

□土質調査結果（抜粋）



DMR 515

**MINISTRY OF TRANSPORT & PUBLIC INFRASTRUCTURE
CENTRAL MATERIALS LABORATORY**

**Reconstruction & Expansion
of Selected Community Day Secondary Schools
In Republic of Malawi
REPORT ON**

GEOTECHNICAL INVESTIGATIONS

January, 2010

Secretary for Transport & Public Infrastructure
Private Bag 322
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LILONGWE

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SELECTED COMMUNITY DAY SECONDARY SCHOOLS

1.0 INTRODUCTION

This report covers soil investigations for the Selected Community Day Secondary Schools. There are a total of six sites which cover the two out of three regions of Malawi. The two are the Central and the Southern Regions. In the Southern Region, three districts were proposed for the project which included Mulanje allocated Lot 1 at Chakhwaza, Balaka which was allocated Lot 2 at Dziwe and Lot 5 at Namalomba. Blantyre District was allocated Lot 3 at Nankumba which is in rural area and Lot 6 at Nanjiriri in urban area. In the Central region Lilongwe was allocated Lot 4 at Mseche which is in rural area. The project is under Education Development Management (EDMU) of Ministry of Education, Science and Technology. The Japanese Government wants to assist the Government of the Republic of Malawi to implement the project. In order to do this, the Government of Japan identified Matsuda Consultants International Company Limited to carry out the design and supervision works. Central Materials Laboratory in Ministry of Transport and Public Infrastructure was sub-contracted to carry out Soil Investigations on the proposed sites and subsequent testing in order to furnish the client with the information leading to proper designing of the structures. The sites Investigations commenced on 27th November, 2009 and were completed on 12th December, 2009 while laboratory testing was completed on 22nd December, 2009.

2.0 FIELD WORKS

This involved the drilling of three boreholes to depth of 5.00 metres on each proposed site and carrying out percolation test at a depth of 1 metre. In each borehole, disturbed at soil change and undisturbed samples before Standard Penetration Test (SPT) were collected for classification and Shear strength testing respectively. Soil profiles were also recorded in each trial pit. The sampling was done in accordance to BS 5930. The Borehole logs are appended in appendix B and Percolation test results are appended in Appendix E.

3.0 SITE LOCATIONS

(a) MULANJE

Chikhwaza Community Day Secondary School site which is Lot 1, lies on the South West of Mulanje and is about twelve kilometres from Mulanje District Headquarters.

(b) BALAKA

This district has two sites. Dziwe Community Day Secondary School which is Lot 2 is situated to the South East of Balaka. The site is about 30 Kilometres from Balaka Headquarters and about 10 Kilometres south of Liwonde Township along Shire River.

Namalomba Community Day Secondary School labelled Lot 5 is situated to the East of Balaka is about 40 Kilometres away. The site is close at Ulongwe Trading Centre on Lilonde – Mangochi Road.

(c) BLANTYRE

Blantyre District also has two sites. Nankumba Community Day Secondary School is in the rural area south of Blantyre District Headquarters. The site is about 20 Kilometres from the City on Blantyre – Chikwawa Road at Chadzunda in Mpemba.

Nanjiriri Community Day Secondary School is Lot 6 and is in the urban area. The school is situated to the north of the City of Blantyre and is about 7 Kilometres. The school is in Machinjiri Location.

(d) LILONGWE

Mseche Community Day Secondary School site labelled Lot 4 lies to the east of Lilongwe City. The distance to the site is about 35 Kilometres and is on Lilongwe - Salima Road.

The site locations are appended in appendix A.

3.1 GEOLOGY OF THE SITES (AREAS)

(i) MULANJE

Chikhwaza CDSS site is geologically dominated by Greyish to Reddish brown sandy silt CLAY which is underlain by Semi-pelitic rocks: biotite- and hornblende-gneiss, commonly garnetiferous and locally graphitic.

(ii) BALAKA

Dziwe CDSS site has some clayey quartz GRAVEL and sandy silt CLAY while Namalomba CDSS site has also clayey SILT and clayey SAND. Both sites are underlain by Alluvium.

(iii) BLANTYRE

Both sites Nankumba and Nanjiriri CDSS have sandy silt CLAY but Nankumba has also some clayey GRAVEL while Nanjiriri in addition has some weathered ROCK. The two sites are underlain by Charnockitic suite: banded pyroxene - granulites and gneisses, hypersthene-granite.

