REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

DETAILED DESIGN OF BISRI DAM PROJECT

CONTRACT NO.17909

ROCK MATERIAL SOURCES

GEOTECHNICAL INVESTIGATION REPORT IX

FACTUAL

November 2014

Founded 1956

DAR AL HANDASAH NAZIH TALEB & PARTNERS

دار الهندسة نزيه طالب وشركاه

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	Signature:	

1. Introduction

8 boreholes were located (Appendix 1) and drilled within the areas (right abutment, RQ-1a/1b and RQ-2a/2b) proposed as potential rock material sources, to determine subsurface conditions and to obtain samples for laboratory testing and to estimate the quantity of material that is available in the potential rock material sources (surface plane area of the usable material).

RQ-1b

BHRQ1: 60m

BHRQ2: 45m

BHRQ3: 45m

RQ-2a

BHRQ4: 45m

BHRQ5: 42.5m

RQ-2b

BHRQ6: 45m

BHRQ7: 15m (field activity was physically blocked by the landowner)

BHRQ8: 45m

RQ-3a/3b

Old boreholes BHLA3, BHLA4 and EV10 (please refer to Report Volume I and VI) were used to evaluate the subsurface conditions and for laboratory testing.

2. Potential Rock Material Sources

The proposed rock material sources (RQ-1a/1b, RQ-2a/2b and RQ-3a/3b) are situated along with the right (RQ-1a/1b, at elevation above 550) and left (RQ-3a/3b, at elevation above 450) downstream abutments and at the top of the right abutment (RQ-2a/2b, at elevation above 725), as shown on related drawing (Appendix 1).

Figure 1: RQ-1a/1b

Figure 2: RQ-2a/2b

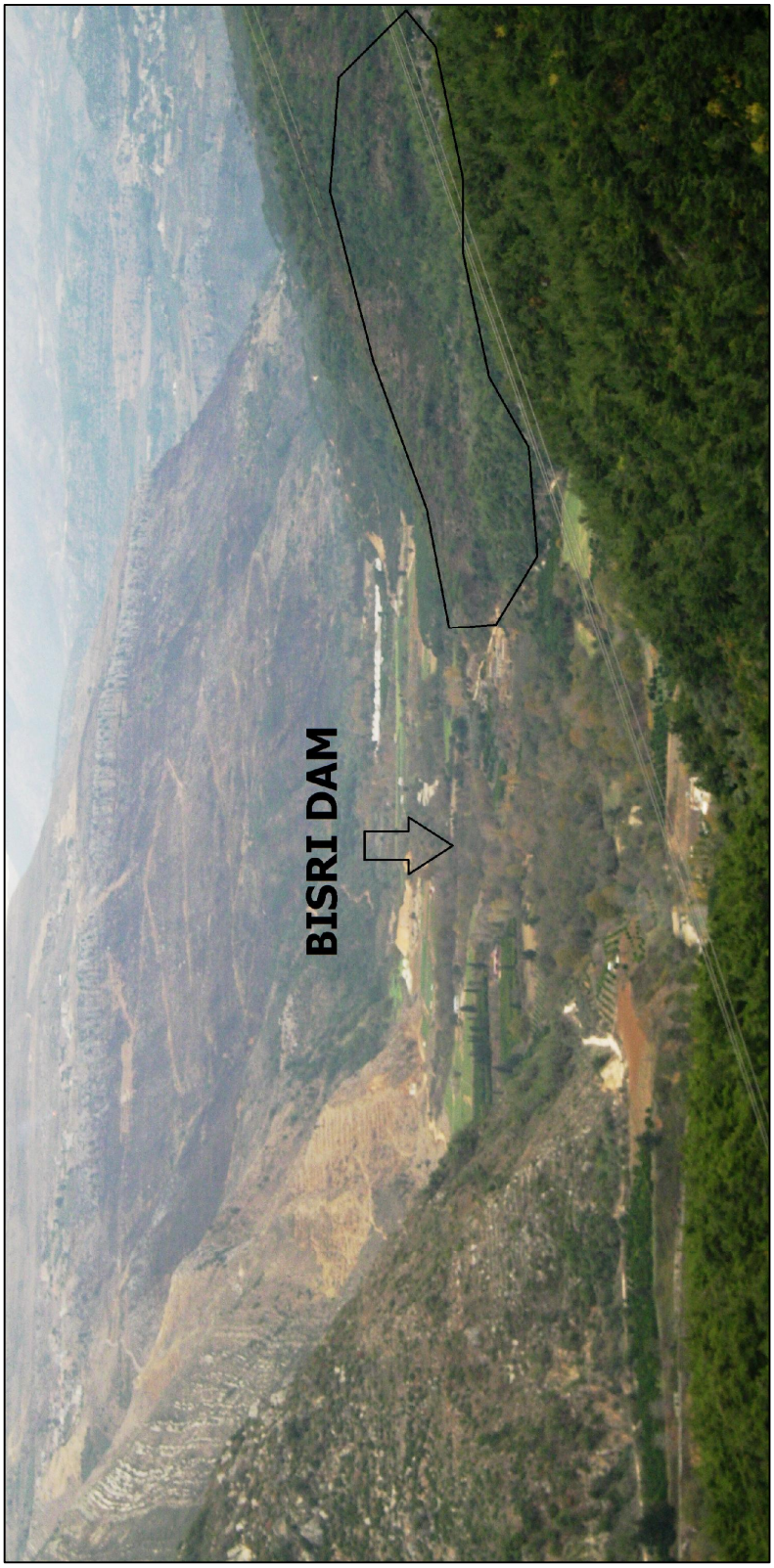

Figure 3: RQ-3a/3b

3. Field Investigation

The field investigation was performed between August 11 and September 25, 2014. Eight boreholes to a maximum depth of 60m were drilled at locations shown on Figure 4. Truck and crawler mounted rotary drill rigs (see Figure 5 & 6) were used in field investigation.

