Geological Investigation
for
the Broadlands Hydropower Project

Appendix

CHAPTER 3

LABORATORY TESTS

Quantity of Laboratory Test for the Broadlands Hydropower Project

No.	Items	ASTM No.	Unit	Quantity
Phase1				
1	Concrete Aggregates (from test pits sample)			
1.1	Sieve analysis of aggregates	ASTM C136	samples	2
1.2	Specific gravity and water absorption (fine)	ASTM C128	samples	2
1.3	Specific gravity and water absorption (coarse)	ASTM C127	samples	2
1.4	Clay lumps and friable particles in aggregate	ASTM C142	samples	2
1.5	Soundness tests by sodium sulfate	ASTM C88	samples	2
1.6	Abrasion test of coarse aggregate by Los Angeles machine	ASTM C535	samples	2
1.7	Chemical (Alkali) reactivity test	ASTM C289	samples	2
2	Rock (from drilling-core sample)			
2.1	Water absorption and bulk specific gravity	ASTM C127	samples	6
2.2	Unconfined compression and Poisson's ratio	ASTM D2938	samples	6
2.3	Ultra-sonic wave velocity	ASTM D2845	samples	6
2.4	Soundness tests by sodium sulfate	ASTM C88	samples	2
2.5	Chemical (alkali) reactivity test	ASTM C289	samples	2
3	Test Pitting and Sampling (includes Geodetic Measurement)		nos.	2
Phase 2				
1	Concrete Aggregates (from test pits sample)			
1.1	Sieve analysis of aggregates	ASTM C136	samples	2
1.2	Specific gravity and water absorption (fine)	ASTM C128	samples	2
1.3	Specific gravity and water absorption (coarse)	ASTM C127	samples	1
1.4	Clay lumps and friable particles in aggregate	ASTM C142	samples	2
1.5	Soundness tests by sodium sulfate	ASTM C88	samples	1
1.6	Abrasion test of coarse aggregate by Los Angeles machine	ASTM C535	samples	1
1.7	Chemical (Alkali) reactivity test	ASTM C289	samples	1
2	Rock (from drilling-core sample)			
2.1	Water absorption and bulk specific gravity	ASTM C127	samples	18
2.2	Unconfined compression and Poisson's ratio	ASTM D2938	samples	20
2.3	Ultra-sonic wave velocity	ASTM D2845	samples	18
2.4	Soundness tests by sodium sulfate	ASTM C88	samples	1
2.5	Chemical (alkali) reactivity test	ASTM C289	samples	1
2.6	Abrasion test of coarse aggregate by Los Angeles machine	ASTM C535	samples	1
3	Test Pitting and Sampling (includes Geodetic Measurement)		nos.	2

Our Ref: CB/EPC/LAB/04C

TEST CERTIFICATE NO: DRL/AT/2003060

Issued By : Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CECB, No.11, Jawatte Road, Colombo 05.

Assured To : Jica Study Team
Electric Power Development Co., Ltd
Nippon Koel Co., Ltd.

Project : Broadlands Hydropower Project

Job Requested : Testing of Aggregates, Rock & Soil samples from Broadlands Hydropower Project.

Job Ref : DRL/2/011

Tested for : 1) Concrete Aggregates (from test pit samples)

1.1) Sieve Analysis of Coarse Aggregates, Fine Aggregates & Soil samples
1.2) Specific gravity and water absorption (Fine)
1.3) Specific gravity and water absorption (Coarse)
1.4) Clay lumps and friable particles in (Coarse & Fine) Aggregates
1.5) Soundness tests by sodium sulphate
1.6) Abrasion test of Aggregate by Los Angeles machine
1.7) Chemical (Alkali) reactivity test

2.) Rock (from drilling core samples)

2.1) Water absorption and bulk specific gravity
2.2) Unconfined compression and Poisson's ratio
2.3) Ultra-sonic wave velocity
2.4) Soundness tests by sodium sulphate
2.5) Chemical (Alkali) reactivity test

Results: As tabulated in pages 02-05.

Results:

1.1) *Results of **Sieve Analysis*** of Coarse Aggregates, Fine Aggregates & Soil Samples

Sample Description	Φ 60% (mm)	Φ 30% (mm)	Φ 10% (mm)	C_u	C_c
TP-2(Coarse Aggregates)	10.600	10.300	10.100	1.050	0.991
River Sand	0.370	0.220	0.120	3.083	1.090
TP-1 (Soil)	2.800	0.510	-	-	-
TP-2 (Soil)	4.300	1.100	0.280	15.357	1.005

1.2) *Results of **Specific Gravity and Water Absorption*** of Fine Aggregates

Sample Description	Bulk Specific Gravity	Bulk Specific Gravity (SSD* Basis)	Apparent Specific Gravity	Water Absorption (%)
River Sand	2.541	2.562	2.594	0.802

*SSD- Saturated-Surface-Dry Basis

1.3) *Results of **Specific Gravity and Water Absorption*** of Coarse Aggregates

Sample Description	Bulk Specific Gravity	Bulk Specific Gravity (SSD* Basis)	Apparent Specific Gravity	Water Absorption (%)
TP-1(Coarse Aggregates)	2.476	2.540	2.646	2.596
TP-2(Coarse Aggregates)	3.013	3.027	3.054	0.445

*SSD- Saturated-Surface-Dry Basis

1.4) *Results of **Clay Lumps and Friable Particles*** in (Coarse & Fine) Aggregates

Sample Description	Particle Size (mm)	Percentage of Clay Lumps and Friable Particles (%)
TP-2(Coarse Aggregates)	4.75-9.5	0.17
	9.5-19.0	0.58
	19.0-38.1	0.10
River Sand	>1.18	27.5

Reported By: .....
R.M.K.R.Bandara / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Virajh Dias
Engineer In Charge

.....
B.M.A.P.Mapa
Project Manager Laboratory & Site Investigation Unit

Date : 12-02-2003.

Results:

1.5) *Results of **Soundness** Tests by Sodium Sulphate of Aggregates*

Sample Description	Soundness of Rock sample (Loss in weight) %
TP-1(Coarse Aggregates)	1.52
TP-2(Coarse Aggregates)	0.22

1.6) *Results of **Loss Angeles Abrasion** Test of Aggregates*

Sample Description	Los Angeles Abrasion Value (%)	
	100 Revolutions	500 Revolutions
TP-1(Coarse Aggregates)	22.18	65.77
TP-2(Coarse Aggregates)	8.61	30.18

1.7) *Results of **Chemical (Alkali) Reactivity** Test of Aggregates*

Sample Description	Quantity of Dissolved Silica (Sc) mmol/L	Quantity of Reduction in Alkalinity (Rc) mmol/L
TP-1(Coarse Aggregates)	2.90	60
TP-2(Coarse Aggregates)	4.42	30

Reported By: .....
R.M.K.R.Bandara / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Virajh Dias
Engineer In Charge

.....
B.M.A.P.Mapa
Project Manager Laboratory
& Site Investigation Unit

Date : 12-02-2003.

Results:

2.1) *Results of **Water Absorption and Bulk Specific Gravity** of Rock Samples*

Bore Hole No.	Rock Type	Depth (m)	Bulk Specific Gravity	Bulk Specific Gravity (SSD* Basis)	Apparent Specific Gravity	Water Absorption (%)
MB 1	Charnokitik-gneiss	24.49-25.00	2.638	2.641	2.645	0.091
MB 3	Biotite rich gneiss	22.00-22.38	3.071	3.072	3.074	0.035
DT 1	Calk-gneiss	19.45-19.85	2.871	2.895	2.939	0.815
MT 3	Garnet rich biotite gneiss	14.31-14.76	2.813	2.815	2.818	0.059
MT 2	Quartzite	32.56-33.00	2.624	2.625	2.628	0.051
MT 1	Quartz rich feldspathic gneiss	34.93-35.35	2.581	2.600	2.631	0.727

*SSD- Saturated-Surface-Dry Basis

2.2) *Results of **Unconfined compression and Poisson's Ratio** of Rock Cores*

Rock Type	Bore Hole No.	Depth (m)	Unconfined Compressive Strength (N/mm^2)
Charnokitik-gneiss	MB 1	24.49-25.00	65.66
Biotite rich gneiss	MB 3	22.00-22.38	38.52
Calk-gneiss	DT 1	19.45-19.85	12.99
Garnet rich biotite gneiss	MT 3	14.31-14.76	17.05
Quartzite	MT 2	32.56-33.00	35.37
Quartz rich feldspathic gneiss	MT 1	34.93-35.35	65.99

Reported By: .....
R.M.K.R.Bandara / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Virajh Dias
Engineer In Charge

.....
B.M.A.P.Mapa
Project Manager Laboratory
& Site Investigation Unit

Date : 12-02-2003.

Results:

2.3) *Results of **Ultra-Sonic Wave Velocity** of Rock Cores*

Rock Type	Bore Hole No.	Depth (m)	Pulse Travel Time Observed (μs)	Pulse Velocity (km/s)
Charnokitik-gneiss	MB 1	24.49-25.00	15.8	6.8
Biotite rich gneiss	MB 3	22.00-22.38	16.2	6.0
Calk-gneiss	DT 1	19.45-19.85	49.5	2.2
Garnet rich biotite gneiss	MT 3	14.31-14.76	22.7	4.9
Quartzite	MT 2	32.56-33.00	26.3	4.1
Quartz rich feldspathic gneiss	MT 1	34.93-35.35	42.1	2.6

2.4) *Results of **Soundness Tests by Sodium Sulphate** of Rock Samples*

Rock Type	Sample No.	Bore Hole No. & Location	Soundness of Rock Sample (Loss in weight) %
Charnokitik formation	01	MB 1/16.00-16.15, MB 4/21.66-21.82m, MB 3/5.46-5.67m, CT 1/14.60-14.75m	3.72
Gneissic formation	02	MB 2/30.00-30.13m MB 3/47.20-47.37m, MB 1/39.42-39.55m, MB 4/9.28-9.44m,	8.18

2.5) *Results of **Chemical (Alkali) Reactivity** Test of Rock Samples*

Rock Type	Bore Hole No.	Depth (m)	Quantity of Dissolved Silica (Sc) mmol/L	Quantity of Reduction in Alkalinity (Rc) mmol/L
Charnokitik-gneiss	MB 2	11.00-11.21	3.53	30
Garnetiferrous biotite gneiss	CT 2	7.15-7.30	0.71	165

Reported By: .....
R.M.K.R.Bandara / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