(iv) LILONGWE

Mseche CDSS site has a number of soils ranging from sandy silt CLAY, clayey silt SAND, quartz GRAVEL and weathered ROCK. Generally the site is geologically underlain by semi-pelitic rocks: - biotite and horn-blend gneisses commonly garnetiferous and locally graphitic.

4.0 ENVIRONMENTAL CONDITIONS

Since environment conditions play an important role in the design assumptions, here are some meteorological data for the sites:-

(i) LOT 1 CHIKHWAZA CDSS IN MULANJE:

Mean rainfall	=	1200mm
Mean temperatures	=	28 °C
Mean relative humidity	=	70%

(ii) LOT 2 DZIWE CDSS IN BALAKA

Mean rainfall	=	816mm
Mean temperatures	=	32 °C
Mean relative humidity	=	72%

(iii) LOT 3 NANKUMBA CDSS IN BLANTYRE RURAL

Mean rainfall	=	1140mm
Mean temperatures	=	19.1 °C
Mean relative humidity	=	74%

(iv) LOT 4 MSECHE CDSS IN LILONGWE RURAL

Mean rainfall	=	848mm
Mean temperatures	=	20 °C
Mean relative humidity	=	70%

(v) LOT 5 NAMALOMBA CDSS IN BALAKA

Mean rainfall	=	816mm
Mean temperatures	=	32 °C
Mean relative humidity	=	72%

(vi) LOT 6 NANJIRIRI CDSS IN BLANTYRE URBAN

Mean rainfall	=	1140mm
Mean temperatures	=	19.0 °C
Mean relative humidity	=	74%

5.0 FIELD AND LABORATORY TEST RESULTS

In the field Standard Penetration Tests (SPT) were performed in the borehole at an average depth of 1.5 metres in accordance with BS 5930 of 1990. The N-Values derived from the SPT have been calculated to Estimated Ultimate Bearing Capacities. The Bearing Capacities are appended in appendix C.

In the Laboratory the following tests were performed in accordance with BS 1377 of 1990.

- (i) Atterberg Limits
- (ii) Sieve Analysis (Particle Size Distribution)
- (iii) Shear strength parameters on undisturbed samples.

The results are appended in appendix D.

6.0 ANALYSIS OF THE RESULTS

Field description, Standard Penetration Tests (SPT) N-Values and laboratory test results confirm that:

- (i) Chikhwaza CDSS site is underlain by clayey soils with classifications of A-7-5 and A-7-6 with group indices ranging from 4 to 19. Soils with A-7 are rated poor materials.
- (ii) Dziwe CDSS site has very poor material close to the surface with classification of A-7-5 at BH 1, A-6 at BH2 and A-7-6 at BH3. Below these soils, the site has clayey gravels with classification of A-2-7 having group indices ranging from 0 to 3. Samples with classification of A-2-7 group are rated fair materials.
- (iii) Nankumba CDSS site has clayey soils except in BH1 where soil with classification of A-2-4 was encountered from 0.00 to 0.40. In BH2, soil with classification of A-4 was encountered from 1.50 to 1.95. The material is silt. Both of them are non plastic while in BH3, all are clayey soils with classification of A-7-6 which are rated poor soils.
- (iv) Mseche CDSS site generally has clayey gravel with classification ranging from A-2-4 to A-2-7 which are rated good to fair soils except in BH2 where clayey material was encountered from 0.40 to 1.60 metres. In BH3, clayey soils were encountered from 0.00 to 1.80 metres.
- (v) Namalomba CDSS site generally has clayey soils as indicated in BH1 and BH3 with classification of A-6 with exception of A-4 in BH1 from 0.00 to 0.64 of a metre which is silt material. BH2 has a very different materials compared to BH1 and BH3. The soils classification in BH2 from 0.00 to 0.70m is A-2-4 which is rated good material, from 0.70 – 3.00m the material has a classification of A-2-6 and is rating as fair material while from 3.00 to 5.00 the soil has a classification of A-1-b which is excellent material.
- (vi) Nanjiriri CDSS site has different soils as encountered during boring. BH1 was drilled down to 5.00 metres with clayey soil from 0.00 to 0.45m. From 0.45 to 0.95 the material changes from clayey to silt gravel which is rated as good. From 0.90 to 1.60 metres, the material is fine sand which is also rated as good subgrade with a classification of A-3. From 1.60 to 5.00, the soil has been classified as A-2-6 which shows that the material is clayey gravel and is rated

