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Geotechnical Investigation Report on a land proposed for the construction of a three (3) Storey Hostel Facility at the University of Cape Coast, Cape Coast

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1 INTRODUCTION

1.1 Background

The University of Cape Coast in partnership with LEDing Hostels Ghana Limited are planning to undertake of a three (3) storey hostel facility and ancillary structures in order to reduce student accommodation challenges. Gyam Engineering and Construction works Limited has been commissioned as Consult7ant for the project, to undertake geotechnical investigation for the project.

The investigation carried out at the allocated site comprised of a sub-surface exploration with the Dynamic Cone Penetrometer (DCP), trial pitting and laboratory testing of recovered disturbed soil samples. Results from the tests will provide information on the subsurface profile, strength of the soil strata with depth which will facilitate the making of recommendations for foundation design and treatment.

1.2 Objective of work

This report will seek to give recommendations for the foundation by determining the following:

- Geology, seismology and climatic conditions
- Bearing Capacity and depth of tested ground
- Chemical composition of Soil or Groundwater
- Soil characteristics and properties
- Requirement for site improvement.

The report includes project introduction, fieldwork, laboratory test, analysis of results, conclusion and recommendations.

2. PROJECT DESCRIPTION

2.1 Location and site condition

The allocated site for the proposed project is located about 100 meters from the Kwame Nkrumah Hall and located on a 30-acre land. The site is covered with trees and shrubs as indicated in the Figures 2.1 and 2.2 below.

Figure 2.1: Northside site view with trees and shrubs with maize farm

Figure 2.2: Northwards interior view of site with tree and shrubs

2.2 Geology

The Cape Coast Granite complex consists of well foliated and medium grained muscovite-bioitite granite, granodiorites and pegmatites. It is often associated with schists and gneisses and intrudes the lower Birrimian meta-sediments (Anon, 2008). One characteristic of the granite is that, it is not inherently permeable, but secondary permeability and porosity have developed as a result of fracturing and weathering. The hydraulic potential depends on the degree of fracturing and on the potential recharge of the aquifer, which is directly related to the annual rainfall and water streaming. For this reason, the underlying granites have been categorized into two groups: those located in the southwestern savanna zone and those in the forest zone (Anon, 2008).

a) Southwestern Savanna Zone

The towns located in the south-western savannah zone are underlain by Cape Coast and Dixcove granites. Annual rainfall (about 800 mm) that enhances the development of secondary permeability and porosity in granite is low in this zone. The depth to bedrock is shallow, ranging between 0-5 m. Deep weathering has not occurred in these areas. Fractures that also accumulate groundwater are not well developed and ground water potential is low in this zone. Average yield from boreholes in this zone is about 0.41 m^3/h with very low success ratio of about 20%. The groundwater in this zone is often saline probably because the rainfall that is to recharge the groundwater flows into the stream channels as runoff due to the impermeable nature of the topsoil and shallow bedrock (Anon, 2009a).

b) Forest Zone

In this zone annual rainfall is high (1 000-1 600 mm) and weathering processes penetrate deeply along fracture systems in the granite and gneiss and they commonly have been eroded down to low-lying areas. Boreholes could yield as high as 54 m^3/h, with an average of 9 m^3/h (Anon, 2009a).

Tables 2.1 and 2.2, give summaries of the physical properties and chemical composition of the Cape Coast granite.

Table 2.1: Physical properties of the Cape Coast Granite.

Hardness	6 to 7 on Moh's Scale
Density	2.6 to 2.8 Kg/cm^3
Compressive Strength	140 to 210 N/mm^2
Modulus of Rupture	15 to 25 N/mm^2
Water Absorption	0.1-0.6%
Average Wear	Less than 1%
Porosity	Quite low
Weather Impact	Resistant

Source: Anon, (2009a)

c) Chemical Properties

Chemically, granitic rocks are igneous/metamorphic; composed of quartz, feldspar and ferromagnesian minerals like kriolite, chlorite, garnet, etc. Typical granite will have the following chemical composition (Anon, 2009a):

Table 2.2: Chemical composition of Cape Coast granite.

Silica (SiO2)	70-75%
Al2O3	10-15%
CaO+MgO	Less than 0.5%
FeO + Fe2O3	2-4%
Alkalies	4-6%
TiO2	Less than 0.5%
Loss On Ignition (LOI)	Less than 0.5%

2.2.1 Topography

The site slope gently towards the north-south direction. The area is therefore virtually not susceptible to ponding since run-offs can be managed by the terrain. Notwithstanding, lined drains are recommendable to discharge any excess when peak run-off occurs.

2.2.2 Lithology

Cape Coast as shown in Figure 2.3 is bedded on mainly on protolithic Birimian super rock with some overprint of metamorphic properties. The formations are composed mainly of biotite gneiss and minor components of biotite schist with some garnet and amphibole minerals and in some cases without. As known, rocks with protolithic characteristics and coarse-grained metamorphic rocks are generally stable and strong and their decomposition may result in residual sandy and gravelly soils.