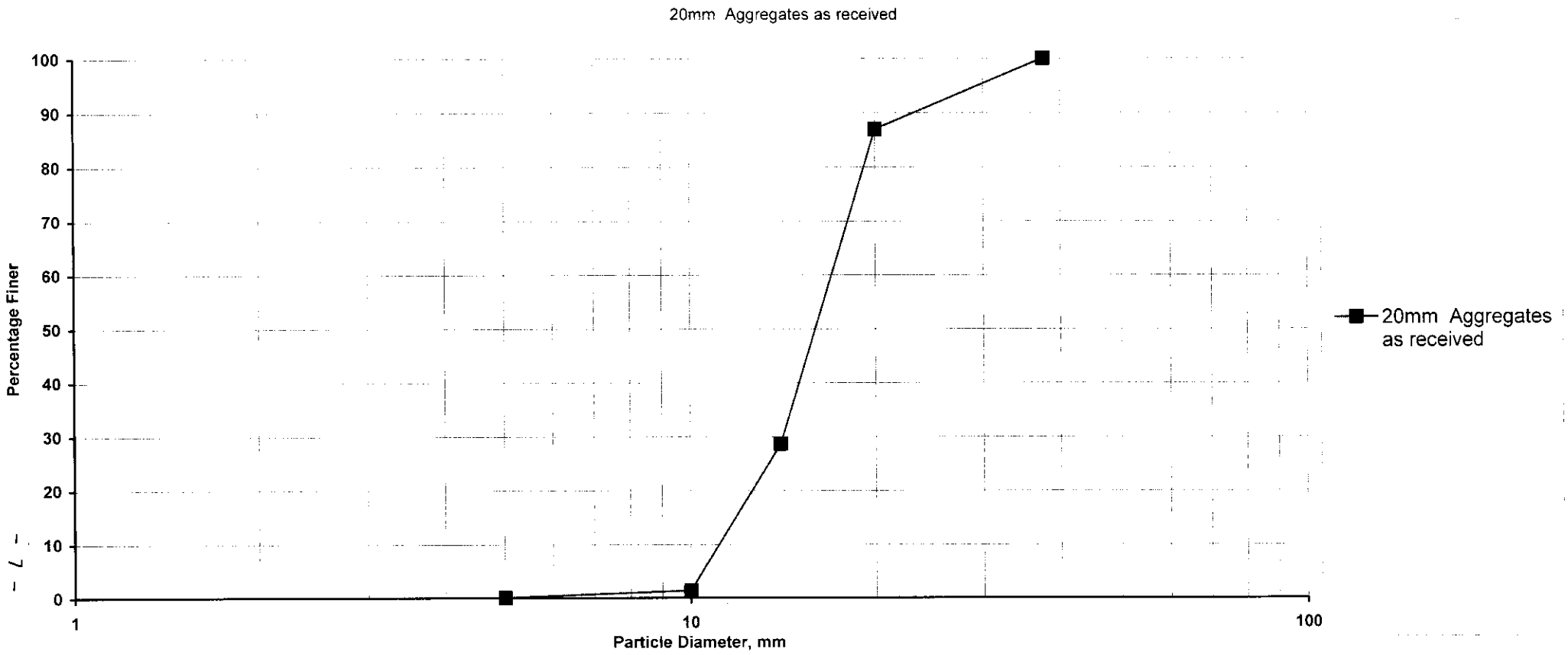
Certified By .....
A.A.Virajh Dias
Engineer In Charge

.....
B.M.A.P.Mapa
Project Manager Laboratory
& Site Investigation Unit

Date : 12-02-2003.

Particle Size Analysis Data (sieve analysis) -20mm Aggregates

Sample No:S1 mm	Mass Retained g	Percentage Retained (%)	Percentage Passing(%)
37.5	0.00	0.00	100.00
20	260.56	13.03	86.97
14	1,165.90	58.30	28.68
10	544.11	27.21	1.47
5	26.95	1.35	0.12
Pan	2.48	0.12	0.00
Sample Weight	2,000.00		



PROJECT : **Broadlands Hydropower Project**

PARTICLE SIZE DISTRIBUTION CURVE
BY **SIEVE ANALYSIS**

Sample	Plot	Location of Source	Results					Date of Test	Job Ref.
			ϕ 60%	ϕ 30%	ϕ 10%	C_U	C_C		
A03008	■	TP-2	10.600	10.300	10.100	1.050	0.991	20-Jan-03	DRL/2/011

WMS/MGC	TSR	RMMB
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Specifications
BS 882 : 1992

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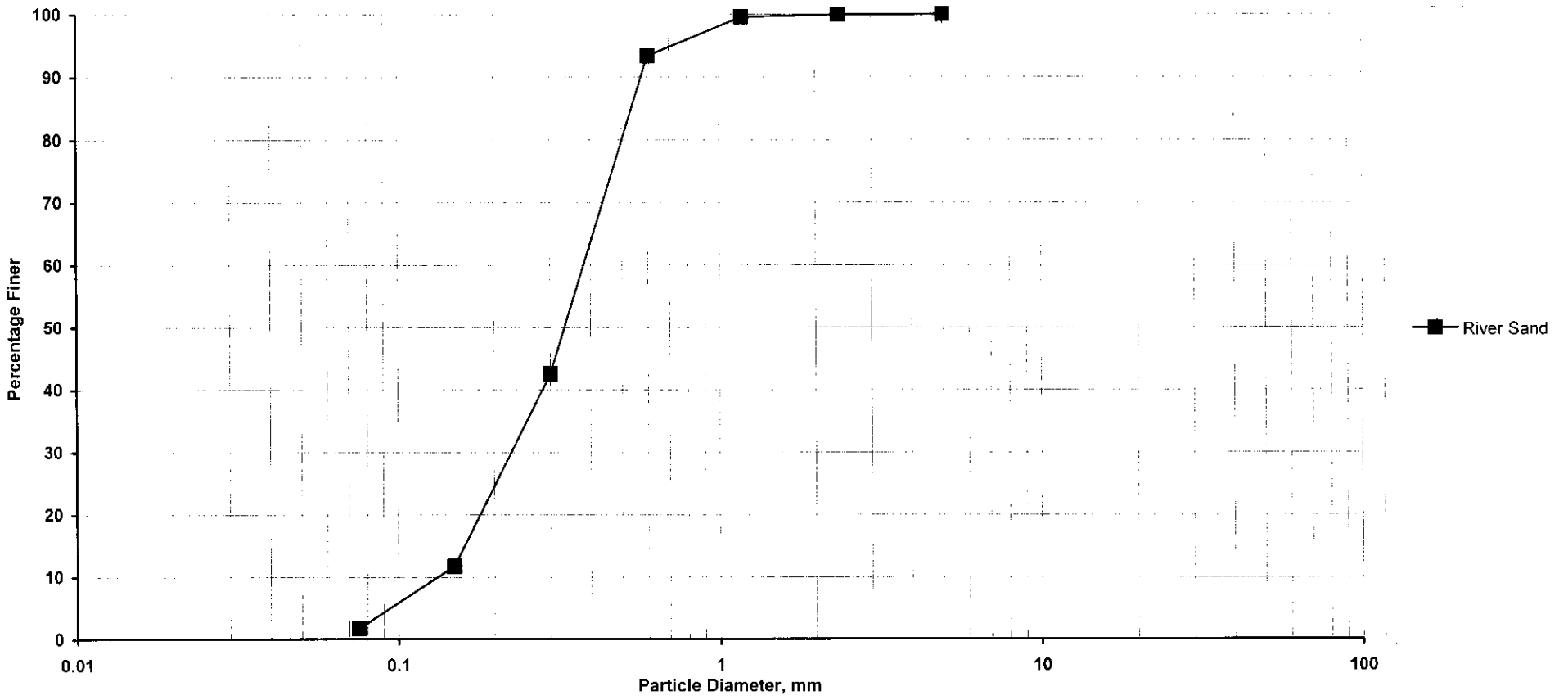
Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11, Jawatta Road ,Colombo 05,
Sri Lanka.

Particle Size Analysis Data (sieve analysis)- River Sand from Broadland

River Sand			
Sieve size mm	**Mass Retained g**	**% Retained**	**% Passing**
5	0.00	0.00	100.00
2.36	0.67	0.03	99.97
1.18	7.61	0.38	99.59
0.600	124.48	6.22	93.36
0.300	1,015.40	50.77	42.59
0.150	617.10	30.86	11.74
0.075	199.76	9.99	1.75
Pan	34.98	1.75	
Sample Weight	2000		



PROJECT : **Broadlands Hydropower Project**

PARTICLE SIZE DISTRIBUTION CURVE
BY **SIEVE ANALYSIS**

Sample	Plot	Source	Results					Date of Test	Test Code
			ϕ 60%	ϕ 30%	ϕ 10%	C_U	C_C		
A03009	■	River Sand	0.370	0.220	0.120	3.083	1.090	23-01-2003	DRL/2/011

WMS/ MGC	SR	RMKRB	Specifications
Lab.Assistant Tested By	Lab. Technician Checked By	Lab.Engineer Certified By	BS 882 : Part 2: 1973

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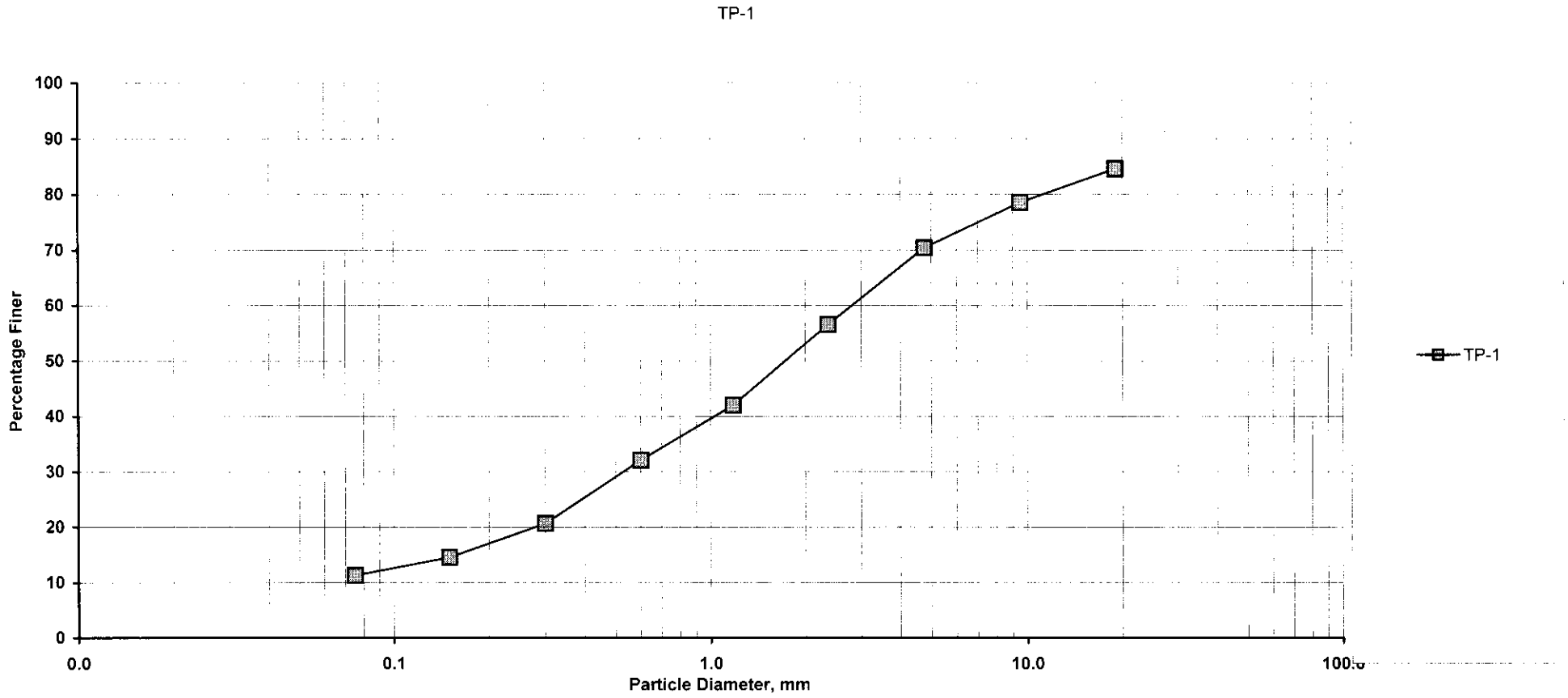
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11, Jawatta Road ,Colombo 05,
Sri Lanka.