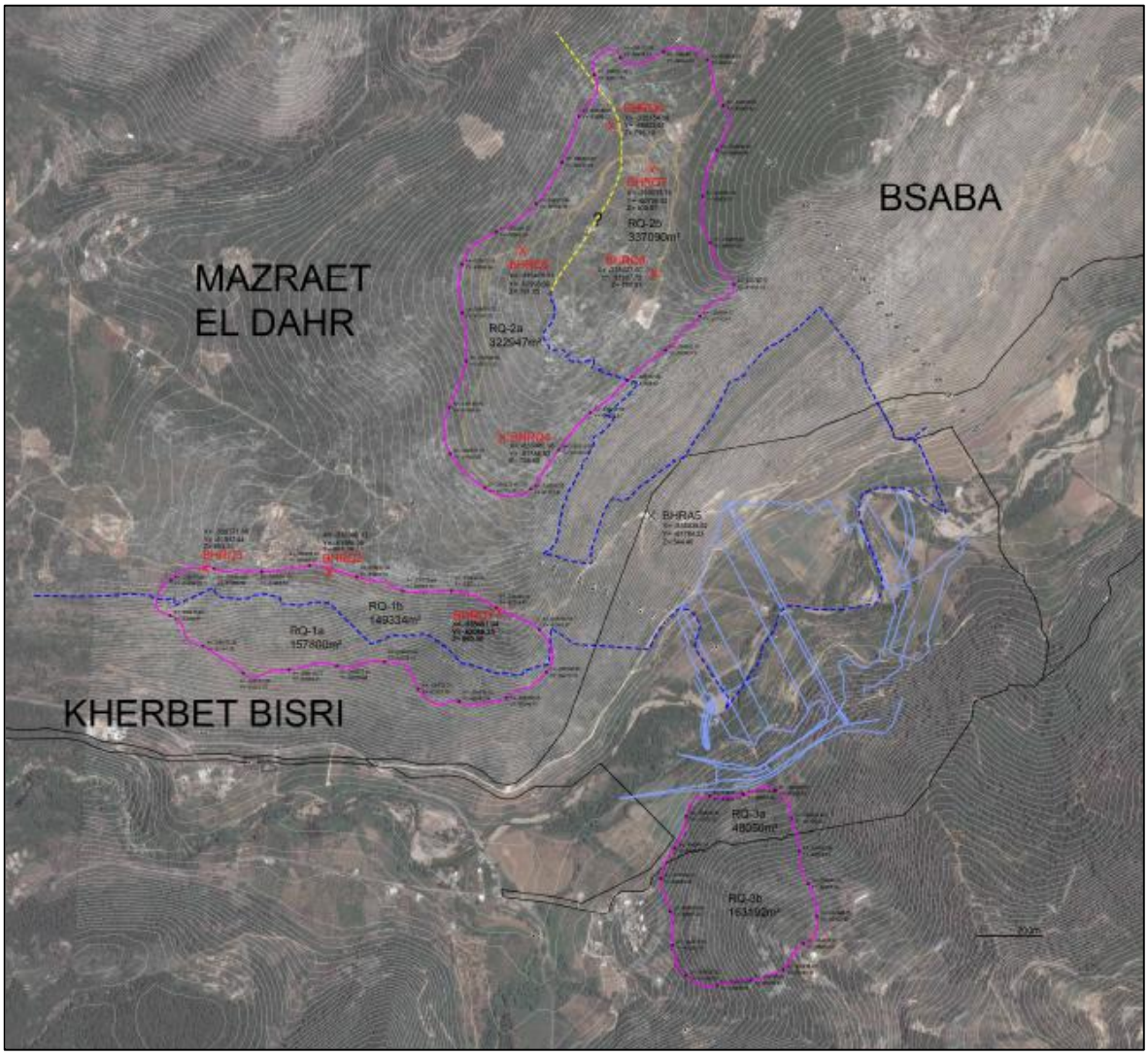

Figure 4: Locations of the boreholes drilled within the potential rock material sources

RQ-1b:

BHRQ1 / Piezometer: 60 meters deep.

0-3m: Transition zone from lower saprolite to the parent rock.

3-60m: Cenomanian dolomitic LIMESTONE (C4).

BHRQ2 / Piezometer: 45 meters deep.

0-5m: Transition zone from lower saprolite to the parent rock.

5-45m: Cenomanian dolomitic LIMESTONE (C4).

BHRQ3 / Piezometer: 45 meters deep.

0-1.5m: Transition zone from lower saprolite to the parent rock.

1.5-45m: Cenomanian dolomitic LIMESTONE (C4).

RQ-2a:

BHRQ4 / Piezometer: 45 meters deep.

0-1.5m: Transition zone from lower saprolite to the parent rock.

1.5-45m: Cenomanian dolomitic LIMESTONE (C4).

BHRQ5 / Piezometer: 42.5 meters deep.

0-0.5m: Transition zone from lower saprolite to the parent rock.

0.5-36.5m: Cenomanian dolomitic LIMESTONE (C4).

36.5-42.5m: *Cavity*

RQ-2b:

BHRQ6 / Piezometer: 45 meters deep.

0-45m: Cenomanian dolomitic LIMESTONE (C4).

BHRQ7: 15 meters deep, field activity was physically blocked by the landowner.

0-3.5m: Transition zone from lower saprolite to the parent rock.

3.5-15m: Cenomanian dolomitic LIMESTONE (C4).

BHRQ8 / Piezometer: 45 meters deep.

0-3m: Transition zone from lower saprolite to the parent rock.

3-45m: Cenomanian dolomitic LIMESTONE (C4).

Figure 5: BHRQ3 (RQ-1b)

Figure 6: BHRQ5 (RQ-2a)

4. Scope of Works

The scope of works of this field investigation consisted of the followings:

- Continuous core drilling in soil (Saprolite) and rock.
- Installing standpipe open piezometers into the borehole and measuring the depth and fluctuations of the groundwater table.

86mm diameter (OD) double tube core barrel (T2) equipped with tungsten carbide core bit was used in continuous core drilling with NW drill rods and HW casings (see Figure 7)

Core drilling was performed by using as minimum as possible amount of circulation water, only clean water was used during the drilling, water losses were recorded on site and indicated in logs of borings.

Cores taken from the boreholes were stored in standard wooden core boxes. All the necessary information related to the runs of coring and boreholes were clearly indicated on the boxes. Photos of core boxes are presented in Appendix 3 of this factual report.

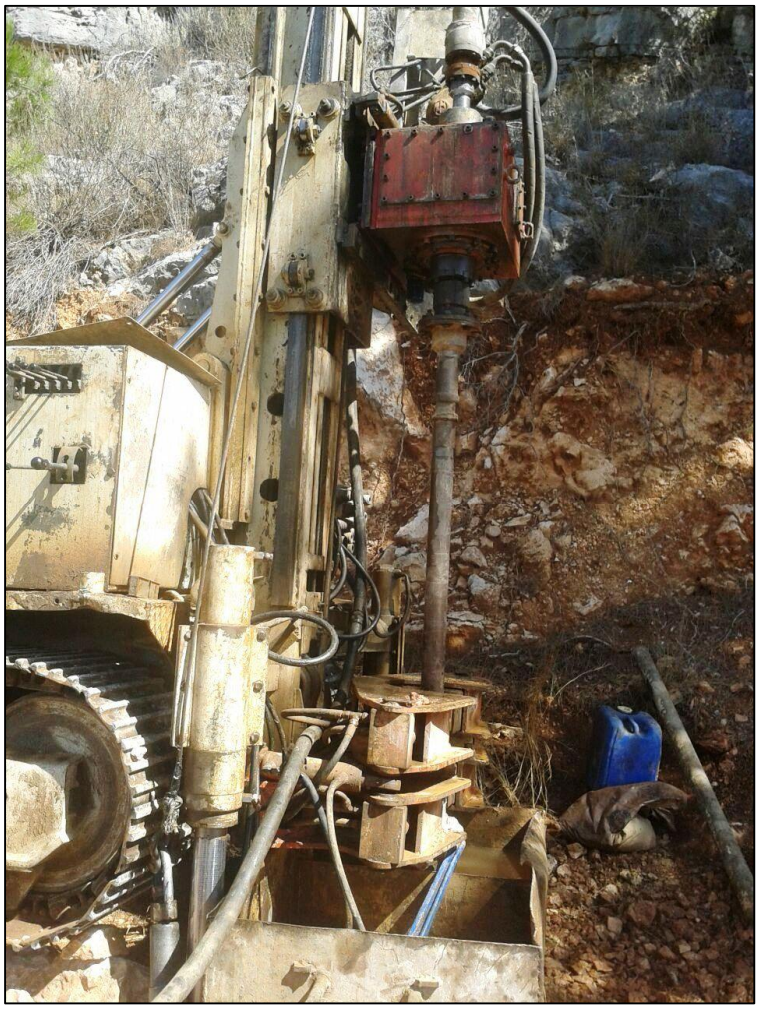

Figure7: Double tube core barrel (BHRQ2, RQ-1b)

Perforated (one third of the standpipe) UPVC pipes, 50mm diameter (OD) and 3.7mm thick, wrapped with geotextile (PP, 150 gr/m^2) were installed into the boreholes as open standpipe piezometers with concrete heading and steel pipe protection (see Figure 7), in a manner to measure the depth and fluctuations of the groundwater table.

Figure 8: BHRQ3 (RQ-1b)

All the field works were performed according to ASTM standards (ASTM D6640: Core drilling in soil and rock and ASTM D4750: Determining Subsurface Liquid Level in a borehole) and were supervised by an engineering geologist.

5. Subsurface Strata

According to the cores taken from the boreholes, the following subsurface soil (Saprolite) and rock stratums were encountered within the drilled boreholes. The logs of borings are presented in Appendix 2 of this factual report.

BHRQ1 (RQ-1b) / Piezometer (NGL: +665.56): 60 meters deep, *dry (October 14, 2014)*

0-3m: Transition zone from lower saprolite to the parent rock, (*loss of water circulation, 100%, at 3m*)

3-60m: C4 (Cenomanian)

3-31.5m: Light olive brown to cream slightly weathered mainly blocky and seamy occasionally massive and fractured/crushed strong rarely/slightly karstified and porous dolomitic LIMESTONE.

31.5-45m: Light olive brown to cream slightly and slightly - moderately weathered blocky/seamy and fractured occasionally crushed moderately strong to strong rarely karstified and porous slightly dolomitic LIMESTONE.

45-60m: Light olive brown to cream and white slightly - moderately and moderately to completely weathered mainly fractured and crushed sometimes block/seamy to fractured moderately strong occasionally karstified and slightly porous dolomitic LIMESTONE.