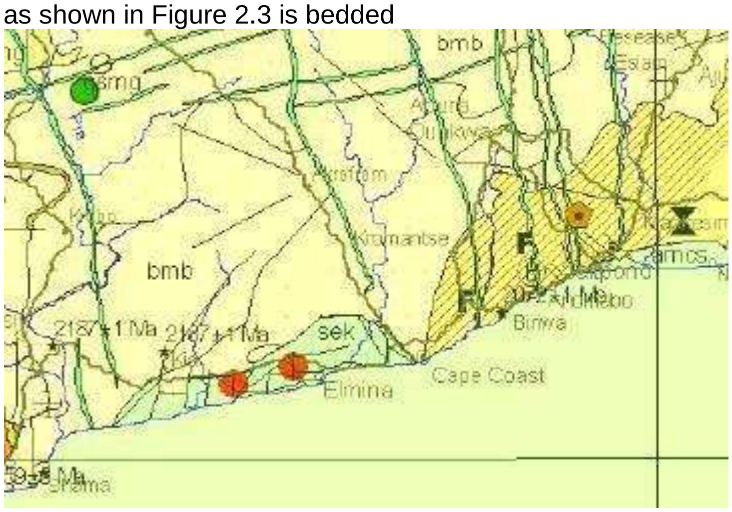

Figure 2.3: Geological location of University of Cape Coast

2.3 Seismology

From the Seismic Hazard Map of Ghana in Figure 2.4, Cape Coast falls under Zone 3, which is a relatively high seismic zone. The zone is believed to be geologically unstable. Precautions should therefore be taken in the design of the foundation, particularly where high-storey structures are expected

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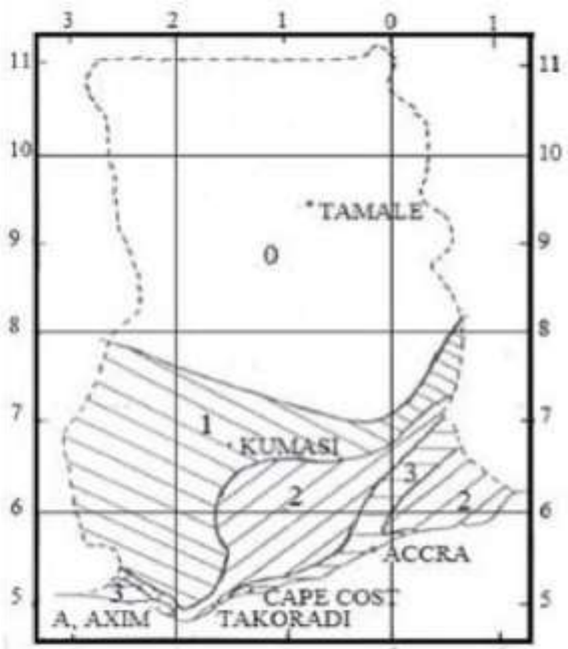

Figure 2.4: Seismic Hazard Map of Ghana

A Peak Horizontal Ground Acceleration of 0.35g is assigned by the Ghana Building Code to building in Zone 3 as shown in Table 2.3 below

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Table 2.3: Ghana Building Code on peak horizontal ground acceleration (BRRI, 1999, 2010)

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Seismic Hazard zone	Assigned peak horizontal ground acceleration, (g /unit of gravity)
0	0.00
1	0.15
2	0.25
3	0.35

2.4 Climatic Conditions

Cape Coast falls within the Coastal Savanna Zone which is characterized by two climatic seasons: Rainy and Harmattan or dry. Two rainy periods occur with their peaks mostly in June and October. The major one starts from mid-April to early July and the minor from September to November. This pattern is not finite and therefore the rains sometimes extends into the dry seasons. The average annual rainfall ranges from 838mm to 1,038 mm with considerable variations inthe time of onset, duration and intensity over the years. Mostly during the rainy seasons, the ground water tables are generally high.

3. FIELD WORK

Fieldwork was undertaken on the 25th of July 2020 and was carried out in accordance with BS 5930. The activities comprised of the DCP (DIN 4094) test and trial/test pitting. The location of the pits and DCP points were selected to cover the section of the land allocated for the proposed project. GPS locations of the pits and DCP spots were recorded and displayed in Figure 3.1.

Figure 3.1: Layout of site with DCP test spots and trial pit

3.1 Dynamic Cone Penetrometer Test (DCPT-DIN 4094)

A total of five (5) number Dynamic Cone Penetrometer tests were conducted with the Lightweight Dynamic Cone Penetrometer (DIN 4094) to assess the soil strength or bearing capacity at varying depth. Each DCP test was terminated at refusal or when over 50 blows per 100mm was achieved. Figure 3.2 shows DCP being sunk.