Particle Size Analysis Data (sieve analysis)

TP-1			
Sieve size mm	Mass Retained g	% Retained	% Passing
50.0	0.00	0.00	100.00
37.5	204.89	7.21	92.79
28.0	92.87	3.27	89.53
19.0	139.85	4.92	84.61
9.5	172.11	6.05	78.55
4.75	233.86	8.23	70.33
2.36	392.39	13.80	56.53
1.18	414.20	14.57	41.96
0.600	280.20	9.86	32.10
0.300	325.49	11.45	20.65
0.150	174.64	6.14	14.51
0.075	91.00	3.20	11.31
Pan	759.19	26.70	
Sample Weight	2843.08		



PROJECT : **Broadlands Hydropower Project**

PARTICLE SIZE DISTRIBUTION CURVE
BY **SIEVE ANALYSIS**

Sample	Plot	Source	Results					Date of Test	Job No.
			ϕ 60%	ϕ 30%	ϕ 10%	C_U	C_C		
S030033		TP-1	2.800	0.510	-	-	-	21-Jan-03	DRL/2/011

WMS/ MGC	TSR	RMKRB	Specifications
Lab.Assistant	Lab. Technician	Lab.Engineer	ASTM D421 & D422
Tested By	Checked By	Certified By	

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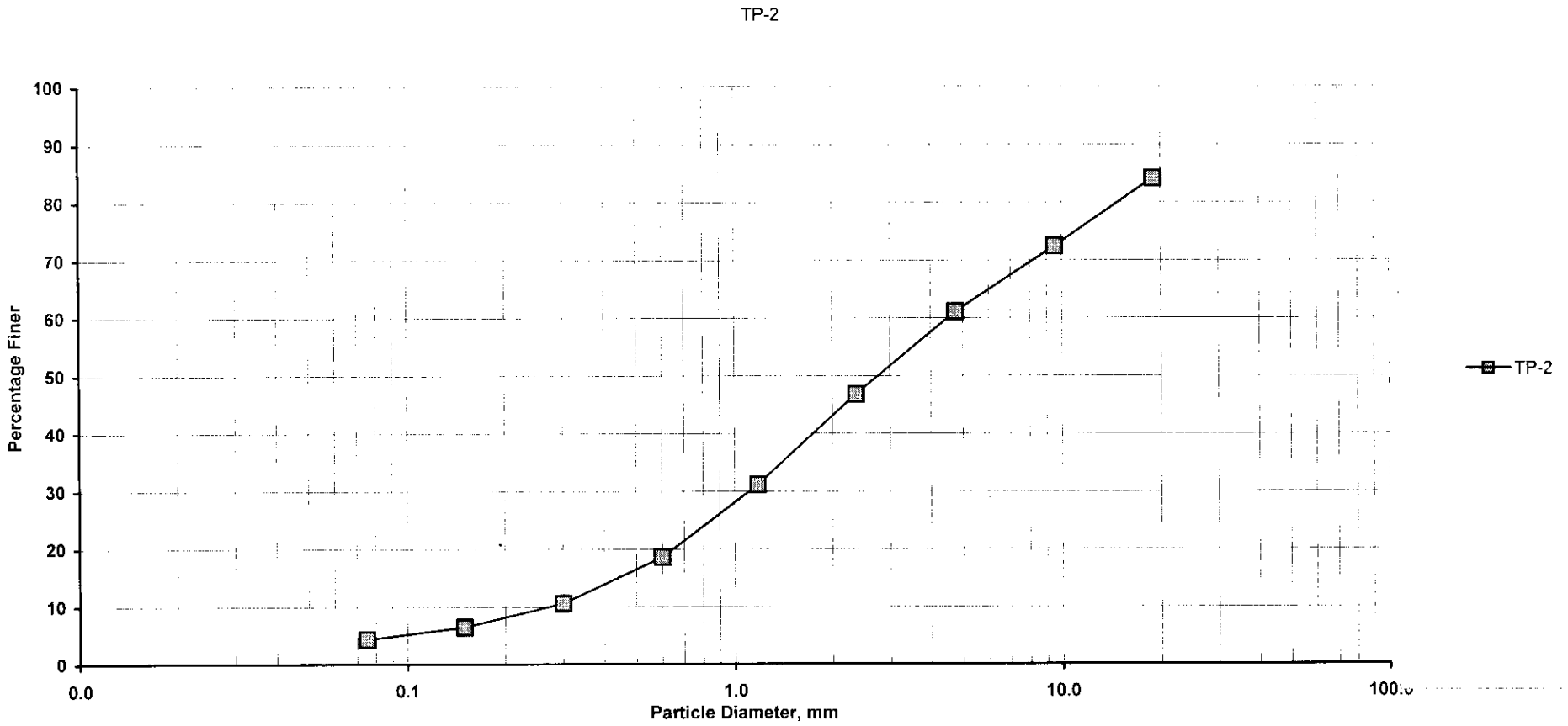
Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11, Jawatta Road ,Colombo 05,
Sri Lanka.

Particle Size Analysis Data (sieve analysis)

TP-2			
Sieve size mm	**Mass Retained g**	**% Retained**	**% Passing**
50.0	0.00	0.00	100.00
37.5	157.62	6.39	93.61
28.0	156.19	6.33	87.28
19.0	77.20	3.13	84.16
9.5	289.75	11.74	72.41
4.75	279.20	11.31	61.10
2.36	353.66	14.33	46.77
1.18	385.32	15.61	31.16
0.600	310.25	12.57	18.58
0.300	196.93	7.98	10.60
0.150	101.92	4.13	6.47
0.075	52.66	2.13	4.34
Pan	498.11	20.18	
Sample Weight	2467.8		



PROJECT : **Broadlands Hydropower Project**

PARTICLE SIZE DISTRIBUTION CURVE
BY **SIEVE ANALYSIS**

Sample	Plot	Source	Results					Date of Test	Job No.
			ϕ 60%	ϕ 30%	ϕ 10%	C_U	C_C		
S030034		TP-2	4.300	1.100	0.280	15.357	1.005	21-Jan-03	DRL/2/011

WMS/ MGC	TSR	RMKRB	Specifications
Lab.Assistant Tested By	Lab. Technician Checked By	Lab.Engineer Certified By	ASTM D421 & D422

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Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11, Jawatta Road ,Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF FINE AGGREGATES	Our Reference
A030009		CB/EPC/LAB/04DR1.
Date of Report 11-Feb-03	**Specification No:** **ASTM C128**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	River sand
Date of Test	27-Jan-03

Sample No.			1	2	Average
Wt. in Air of Oven Dry Sample	(g)	A	495.4	496.6	
Wt. in Air of Saturated Surface Dry Sample	(g)	D	500.0	500.0	
Wt.of Picnometer Filled with Water	(g)	B	2,691.0	2,691.0	
Wt.of Picnometer Filled with Sample & Water to Calibration Mark	(g)	C	2997	2,994.6	
Bulk Specific Gravity $\frac{A}{B+D-C}$			2.554	2.529	2.541
Bulk Specific Gravity (Saturated-Surface-Dry) $\frac{D}{B+D-C}$			2.577	2.546	2.562
Apparent Specific Gravity $\frac{A}{B+A-C}$			2.616	2.573	2.594
Absorption % $\frac{D-A}{A} \cdot 100\%$			0.927	0.677	0.802

Remarks :

MGC	TSR	RMKRB	ENGINEERS & ARCHITECTS ceeb	**Laboratory & Site Investigation Unit**
Lab.Assistant Tested By	Lab.Technician Checked By	Engineer Certified By		Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No11,Jawatta Road,Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A03007		CB/EPC/LAB/04DRL
Date of Report 23/01/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	TP-1
Date of Test	21-01-2003
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type				
Wt in Saturated Surface Dry (g)	A	582.2	584.8	
Wt in Air of Oven Dry Sample (g)	B	567.9	569.6	
Wt of Sample in Water (g)	C	351.5	356.1	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.462	2.490	2.476
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.524	2.557	2.540
Apparent Specific Gravity $= \frac{B}{B - C}$		2.625	2.668	2.646
Absorption % $= \frac{A - B}{B} * 100\%$		2.520	2.672	2.596
Remarks :				

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Date of Test 21/01/2003	**Laboratory & Site Investigation Unit**
Job Code DRL/2/011	Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code A03008	**SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES**	Our Reference CB/EPC/LAB/04DRL
Date of Report 23/01/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	TP-2
Date of Test	21-01-2003
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type				
Wt in Saturated Surface Dry (g)	A	1,793.8	1,838.4	
Wt in Air of Oven Dry Sample (g)	B	1,786.0	1,830.1	
Wt of Sample in Water (g)	C	1,200.4	1,231.7	
Bulk Specific Gravity $= \frac{B}{A - C}$		3.010	3.016	3.013
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		3.023	3.030	3.027
Apparent Specific Gravity $= \frac{B}{B - C}$		3.050	3.058	3.054
Absorption % $= \frac{A - B}{B} * 100\%$		0.437	0.454	0.445
Remarks :				

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Date of Test 21/01/2003	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.
Job Code DRL/2/011	

Test code	CLAY LUMPS AND FRIABLE PARTICLES IN AGGREGATES (Coarse Aggregates)	Our Reference
A030008		CB/EPC/LAB/04/DRL
Date of Test 30-Jan-2003	Specification No: ASTM C 142	

PROJECT : Broadlands Hydropower Project

Location Reference of the Sample :	TP2
Description :	Concrete Aggregates (Coarse)

Size of Particles Making Up Test Sample (mm)	Dry Weight of Test Sample (g)	Size of Sieve for Removing Residue of Clay Lumps and Friable Particles (mm)	Weight of Particles Retained on Designated Sieve (g)	Percentage of Clay Lumps & Friable Particles %
4.75-9.5	1237.3	2.36	1235.2	0.17
9.5-19.0	2493.5	4.75	2479.1	0.58
19.0-38.1	2378.1	4.75	2375.7	0.10
>38.1	-	4.75	-	-

Lab.Assistant Tested By	Lab.Technician Checked By	Engineer Certified By	ENGINEERS & ARCHITECTS cecb

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11,Jawatta Road,Colombo 05,
Sri Lanka.