BHRQ2 (RQ-1b) / Piezometer (NGL: +665.29): 45 meters deep, *groundwater table (GWT) at a depth of 23.1m (GWT: +642.19, October 14, 2014).*

0-5m: Transition zone from lower saprolite to the parent rock, (*loss of water circulation, 100%, at 5m*)

5-45m: C4 (Cenomanian)

5-18m: Light olive brown to cream slightly and slightly - moderately sometimes highly weathered fractured and crushed weak to moderately strong and strong rarely/slightly karstified dolomitic LIMESTONE.

18-27m: Light olive brown to cream and white slightly - moderately and moderately sometimes highly weathered blocky/seamy to fractured and crushed weak and weak to moderately strong karstified and porous dolomitic LIMESTONE.

27-32m: Light olive brown to cream slightly and slightly - moderately weathered mainly blocky and seamy sometimes fractured and crushed moderately strong to strong rarely/slightly karstified and porous dolomitic LIMESTONE.

32-36m: Light olive brown to cream slightly - moderately weathered blocky/seamy to fractured and crushed moderately strong to strong rarely/slightly karstified and porous dolomitic LIMESTONE.

36-40m: Light olive brown to cream and white slightly - moderately and moderately weathered fractured and crushed weak to moderately strong karstified and porous dolomitic LIMESTONE.

40-45m: Light olive brown to cream slightly - moderately weathered blocky/seamy to fractured moderately strong to strong slightly dolomitic LIMESTONE.

BHRQ3 (RQ-1b) / Piezometer (NGL: +652.94): 45 meters deep, *dry (October 14, 2014)*

0-1.5m: Transition zone from lower saprolite to the parent rock, (*loss of water circulation, 100%, at 0.5m*)

1.5-45m: C4 (Cenomanian)

1.5-26m: Light olive brown to cream and white slightly weathered mainly massive to blocky/seamy sometimes fractured and crushed moderately strong to strong occasionally/slightly karstified and porous dolomitic LIMESTONE.

26-29m: Light olive brown to cream slightly - moderately weathered fractured moderately strong slightly porous dolomitic LIMESTONE.

29-35m: Light olive brown to cream slightly - moderately weathered massive to blocky and seamy weak to moderately strong and strong rarely porous dolomitic LIMESTONE.

35-39m: Light olive brown to cream slightly weathered blocky and seamy strong dolomitic LIMESTONE.

39-45m: Light olive brown to cream and white mainly slightly sometimes moderately weathered blocky/seamy to fractured and crushed moderately strong to strong sometimes weak to moderately strong occasionally karstified and slightly porous dolomitic LIMESTONE.

BHRQ4 (RQ-2a) / Piezometer (NGL: +759.08): 45 meters deep, *groundwater table (GWT) at a depth of 43.55m (GWT: +715.53).*

0-1.5m: Transition zone from lower saprolite to the parent rock.

1.5-45m: C4 (Cenomanian)

1.5-6m: Light olive brown to cream slightly weathered blocky/seamy to fracture strong occasionally/slightly karstified dolomitic LIMESTONE (*cavity between 4 and 4.3m*).

6-9.5m: Light olive brown to cream and white slightly - moderately weathered fractured and crushed weak to moderately strong occasionally karstified and porous dolomitic LIMESTONE.

9.5-18m: Light olive brown to cream and white slightly and slightly to moderately weathered blocky/seamy to fractured and crushed moderately strong rarely/slightly marly dolomitic LIMESTONE (*loss of water circulation, 100%, at 10.3m*)

18-32.5m: Light olive brown to cream faintly weathered mainly blocky/seamy occasionally fractured and crushed moderately strong to strong rarely/slightly karstified dolomitic LIMESTONE (*cavity between 25.5 and 26.5m*).

32.5-39.5m: Light olive brown to cream and white slightly and slightly - moderately sometimes highly weathered mainly fractured occasionally crushed weak and weak to moderately strong karstified and porous slightly dolomitic LIMESTONE.

39.5-45m: Light olive brown to cream slightly - moderately weathered blocky/seamy to fractured occasionally crushed weak to moderately strong LIMESTONE.

BHRQ5 (RQ-2a) / Piezometer (NGL: +790.86): 42.5 meters deep, *dry (October 14, 2014)*

0-0.5m: Transition zone from lower saprolite to the parent rock.

0.5-36.5m: C4 (Cenomanian)

0.5-9.5m: Light olive brown to cream slightly sometimes moderately weathered blocky/seamy to fractured moderately strong to strong occasionally karstified (karst voids are filled with clay) dolomitic LIMESTONE.

9.5-25.5m: Light olive brown to cream slightly to moderately and moderately weathered fractured and crushed weak and weak to moderately strong karstified (karst voids are filled with clay) dolomitic LIMESTONE (*loss of water circulation, 100%, at 10.5m*).

25.5-36.5m: Light olive brown to cream slightly weathered blocky/seamy to fractured sometimes crushed moderately strong to strong occasionally karstified (karst voids are filled with clay) slightly dolomitic LIMESTONE.

36.5-42.5m: *Cavity*

BHRQ6 (RQ-2b) / Piezometer (NGL: +799.10): 45 meters deep, *dry (October 14, 2014)*

0-1.5m: Mylonitized LIMESTONE

1.5-45m: C4 (Cenomanian)

1.5-6.5m: Light olive brown to cream slightly weathered blocky/seamy to fracture moderately strong to strong slightly dolomitic LIMESTONE.

6.5-12m: Light olive brown to cream and white faintly weathered massive to blocky/seamy moderately strong to strong slightly dolomitic LIMESTONE.

12-16.5m: Light olive brown to cream and white faintly weathered blocky/seamy to fracture moderately strong to strong slightly dolomitic LIMESTONE.

16.5-45m: Light olive brown to cream and white faintly weathered mainly massive to blocky/seamy rarely fractured moderately strong to strong occasionally/slightly karstified dolomitic LIMESTONE.

BHRQ7 (RQ-2b, NGL: +808.67): 15 meters deep, *field activity was physically blocked by the landowner.*

0-3.5m: Transition zone from lower saprolite to the parent rock (*loss of water circulation, 100%, at 1.5m*)

3.5-15m: C4 (Cenomanian)

3.5-15m: Light olive brown to cream and white slightly weathered mainly fractured sometimes crushed moderately strong to strong occasionally/slightly karstified (karst voids are filled with clay) dolomitic LIMESTONE.

BHRQ8 (RQ-2b) / Piezometer (NGL: +787.97): 45 meters deep, *groundwater table (GWT) at a depth of 41.7m (GWT: +746.27).*

0-3m: Transition zone from lower saprolite to the parent rock, (*loss of water circulation, 100%, at 3m*)

3-45m: C4 (Cenomanian)

3-6.5m: Light olive brown to cream slightly and moderately weathered mainly fractured sometimes crushed weak to moderately strong and strong rarely/slightly karstified dolomitic LIMESTONE.

6.5-16.5m: Light olive brown to cream slightly weathered blocky and seamy moderately strong to strong occasionally/slightly karstified (karst voids are filled with clay) dolomitic LIMESTONE.

16.5-45m: Light olive brown to cream and white slightly to moderately weathered blocky/seamy to fractured and crushed weak to moderately strong rarely/slightly karstified (karst voids are filled with clay) occasionally porous dolomitic LIMESTONE.

6. Sampling & Laboratory Testing

Representative rock/core samples from the boreholes (BHRQ1, BHRQ3, BHRQ4, BHRQ5, BHRQ6, BHRQ8 and EV10) at different depths were selected (see Figure 9 - 15) for laboratory testing in Lebanon and Turkey (*Petrography & Hardness, see Figure 16 - 19*). List of sampling and laboratory testing program is presented in Appendix 4 of this factual report.

The following tests were adopted for laboratory testing:

- Water Absorption.
- Dry & Soaked Density.
- LA (500 revolution).
- Soundness (Sodium Sulphate).
- Wetting – Drying Loss (35 cycle)
- Dry & Soaked Uni-Axial Compressive Strength.
- AAR (Alkali Aggregate Reactions).
- Petrography & Hardness.

The following samples were selected for laboratory testing:

BHRQ1 (RQ-1b)

From 12 to 16m: Light olive brown to cream slightly weathered mainly blocky and seamy occasionally crushed moderately strong to strong rarely karstified dolomitic LIMESTONE (C4).

BHRQ3 (RQ-1b)

From 4.5 to 7.8m: Light olive brown to cream slightly weathered blocky/seamy to massive moderately strong to strong occasionally karstified and porous dolomitic LIMESTONE (C4).