Figure 3.2: Sinking of DCP 1 at the site

3.2 Trial Pitting

Eight (8) test pits of an average area of about 2.5m² each were excavated with a backhoe as shown in Figure 3.2 and terminated at varying depths. The test pits revealed the soil profile and subsurface soil characteristics. Disturbed soil samples were recovered for laboratory testing as shown in Figure 3.3 and 3.4. Groundwater was not encountered in all the pits excavated.

Figure 3.3: Trial pit being sunk

Figure 3.4: Material sampling in the excavated

4. LABORATORY TESTING

Laboratory tests were conducted on groundwater and the retrieved disturbed samples for classification and further determination of their characteristics and effect to foundation. The tests were undertaken in accordance with BS 1377 and ASTM Standards.

The tests undertaken included: -

- Natural moisture content determination
- Atterberg limits
- Sieve analysis
- Free Swell test

Summary of soil classification is presented in Table 4.1 and results are displayed at Appendix 1.

Table 4.1: Soil classification (Unified method)

Sample identification				Particle size distribution (%)			Soil description (ASTM D 2487)	Differential Swell (%)
Pit No.	Ds	Depth (m)	Sample ID	Gravel	Sand	Fines		
PIT 1	1	0.00 - 1.2	P1S1	5	8	87	Fat CLAY	13
	2	1.2 - 2.19	P1S2	33	10	57	gravelly elastic SILT	19
PIT 2	1	0.00 - 0.45	P2S1	56	16	28	gravelly fat CLAY with sand	-
	2	0.45 - 2.15	P2S2	40	4	56	gravelly elastic SILT	36
PIT 3	1	0.00 - 1.2	P3S3	19	20	61	sandy elastic SILT with gravel	33
	2	1.2 - 1.7	P3S2	4	11	85	sandy fat Clay	18
	3	1.7 - 2.9	P3S1	0	6	94	Fat CLAY	13
PIT 4	1	0.00 - 1.7	P4S2	36	20	44	gravelly silt with sand	25
	2	1.7 - 2.7	P4S1	35	15	50	gravelly elastic SILT with sand	21
PIT 5	1	1.5 - 1.95	P5S1	39	11	50	gravelly elastic SILT	25
PIT 6	1	0.00 - 1.75	P6S2	0	24	76	sandy silty CLAY	-
	2	1.75 - 2.5	P6S1	19	17	64	gravelly SILT with sand	6
PIT 7	1	0.7 - 1.00	P7S1	23	50	27	silty SAND with gravel	0
PIT 8	1	0.00 - 1.2	P8S2	1	37	62	sandy silty CLAY	15
	2	1.2 - 2.00	P8S1	30	28	42	gravelly silty clay with sand	17

5. ANALYSIS AND DISCUSSION

5.1 Subsurface Condition

Generally, the ground which is rid of top soil is mainly underlain by a thick layer of dry dense gravelly silt with sand and further by very dense moist sandy silt material which underlain by decomposed rock within the north-east section of the site. The pit log at Appendix 2 shows the profile of the subsoils. The soil samples were classified by the Unified System of Classification (ASTM D 2487).

5.2 Soil Characteristics and Property

A plot of Plasticity Indices (PI) against Liquid Limits (LL) of the fine particles of the soil samples on the Cassagrande Plasticity Chart with respect to the A-Line is as shown in Figure 5.1. The fines of sample P7S1 is non-plastic and cohesionless. P6S1, P8SI and P8S2 have inorganic silt with low compressibility. P4S1 and P6S2 fall under the A-line and they are identified as inorganic silt of medium compressibility and organic silts. The fines from samples: P2S1, P3S2, and P3S2 are inorganic clays of high plasticity. The rest of the fines, P1S2, P2S2, P4S2, P5S1 and P3S1, which are the majority are inorganic silt of high compressibility and organic clay. It is, therefore, anticipated that majority of the fines of the subsoil will be inorganic silts of low to high compressibility and few inorganic clays of high plasticity

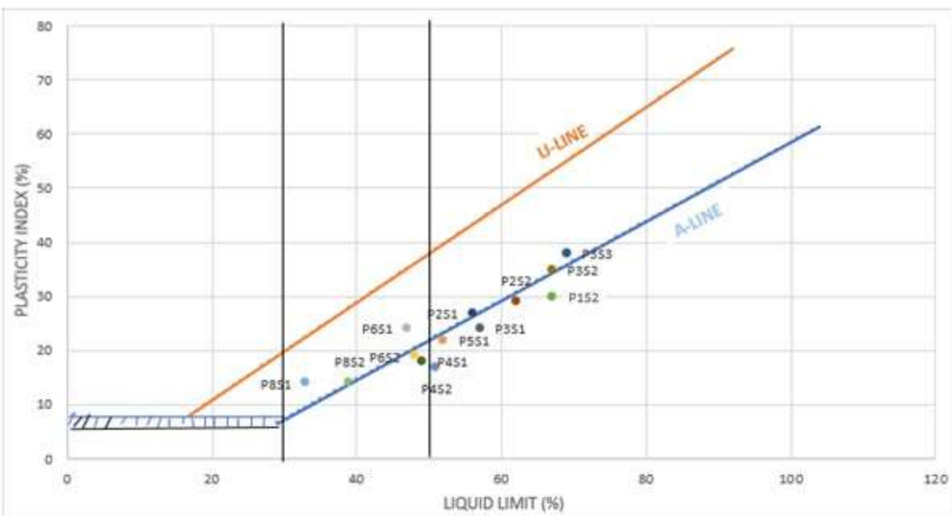

Figure 5.1: Casagrande Plasticity Chart

Various researches have sought to compare Atterberg limits and swell or shrink potential of soil. Table 5.1 summarizes the U.S Army Waterways Experiment Station criterion compiled by O'Neill and Poormoayed (1980).