Test code	CLAY LUMPS AND FRIABLE PARTICLES IN AGGREGATES (Fine Aggregates)	Our Reference
A030009		CB/EPC/LAB/04/DRL
Date of Test 30-Jan-2003	Specification No: ASTM C 142	

PROJECT : Broadlands Hydropower Project

Location Reference of the Sample :	River sand

Size of Particles Making Up Test Sample (mm)	Dry Weight of Test Sample (g)	Size of Sieve for Removing Residue of Clay Lumps and Friable Particles (mm)	Weight of Particles Retained on Designated Sieve (g)
>1.18	54.38	0.85	39.426

Percentage of Clay Lumps and Friable Particles = 27.50 %

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Engineer Certified By

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Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11,Jawatta Road,Colombo 05,
Sri Lanka.

Sample Test Code A03007	SOUNDNESS TEST OF COARSE AGGREGATES	Our Reference CB/EPC/LAB/04DRL
Date 30-Jan-2003	Specification No: ASTM C88	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	TP-1

Weight of Sample Passing 37.5mm and Retained on 19.1mm	(g)	1498.97
Weight of Sample Retained on 19.1mm after test	(g)	1476.24
Weight loss after test	(g)	22.73
Soundness of Rock Sample (Loss in Weight)	(%)	1.52

Solution Used Sodium Sulphate

No. of Cycles 5

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Engineer
Certified By

Job No.
DRL/2/011

ENGINEERS & ARCHITECTS cecb

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code A03008	SOUNDNESS TEST OF COARSE AGGREGATES	Our Reference CB/EPC/LAB/04DRL
Date 30/Jan/2003	Specification No: ASTM C88	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	TP-2

Weight of Sample Passing 19.1mm and Retained on 12.5mm	(g)	702.21
Weight of Sample Retained on 12.5mm after test	(g)	700.64
Weight loss after test	(g)	1.57
Soundness of Rock Sample (Loss in Weight)	(%)	0.22

Solution Used Sodium Sulphate

No. of Cycles 5

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Engineer
Certified By

Job No.
DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	LOS ANGELES ABRASION TEST	Our Reference
A03007		CB/EPC/LAB/04DRL
Date of Report 23-Jan-2003	Specification No: ASTM C131/76	

SUPPLIER: **Broadlands Hydropower Project**

Location Reference of the Sample	TP-1
Description of sample	19mm aggregates
Type of Fraction	19.0mm-9.5mm
Quarry Location	

Passing	Retained	Weight (g)
19.0mm	12.5mm	2500
12.5mm	9.5mm	2500
No. of steel spheres used		11 nos.

ITEM	100 REVOLUTIONS	500 REVOLUTIONS
Wgt .of sample before (g)	5000.00	5000.00
Wgt. Of sample retained on 1.7mm sieve after test (g)	3890.80	1711.60
Wgt of sample passing 1.7mm sieve (g)	1109.20	3288.40
LOS ANGELES ABRASION VALUE	22.18%	65.77%

WMS/MGC/UM	SR	RMKRB
Lab.Assistant Tested By	Lab. Technician Checked BY	Engineer Certified BY

Date of Test 17-Jan-03		
Job Code DRL/2/011	ENGINEERS & ARCHITECTS cecb	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No. 11, Jawatta Road,Colombo 5, Sri Lanka.

Sample Test Code	LOS ANGELES ABRASION TEST	Our Reference
A03008		CB/EPC/LAB/04DRL
Date of Report 23-Jan-2003	**Specification No: ASTM C131/76**	

SUPPLIER: **Broadlands Hydropower Project**

Location Reference of the Sample	TP-2
Description of sample	19mm aggregates
Type of Fraction	19.0mm-9.5mm
Quarry Location	

Passing	Retained	Weight (g)
19.0mm	12.5mm	2500
12.5mm	9.5mm	2500
No. of steel spheres used		11 nos.

ITEM	100 REVOLUTIONS	500 REVOLUTIONS
Wgt .of sample before (g)	5000.00	5000.00
Wgt. Of sample retained on 1.7mm sieve after test (g)	4569.50	3491.20
Wgt of sample passing 1.7mm sieve (g)	430.50	1508.80
LOS ANGELES ABRASION VALUE	8.61%	30.18%

WMS/MGC/UM	TSR	RMKRB
Lab.Assistant Tested By	Lab. Technician Checked BY	Engineer Certified BY

Date of Test 17-Jan-03		
Job Code DRL/2/011	ENGINEERS & ARCHITECTS ceeb	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No. 11, Jawatta Road,Colombo 5, Sri Lanka.

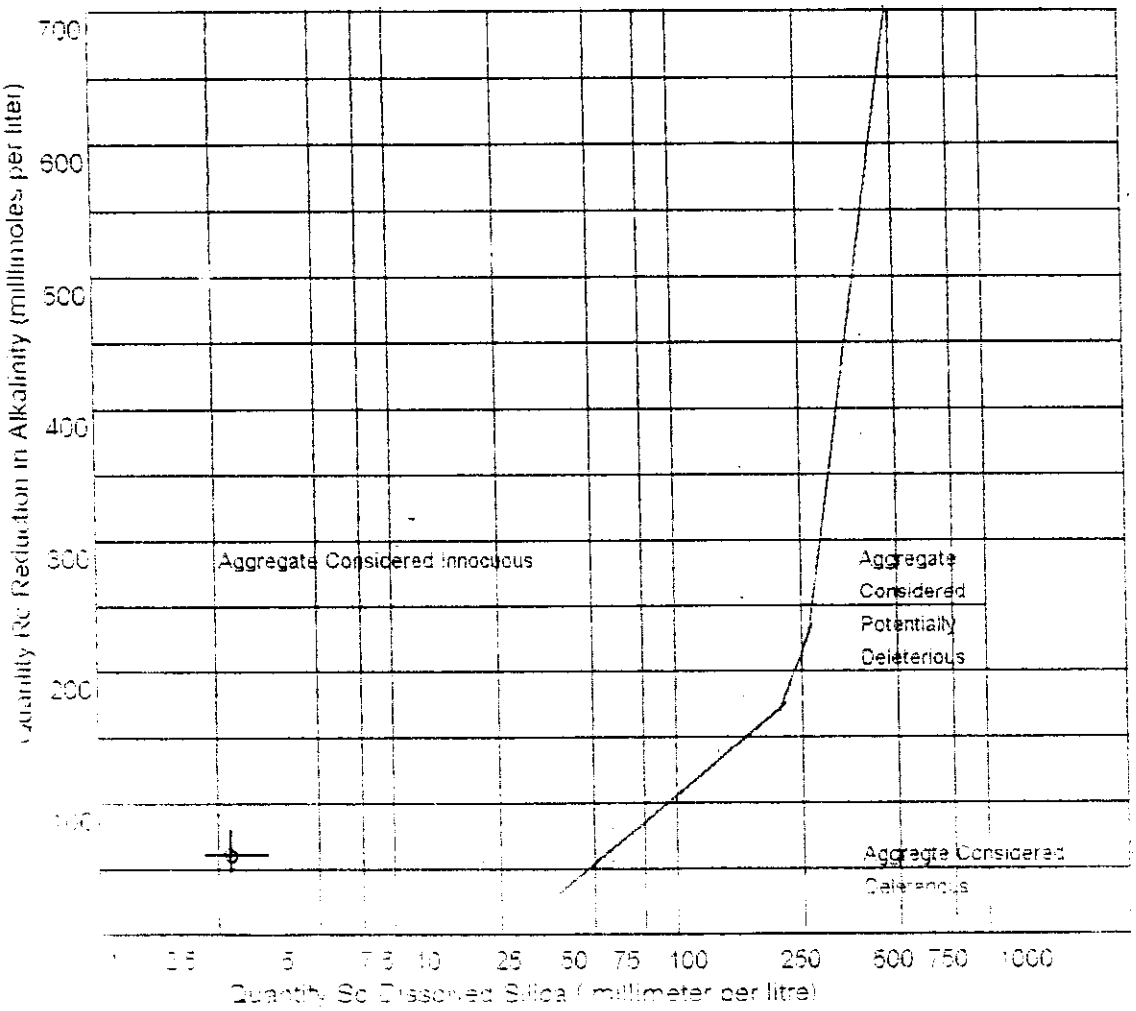
Sample Test Code	POTENTIAL ALKALI-SILICA REACTIVITY OF AGGREGATES (CHEMICAL METHOD)	Our Reference
A030007		CB/EPC/LAB/04DRL
Date 9-Feb-2003	Specification No: ASTM C-289	

PROJECT : **Broadlands Hydropower Project**

Type of Sample	TP-1 (Coarse Aggregates)

Scope This test method covers chemical determination of the potential reactivity of an aggregate with alkalies in portland cement concrete as indicated by the amount of reation during 24h at 80C between 1N Sodium Hydroxide solution and aggregate that has been crushed and sieved to pass a 300mm sieve and be retained on a 150mm sieve.

Quantity of Dissolved Silica (Sc)	2.90	mmol/L
Quantity of Reduction in Alkalinity(Rc)	60.00	mmol/L



Engineer
Certified By

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Job No.
DRL/2/011

ENGINEERS & ARCHITECTS ceb

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05.
Sri Lanka.