BHRQ4 (RQ-2a)

From 10.5 to 14m: Light olive brown to cream and white slightly and slightly to moderately weathered blocky/seamy to fractured and crushed moderately strong slightly marly (rarely) dolomitic LIMESTONE (C4).

BHRQ5 (RQ-2a)

From 1.5 to 4.5m: Light olive brown to cream slightly sometimes moderately weathered blocky/seamy to fractured and crushed moderately strong to strong occasionally karstified (karst voids are filled with clay) dolomitic LIMESTONE (C4).

BHRQ6 (RQ-2b)

From 3 to 6m: Light olive brown to cream slightly weathered blocky/seamy to fracture moderately strong to strong slightly dolomitic LIMESTONE (C4).

From 13.5 to 16.8m: Light olive brown to cream and white faintly weathered blocky/seamy to fracture moderately strong to strong slightly dolomitic LIMESTONE (C4).

BHRQ8 (RQ-2b)

From 6 to 9.3m: Light olive brown to cream slightly weathered blocky/seamy to fracture moderately strong to strong occasionally/slightly karstified dolomitic LIMESTONE (C4).

EV10 (RQ-3a)

From 22.5 to 30m: Beige slightly weathered fractured and crushed moderately strong to strong occasionally karstified slightly sandy and dolomitic LIMESTONE (J7-J6)

Figure 9: Sampling Box No.:1

Figure 10: Sampling Box No.:2

Figure 11: Sampling Box No.:3

Figure 12: Sampling Box No.: 4

Figure 13: Sampling Box No.: 5

Figure 14: Sampling Box No.: 6

Figure 15: Sampling Boxes (No. 1 to 6)

The following samples were selected for petrographic analysis (including Hardness):

BHRQ1 (RQ-1b)

Core sample at 13m

BHRQ3 (RQ-1b)

Core sample at 5m

Figure 16: BHRQ1 & BHRQ3 (RQ-1b)

BHRQ4 (RQ-2a)

Core sample at 12m

BHRQ5 (RQ-2a)

Core sample at 2.5m

BHRQ6 (RQ-2b)

Core sample at 15.5m

BHRQ8 (RQ-2b)

Core sample at 9m

Figure 17: BHRQ4, BHRQ5, BHRQ6 & BHRQ8 (RQ-2a/2b)

EV10 (RQ-3a)

Core sample at 24m

Figure 18: EV10 (RQ-3a)

Figure 19: RQ-1b, RQ-2a/2b & RQ-3a

7. Alternative Rock Material Sources (Existing Quarries)

There are three active rock quarries (*Mazraat Ez Zaarouriye, Douaouir El Bitar and Mrah El Habas*) officially running at locations shown on Figure 20. These quarries *to be investigated* are far from BISRI DAM site around *25* kilometres.

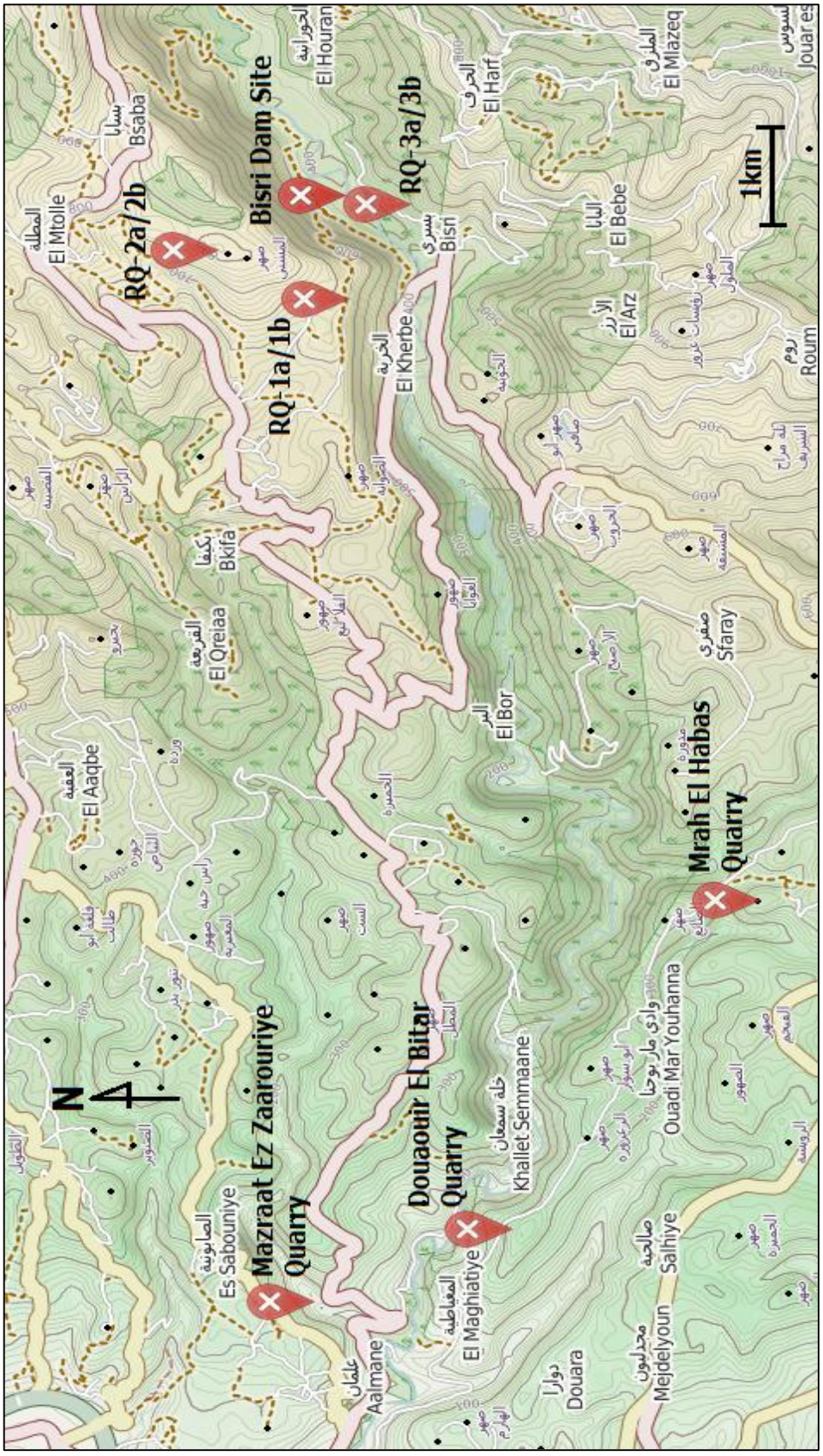

Figure 20

8. Assessment of Rock Material Sources

Please refer to Table 1 below.

Table 1: Assessment of Rock Material Sources

Rock Material Sources	Topography	Landforming	Geology	Intact rock strength (Marinos & Hoek, 2001)	Surface Area (Hectares)	Rock cut height (meters, multi-bench system)	Estimated quantity of rock can be quarried (Cubic meters, millions)	Accessibility	Environmental Impact	Nearby and/or existing Structures	Legal Situation	Additional cost of transportation (USD per cubic meters, estimated)
RQ-1a (***Kherbet Bisri***)	Downhill steep slope.	Difficult	***Cenomanian/Albian limestone, marly limestone and marlstone (C4-C3)***	***Highly variable***	15.8	28	> 1.5	Inaccessible	Bush type ***sparse*** vegetation / Reptiles.	No	To be expropriated (***Kherbet Bisri***).	
RQ-1b (***Mazraet El Dahr***)	Downhill steep slope.	Difficult	Cenomanian limestone (C4)	Strong (R4)	14.9	28	> 2	Accessible	Bush type ***sparse*** vegetation / Reptiles.	A small quarry (blocks of rock) and a villa (nearby).	To be expropriated (***objection from Mazraet El Dahr Municipality***).	
RQ-2a (***Mazraet El Dahr***)	Downhill moderately inclined slope.	Easy	Cenomanian limestone (C4)	Strong (R4)	32.3	30	> 4.5	Accessible	Bush type ***sparse*** vegetation / Reptiles.	No	To be expropriated (***it may be subject to objection of Mazraet El Dahr Municipality***).	
RQ-2b (***Bsaba***)	Hilly terrain with slightly to moderately inclined downhill and uphill slopes.	Easy	Cenomanian limestone (C4)	Strong to very strong (R4-R5)	33.7	24	> 4	Accessible	Bush type ***sparse*** vegetation / Reptiles.	A small house and a chicken farm (exsist).	To be expropriated (***Bsaba***).	
RQ-3a (***Bisri, under expropriation***)	Downhill steep slope.	Difficult	Jurassic limestone (J7-J6)	Strong to very strong (R4-R5)	4.8	34	> 0.5	Inaccessible	Bush type ***dense*** vegetation / Reptiles, ***Avifauna and Mammals.***	No	Under expropriation (***Bisri***)	
RQ-3b (***Bisri / Taaid / Bteddine El Liqch***)	Downhill steep slope.	Difficult	Jurassic limestone (J7-J6)	Strong to very strong (R4-R5)	16.3	36	> 2	Accessible	Bush type ***dense*** vegetation / Reptiles, ***Avifauna and Mammals.***	Bisri village (nearby)	To be expropriated (***Bisri / Taaid / Bteddine El Liqch***).	
Mazraat Ez Zaarouriye (***active quarry***)	Deep valley with rocky valley walls.	Difficult	***To be investigated.***				> 1	Accessible			Working under permission (***private person***).	5
Douaouir El Bitar (***active quarry***)	Hilly terrain	Easy	***To be investigated.***				> 2					
Mrah El Habas (***active quarry***)	Hilly terrain	Easy	***To be investigated.***				> 2.5					