Table 5.1: Relationship between LL, PI and swelling potential

Liquid Limit (%)	Plasticity Index (%)	Potential Swell (%)	Swelling Potential
< 50	< 25	< 0.5	Low
50-60	25-35	0.5 – 1.5	Medium
> 60	> 35	> 1.5	High

The maximum recorded LL and PI of the soil samples are 69% and 38% respectively which per Table 5.1 indicates that potential swell is high.

With reference to Table 5.2 which relates the differential free swell to degree of expansiveness of cohesive soils for light loaded structures, the degree of expansiveness in the presence of moisture is also expected to be generally low to high as the differential swell varies between 6% and 36%.

Settlement which is related to soil expansiveness may therefore be relatively low to moderate with some isolated high cases

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Table 5.2: Relationship between differential swell and degree of expansiveness

Differential Free Swell (%)	Degree of Expansiveness
< 20	Low
20 -35	Moderate
35 – 50	High
> 50	Very High

5.3 Chemical Analysis

The result of chemical analysis on samples of soil showed a maximum pH value of 4.53 which is acidic and falls below the acceptable range of 5-7. Soluble acids attack concrete, leading to leaching and subsequent erosion on concrete. Concrete should therefore be densified and protected to reduce impact. The maximum chloride concentration in the soil sample is 36mg/l and it falls below the acceptable maximum limit of 300mg/l to present any possible corrosion to the steel reinforcement and spalling of good quality concrete. Very dense good quality concrete should therefore be produced. The maximum sulphate (SO3) content in the soil is 198 mg/l which is very close to the maximum acceptable limit of 200mg/l suggestive of possible high sulphate content which may weaken cement in concrete and thereby reduce the strength of concrete drastically.

The foundation concrete may therefore be produced with a sulphate-resisting cement or Ordinary Portland Cement with a very dense consistency. Dense concrete tends to be impervious and less vulnerable to any attack. When Ordinary Portland Cement is used for the foundation concrete, all the substructure or foundation (footing and columns) should be wrapped with appropriate tough plastic sheets or damp-proof material to avoid contact with any soil material and groundwater which can result in wet foundation and gradual ingress of soluble sulphate. Adequate curing of concrete should be ensured before wrapping the substructure to prevent cracking of concrete. Summary of the chemical test results are as below in Table 5.3.

Table 5.3. Summary of chemical test results and specification

Type of test	Test results on soil sample			Acceptable limit
	Sample 1 (Pit 1)	Sample 2 (Pit 7)	Sample 3 (Pit 8)	
pH	3.83	4.29	**4.5** **3**	**5-7**
Sulphate content (mg/l)	198	48	**45**	**200**
Chloride content (mg/l)	28	29	**36**	**300**

5.4 Bearing Capacity

The correlation for obtaining bearing capacity from DCP (DIN 4094) test is given as;
qu = 30r, where qu is the ultimate bearing capacity and r is resistance or blows/100mm penetration. DCP test results have been analyzed using the above correlation and presented in Table 5.4.

A factor of safety of 3 was considered in the analysis. At refusal the safe bearing capacity is expected to be in excess of 500KN/m^2. The latter is comparable to the bearing capacity of dense gravel which is expected to be greater than 400KN/m^2 and mostly very adequate for most footing types.

The DCP test at a depth of 3.8m recorded a minimum and average safe bearing capacities of 180KN/m^2 and 240KN/m^2 respectively which will be adequate for the structure. The foundation may therefore be placed and designed to a depth of 3.8m or deeper with an allowable bearing capacity between 180KN/m^2 to 200KN/m^2.