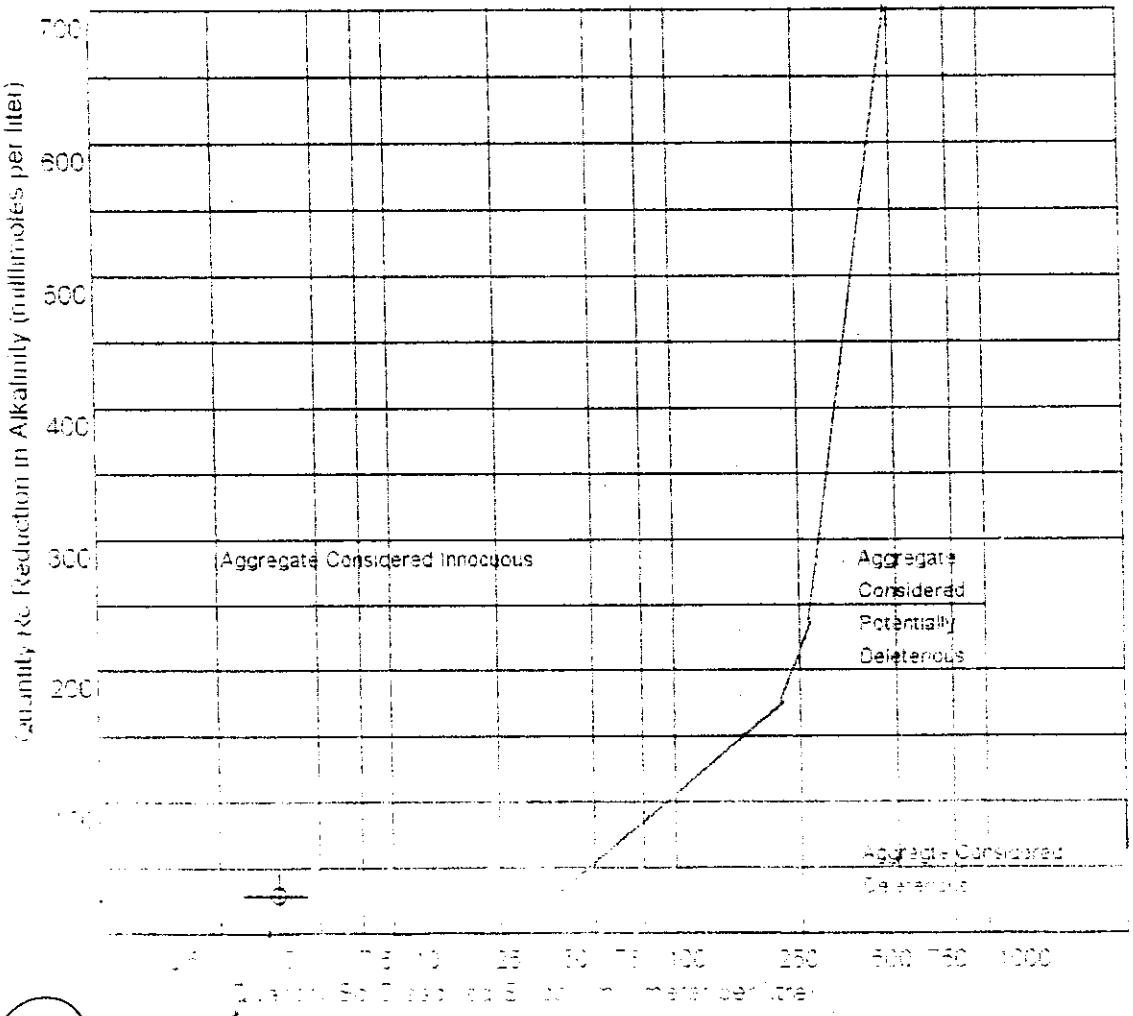
Sample Test Code	POTENTIAL ALKALI-SILICA REACTIVITY OF AGGREGATES (CHEMICAL METHOD)	Our Reference
A030008		CB/EPC/LAB/04DRL
Date 9-Feb-2003	Specification No: ASTM C-289	

PROJECT : Broadlands Hydropower Project

Type of Sample	TP-2 (Coarse Aggregates)

Scope This test method covers chemical determination of the potential reactivity of an aggregate with alkalies in portland cement concrete as indicated by the amount of reation during 24h at 80C between 1N Sodium Hydroxide solution and aggregate that has been crushed and sieved to pass a 300mm sieve and be retained on a 150mm sieve

Quantity of Dissolved Silica (Sc)	4.42	mmol/L
Quantity of Reduction in Alkalinity(Rc)	30.00	mmol/L



Engineer
Certified By

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Job No.
DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF ROCK CORES	Our Reference
A03016		CB/EPC/LAB/04DRL
Date of Report 11-Feb-03	**Specification No:** **ASTM C127**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	MB 1/depth 24.49-25.00m
Rock Type	Charnokitik-gneiss
Particle Size	20-5 mm

Sample No.		1	2	Average
Wt in Saturated Surface Dry (g)	A	901.3	838.8	
Wt in Air of Oven Dry Sample (g)	B	900.8	837.7	
Wt of Sample in Water (g)	C	559.0	522.1	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.632	2.645	2.638
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.633	2.648	2.641
Apparent Specific Gravity $= \frac{B}{B - C}$		2.635	2.654	2.645
Absorption % $= \frac{A - B}{B} * 100\%$		0.051	0.131	0.091

Remarks :

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Lab.Engineer Certified By

Date of Test 07-Feb-03

Job No. DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF ROCK CORES	Our Reference
A03017		CB/EPC/LAB/04DRL
Date of Report 11-Feb-03	**Specification No:** **ASTM C127**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	MB 3/depth 22.00-22.38m
Rock Type	Biotite rich gneiss
Particle Size	20-5 mm

Sample No.		1	2	Average
Wt in Saturated Surface Dry (g)	A	955.5	1,062.5	
Wt in Air of Oven Dry Sample (g)	B	955.2	1,062.1	
Wt of Sample in Water (g)	C	643.7	717.5	
Bulk Specific Gravity $= \frac{B}{A - C}$		3.064	3.079	3.071
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		3.064	3.080	3.072
Apparent Specific Gravity $= \frac{B}{B - C}$		3.066	3.082	3.074
Absorption % $= \frac{A - B}{B} * 100\%$		0.031	0.038	0.035
Remarks :				

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Lab.Engineer Certified By

Date of Test 07-Feb-03

Job No. DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF ROCK CORES	Our Reference
A03018		CB/EPC/LAB/04DRL
Date of Report 11-Feb-03	**Specification No:** **ASTM C127**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	DT 1/depth 19.45-19.85m
Rock Type	Calk-gneiss
Particle Size	25-3 mm

Sample No.		1	2	Average
Wt in Saturated Surface Dry (g)	A	940.7	621.5	
Wt in Air of Oven Dry Sample (g)	B	935.5	614.9	
Wt of Sample in Water (g)	C	621.2	403.1	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.928	2.815	2.871
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.944	2.845	2.895
Apparent Specific Gravity $= \frac{B}{B - C}$		2.976	2.903	2.939
Absorption % $= \frac{A - B}{B} * 100\%$		0.556	1.073	0.815

Remarks :

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Lab.Engineer Certified By

Date of Test 07-Feb-03	**Laboratory & Site Investigation Unit**
Job No. DRL/2/011	Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF ROCK CORES	Our Reference
A03019		CB/EPC/LAB/04DRL
Date of Report 11-Feb-03	**Specification No:** **ASTM C127**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	MT 3/depth 14.31-14.76m
Rock Type	Garnet rich biotite gneiss
Particle Size	25-4 mm

Sample No.		1	2	Average
Wt in Saturated Surface Dry (g)	A	960.2	784.7	
Wt in Air of Oven Dry Sample (g)	B	959.8	784.1	
Wt of Sample in Water (g)	C	616.5	508.0	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.793	2.834	2.813
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.794	2.836	2.815
Apparent Specific Gravity $= \frac{B}{B - C}$		2.796	2.840	2.818
Absorption % $= \frac{A - B}{B} * 100\%$		0.042	0.077	0.059
Remarks :				

MGC	SR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Lab.Engineer Certified By

Date of Test 07-Feb-03

Job No. DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF ROCK CORES	Our Reference
A03020		CB/EPC/LAB/04DRL
Date of Report 11-Feb-03	**Specification No:** **ASTM C127**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	MT 2/depth 32.56-33.00m
Rock Type	Quartzite
Particle Size	22-5 mm

Sample No.		1	2	Average
Wt in Saturated Surface Dry (g)	A	787.4	774.6	
Wt in Air of Oven Dry Sample (g)	B	787.1	774.1	
Wt of Sample in Water (g)	C	489.4	477.6	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.642	2.606	2.624
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.643	2.608	2.625
Apparent Specific Gravity $= \frac{B}{B - C}$		2.644	2.611	2.628
Absorption % $= \frac{A - B}{B} * 100\%$		0.038	0.065	0.051

Remarks :

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Lab.Engineer Certified By

Date of Test 07-Feb-03

Job No. DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF ROCK CORES	Our Reference
A03021		CB/EPC/LAB/04DRL
Date of Report 11-Feb-03	**Specification No:** **ASTM C127**	

PROJECT : **Broadlands Hydropower Project**

Location of the Sample	MT 1/depth 34.93-35.35m
Rock Type	Quartz rich feldspathic gneiss
Particle Size	25-5 mm

Sample No.		1	2	Average
Wt in Saturated Surface Dry (g)	A	854.8	765.0	
Wt in Air of Oven Dry Sample (g)	B	849.5	758.7	
Wt of Sample in Water (g)	C	523.4	473.2	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.563	2.600	2.581
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.579	2.621	2.600
Apparent Specific Gravity $= \frac{B}{B - C}$		2.605	2.657	2.631
Absorption % $= \frac{A - B}{B} * 100\%$		0.624	0.830	0.727
Remarks :				

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Lab.Engineer Certified By

Date of Test 07-Feb-03

Job No. DRL/2/011

ENGINEERS & ARCHITECTS ceeb

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Code	COMPRESSION TEST ON ROCK SAMPLES	Our Reference
A030010-15		CB/EPC/LAB/04DRL
Date of Report		
3-Feb-2003		

PROJECT : **Broadlands Hydropower Project**

GEOLOGICAL NAME OF ROCK SAMPLE	BORE HOLE NO. & DEPTH (m)	DIAMETER (mm)				LENGTH OF SAMPLE (mm)				WEIGHT OF SAMPLE (g)	LOAD AT FAILURE (kN)	UNCONFINED COMPRESSIVE STRENGTH (N/mm2)
		1	2	3	MEAN	1	2	3	MEAN			
Charnokitic gneiss	MB1/24.49-24.68 (S.No.2)	49.8	49.8	49.8	49.8	108.5	108.5	109.1	108.7	560.99	128.00	65.66
Biotite rich gneiss	MB3/22.00-22.15 (S.No.2)	54.5	54.5	54.6	54.5	98.6	98.6	98.8	98.7	718.2	90.00	38.52
Calk-gneiss	DT1/19.68-19.85 (S.No.2)	49.5	49.5	49.5	49.5	111.5	111.4	111.3	111.4	616.03	25.00	12.99
Garnet rich biotite gneiss	MT3/14.58-14.76 (S.No.1)	49.6	49.6	49.7	49.6	112.8	112.8	112.9	112.8	629.7	33.00	17.05
Quartzite	MT2/32.86-33.00 (S.No.2)	49.5	49.4	49.5	49.5	109.7	109.1	109.9	109.6	551.05	68.00	35.37
Quartz rich feldspathic gneiss	MT1/35.08-35.25 (S.No.2)	54.5	54.5	54.5	54.5	110.9	110.9	111.1	111.0	690.9	154.00	65.99

MGC	TSR	RMKRB
Lab.Assistant Tested By	Lab.Technician Checked By	Lab. Engineer Certified By

Date of Test	
29-Jan-2003	
Job Ref: DRL/2/011	

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No. 11, Jawatta Road,Colombo 5,
Sri Lanka.

	DETERMINATION OF ULTRASONIC PULSE VELOCITY OF ROCK CORE SAMPLES	Our Reference CB/EPC/LAB/04DRL
Date of Report 23-Jan-2003	Specification No: ASTM D 2845-1983	

PROJECT : **Broadlands Hydropower Project**

Serial No.	1	2	3	4	5	6
Bore hole No.	MB1	MB3	DT1	MT3	MT2	MT1
Depth of extraction	24.49-24.68	22.00-22.15	19.68-19.85	14.58-14.76	32.86-33.00	35.08-35.25
Length as received (mm)	108	98	110	112	108	110
Weight as received (g)	559.33	716.02	616.48	627.80	549.62	688.88
Oven dry weight (g)	559.03	715.75	613.31	627.59	549.12	688.29
Observed diameter (mm)	50	55	49	50	50	55
Density (kg/m^3)	2648	3103	2914	2886	2621	2685
Pulse travel time observed (μs)	15.8	16.2	49.5	22.7	26.3	42.1
Pulse velocity (km/s)	6.8	6.0	2.2	4.9	4.1	2.6
Water content (%) (% oven dry basis)	0.05	0.04	0.51	0.03	0.09	0.09

Tested at : National Building Research Organisation
Colombo-05, Sri Lanka.