as fair subgrade. In BH2 there is clayey soil from 0.00 to 0.50m with a classification of A-6 but from 0.50 to 2.15, the materials are good to fair with classifications of A-2-4 and A-2-6. The two samples are silt and clayey gravels respectively. In BH3, from 0.00 to 0.22 the material is silt gravel with classification of A-2-4 while from 0.22 to 1.50 metres the soils have a classification of A-6 which is rated poor subgrade.

(vii) Estimated Ultimate Bearing Capacities:

The bearing capacities have been calculated from Standard Penetration Test (SPT) N-Values for continuous and squarely foundations to assist the designer to make a sound judgement on design assumptions. It should also be noted that when calculating the Estimated Ultimate Bearing Capacities the ratio of water was one.

APPENDIX A

Site Location



APPENDIX B

Bore Hole Logs

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**






















PROJECT :		Selected CDSS		AREA: Mulanje	
LOCATION :		Chikhwaza Lot 1		GWL:	
GROUND ELEV :				RECORDED BY: P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		1		DATE: 3/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00		0.48						Very loose dark brown silty sandy CLAY	
1.00		1.95	UD					Very loose reddish brown silty sandy CLAY	
2.00		2.40	SPT	1	2	2	4		
3.00		2.50	D						
4.00		3.45	UD						
		3.90	SPT	4	6	6	12		
5.00		5.25	D						
			SPT	6	9	10	19		END OF B.H.
6.00									

UD	Undisturbed Sample	*..**..*	=	Silty Fine SAND
N	= SPT N-Value	.....	=	Fill Material
D	= Disturbed Sample	-*o*o*-	=	Sand with Pebbles
..:..:-	= Clayey SILT	**..**.*	=	Clayey SAND
....*	= Silty Sandy CLAY	..*..*..	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS		AREA: Mulanje	
LOCATION :		Chikhwaza Lot 1		GWL:	
GROUND ELEV :				RECORDED BY: P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		2		DATE: 4/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00								Loose dark brown sandy silty CLAY	
1.00		0.45							
2.00									
									
									
		1.95	UD						
									
									
		2.40	SPT	4	5	5	10		
									
3.00								Medium to dense reddish brown silty sandy CLAY	
									
									
		3.55	UD						
									
4.00									
		4.00	SPT	8	9	9	18		
									
									
		4.95	SPT	9	6	6	12		
5.00		5.00	D						END OF B.H.
6.00									

UD	Undisturbed Sample	*..*..*	=	Silty Fine SAND
N	SPT N-Value	.....	=	Fill Material
D	Disturbed Sample	*o*o*	=	Sand with Pebbles
---:-	Clayey SILT	**..**..*	=	Clayey SAND
....*	Silty Sandy CLAY	---*..*	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS				AREA: Mulanje	
LOCATION :		Chikhwaza Lot 1				GWL:	
GROUND ELEV :						RECORDED BY: P.G. Goba	
COORDINATES :						LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		3				DATE: 4/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00		0.90	D					Very loose greyish brown sandy silty CLAY	
1.00									
1.50		D					Loose reddish brown silty sandy CLAY		
1.95		UD					Firm to stiff reddish brown sandy silty CLAY		
2.40		SPT	3	4	4	8			
3.45		UD							
3.90		SPT	5	7	6	13			
4.00		SPT	8	9	9	18			
5.40		D							
		SPT	6	8	11	19			
6.00									

UD	Undisturbed Sample	*..**	=	Silty Fine SAND
N	SPT N-Value	.....	=	Fill Material
D	Disturbed Sample	..*o*o*	=	Sand with Pebbles
..:..:	Clayey SILT	**..**.*	=	Clayey SAND
....*	Silty Sandy CLAY	..*..*..	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT : Selected CDSS				AREA: Balaka					
LOCATION : Dziwe Lot 2				GWL:					
GROUND ELEV :				RECORDED BY P.G. Goba					
COORDINATES :				LOGGED BY: E.G.S. Machila					
BORE HOLE NO. : 1				DATE: 5/12/2009					
DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	*****								
1.00	*****							Soft to firm dark brown sandy silty CLAY	
	*****	1.30							