Table 5.4: Safe bearing capacities (q), for the various DCP points

Depth of penetration (m)	DCP 1	DCP 2	DCP 3	DCP 4	DCP 5		
	q1	**q2**	**q3**	**q4**	**q5**	**qmin**	**qav.**
	(KN/m^2)						
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
-0.1	10	10	60	30	30	10	28
-0.2	60	30	200	110	180	30	116
-0.3	130	50	160	160	240	50	148
-0.4	140	170	160	100	240	100	162
-0.5	**150**	**340**	**140**	**190**	**270**	**140**	**218**
-0.6	180	380	140	220	340	140	252
-0.7	130	290	150	230	340	130	228
-0.8	110	340	150	150	360	110	222
-0.9	100	300	160	130	360	100	210
-1.0	**90**	**250**	**160**	**270**	**290**	**90**	**212**
-1.1	80	300	150	300	260	80	218
-1.2	80	280	160	450	270	80	248
-1.3	90	260	190	410	280	90	246
-1.4	90	270	190	290	250	90	218
-1.5	**100**	**240**	**180**	**270**	**260**	**100**	**210**
-1.6	100	220	170	350	240	100	216

-1.7	100	190	170	340	260	100	212
-1.8	120	170	180	320	200	120	198
-1.9	130	200	200	140	190	130	172
-2.0	**110**	**270**	**180**	**90**	**230**	**90**	**176**
-2.1	120	290	200	110	200	110	184
-2.2	100	290	200	190	260	100	208
-2.3	110	280	230	200	290	110	222
-2.4	120	300	230	220	300	120	234
-2.5	**80**	**300**	**210**	**240**	**320**	**80**	**230**
-2.6	110	300	200	330	330	110	254
-2.7	120	360	240	330	310	120	272
-2.8	120	310	230	210	340	120	242
-2.9	180	340	230	240	360	180	270
-3.0	**160**	**260**	**230**	**170**	**380**	**160**	**240**
-3.1	150	270	250	210	430	150	262
-3.2	140	300	280	330	440	140	298
-3.3	310	350	350	400	460	310	374
-3.4	160	350	350	480	440	160	356
-3.5	**240**	**310**	**330**	**500**	**490**	**240**	**374**
-3.6	210	280	260		500	210	313
-3.7	220	270	260			220	250
-3.8	180	300	240			180	240
-3.9	200	280	270			200	250
-4.0	**200**	**280**	**290**			**200**	**257**
-4.1	200	300	290			200	263
-4.2	200	210	270			200	227
-4.3	200	200	290			200	230
-4.4	210	240	320			210	257
-4.5	**220**	**270**	**330**			**220**	**273**
-4.6	250	280	330			250	287
-4.7	250	270	310			250	277
-4.8	260	300	300			260	287
-4.9	260	290	240			240	263
-5	220	320	250			220	263
-5.1	220	310	280			220	270
-5.2	290	370	330			290	330
-5.3	230	370	360			230	320
-5.4	230	370	400			230	333
-5.5	260	410	330			260	333
-5.6	320	410	410			320	380
-5.7	300	490	440			300	410
-5.8	330	510	460			330	433
-5.9	340		500			340	420
-6.0	390					390	390
-6.1	500					500	500

5.5 Foundation Depth and Type

The foundation footings should be carried below topsoil since the topsoil zones tend to have high volume changes resulting from moisture fluctuation and unconsolidated material which may result in excessive settlement. At the maximum depth of 3.8m or deeper the dry soil strata are much denser and competent to support a conventional pad or strip foundation for the type of structure proposed. The depth at which the DCP test were terminated were not uniform and ranged from 6.1m to 3.5m at which the number of blows were adequate and indicative of adequate and competent bearing capacity.

5.6 Settlement and subsurface treatment

The subsurface soils in the presence of water may have high swelling or collapse potential and compressibility and moderate expansiveness. Settlement is therefore expected to be moderate. Tied beams should therefore be provided to control any differential settlement that may occur. The ground should also be stabilized with 200mm thick 0-75mm crushed rock before placing the footing. The crushed rock should be well loaded or compacted to ensure stability. This will serve as a filter and free drainage for the groundwater as it stabilizes the ground and also bring up the foundation depth.

Hardcore filling should be done with a well-drained gravel material and compacted to adequate densities in order to prevent ground floor slab settlement and subsequent cracking or collapse.

5.7 Groundwater

Groundwater was not encountered in all pits; however, soil was found to be moist. Should groundwater be encountered during construction as a result of rise in water table, a dewatering system should be used. In dewatering, the sides of trenches may be braced or protected to avoid collapse.

6.0 CONCLUSION AND RECOMMENDATION

A geotechnical investigation has been carried out at the designated sites, proposed for the construction of 3-storey student hostel at Cape Coast University campus in the Central Region and the following are the findings and recommendations:

i. Strip or pad foundation may be used.
ii. An allowable bearing capacity between 200 KN/m^2 may be used for the footing design.
iii. The foundation may be placed at a depth of 3.8m or deeper.
iv. All foundation ground should be stabilized with 200mm thick 0-75mm crushed rock. This will additionally bring the foundation depth up.
v. All crushed rock should be loaded, tamped or compacted to ensure their firmness in the ground.
vi. Peak Horizontal Design Ground Acceleration of 0.35g should be considered for seismic design considerations.
vii. Settlement is expected to be moderate to high, therefore ground tied-beams should be provided for all the areas.
viii. A well compacted hardcore filling should be undertaken using a well-drained or coarse-grained gravel material.
ix. Quality concrete for especially the substructure should be produced from Sulphate-Resisting Cement or Ordinary Portland Cement with a very dense consistency and free water/cement ratio not greater than 0.55. Concrete should be well vibrated with a poker vibrator to achieve the density.
x. Where Ordinary Portland Cement is used for the foundation concrete, all substructure concrete should be wrapped with damp-proof material or tough plastic sheets to prevent any contact of substructure (footing base and column) with soluble acids or sulphate. Ensure adequate curing before full wrapping of concrete.
xi. Even though the land slopes to allow easy flow of runoffs in case of peaks, drainage should be managed effectively with the construction of lined drains.
xii. A dewatering system should be adopted when groundwater is encountered during construction.
xiii. The sides of all trenches may be braced to avoid collapse should there be dewatering.