9. Closure

The findings presented in this factual report are based on the assumption that the subsurface soil (Saprolite) and rock stratums and their conditions do not deviate appreciably from those disclosed in boreholes. There may be conditions pertaining to the site which were not disclosed by this subsurface soil (Saprolite)/rock survey, and thus could not be taken into account. Therefore, the findings are valid under this assumption only.

APPENDICES

APPENDIX 1. POTENTIAL ROCK MATERIAL SOURCES & BOREHOLE LOCATIONS

MAZRAET
EL DAHR

BSABA

KHERBET BISRI

BHRQ6
X= -335154.16
Y= -60623.51
Z= 799.10

BHRQ7
X= -335033.74
Y= -60756.82
Z= 808.67

RQ-2b
337090m²

BHRQ5
X= -335420.31
Y= -60938.69
Z= 791.05

BHRQ8
X= -335027.60
Y= -61067.72
Z= 787.97

RQ-2a
322947m²

BHRQ4
X= -335480.98
Y= -61558.92
Z= 759.08

BHRA5
X= -335035.02
Y= -61794.23
Z= 544.40

BHRQ3
X= -336371.66
Y= -61957.44
Z= 653.33

BHRQ2
X= -335996.13
Y= -61988.09
Z= 665.29

RQ-1b
149334m²

BHRQ1
X= -335491.04
Y= -62088.33
Z= 865.56

RQ-1a
157800m²

RQ-3a
48050m²

RQ-3b
163192m²

200m

1:4,000@A(

APPENDIX 2. LOGS OF BORINGS

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ01**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.56	**SHEET:** 1	**OF:** 6
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	60m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/15/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/25/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					SAPROLITE: transition from residaual to parent soil (crushed and fractured limestone with pockets of clay and mar)		39	21	7.3		
2							37	13	0		Casing down to 1.5m
3											Flushing water loss at 3m
4					light grey moderately weathered fractured porous dolomitic LIMESTONE		57	57	37		
5					light to creamish grey and cream fresh to slightly weathered partially fractured mainly blocky seamy and blocky seamy to massive strong dolomitic LIMESTONE		85	85	83		
6											
7							92	92	92		
8											
9							100	100	100		
10							100	100	100		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ01**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.56	**SHEET:** 2	**OF:** 6
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	60m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/15/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/25/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					ditto		100	100	100		
12					cream moderately weathered fractured weak porous		95	95	65		
13					light to creamish grey and cream fresh to slightly weathered partially fractured mainly blocky seamy and blocky seamy to massive strong dolomitic LIMESTONE		100	100	80		
14							100	100	100		
15											
16							84	84	84		
17											
18					light olive greenish grey fresh to moderately weathered fractured and fractured to blocky seamy strong dolomitic LIMESTONE		100	100	100		
19							95	95	95		
20							91	91	91		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHR01**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.56	**SHEET:** 3	**OF:** 6
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	60m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/15/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/25/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
21					light olive greenish grey fresh to moderately weathered fractured and fractured to blocky seamy strong dolomitic LIMESTONE		91	91	91		
22							100	100	100		
23							100	100	100		
24											
25							100	100	100		
26											
27							97	93	47		
28							88	75	75		
29											
30							87	73	69		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	DAR-TALEB	**FILE NO.:**	14-015	**BOREHOLE NO.:**	BHR01
PROJECT:	BISRI DAM / THIRD PACKAGE (Rock Quarries)				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.56	**SHEET:** 4	**OF:** 6
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	60m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/15/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/25/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
31					light olive greenish grey fresh to moderately weathered fractured and fractured to blocky seamy strong dolomitic LIMESTONE		80	73	67		
32					greyish white fresh to moderately weathered partially crushed mainly fractured and fractured to blocky seamy medium strong to strong LIMESTONE some times dolomitic		88	88	75		
33											
34							101	101	73		
35											
36							93	93	59		
37							100	93	42		
38											
39							80	80	27		
40							93	85	17		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHR01**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.56	**SHEET:** 5	**OF:** 6
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	60m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/15/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/25/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
41					porous fractured		93	85	17		
42					greyish white fresh to moderately weathered partially crushed mainly fractured and fractured to blocky seamy medium strong to strong LIMESTONE some times dolomitic		100	100	87		
43							80	80	80		
44							100	100	100		
45											
46							65	58	7.3		
47					creamish white moderately to highly weathered partially crushed mainly fractured porous medium strong dolomitic LIMESTONE sometimes karistied		47	47	47		
48											
49							60	36	6.7		
50							65	37	0		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHR01**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.56	**SHEET:** 6	**OF:** 6
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	60m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**9/15/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**9/25/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
51					creamish white moderately to highly weathered partially crushed mainly fractured porous medium strong dolomitic LIMESTONE sometimes karistied		65	37	0		
52							71	47	25		
53					whitish cream moderately to highly weathered crushed medium strong porous and karstifed LIMESTONE with pockets of marl						
54							35	20	0		
55							50	13	0		
56					light to whitish grey slightly to moderately weathered partially crushed fractured to blocky seamy dolomitic LIMESTONE some times porous						
57							87	87	51		
58							94	94	57		
59											
60							100	100	93		
					End of borehole at 60m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ02**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.29	**SHEET:** 1	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/10/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/15/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					SAPROLITE: tranistion from the residual to parent soil (cream crushed and fractured limestone with pockets of clay		57	0	0		
2							77	4.7	0		
3											
4							41	13	0		
5							43	20	6.7		Casing down to 4.5m Flushing water loss at 5m
6					creamish grey moderately weathered crushed and fractured medium strong dolomitic LIMESTONE with pockets of marl						
7							55	38	33		
8											
9							36	36	0		
10							31	11	6.7		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ02**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.29	**SHEET:** 2	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/10/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/15/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					creamish grey moderately weathered crushed and fractured medium strong dolomitic LIMESTONE with pockets of marl		31	11	6.7		
12							42	10	0		
13							36	6.7	0		
14							42	10	0		
15											
16							34	27	6.7		
17											
18							40	21	17		
19					white moderately to highly weathered partially crushed mainly fractured weak to moderately strong porous and karstified dolomitic LIMESTONE		97	97	51		
20							100	100	58		

SPT Standard Penetration Test
UCS Unconfined Compressive Strength
LT Layer Thickness
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

TCR Total Core Recovery
RQD Rock Quality Designation
SCR Solid Core Recovery

ST Sample Type
SYM Symbol
WT Water Table

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ02**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.29	**SHEET:** 3	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/10/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/15/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
21					white moderately to highly weathered partially crushed mainly fractured weak to moderately strong porous and karstified dolomitic LIMESTONE		100	100	58		
22							80	70	27		
23							77	67	17		
24											
25							75	67	40		
26											
27							100	100	16		
28					light grey to greyish and brownish cream fresh to moderately weathered partially crushed mainly fractured medium strong to strong sometimes porous and dolomitic LIMESTONE		89	89	65		
29											
30							85	85	20		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ02**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.29	**SHEET:** 4	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/10/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/15/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
31					light grey to greyish and brownish cream fresh to moderately weathered partially crushed mainly fractured medium strong to strong sometimes porous and dolomitic LIMESTONE		89	89	61		
32											
33					white moderately to highly weathered crushed and fractured weak to medium strong porous dolomitic LIMESTONE		67	57	37		
34							49	33	93		
35											
36							73	73	41		
37							82	82	0		
38											
39							83	77	17		
40							85	79	35		