2.00	*****							Stiff darkish grey sandy silty CLAY with quartz	
	*****	1.90	D						
	*****	1.95	SPT	21	22	10	32		
3.00	*****								
	*****	2.65	SPT	13	17	13	30		

4.00	*****								
	*****	3.45	SPT	27	23	51	74		
	*****							Very dense dark grey quartz GRAVEL	
5.00	*****								
	*****	4.95	SPT	30	41	55	96		
	*****	5.00	D						END OF B.H.
6.00									
UD Undisturbed Sample				*.*.* =			Silty Fine SAND		
N = SPT N-Value				: : : : : =			Fill Material		
D = Disturbed Sample				-o*o*- =			Sand with Pebbles		
--:--: = Clayey SILT				**.*.* =			Clayey SAND		
::* = Silty Sandy CLAY				--*--* =			Decomposed ROCK/Weathered ROCK		

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS				AREA: Balaka			
LOCATION :		Dziwe Lot 2				GWL:			
GROUND ELEV :						RECORDED BY P.G. Goba			
COORDINATES :						LOGGED BY: E.G.S. Machila			
BORE HOLE NO. :		2				DATE: 5/12/2009			
DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	.....		D					Firm to stiff darkish grey sandy silty CLAY	
	.....	0.30							
1.00	..... -o-o-o-		D					Firm yellowish brown clayey quartz GRAVEL	
	..... -o-o-o-	1.50							
2.00	..... ..... ..... ..... .....	1.95	SPT	5	6	10	16		
	..... ..... ..... ..... .....							Dense to very dense greyish brown sandy silty CLAY	220 Pen. END OF B.H.
3.00	..... ..... ..... ..... .....	3.22	SPT	40	55++				
4.00									
5.00									
6.00									
UD =		Undisturbed Sample			*..** =		Silty Fine SAND		
N =		SPT N-Value			:~::~: =		Fill Material		
D =		Disturbed Sample			-o-o-o- =		Sand with Pebbles		
--::-- =		Clayey SILT			**..**.* =		Clayey SAND		
::: =		Silty Sandy CLAY			--*--* =		Decomposed ROCK/Weathered ROCK		

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS				AREA: Balaka	
LOCATION :		Dziwe Lot 2				GWL:	
GROUND ELEV :						RECORDED BY: P.G. Goba	
COORDINATES :						LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		3				DATE: 5/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	*::*::*::*		D					Medium to dense dark brown sandy silty CLAY	
	::::*::*	0.20	D					Stiff greyish brown sandy CLAY with quartz	
	::::*o*o*	0.60							
1.00	*::*::*o*o*		D					Dense yellowish brown sandy CLAY with quartz	
	::::*o*o*	1.10							
	--*--*--								
	--*--*--								
2.00	--*--*--	1.95	SPT	12	13	12	25		
	--*--*--								
	--*--*--								
	--*--*--								
3.00	--*--*--							Medium to dense micaceous decomposed ROCK	
	--*--*--								
	--*--*--								
	--*--*--								
	--*--*--								
4.00	--*--*--								
	--*--*--								
	--*--*--								
	--*--*--								
	--*--*--								
	--*--*--								
5.00	--*--*--	5.00	SPT	7	9	11	20		END OF B.H.
6.00									

UD	Undisturbed Sample	*::*::*	=	Silty Fine SAND
N	SPT N-Value	::::::::::	=	Fill Material
D	Disturbed Sample	*o*o*	=	Sand with Pebbles
--::--	Clayey SILT	**::*	=	Clayey SAND
::::*	Silty Sandy CLAY	--*--*	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS		AREA: Blantyre Rural	
LOCATION :		Nankumba Lot 3		GWL:	
GROUND ELEV :				RECORDED BY P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		1		DATE: 27/11/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	~o~o~o~o~		D					Loose dark brown	
	~o~o~o~o~	0.40						silty clayey GRAVEL	
1.00	~o~o~o~o~								
	~o~o~o~o~								
2.00	~o~o~o~o~								
	~o~o~o~o~	1.95	SPT	9	7	11	18		
3.00	~o~o~o~o~								
	~o~o~o~o~								
4.00	~o~o~o~o~								
	~o~o~o~o~	3.45	SPT	7	8	10	18	Medium to dense reddish brown sandy silty CLAY	
5.00	~o~o~o~o~								END OF B.H.
	~o~o~o~o~	5.05	D SPT	5	6	9	15		
6.00									