Engineer
Certified By

Job No.
DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05.
Sri Lanka.

	SOUNDNESS TEST OF COARSE AGGREGATES	Our Reference CB/EPC/LAB/04DRL
Date 30-Jan-2003	**Specification No:** **ASTM C88**	

PROJECT : **Broadlands Hydropower Project**

Sample No.	1

Weight of Sample Passing 9.5mm and Retained on 4.75mm	(g)	322.00
Weight of Sample Retained on 4.75mm after test	(g)	310.02
Weight loss after test	(g)	11.98
Soundness of Rock Sample (Loss in Weight)	(%)	3.72

Solution Used Sodium Sulphate

No. of Cycles 5

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Engineer
Certified By

Job No.
DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

	SOUNDNESS TEST OF COARSE AGGREGATES	Our Reference CB/EPC/LAB/04DRL
Date 30/Jan/2003	**Specification No:** **ASTM C88**	

PROJECT : **Broadlands Hydropower Project**

Sample No.	2

Weight of Sample Passing 19.1mm and Retained on 12.5mm	(g)	998.00
Weight of Sample Retained on 12.5mm after test	(g)	916.41
Weight loss after test	(g)	81.59
Soundness of Rock Sample (Loss in Weight)	(%)	8.18

Solution Used Sodium Sulphate

No. of Cycles 5

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Engineer
Certified By

Job No.
DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

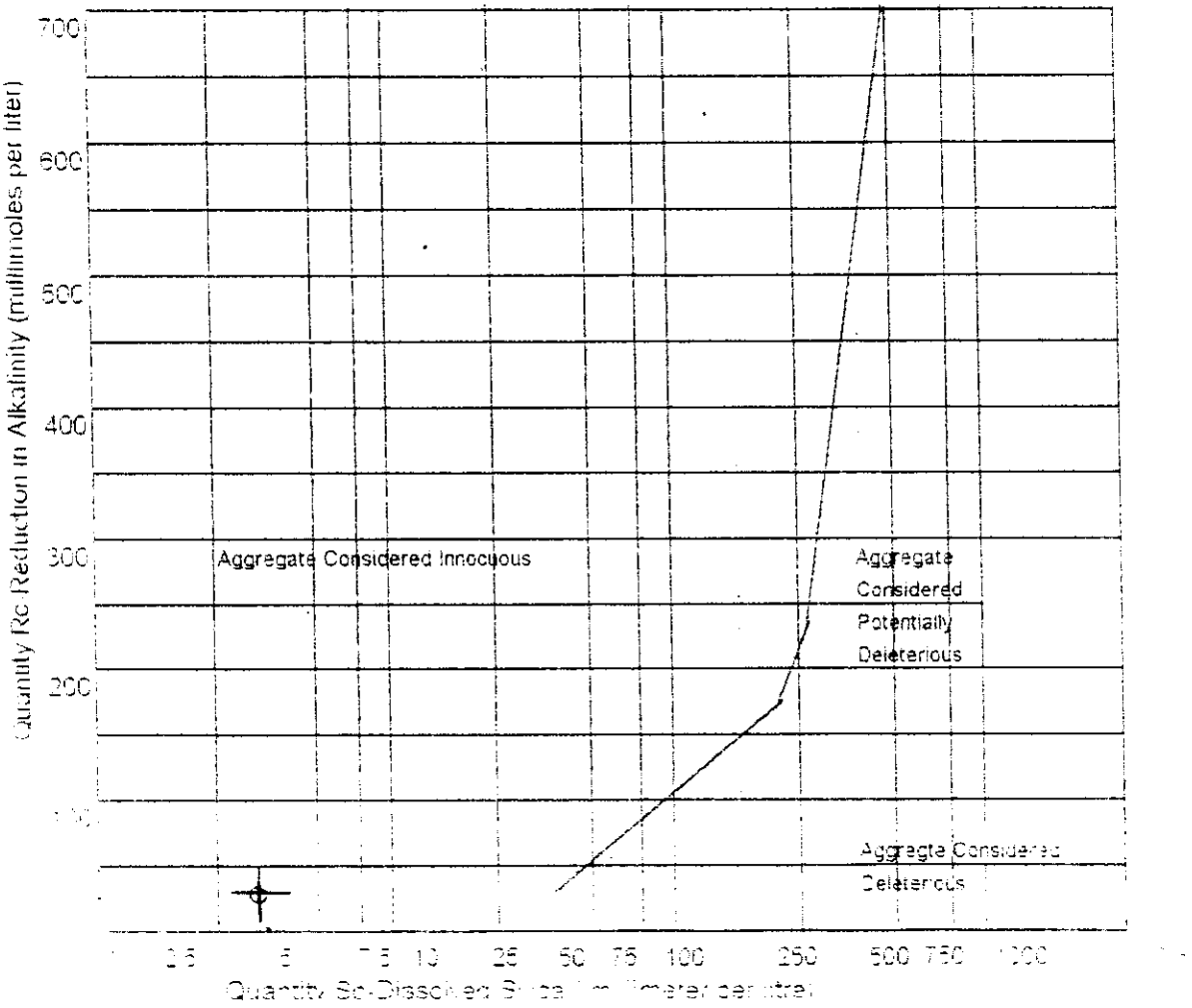
	POTENTIAL ALKALI-SILICA REACTIVITY OF AGGREGATES (CHEMICAL METHOD)	Our Reference CB/EPC/LAB/04DRL
Date 9-Feb-2003	Specification No: ASTM C-289	

PROJECT : **Broadlands Hydropower Project**

Type of Sample	Sample No.01 (Rock Core)

Scope This test method covers chemical determination of the potential reactivity of an aggregate with alkalies in portland cement concrete as indicated by the amount of reation during 24h at 80C between 1N Sodium Hydroxide solution and aggregate that has been crushed and sieved to pass a 300mm sieve and be retained on a 150mm sieve

Quantity of Dissolved Silica (Sc)	3.53	mmol/L
Quantity of Reduction in Alkalinity(Rc)	30.00	mmol/L



Engineer
Certified By

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Job No.
DRL/2/011

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
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No 11, Jawatta Road, Colombo 05.
Sri Lanka.

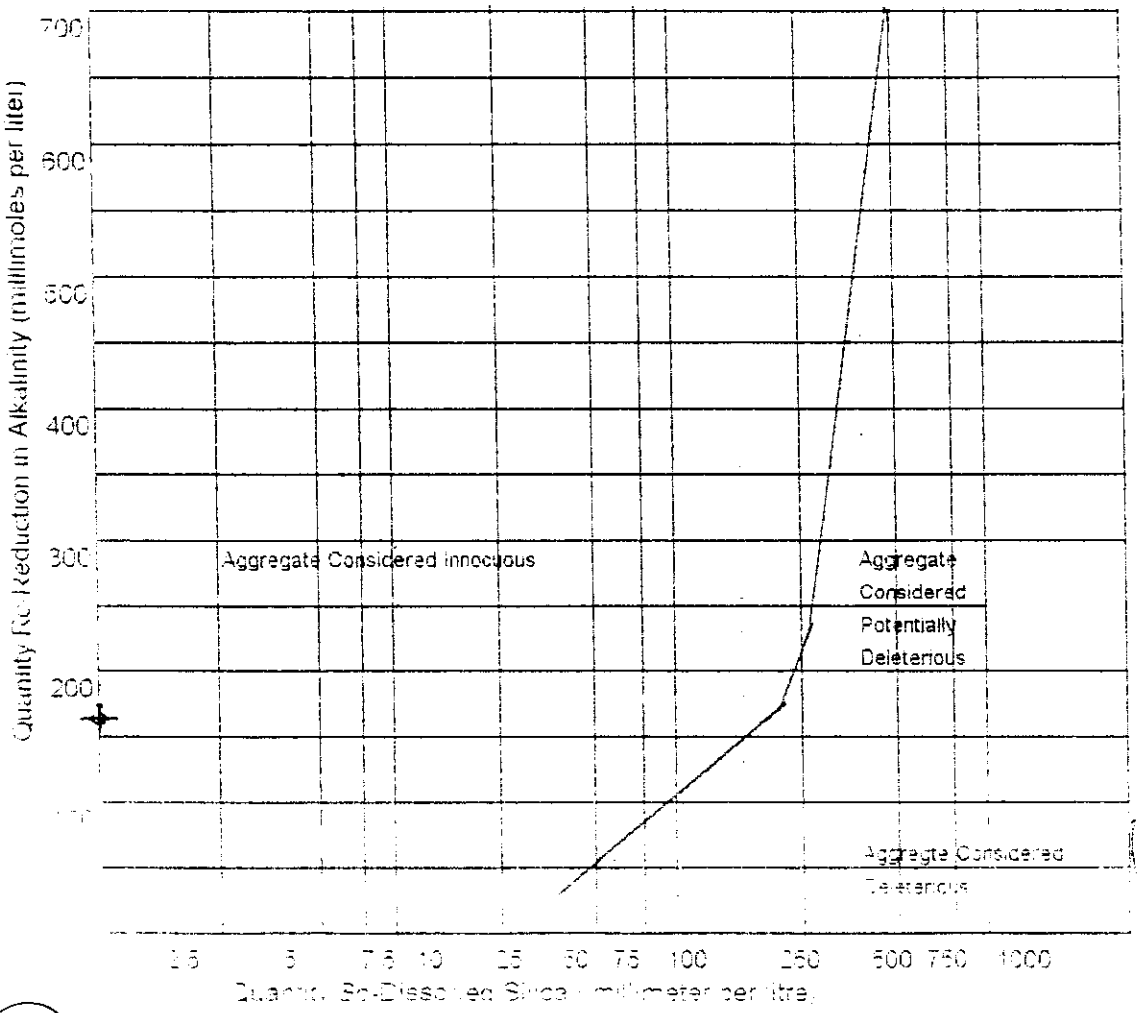
	POTENTIAL ALKALI-SILICA REACTIVITY OF AGGREGATES (CHEMICAL METHOD)	Our Reference CB/EPC/LAB/04DRL
Date 9-Feb-2003	Specification No: ASTM C-289	

PROJECT : **Broadlands Hydropower Project**

Type of Sample	Sample No.02 (Rock Core)

Scope This test method covers chemical determination of the potential reactivity of an aggregate with alkalies in portland cement concrete as indicated by the amount of reation during 24h at 80C between 1N Sodium Hydroxide solution and aggregate that has been crushed and sieved to pass a 300mm sieve and be retained on a 150mm sieve

Quantity of Dissolved Silica (Sc)	0.71	mmol/L
Quantity of Reduction in Alkalinity(Rc)	165.00	mmol/L



Engineer
Certified By

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Job No.
DRL/2/011

ENGINEERS & ARCHITECTS ceeb

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05.
Sri Lanka.