7. DISCLAIMER

The recommendations given are based on subsurface conditions encountered at specified location, time and depth during the field investigations. Subsurface condition at the location which may differ, though unlikely, or change over the passage of time should be brought to the attention of the author immediately for redress.

APPENDIX 1

CHEMICAL TEST RESULTS

GHANA WATER COMPANY LIMITED – CENTRAL REGION
WATER QUALITY ASSURANCE SECTION

NAME OF CLIENT	ROARK Enterprise
SAMPLE DESCRIPTION	PIT 1
LOCATION	
SAMPLE RECEIPT DATE	20-08-2020
ANALYSIS COMPLETION DATE	20-08-2020

PARAMETER	TEST METHOD	UNIT	GHANA STANDARDS	RESULTS
pH	Electrometric	pH Units	6.5-8.5	3.83
Chloride	Titrimetric	mg/L	250	28.0
Sulphate	Spectrophotometric	mg/L	250	198.0

REMARKS: Sample as submitted had low pH.

RECOMMENDATION: Adjustment of pH of the source is recommended.

REGIONAL WATER QUALITY ASSURANCE MANAGER, GHANA WATER CO. LTD. CAPE COAST

MANUEL TETTEH
(Regional Water Quality Assurance Manager)

GHANA WATER COMPANY LIMITED – CENTRAL REGION
WATER QUALITY ASSURANCE SECTION

NAME OF CLIENT	ROARK Enterprise
SAMPLE DESCRIPTION	PIT 7
LOCATION	
SAMPLE RECEIPT DATE	20-08-2020
ANALYSIS COMPLETION DATE	20-08-2020

PARAMETER	TEST METHOD	UNIT	GHANA STANDARDS	RESULTS
pH	Electrometric	pH Units	6.5-8.5	4.29
Chloride	Titrimetric	mg/L	250	29.0
Sulphate	Spectrophotometric	mg/L	250	48.0

REMARKS: Sample as submitted had low pH.

RECOMMENDATION: Adjustment of pH of the source is recommended.

MANUEL TETTEH
(Regional Water Quality Assurance Manager)

GHANA WATER COMPANY LIMITED – CENTRAL REGION
WATER QUALITY ASSURANCE SECTION

NAME OF CLIENT	ROARK Enterprise
SAMPLE DESCRIPTION	PIT 8
LOCATION	
SAMPLE RECEIPT DATE	20-08-2020
ANALYSIS COMPLETION DATE	20-08-2020

PARAMETER	TEST METHOD	UNIT	GHANA STANDARDS	RESULTS
pH	Electrometric	pH Units	6.5-8.5	4.53
Chloride	Titrimetric	mg/L	250	36.0
Sulphate	Spectrophotometric	mg/L	250	45.0

REMARKS: Sample as submitted had low pH.

RECOMMENDATION: Adjustment of pH of the source is recommended.

21/08/20

MANUEL TETTEH
(Regional Water Quality Assurance Manager)

APPENDIX 2

PHYSICAL TEST RESULTS

PROJECT TTLE:	CONSTRUCTION OF 3-STOREY HOSTEL FACILITY AT UCC CAMPUS																		
LABORATORY TEST RESULTS OF SAMPLED SOIL																			
SAMPLE IDENTIFICATION			GRADING TEST PERCENTAGE PASSING BS SIEVE SIZES													ATTERBERG LIMITS			DIFFERENTIAL FREE SWELL (%)
TP	DEPTH (m)	DS	75 mm	53 mm	37.5 mm	26.5 mm	19 mm	9.5 mm	4.75 mm	2 mm	1 mm	425 µm	300 µm	150 µm	75 µm	LL (%)	PL (%)	PI (%)	
PIT 1	0.0 - 1.2m	P1S1	100	100	100	100	100	99	95	92	91	90	89	88	87	69	31	38	13
	1.2 - 2.19m	P1S2	100	100	100	96	92	79	67	61	60	59	59	59	57	67	37	30	19
PIT 2	0.00 - 0.45	P2S1	100	100	100	100	95	68	44	31	30	29	29	28	28	56	29	27	-
	0.45 - 2.15	P2S2	100	100	100	96	82	64	60	59	58	57	57	57	56	62	33	29	36
PIT 3	0.00 - 1.2	P3S3	100	100	100	100	100	94	81	70	68	67	66	64	61	57	33	24	33
	1.2 - 1.7	P3S2	100	100	100	100	100	99	96	92	90	88	87	86	85	67	32	35	18
	1.7 - 2.9	P3S1	100	100	100	100	100	100	100	99	98	97	96	95	94	69	31	38	13
PIT 4	0.00 - 1.7	P4S2	100	100	100	100	98	84	64	52	49	48	47	46	44	49	31	18	25
	1.7 - 2.7	P4S1	100	100	100	100	95	79	65	58	56	55	54	52	50	51	34	17	21
PIT	1.5 - 1.95	P5S1	100	100	100	100	91	71	61	56	55	54	54	52	50	52	30	22	25

