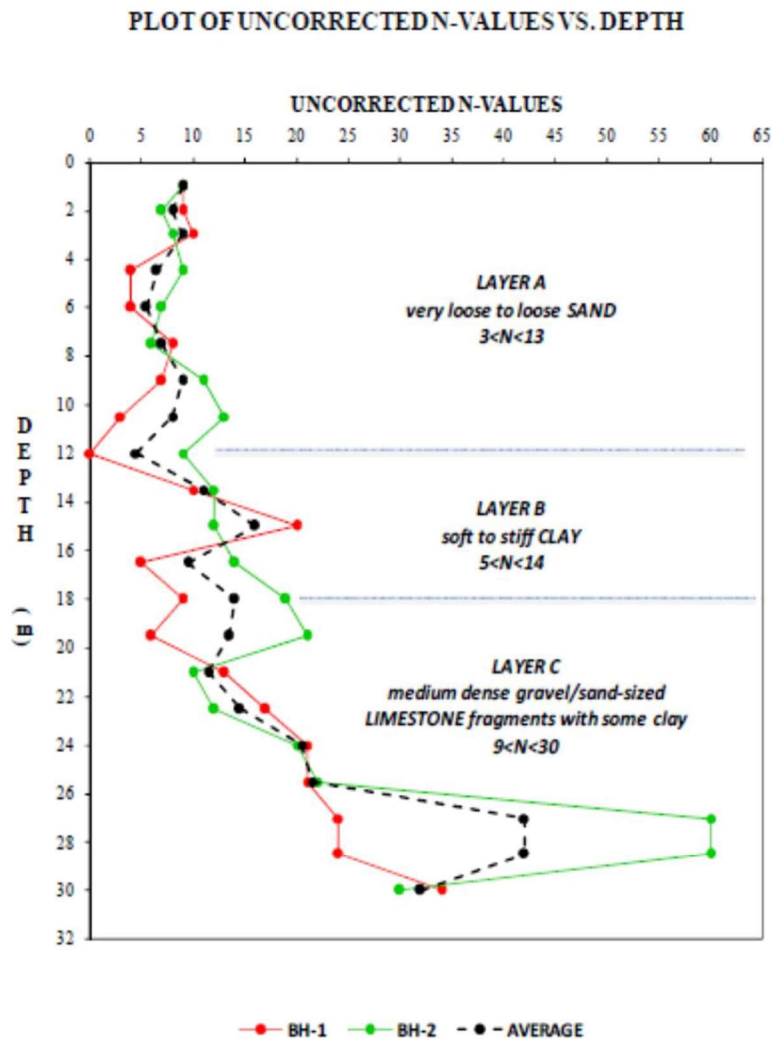


Figure 6-1. Plot of uncorrected N-values vs. depth





6.1. GROUND WATER TABLE MEASUREMENT

The groundwater table was reported in the logs at depth ranging from 0.5m – 1.5m from the existing ground surface. The information is presented below for easy reference:

Table 6-1. Groundwater Table Logs

DATE MEASURED	BH-1	BH-2
9/18/15	1.50m (5PM)	-
9/19/15	0.47m (7AM)	-
	0.47m (5PM)	-
9/20/15	1.5m (7AM)	0.97m (5PM)
9/21/15	-	1.2m (7AM)
	-	1.2m (5PM)

6.2. CHEMICAL TESTS

Representative soil samples were also tested for the determination of the chloride, sulphate and organic content. The results of the following tests are shown below:

Table 6-2. Summary of Chemical Test Results

BH NO.	DEPTH (M)	RESULT OF CHEMICAL TESTS		
		CHLORIDE (mg/kg)	SULPHATE (mg/kg)	ORGANIC CONTENT (%)
BH-1	9.0-9.45	34	3500	-
	16.5-16.95	130	68	-
	19.5-19.95	-	-	3.5
BH-2	2.0-2.45	-	-	3.9
	4.5-4.95	80	1500	-
	24.0-24.45	170	73	-