SPT Standard Penetration Test — TCR Total Core Recovery — ST Sample Type

UCS Unconfined Compressive Strength — RQD Rock Quality Designation — SYM Symbol

LT Layer Thickness — SCR Solid Core Recovery — WT Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ02**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	665.29	**SHEET:** 5	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/10/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/15/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
41					greyish cream moderately weathered fractured weak to medium strong LIMESTONE sometimes dolomitic		85	79	35		
42							93	93	93		
43							97	97	73		
44							100	100	64		
45											
46											
47											
48											
49											
50											
					End of borehole at 45m						

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ03**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	652.94	**SHEET:** 1	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/11/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**13/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1			50/0cm Refusal		SAPROLITE (transistion from residual to parent soil)		40	0	0		Flushing water loss at 0.5m Casing down to 1.5m
2					light cream to white and olive brown mainly blocky seamy sometimes fractured and crushed mainly strong sometimes weak to moderately strong fresh dolomitic sandy LIMESTONE (c5). Time to time porous. sometimes karstified		57	57	47		
3											
4							100	100	100		
5							100	100	100		
6											
7							100	100	100		
8							100	100	100		
9											
10							100	100	100		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ03**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	652.94	**SHEET:** 2	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/11/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**13/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					ditto		100	100	100		
12							100	100	99		
13							100	100	57		
14							100	100	80		
15											
16							100	100	100		
17							100	100	40		
18											
19							100	100	100		
20							100	100	93		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ03**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	652.94	**SHEET:** 3	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/11/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**13/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
21					ditto		100	100	93		
22							100	100	98		
23							100	100	100		
24											
25							100	100	97		
26											
27							100	100	27		
28							100	100	27		
29											
30							100	100	90		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ03**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	652.94	**SHEET:** 4	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/11/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**13/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
31					ditto		100	100	93		
32							100	100	93		
33							100	100	80		
34							100	100	87		
35					same as above in general weaker than above blocky seamy to fractured sometimes crushed with interbeds of calcareous MARLSTONE and marly LIMESTONE.		100	100	97		
36							100	100	93		
37							100	100	33		
38											
39											
40											

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ03**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-1b	**Elevation (m):**	652.94	**SHEET:** 5	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/11/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**13/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
41					ditto		100	100	33		
42							80	80	33		
43							100	100	59		
44							80	80	17		
45											
46											
47											
48											
49											
50											
					End of borehole at 45m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHR04**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	759.08	**SHEET:** 1	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**9/5/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**9/9/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					SAPROLITE (transition from the residual to the parent soil)		67	13	10		
2					light grey fresh to moderately weathered fractured to blocky seamy strong dolomitic LIMESTONE		91	91	88		
3											Casing down to 3m
4							57	50	10		
5					CAVITY						
6					light to whitish grey and white moderately weathered fractured weak to medium strong porous and karstified dolomitic LIMESTONE		90	90	40		
7							85	85	0		
8							72	72	8		
9											
10					please refer to next page		64	64	8.7		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHR04**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	759.08	**SHEET:** 2	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**9/5/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**9/9/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					light grey and greyish cream fresh partially crushed mainly fractured and fractured to blocky seamy medium strong to strong sometimes porous and/ or dolomitic LIMESTONE		64	64	8.7		Flushing water loss at 10.3m
12							95	95	60		
13							94	80	27		
14							57	51	0		
15											
16							73	55	25		
17							76	76	0		
18											
19							76	76	76		
20							83	83	35		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHR04**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	759.08	**SHEET:** 3	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**9/5/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**9/9/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
21					light grey and greyish cream fresh partially crushed mainly fractured and fractured to blocky seamy medium strong to strong sometimes porous and/ or dolomitic LIMESTONE		83	83	35		
22							100	100	59		
23							89	89	89		
24											
25							89	89	42		
26					CAVITY (25.5-26.5m)		31	31	6.7		
27					light grey and greyish cream fresh partially crushed mainly fractured and fractured to blocky seamy medium strong to strong sometimes porous and/ or dolomitic LIMESTONE						
28							51	51	0		
29							81	75	30		
30											

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	DAR-TALEB	**FILE NO.:**	14-015	**BOREHOLE NO.:**	BHR04
PROJECT:	BISRI DAM / THIRD PACKAGE (Rock Quarries)				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	759.08	**SHEET:** 4	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	9/5/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/9/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
31					light grey and greyish cream fresh partially crushed mainly fractured and fractured to blocky seamy medium strong to strong sometimes porous and/ or dolomitic LIMESTONE		96	89	61		
32							90	90	49		
33					whitish cream moderately to highly weathered partially crushed mainly fractured weak to medium strong porous and karstifed LIMESTONE sometimes dolomitic		91	91	32		
34											
35							69	69	17		
36											
37							80	60	7.3		
38											
39							57	57	23		
40					please refer to next page		100	80	80		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHR04**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	759.08	**SHEET:** 5	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**9/5/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**9/9/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
41					greyish to whitish cream moderately weathered partially crushed mainly fractured and fractured to blocky seamy weak to medium strong LIMESTONE		100	80	80		
42							99	99	75		
43							91	91	88		
44							83	75	20		
45											
46											
47											
48											
49											
50											
					End of borehole at 45m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ05**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	790.86	**SHEET:** 1	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	42.5
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	8/29/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/4/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					SAPROLITE: transition from the residual to parent soil		82	70	45		Casing down to 1.5m
2					light grey to greyish and brownish cream fresh to moderately weathered partially crushed mainly fractured to blocky seamy medium strong dolomitic LIMESTONE		100	87	44		
3											
4							100	100	35		
5							100	100	81		
6											
7							100	100	100		
8											
9							97	97	97		
10							88	88	48		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	DAR-TALEB	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ05**
PROJECT:	BISRI DAM / THIRD PACKAGE (Rock Quarries)				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	790.86	**SHEET:** 2	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	42.5
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	8/29/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/4/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					light grey to greyish and brownish cream fresh to moderately weathered partially crushed mainly fractured to blocky seamy medium strong dolomitic LIMESTONE		88	88	48		Flushing water loss at 10.5m
12							53	47	0		
13							77	77	25		
14							93	73	0		
15											
16							100	80	8		
17					brownish cream moderately to highly weathered partially crushed mainly fractured weak to medium strong porous dolomitic LIMESTONE		100	80	63		
18											
19							100	100	100		
20							80	63	0		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ05**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	790.86	**SHEET:** 3	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	42.5
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/29/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**9/4/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
21					ditto		80	63	0		
22					light grey fresh to moderately weathered partiall crushed mainly fractured to blocky seamy LIMESTONE						
23											
24											
25					light grey fresh to moderately weathered partiall crushed mainly fractured to blocky seamy LIMESTONE with thin cavities						
26											
27							100	100	52		
28							97	97	47		
29											
30							95	95	95		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ05**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	790.86	**SHEET:** 4	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	42.5
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	8/29/2014
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	9/4/2014

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
31					light grey fresh to moderately weathered partiall crushed mainly fractured to blocky seamy LIMESTONE with thin cavities		87	87	35		
32							76	76	33		
33											
34							73	73	8		
35											
36											
37					CAVITY						
38											
39											
40											