5																			
PIT 6	0.00 - 1.75	P6S2	100	100	100	100	100	100	100	99	97	95	93	84	76	47	23	24	-
	1.75 - 2.5	P6S1	100	100	100	100	100	92	81	99	97	73	72	68	64	48	29	19	6
PIT 7	0.7 - 1.00	P7S1	100	100	100	100	95	81	77	74	73	72	71	35	27			NP	0
PIT 8	0.00 - 1.2	P8S2	100	100	100	100	100	100	99	98	96	94	92	78	62	33	19	14	15
	1.2 - 2.00	P8S1	100	100	100	100	98	90	70	57	54	53	52	48	42	39	25	14	17

APPENDIX 3

TRIAL PIT LOGS AND PIT AND DCP POINT LOCATION

	Trial Pit Log
Project:	Proposed Construction of a 7-Storey hostel facility at UCC, Cape Coast
Client:-	UCC
Location:-	Cape Coast
Method of Excavation:- Payloader	Date:- 25/7/2020

Trial Pit 1

Depth (m)	Description	Symbol	Sample ID	Thickness (m)
0.0				
0.10				
0.20	Dark brown top soil		Topsoil	0.26m
0.26				
0.30				
0.40				
0.50				
0.60				
0.70				
0.80				
0.90	Dark reddish brown clayey SAND		P1S2	0.99m
1.00				
1.10				
1.20				
1.25				
1.30				
1.40				
1.50				
1.60				
1.70				
1.80				
1.90				
2.00	Grayish brown clayey SAND		P1S1	1.2m
2.10				
2.20				
2.30				
2.40				
2.45				

BOTTOM OF PIT

Trial Pit Log

Project: - Proposed construction of a 3-Storey hostel facility at UCC, Cape Coast

Client:-
Location:- Cape Coast
Method of Excavation:- Payloader **Date:- 25/7/2020**

Trial Pit 2

Depth (m)	Description	Symbol	Sample ID	Thickness (m)
0.0				
0.10				
0.20				
0.30	Dark brown top soil		Topsoil	0.45m
0.40				
0.45				
0.50				
0.60				
0.70				
0.80				
0.90				
1.00				
1.10				
1.20				
1.30	Very dense, dry, dark reddish brown gravelly SAND		P2S2	1.7m
1.40				
1.50				
1.60				
1.70				
1.80				
1.90				
2.00				
2.10				
2.15				
2.20	Compact, dry mottled Yellow, gray, dark red clayey SAND		P2S1	0.45m
2.30				
2.40				
2.50				
2.60				

BOTTOM OF PIT

Trial Pit Log

Project:-	**Proposed Construction of a 3-Storey hostel facility at UCC, Cape Coast**					
Client:-						
Location:-	**Cape Coast**					
Method of Excavation:-		**Payloader**		**Date:-** 25/7/2020		

Trial Pit 3

Depth (m)	Description	Symbol	Sample ID	Thickness (m)
0.0	**Dark brown Topsoil**		**Top soil**	**0.10 m**
0.10				
0.20	**Very dense, reddish brown sandy GRAVEL**		**P3S1**	**1.2m**
0.30				
0.40				
0.50				
0.60				
0.70				
0.80				
0.90				
1.00				
1.10				
1.20				
1.30				
1.4				

Trial Pit Log

Project:-	**Proposed Construction of a 3-Storey hostel facility at UCC, Cape Coast**					
Client:-	**UCC**					
Location:-	**Cape Coast**					
Method of Excavation:- Payloader				**Date:- 25/7/2020**		

Trial Pit 1

Depth (m)	Description	Symbol	Sample ID	Thickness (m)
0.0	**Dark brown top soil**		**Topsoil**	**0.26m**
0.10				
0.20				
0.26				
0.30	**Dark reddish brown clayey SAND**		**P1S2**	**0.99m**
0.40				
0.50				
0.60				
0.70				
0.80				
0.90				
1.00				
1.10				
1.20				
1.25				
1.30	**Grayish brown clayey SAND**		**P1S1**	**1.2m**
1.40				
1.50				
1.60				
1.70				
1.80				
1.90				
2.00				
2.10				
2.20				
2.30				
2.40				
2.45				
BOTTOM PIT				

Trial Pit Log

Project:- **Proposed Construction of a 3-Storey hostel facility at UCC, Cape Coast**