UD	=	Undisturbed Sample	*~*~*	=	Silty Fine SAND
N	=	SPT N-Value	~:~:~:~:~	=	Fill Material
D	=	Disturbed Sample	~o~o~o~	=	Sand with Pebbles
~:~:~:~:~	=	Clayey SILT	~*~*~*	=	Clayey SAND
~*~*~*~*	=	Silty Sandy CLAY	~*~*~*~*	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS		AREA: Blantyre Rural	
LOCATION :		Nankumba Lot 3		GWL:	
GROUND ELEV :				RECORDED BY: P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		2		DATE: 28/11/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS	
				IN 150mm	IN 150mm	IN 150mm				
0.00		0.49	D					Loose greyish brown sandy silty CLAY		
1.00		1.95	UD					Medium to dense reddish brown sandy silty CLAY		
2.00		2.40	SPT	5	5	6	11			
3.00		3.45	SPT	5	9	12	21			
4.00		4.95	SPT	7	16	14	30			
5.00		5.05	D							
6.00										

UD	Undisturbed Sample	*..**	=	Silty Fine SAND
N	= SPT N-Value	.....	=	Fill Material
D	= Disturbed Sample	*o*o*	=	Sand with Pebbles
..:-:-	= Clayey SILT	**..**	=	Clayey SAND
....*	= Silty Sandy CLAY	--*--*	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS		AREA: Blantyre Rural	
LOCATION :		Nankumba Lot 3		GWL:	
GROUND ELEV :				RECORDED BY: P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		3		DATE: 29/11/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00		0.65	D					Loose dark brown silty sandy CLAY	
1.00		1.95	UD						
2.00		2.40	SPT	3	5	6	11		
3.00		3.45	SPT	5	6	8	14		
4.00		5.15	D					Medium to dense reddish brown sandy silty CLAY	
5.00		5.15	SPT	6	8	9	17		
6.00									

UD	=	Undisturbed Sample	*..**	=	Silty Fine SAND
N	=	SPT N-Value	.....	=	Fill Material
D	=	Disturbed Sample	*o*o*	=	Sand with Pebbles
..--:-	=	Clayey SILT	**..**	=	Clayey SAND
....*	=	Silty Sandy CLAY	--*--*	=	Decomposed ROCK/Weathered ROCK

MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG

PROJECT : Selected CDSS							AREA: Lilongwe Rural			
LOCATION : Mseche Lot 4							GWL:			
GROUND ELEV :							RECORDED BY P.G. Goba			
COORDINATES :							LOGGED BY: E.G.S. Machila			
BORE HOLE NO. : 1							DATE: 9/12/2009			
DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS	
				IN 150mm	IN 150mm	IN 150mm				
0.00								Medium to dense reddish brown clayey silty SAND	END OF B.H.	
1.00		D								
		1.70								
2.00		1.95	SPT	4	6	11	17	Medium to dense reddish brown quartz GRAVEL		
3.00			D							
		3.30								
		3.45	SPT	6	8	9	17			
4.00								Medium to dense greyish brown sandy clayey SILT		
		4.90	SPT	7	11	7	18			
5.00		5.00	D							
6.00										
UD = Undisturbed Sample				*_**_ =		Silty Fine SAND				
N = SPT N-Value				: : : : : =		Fill Material				
D = Disturbed Sample				-*o*- =		Sand with Pebbles				
--::-- = Clayey SILT				**.*.* =		Clayey SAND				
:~::~ = Silty Sandy CLAY				..*..* =		Decomposed ROCK/Weathered ROCK				

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS		AREA: Lilongwe Rural	
LOCATION :		Mseche Lot 4		GWL:	
GROUND ELEV :				RECORDED BY: P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		2		DATE: 10/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	***							Loose greyish brown clayey SAND	
	***	0.40	D						
1.00	***							Medium to dense reddish brown sandy silty CLAY	
	***	1.60	D						
2.00	***							Very hard yellowish brown completely weathered micaceous ROCK	
	***	1.95	UD						
