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	DAR-TALEB	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ05**
PROJECT:	BISRI DAM / THIRD PACKAGE (Rock Quarries)				
LOCATION:	Rock Material Sources / RQ-2a	**Elevation (m):**	790.86	**SHEET:**	5 **OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	42.5
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/29/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**9/4/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
41					CAVITY						
42											
43											
44											
45											
46											
47											
48											
49											
50											
					End of borehole at 42.5m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ06**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	**799.1**	**SHEET:** 1	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**24/8/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**28/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					SAPROLITE (transition from residual to parent soil)		48	28	0		No flushing water loss
2					light to whitish grey fresh to slightly weathered partially fractured mainly blocky seamy and blocky seamy to massive medium strong to strong LIMESTONE some times dolomitic		90	90	33		
3											Casing down to 3.0m
4							97	97	70		
5											
6							100	100	76		
7							87	73	67		
8											
9							81	81	81		
10							100	100	95		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ06**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	**799.1**	**SHEET:** 2	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**24/8/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**28/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					light to whitish grey fresh to slightly weathered partially fractured mainly blocky seamy and blocky seamy to massive medium strong to strong LIMESTONE some times dolomitic		100	100	95		
12							83	83	83		
13							100	100	75		
14							97	97	43		
15											
16							85	85	65		
17							90	90	90		
18											
19							93	93	80		
20							89	89	71		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ06**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	**799.1**	**SHEET:** 3	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**24/8/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**28/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
21					light to whitish grey fresh to slightly weathered partially fractured mainly blocky seamy and blocky seamy to massive medium strong to strong LIMESTONE some times dolomitic		89	89	71		
22							80	80	43		
23							67	67	40		
24											
25							80	80	80		
26											
27					whitish cream fresh partially fractured mainly blocky seamy and blocky seamy to massive medium strong to strong dolomitic LIMESTONE		88	88	80		
28							100	100	100		
29							95	95	95		
30											

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ06**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	**799.1**	**SHEET:** 4	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**24/8/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**28/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
31					whitish cream fresh partially fractured mainly blocky seamy and blocky seamy to massive medium strong to strong dolomitic LIMESTONE		100	100	100		
32							100	100	95		
33							100	100	93		
34							100	100	100		
35					light to whitish grey and cream fresh to slightly weathered partially fractured mainly blocky seamy and blocky seamy to massive medium strong to strong dolomitic LIMESTONE		100	100	89		
36							93	93	89		
37							100	100	100		
38											
39											
40											

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ06**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	**799.1**	**SHEET:** 5	**OF:** 5
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**24/8/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**28/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
41					light to whitish grey and cream fresh to slightly weathered partially fractured mainly blocky seamy and blocky seamy to massive medium strong to strong dolomitic LIMESTONE		100	100	100		
42							76	76	48		
43							100	100	88		
44							83	83	78		
45											
46											
47											
48											
49											
50											
					End of borehole at 45m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ07**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	**808.67**	**SHEET:** 1	**OF:** 2
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	15m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/20/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**8/22/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					SAPROLITE (transition from the residual to parent soil		57	37	0		
2					whitish to brownish cream slightly weathered partially crushed and scharet mainly fractured to blocky seamy medium strong to strong dolomitic LIMESTONE		52	52	27		Flushing water loss at 1.5m
3											
4					ditto with pockets of clay		67	40	18		
5							73	73	73		Casing down to 4.5m
6											
7							80	80	80		
8											
9							60	60	23		
10							40	21	0		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ07**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	**808.67**	**SHEET:** 2	**OF:** 2
EQUIPMENT:	CMV 800	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	15m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**8/20/2014**
ENGINEER:	K.S.	**DRILLER:**	A.A.	**DATE FINISHED:**	**8/22/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					whitish to brownish cream slightly weathered partially crushed and scharet mainly fractured to blocky seamy medium strong to strong dolomitic LIMESTONE		40	21	0		
12							77	71	33		
13							76	76	76		
14							54	54	35		
15											
16											
17											
18											
19											
20											
					End of borehole at 15m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ08**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	787.97	**SHEET:** 1	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**14/8/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**16/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					dark brown clayey TOP SOIL		88	33	6.7		
2					light to dark olive brown fresh and fresh to moderately weathered blocky seamy to fractured and fractured sometimes crushed weak to moderately strong and strong dolomitic sandy LIMESTONE time to time porous and karstified		71	50	30		
3											Casing down to 3m
4							75	75	28		Flushing water loss at 3m
5							67	67	20		
6											
7							100	100	57		
8											
9							57	57	51		
10							57	57	33		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ08**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	787.97	**SHEET:** 2	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**14/8/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**16/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					ditto		57	57	33		
12							70	70	53		
13							57	57	50		
14							73	73	44		
15											
16							56	56	40		
17							57	27	0		
18											
19							89	89	53		
20							89	89	13		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ08**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	787.97	**SHEET:** 3	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**14/8/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**16/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
21					ditto		89	89	13		
22							83	83	23		
23							89	89	53		
24											
25							57	57	13		
26											
27							67	67	13		
28							97	97	28		
29											
30							100	100	40		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ08**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	787.97	**SHEET:** 4	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**14/8/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**16/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
31					ditto		100	100	10		
32							100	100	47		
33											
34							67	67	17		
35											
36							47	47	0		
37							53	53	10		
38											
39							100	100	27		
40							73	73	20		

SPT Standard Penetration Test
TCR Total Core Recovery
ST Sample Type
UCS Unconfined Compressive Strength
RQD Rock Quality Designation
SYM Symbol
LT Layer Thickness
SCR Solid Core Recovery
WT Water Table
N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**DAR-TALEB**	**FILE NO.:**	14-015	**BOREHOLE NO.:**	**BHRQ08**
PROJECT:	**BISRI DAM / THIRD PACKAGE (Rock Quarries)**				
LOCATION:	Rock Material Sources / RQ-2b	**Elevation (m):**	787.97	**SHEET:** 5	**OF:** 5
EQUIPMENT:	SAT 2000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	45m
HOLE DAM. (mm):	86 to 114	**CORE DIAM. (mm):**	63	**DATE STARTED:**	**14/8/2014**
ENGINEER:	K.S.	**DRILLER:**	Nawraz	**DATE FINISHED:**	**16/8/2014**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
41					ditto		73	73	20		
42							67	67	17		
43							67	67	20		
44							73	73	0		
45											
46											
47											
48											
49											
50											
					End of borehole at 45m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL	ROCK SYMBOL	SAMPLERS	OTHERS
GP	Dolomite	SPT (disturbed)	**Water Level**
GP-GM	Chalky Limestone	Shelby tube	
GM	Calcarenite	Tricone	
GC	Weak Chalky LIMESTONE	Double tube	
SW	Sandy Limestone		
SP	Basalt / volcanics		
SP - SM	Chert		
SM-SC	CL		
ML	Creamy White LIMESTONE		
CH-MH	Grainstone LIMESTONE		
OL	MARL		
OH	SANDSTONE		
PT	CLAYSTONE		
Fill Material	Oolitic LIMESTONE		
CLAY	Micritic LIMESTONE		
CLAYwith Sand and Gravel	Mudstone		
	Gypsum		
	Siltstone		