Fig 12 : Soundness by Sodium Sulphate - Test in Progress

Fig 13 : Clay Lumps and Friable Particles- Test in Progress

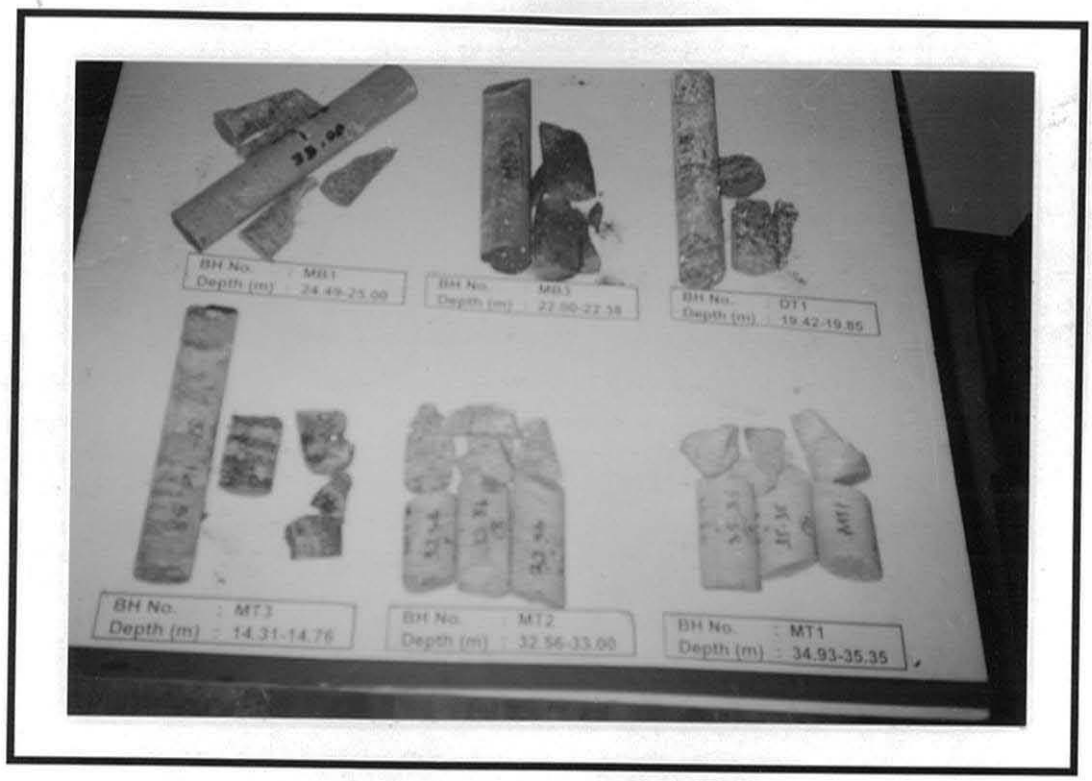


Fig 14 : Rock Core Samples Selected for Testing of Water Absorption and Specific Gravity , Unconfined Compressive Strength and Ultra Sonic Wave Velocity

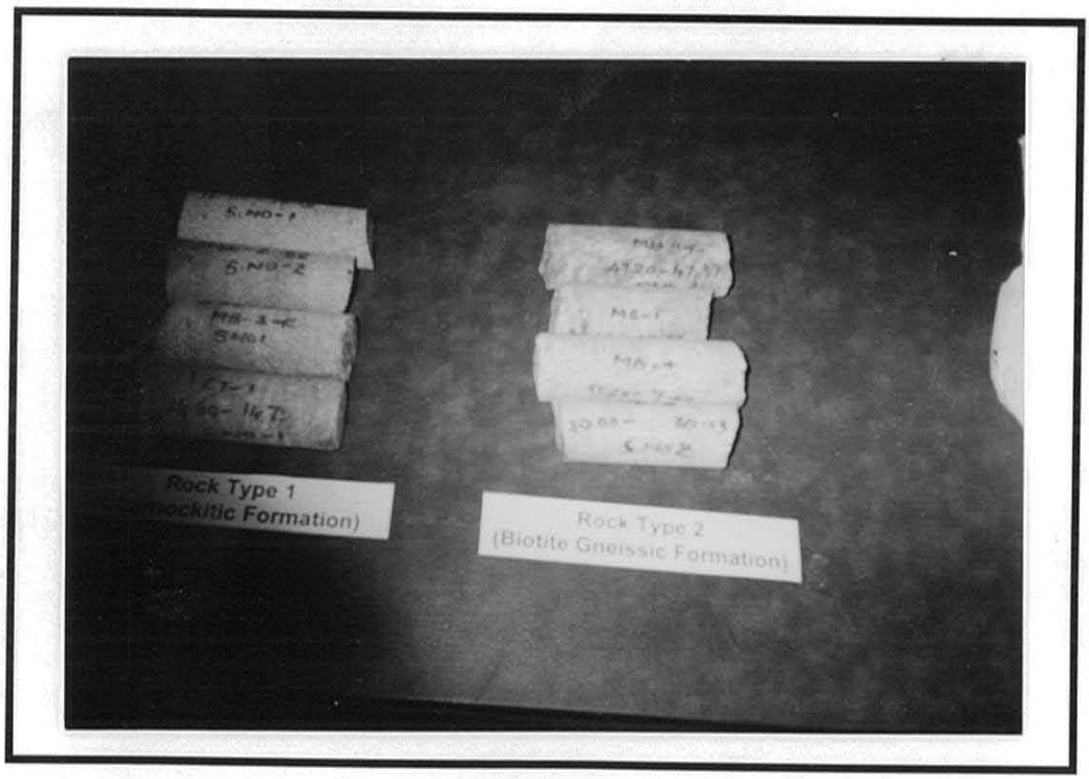


Fig 15 : : Rock Core Samples Selected for Testing of Soundness by Sodium Sulphate and Chemical (Alkali) Reactivity

Our Ref: CB/EPC/LAB/04C

TEST CERTIFICATE NO: DRL/AT/2003386

Issued By :	Laboratory & Site Investigation Unit Engineering Procurement Construction Division CECB, No.11, Jawatte Road, Colombo 05.
Assured To :	Jica Study Team Electric Power Development Co., Ltd Nippon Koel Co., Ltd.
Project :	Broadlands Hydropower Project-Phase II
Job Requested :	Testing of Aggregates & Rock samples from Broadlands Hydropower Project.
Job Ref :	DRL/3/007

Tested for : 1) Concrete Aggregates (from test pit samples)

1.1) Sieve Analysis of Aggregates
1.2) Specific gravity and water absorption (Fine)
1.3) Specific gravity and water absorption (Coarse)
1.4) Clay lumps and friable particles in (Coarse & Fine) Aggregates
1.5) Soundness tests by sodium sulfate
1.6) Abrasion test of Coarse Aggregate by Los Angeles machine
1.7) Chemical (Alkali) reactivity test

2.) Rock (from drilling core samples)

2.1) Water absorption and bulk specific gravity
2.2) Unconfined compressive Strength of Rock Cores
2.3) Ultra-sonic wave velocity
2.4) Soundness tests by sodium sulfate
2.5) Chemical (Alkali) reactivity test
2.6) Abrasion test of Coarse Aggregate by Los Angeles machine

Results: As tabulated in pages 02-07.

Results:

1.1) *Results of **Sieve Analysis*** of Aggregates

Sample Description	Φ 60% (mm)	Φ 30% (mm)	Φ 10% (mm)	C_u	C_c
TP-3	1.100	0.420	0.160	6.875	1.002
TP-4	0.190	0.081	-	-	-

1.2) *Results of **Specific Gravity and Water Absorption*** of Fine Aggregates

Sample Description	Bulk Specific Gravity	Bulk Specific Gravity (SSD* Basis)	Apparent Specific Gravity	Water Absorption (%)
TP-3(Fine Aggregates)	2.286	2.376	2.511	3.92
TP-4(Fine Aggregates)	2.144	2.320	2.602	8.20

*SSD- Saturated-Surface-Dry Basis

1.3) *Results of **Specific Gravity and Water Absorption*** of Coarse Aggregates

Sample Description	Bulk Specific Gravity	Bulk Specific Gravity (SSD* Basis)	Apparent Specific Gravity	Water Absorption (%)
TP-3(Coarse Aggregates)	2.717	2.731	2.756	0.523

*SSD- Saturated-Surface-Dry Basis

1.4) *Results of **Clay Lumps and Friable Particles*** in (Coarse & Fine) Aggregates

Sample Description	Particle Size (mm)	Percentage of Clay Lumps and Friable Particles (%)
TP-3(Coarse Aggregates)	4.75-9.5	13.71
	9.5-19.0	3.36
	19.0-38.1	3.25
	>38.1	1.72
TP-3(Fine Aggregates)	>1.18	5.84

Reported By: .....
A.J.Emmanuel / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Prajh Dias
Engineer In Charge Laboratory

.....
B.M.A.P.Mapa
Project Manager Laboratory

Date : 28-10-2003.

Results:

1.5) *Results of **Soundness** Tests by Sodium Sulphate of Aggregates*

Sample Description	Soundness of Aggregate sample (Loss in weight) %
TP-3(Coarse Aggregates)	10.1

1.6) *Results of **Loss Angeles Abrasion** Test of Aggregates*

Sample Description	Los Angeles Abrasion Value (%)	
	100 Revolutions	500 Revolutions
TP-3(Coarse Aggregates)	21.40	56.51

1.7) *Results of **Chemical (Alkali) Reactivity** Test of Aggregates*

Sample Description	Quantity of Dissolved Silica (Sc) mmol/L	Quantity of Reduction in Alkalinity (Rc) mmol/L
TP-3(Coarse Aggregates)	8.2	35.00

Reported By: .....
A.J.Emmanuel / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Virajh Dias
Engineer In Charge Laboratory

.....
B.M.A.P.Mapa
Project Manager Laboratory

Date : 28-10-2003.