Client:-

Location:- **Cape Coast**

Method of Excavation:- Payloader

Trial Pit 2 **Date:- 25/7/2020**

Depth (m)	Description	Symbol	Sample ID	Thickness (m)
0.0				
0.10				
0.20	Dark brown top soil			
0.30			Topsoil	0.45m
0.40				
0.45				
0.50				
0.60				
0.70				
0.80				
0.90				
1.00				
1.10				
1.20				
1.30	Very dense, dry, dark reddish brown gravelly SAND			
1.40			P2S2	1.7m
1.50				
1.60				
1.70				
1.80				
1.90				
2.00				
2.10				
2.15				
2.20	Compact, dry mottled Yellow, gray, dark red clayey SAND			
2.30			P2S1	0.45m
2.40				
2.50				
2.60				

BOTTOM OF PIT

Trial Pit Log

Trial Pit Log

Project:-	**Proposed Construction of a 3-Storey hostel facility at UCC, Cape Coast**						
Client:-							
Location:-	**Cape Coast**						
Method of Excavation:-		**Payloader**			**Date:- 25/7/2020**		

Trial Pit 3

Depth (m)	Description	Symbol	Sample ID	Thickness (m)
0.0	**Dark brown Topsoil**		**Top soil**	**0.10 m**
0.10				
0.20	**Very dense, reddish brown sandy GRAVEL**		**P3S 1**	**1.2m**
0.30				
0.40				
0.50				
0.60				
0.70				
0.80				
0.90				
1.00				
1.10				
1.20				
1.30				
1.4				

0 1.50 1.60 1.70 1.80	**Compact, dry mottled Yellow, dark red, grayish clayey SAND**		**P3S2**	**0.5m**
1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00	**Very compact, slightly moist reddish brown gray clayey SAND**		**P3S3**	**1.20 m**

BOTTOM OF PIT

Trial Pit Log

Project **Proposed Construction of a 3-Storey hostel facility at UCC, Cape Coast**

Client:-

Location:- **Cape Coast**

Method of

33. Gyamera .

Excavation:- Payloader				25/7/2020	
Trial Pit 4					
Depth (m)	**Description**	**Symbol**	**Sample ID**	**Thickness (m)**	
0.00	**Dark brown Topsoil**		**Top soil**	**0.45 m**	
0.10					
0.20					
0.30					
0.40					
0.45					
0.50	**Dry dense reddish brown sandy GRAVEL**		**P4S1**	**1.0m**	
0.60					
0.70					
0.80					
0.90					
1.00					
1.10					
1.20					
1.30					
1.40					
1.45					

1.50	**Moist, very dense yellowish, reddish brown silty SAND**		**P4S2**	**1.70 m**
1.60				
1.70				
1.80				
1.90				
2.00				
2.10				
2.20				
2.30				
2.40				
2.50				
2.60				
2.70				
2.80				
2.90				
3.00				
3.10				
3.15				
BOTTOM OF PIT				

Project: -		**Proposed Construction of a 3-Storey hostel facility at UCC, Cape Coast**						
Client:-								
Location :-		**Cape Coast**						
Method of Excavation: - **Payloader**						**Date:- 25/7/2020**		

Trial Pit 6

Depth (m)	**Description**	**Symbol**	**Sample ID**	**Thickness (m)**
0.0				
0.10	**Dark brown**		**Topsoil**	**0.20m**
0.20	**Topsoil**			
0.30				
0.40				
0.45				
0.50				
0.60	**Dry dense yellowish brown sandy**		**P6S1**	**0.75m**
0.70	**GRAVEL**			
0.80				
0.90				
0.95				
1.00				
1.10				
1.20				
1.30				
1.40				
1.45				
1.50				
1.60				
1.70				
1.80				
1.90	**Dense yellow, reddish brown clayey**		**P6S2**	**1.75m**
2.00	**SAND**			
2.10				
2.20				
2.30				
2.40				
2.50				
2.60				
2.70				

BOTTOM OF PIT

LOCATION OF TRIAL PITS AND DCP TEST POINTS

ITEM	LONGITUDE	LATITUDE
PIT 1	1°16'47.73"W	5° 7'3.90"N
PIT 2	1°16'48.74"W	5° 7'4.01"N
PIT 3	1°16'49.09"W	5° 7'5.22"N
PIT 4	1°16'49.93"W	5° 7'4.31"N
PIT 5	1°16'50.12"W	5° 7'5.96"N
PIT 6	1°16'49.61"W	5° 7'6.84"N
PIT 7	1°16'49.69"W	5° 7'8.86"N
PIT 8	1°16'51.52"W	5° 7'8.11"N
DCP 1	1°16'47.98"W	5° 7'4.26"N
DCP2	1°16'48.57"W	5° 7'4.06"N
DCP 3	1°16'49.00"W	5° 7'5.13"N
DCP 4	1°16'49.80"W	5° 7'4.36"N
DCP 5	1°16'50.00"W	5° 7'6.24"N