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

APPENDIX 3. PHOTOS OF CORE BOXES


Bsaba
BH:R1 Box:01
0 → 6.85
1.50
3.00
4.50
6.00


Bsaba
BH:R1 Box:02
6.85 → 10.5
7.50
9.00
10.50


Bsaba
BH:R1 Box:03
10.5 → 14.5
12,00 →
13,50 →


Bsaba
BH:R1 Box:04
14.5 → 18
15,00 →
16,50 →
18,00 →


Bsaba
BH:R1 Box:05
18 → 22
19,50→
21,00→


Bsaba
BH:R1 Box:06
22 → 26.2
22,50→
24,00→
25,50→


Bsaba
BH:R1 Box:07
26.2 → 31
28,00
28,50
30,00


Bsaba
BH:R1 Box:08
31 → 35.2
32,50
33,00
34,50


Bsaba
BH:R1 Box:09
35.2 → 39.7
36.00
37.50
39.00


Bsaba
BH:R1 Box:10
39.7 → 44
42.00


Bsaba
BH:R1 Box:11
44 → 50.4
45.00 →
46.50
فراغات صغيرة
48.00
49.50


Bsaba
BH:R1 Box:12
50.4 → 57
51.00
52.50
54.00
55.50
57.00


Bsaba
BH:R1 Box:13
57 → 60
57.00 →
58.50
60.00


Bsaba
BH: R2 Box:01
0 → 7.5
1.50
3.00
4.50
6.00
7.50


Bsaba
BH: R2 Box:02
7.5 → 18
9.00
10.50
12.00
13.50
15.00
16.50
18.00


Bsaba
BH: R2 Box:03
18 → 22.5
19,50
21,00
22,50


Bsaba
BH: R2 Box:04
22.5 → 27.5
24,00
25,50
27,00


Bsaba
BH; RL2 Box;05
27.5 → 32.2
28,50
30100
31,50→


Bsaba
BH; RL2 Box;06
32.2 → 38
34,50→
36,00→
37.50


Bsaba
BH; R2 Box;07
38 → 42.7
39,00→
40,50
42,00→


Bsaba
BH; R2 Box;08
42.7 → 45
43.50
45.00


Besri
BHRQ:03 Box:01
0 → 5.25
1.50
3.00
4.50


Besri
BHRQ:03 Box:02
5.25 → 9


Besri
BHRQ:03 Box:03
9 → 12.85


Besri
BHRQ:03 Box:04
12.85 → 16.5


Besri
BHRQ:03 Box:05
16.5 → 20.25


Besri
BHRQ:03 Box:06
20.25 → 24.5


Besri
BHRQ:03 Box:07
24.5 → 29


Besri
BHRQ:03 Box:08
29 → 32.5


Besri
BHRQ:03 Box#09
32.5 → 36.7


Besri
BHRQ:03 Box#10
36.7 → 40.3


Besri
BHRQ:03 Box#11
40.3 → 45


Bsaba
BH:R4 Box:01
0 → 5.5


Bsaba
BH:R4 Box:02
5.5 → 10.5


Bsaba
BH:R4 Box:03
10.5 → 15.5
13,50
15,00 →


Bsaba
BH:R4 Box:04
15.5 → 20
18.00
19.50


Bsaba
BH:R4 Box:05
20 → 24.5
21,00
22,50
24,00


Bsaba
BH:R4 Box:06
24.5 → 30.85
25,50
27,00
28,50
30,00


Bsaba
BH:R4 Box:07
30.85 → 35.5
33.00
34.50


Bsaba
BH:R4 Box:08
35.5 → 40.5
36.00
37.50
39.00


Bsaba
BH:R4 Box:09
40.5 → 45
42,00
43,50
43,00


Bsaba
BH:RS Box:01
0 → 4
1.50
3.00


Bsaba
BH:RS Box:02
4 → 9
6.00
7.50


Bsaba
BH:R5 Box:03
9 → 12.5
9,00→
10,50
12,00→


Bsaba
BH:R5 Box:04
12.5 → 16.8
13,50→
15,00→
16,50


Bsaba
BH:RS Box:05
16.8 → 21
18,00→
19,50→
21,00


Bsaba
BH:RS Box:07
25.5 → 29.5
27,00→
28,50→


Bsaba
BH:RS Box:08
29.5 → 34.5
ورشة: سابا
31,50 →
33,00 →


Bsaba
BH;R6 Box:01
0 → 4.8
1.50
3.00
4.50


Bsaba
BH;R6 Box:02
4.8 → 9
6,00
7,50
9,00


Bsaba
BH:R6 Box:03
9 → 13
10,50
12,00


Bsaba
BH:R6 Box:04
13 → 17
15,00
16,50


Bsaba
BH:R6 Box:05
17 → 21.5
18,00 →
19,50 →
21,00 →


Bsaba
BH:R6 Box:06
21.5 → 26.5
23,00
24,50 →
26,00


Bsaba
BH:R6 Box:07
26.5 → 30
27,50 →
29,00 →


Bsaba
BH:R6 Box:08
30 → 33.8
30,50 →
32,00 →
33,50 →


Bsaba
BH:R6 Box:09
33.3 → 37
39,50 →
36,


Bsaba
BH:R6 Box:10
37 → 41
39,
40,50 →


Bsaba
BH:R6 Box:II
41 → 45
42.00
45.00


Bsaba
BH:A7 Box:01
0 → 6.5
3,00
4,50
6,00


Bsaba
BH:A7 Box:02
6.5 → 12.5
7,50
9,00
10,50
12,00


Bsaba
BH:A7 Box:03
125→15
15,00


Bcsri
BHRQ:08 Box: 01
0 → 5.8


Bcsri
BHRQ:08 Box: 02
5.8 → 11.8


Besri
BHRQ:08 Box:03
11.8→18.5


Besri
BHRQ:08 Box:04
18.5→23


Besri
BHRQ:08 Box:05
23 → 28.8


Besri
BHRQ:08 Box:06
28.8 → 32.8


Besri
BHRQ:08 Box:07
32.8 → 39


Besri
BHRQ:08 Box:08
39 → 45

APPENDIX 4. LIST OF SAMPLING & LABORATORY TESTING PROGRAM – ROCK MATERIAL SOURCES (RQ-1b, RQ-2a/2b & RQ-3a)

BISRI DAM LABORATORY TESING - BOREHOLES (BHRQ) / ROCK MATERIAL SOURCES / RQ-1b					Testing											
Sampling																
No. of Test Pit	Depth of Sampling (m)	Type of Sample	Sample Description	Date of Sampling	Unit (U)	Crushing (Sample Preparation)	Water Absorption	Dry & Soaked Density	LA (500 revolutions)	Soundness (Sodium Sulphate)	Wetting – Drying Loss (35 cycles)	Dry Uni-Axial Compressive Strength	Soaked Uni-Axial Compressive Strength	AAR (Alkali aggregate reactions)	Petrography (including Hardness)	**General Total**
						2	2	2	2	2	1	2	2	1	2	**16**
BHRQ3	from 4.5 to 7.8m	Core	Light olive brown to cream slightly weathered blocky/seamy to massive strong occasionally karstified and porous dolomitic LIMESTONE	15.10.2014		1	1	1	1	1		1	1	1	1	
BHRQ1	from 12 to 16m	Core	Light olive brown to cream slightly weathered mainly blocky and seamy occasionally crushed strong rarely karstified dolomitic LIMESTONE			1	1	1	1	1	1	1	1		1	

BISRI DAM LABORATORY TESING - BOREHOLES (BHRQ) / ROCK MATERIAL SOURCES / RQ-2a/2b					Testing										
Sampling															
No. of Test Pit	Depth of Sampling (m)	Type of Sample	Sample Description (Site)	Date of Sampling	Unit (U)	Crushing (Sample Preparation) 5	Water Absorption 5	Dry & Soaked Density 5	LA (500 revolutions) 5	Soundness (Sodium Sulphate) 5	Wetting – Drying Loss (35 cycles) 2	Dry Uni-Axial Compressive Strength 5	Soaked Uni-Axial Compressive Strength 5	AAR (Alkali aggregate reactions) 3	Petrography (including Hardness) 4	**General Total 40**
BHRQ8	from 6 to 9.3m	Core	Light olive brown to cream slightly weathered blocky/seamy to fractured moderately strong to strong occasionally/slightly karstified dolomitic LIMESTONE.	15.10.2014		1	1	1	1	1		1	1	1	1	
BHRQ6	from 3 to 6m	Core	Light olive brown to cream slightly weathered blocky/seamy to fracture moderately strong to strong slightly dolomitic LIMESTONE.			1	1	1	1	1	1	1	1			
	from 13.5 to 16.8m		Light olive brown to cream and white faintly weathered blocky/seamy to fracture moderately strong to strong slightly dolomitic LIMESTONE.			1	1	1	1	1		1	1	1	1	
BHRQ5	from 1.5 to 4.5m		Light olive brown to cream slightly sometimes moderately weathered blocky/seamy to fractured and crushed strong occasionally karstified (karst voids are filled with clay) dolomitic LIMESTONE.			1	1	1	1	1		1	1	1	1	
BHRQ4	from 10.5 to 14m		Light olive brown to cream and white slightly and slightly to moderately weathered blocky/seamy to fractured and crushed strong slightly marly (rarely) dolomitic LIMESTONE			1	1	1	1	1	1	1	1		1	

BISRI DAM LABORATORY TESING - BOREHOLES (BHRQ) / ROCK MATERIAL SOURCES / RQ-3a					Testing										
Sampling															
No. of Test Pit	Depth of Sampling (m)	Type of Sample	Sample Description	Date of Sampling	Unit (U)	Crushing (Sample Preparation)	Water Absorption	Dry & Soaked Density	LA (500 revolutions)	Soundness (Sodium Sulphate)	Wetting – Drying Loss (35 cycles)	Dry Uni-Axial Compressive Strength	Soaked Uni-Axial Compressive Strength	AAR (Alkali aggregate reactions)	Petrography (including Hardness)	**General Total**
						1	1	1	1	1	1	1	1	1	1	**9**
EV10	from 22.5 to 30m	Core	Beige slightly weathered fractured and crushed strong to very strong occasionally karstified slightly sandy and dolomitic LIMESTONE	15.10.2014		1	1	1	1	1	1	1	1	1	1	