	***	2.40	SPT	10	7	6	13		
3.00	***							Very hard yellowish brown completely weathered micaceous ROCK	

	***	3.45	SPT	13	14	16	30		

4.00	***								
	***	4.95	SPT	17	26	41	67		
5.00	***	5.00	D						END OF B.H.
6.00									

UD	=	Undisturbed Sample	*..*	=	Silty Fine SAND
N	=	SPT N-Value	.....	=	Fill Material
D	=	Disturbed Sample	*o*o*	=	Sand with Pebbles
---:-	=	Clayey SILT	**..*	=	Clayey SAND
....*	=	Silty Sandy CLAY	---*--	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT		:	Selected CDSS				AREA: Lilongwe Rural		
LOCATION		:	Mseche Lot 4				GWL:		
GROUND ELEV		:					RECORDED BY P.G. Goba		
COORDINATES		:					LOGGED BY: E.G.S. Machila		
BORE HOLE NO.		:	3				DATE: 11/12/2009		
DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00		0.50	D					Loose greyish brown sandy silty CLAY	
1.00									
			1.80	D					
									
2.00		1.95	SPT	11	6	3	9	Medium to dense reddish brown clayey quartz GRAVEL	
									
									
									
3.00		3.00	D						
4.00		3.55	SPT	6	7	8	15	Medium to dense greyish brown completely weathered ROCK	
		4.95	UD						
									
									
5.00				5.40	D				
		SPT	6			9	12		21
6.00									
UD = Undisturbed Sample				*.*.* =			Silty Fine SAND		
N = SPT N-Value				: : : : : =			Fill Material		
D = Disturbed Sample				-*o*o* =			Sand with Pebbles		
--:--: = Clayey SILT				**.*.* =			Clayey SAND		
..* = Silty Sandy CLAY				--*--* =			Decomposed ROCK/Weathered ROCK		

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT : Selected CDSS				AREA: Balaka					
LOCATION : Namalomba Lot 5				GWL:					
GROUND ELEV :				RECORDED BY P.G. Goba					
COORDINATES :				LOGGED BY: E.G.S. Machila					
BORE HOLE NO. : 1				DATE: 7/12/2009					
DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00								Very loose yellowish brown clayey SILT	
		0.64	D						
1.00									
		1.95	UD						
2.00								Medium to dense dark grey silty sandy CLAY	
		2.40	SPT	5	6	6	12		
3.00									
		3.10	D						
		3.45	UD						
		3.90	SPT	6	9	12	21		
4.00									
		4.95	UD					Medium to dense greyish brown sandy silty CLAY	
5.00									
			D						
		5.40	SPT	6	10	14	24		END OF B.H.
6.00									
UD = Undisturbed Sample				*..** =		Silty Fine SAND			
N = SPT N-Value				:..... =		Fill Material			
D = Disturbed Sample				-°o°o°- =		Sand with Pebbles			
--[]-- = Clayey SILT				**..** =		Clayey SAND			
....* = Silty Sandy CLAY				--*--* =		Decomposed ROCK/Weathered ROCK			

DRILLING HOLE LOG

END OF B.H.

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS		AREA: Balaka	
LOCATION :		Namalomba Lot 5		GWL:	
GROUND ELEV :				RECORDED BY: P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		3		DATE: 7/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00		0.40	D					Loose yellowish brown sandy silty CLAY	
1.00		1.95	SPT	6	6	7	13	Medium to dense greyish brown silty sandy CLAY	
2.00		2.70	D						
3.00		3.45	SPT	5	8	9	17	Medium to dense dark brown sandy silty CLAY	
4.00		4.95	SPT	4	7	10	17		
5.00		5.00	D						
6.00									
<div style="display: flex; justify-content: space-between;"> <div> UD = Undisturbed Sample N = SPT N-Value D = Disturbed Sample --::-- = Clayey SILT *:::* = Silty Sandy CLAY </div> <div> *::** = Silty Fine SAND ::: = Fill Material -*o*- = Sand with Pebbles **::* = Clayey SAND --*-- = Decomposed ROCK/Weathered ROCK </div> </div>									

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS				AREA: Blantyre Urban	
LOCATION :		Nanjiriri Lot 6				GWL:	
GROUND ELEV :						RECORDED BY: P.G. Goba	
COORDINATES :						LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		1				DATE: 1/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	*:~::~~::~~		D					Loose yellowish	
	*:~::~~::~~	0.45	D					brown sandy silty CLAY	
	--*~::~~::~~	0.90	D					Medium dense yellowish brown weathered ROCK	
1.00	--*~::~~::~~							Medium dense greyish brown weathered ROCK	
	--*~::~~::~~	1.60	D						
	--*~::~~::~~	1.95	SPT	8	12	16	28		
2.00	--*~::~~::~~								
	--*~::~~::~~								
3.00	--*~::~~::~~								
	--*~::~~::~~	3.45	SPT	8	11	14	25	Dense to very dense yellowish brown completely weathered ROCK	
4.00	--*~::~~::~~								
	--*~::~~::~~	4.95	SPT	20	21	39	60		
5.00	--*~::~~::~~	5.00	D						END OF B.H.
6.00									

UD	=	Undisturbed Sample	*~::~~	=	Silty Fine SAND
N	=	SPT N-Value	:::~::~~	=	Fill Material
D	=	Disturbed Sample	-*~::~~	=	Sand with Pebbles
--:~::~~	=	Clayey SILT	**~::~~	=	Clayey SAND
:~::~~	=	Silty Sandy CLAY	--~::~~	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS				AREA: Blantyre Urban	
LOCATION :		Nanjiriri Lot 6				GWL:	
GROUND ELEV :						RECORDED BY: P.G. Goba	
COORDINATES :						LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		2				DATE: 2/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	*:~::~~*~*~*							Very loose yellowish brown sandy silty CLAY	
1.00	*:~::~~*~*~*	0.50	D						
	~~*~*~*~*							Loose greyish brown completely weathered ROCK	
	~~*~*~*~*	1.50	D						
2.00	*~*~*~*~*~*	1.95	UD					Dense greyish brown completely weathered ROCK	
	~~*~*~*~*	2.15	D						
3.00	*~*~*~*~*~*	2.40	SPT	9	15	17	32	Very hard weathered ROCK	
	~~*~*~*~*								
	~~*~*~*~*	3.23	SPT	18	41	55	96		
	~~*~*~*~*	3.50	SPT	55++					
4.00									
5.00									
6.00									

UD	=	Undisturbed Sample	*~*~*~*~*~*	=	Silty Fine SAND
N	=	SPT N-Value	:~::~~*~*~*	=	Fill Material
D	=	Disturbed Sample	*~*~*~*~*~*	=	Sand with Pebbles
--::~~*~*~*	=	Clayey SILT	**~*~*~*~*	=	Clayey SAND
~~*~*~*~*	=	Silty Sandy CLAY	--*~*~*~*	=	Decomposed ROCK/Weathered ROCK

**MINISTRY OF TRANSPORT AND PUBLIC INFRASTRUCTURE
MATERIALS LABORATORY
DRILLING HOLE LOG**

PROJECT :		Selected CDSS		AREA: Blantyre Urban	
LOCATION :		Nanjiriri Lot 6		GWL:	
GROUND ELEV :				RECORDED BY P.G. Goba	
COORDINATES :				LOGGED BY: E.G.S. Machila	
BORE HOLE NO. :		3		DATE: 3/12/2009	

DEPTH (m)	GRAPHIC	DEPTH (m)	SAMPLE TYPE	NUMBER OF BLOWS			SPT N IN 300mm	DESCRIPTION OF MATERIAL	REMARKS
				IN 150mm	IN 150mm	IN 150mm			
0.00	***.***							Greyish brown silty clayey SAND	
	.	0.22	D					Yellowish brown sandy silty CLAY	
	.	0.70	D					Very dense greyish brown weathered ROCK	
1.00	***.***		D						
	.	1.32	SPT	55++					END OF B.H.
2.00									
3.00									
4.00									
5.00									
6.00									

UD	Undisturbed Sample	*.**.*	=	Silty Fine SAND
N	= SPT N-Value	*****	=	Fill Material
D	= Disturbed Sample	.*o*o*	=	Sand with Pebbles
---:-	= Clayey SILT	***.***	=	Clayey SAND
:~::~	= Silty Sandy CLAY	---**	=	Decomposed ROCK/Weathered ROCK