Results:

2.1) *Results of **Water Absorption and Bulk Specific Gravity** of Rock Samples*

Bore Hole No.	Rock Type	Depth (m)	Bulk Specific Gravity	Bulk Specific Gravity (SSD* Basis)	Apparent Specific Gravity	Water Absorption (%)
MB-5	Charnokitic-gneiss	2.12-2.28	2.648	2.658	2.676	0.404
MB-5	Charnokitic-gneiss	2.26-3.45	2.650	2.658	2.673	0.326
MB-5	Charnokitic-gneiss	3.45-3.60	2.638	2.647	2.662	0.348
MB-5	Charnokitic-gneiss	5.00-5.59	2.658	2.667	2.681	0.334
MB-5	Quartz rich garnet biotite gneiss	22.00-22.18	2.603	2.629	2.673	1.011
MB-5	Quartz rich garnet biotite gneiss	22.18-22.32	2.607	2.633	2.678	1.023
MT-6	Quartz rich garnet biotite gneiss	39.34-39.68	2.795	2.809	2.833	0.472
MT-6	Quartz rich garnet biotite gneiss	39.48-39.68	2.684	2.697	2.719	0.474
MT-6	Quartz rich garnet biotite gneiss	39.68-39.82	2.832	2.846	2.872	0.500
MT-6	Quartz rich garnet biotite gneiss	39.40-39.98	2.690	2.702	2.724	0.461
MT-7	Biotite gneiss	46.18-46.31	3.042	3.052	3.074	0.341
MT-7	Biotite gneiss	46.31-46.41	3.064	3.071	3.087	0.242
MT-8	Biotite gneiss	56.20-56.40	2.865	2.870	2.881	0.195
MT-8	Biotite gneiss	56.40-56.60	2.661	2.667	2.676	0.208
TR-1	Biotite gneiss	10.16-10.49	2.662	2.685	2.725	0.877
TR-1	Biotite gneiss	18.38-18.83	3.058	3.080	3.125	0.705
BQ-2	Granitic gneiss	16.32-16.73	2.585	2.606	2.642	0.842
BQ-2	Granitic gneiss	18.00-18.39	2.582	2.606	2.644	0.913

*SSD- Saturated-Surface-Dry Basis

Reported By: .....
A.J.Emmanuel / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Virajh Dias
Engineer In Charge Laboratory

.....
B.M.A.P.Mapa
Project Manager Laboratory

Date : 28-10-2003.

2.2) *Results of **Unconfined compressive Strength** of Rock Cores*

Bore Hole No.	Rock Type	Depth (m)	Unconfined Compressive Strength (N/mm^2)
MB-5	Charnokitic-gneiss	5.73-5.83	92.51
MB-5	Charnokitic-gneiss	9.00-9.10	74.87
MB-5	Charnokitic-gneiss	9.52-9.62	51.81
MB-5	Charnokitic-gneiss	22.00-22.38	136.13
MT-6	Quartz rich garnet biotite gneiss	39.00-39.10	85.21
MT-6	Quartz rich garnet biotite gneiss	39.46-39.56	48.90
MT-6	Quartz rich garnet biotite gneiss	39.58-39.68	55.90
MT-6	Quartz rich garnet biotite gneiss	39.68-39.78	63.05
MT-7	Biotite gneiss	29.64-29.75	70.42
MT-7	Quartz rich biotite gneiss	46.00-46.11	93.12
MT-8	Biotite gneiss	51.43-51.54	107.30
MT-8	Quartz rich biotite gneiss	74.76-74.86	69.86
TR-1	Biotite gneiss	10.00-10.15	69.95
TR-1	Biotite gneiss	18.90-19.00	42.02
BQ-1	Quartzo feldspathic gneiss	17.10-17.24	50.93
BQ-1	Quartzo feldspathic gneiss	17.39-17.75	54.69
BQ-1	Impure quartzite	20.60-22.75	26.88
BQ-2	Granitic gneiss	22.52-22.62	10.19
BQ-2	Granitic gneiss	22.62-22.72	55.31
BQ-2	Granitic gneiss	22.90-23.00	71.79

Reported By: .....
A.J.Emmanuel / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Virajh Dias
Engineer In Charge Laboratory

.....
B.M.A.P.Mapa
Project Manager Laboratory

Date : 28-10-2003.

Results:

2.3) *Results of **Ultra-Sonic Wave Velocity** of Rock Cores*

Bore Hole No.	Depth (m)	Rock Type	Diameter (mm)	Length (mm)	Ultrasonic Pulse Velocity (km/s)
MB 5	5.73-5.83	Charnokitic-gneiss	49.80	99.92	6.891
MB 5	9.00-9.10	Charnokitic-gneiss	49.62	101.20	7.845
MB 5	9.52-9.62	Charnokitic-gneiss	49.72	101.28	7.558
MB 5	22.00-22.38	Charnokitic-gneiss	49.62	100.58	7.396
MT 6	39.00-39.10	Quartz rich garnet biotite gneiss	50.00	100.92	8.010
MT 6	39.46-39.56	Quartz rich garnet biotite gneiss	49.62	102.62	7.029
MT 6	39.58-39.68	Quartz rich garnet biotite gneiss	49.60	96.80	5.500
MT 6	39.68-39.78	Quartz rich garnet biotite gneiss	49.52	100.22	4.494
MT 7	29.64-29.75	Quartz rich biotite gneiss	54.72	111.00	6.000
MT 7	46.00-46.11	Biotite gneiss	54.40	111.80	7.260
MT 8	51.43-51.54	Biotite gneiss	54.30	111.10	7.032
MT 8	74.76-74.86	Quartz rich biotite gneiss	54.42	92.00	6.301
BQ 1	17.10-17.24	Quartzo feldspathic gneiss	54.42	114.20	6.880
BQ 1	17.39-17.50	Quartzo feldspathic gneiss	54.40	109.00	6.566
BQ 1	20.60-22.75	Impure quartzite	54.38	65.20	7.581
BQ 2	22.52-22.62	Granitic gneiss	49.80	100.20	3.976
BQ 2	22.62-22.72	Granitic gneiss	50.30	100.82	4.272
BQ 2	22.90-23.00	Granitic gneiss	49.96	101.54	3.982

Reported By: .....
A.J.Emmanuel / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

Certified By .....
A.A.Virajh Dias
Engineer In Charge Laboratory

.....
B.M.A.P.Mapa
Project Manager Laboratory

Date : 28-10-2003.

Results:

2.4) *Results of **Soundness Tests by Sodium Sulphate** of Rock Samples*

Bore Hole No.	Rock Type	Soundness of Rock sample (Loss in weight) %
BQ-2	Granitic gneiss	0.4

2.5) *Results of **Chemical (Alkali) Reactivity** Test of Rock Samples*

Bore Hole No.	Rock Type	Quantity of Dissolved Silica (Sc) mmol/L	Quantity of Reduction in Alkalinity (Rc) mmol/L
BQ-2	Granitic gneiss	2.57	26.00

2.6) *Results of **Loss Angeles Abrasion** Test of Aggregates*

Bore Hole No.	Rock Type	Los Angeles Abrasion Value (%)	
		100 Revolutions	500 Revolutions
BQ-2	Granitic gneiss	12.21	48.04

Reported By: .....
A.J.Emmanuel / Laboratory Engineer

Checked By: .....
S.S.I.Kodagoda / Coordinator - Testing and Analysis

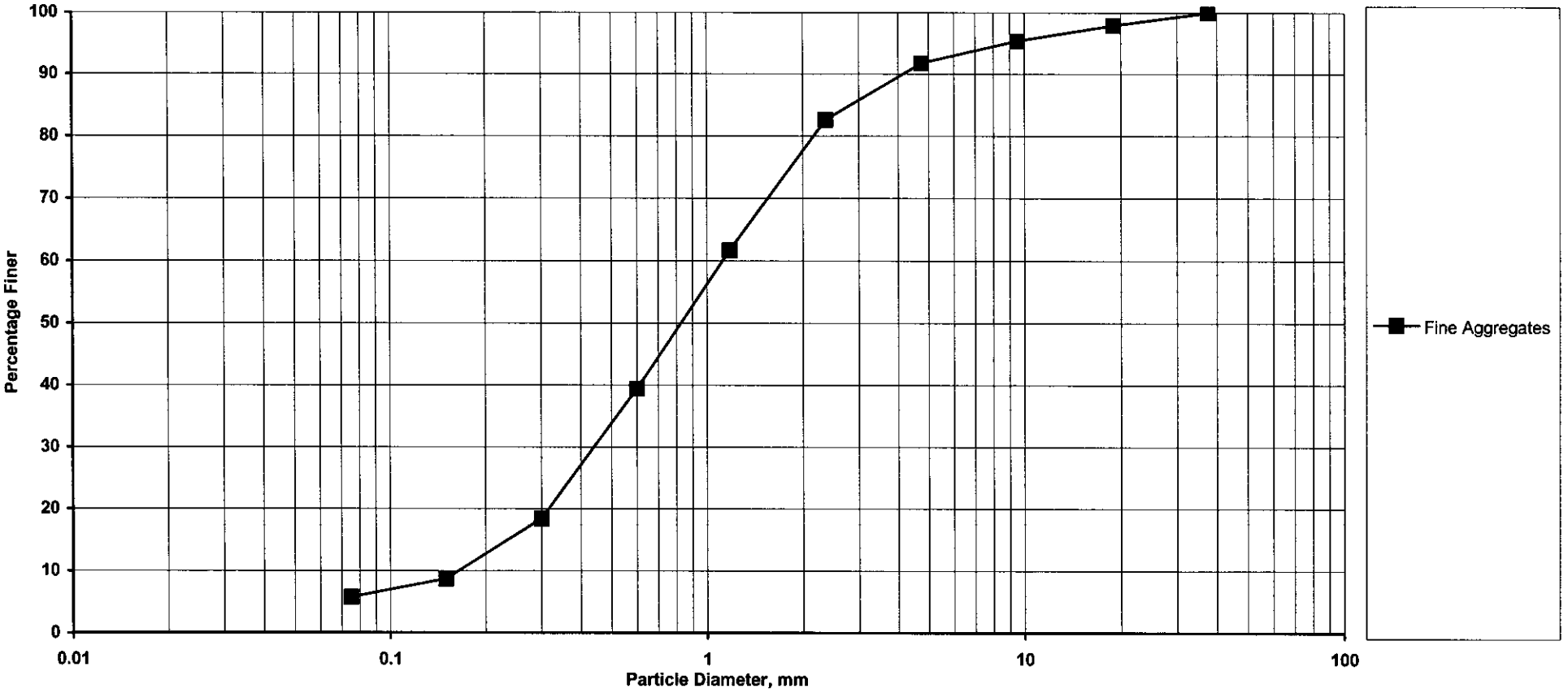
Certified By .....
A.A.Virajh Dias
Engineer In Charge Laboratory

.....
B.M.A.P.Mapa
Project Manager Laboratory

Date : 28-10-2003.

Particle Size Analysis Data (sieve analysis)- Fine Aggregates

TP-3			
Sieve size mm	Mass Retained g	% Retained	% Passing
37.5	0.00	0.00	100.00
19	33.82	2.07	97.93
9.5	41.14	2.52	95.41
4.75	59.34	3.63	91.77
2.36	149.33	9.15	82.63
1.18	341.74	20.93	61.69
0.6	362.99	22.24	39.46
0.3	343.42	21.04	18.42
0.15	158.75	9.72	8.70
0.075	47.67	2.92	5.78
Pan	94.30	5.78	
Sample Weight	1632.5		



PROJECT : **Broadlands Hydropower Project-Phase II**

PARTICLE SIZE DISTRIBUTION CURVE
BY **SIEVE ANALYSIS**

Sample	Plot	Source	Results					Date of Test	Test Code
			ϕ 60%	ϕ 30%	ϕ 10%	C_U	C_C		
A030074	■	TP-3	1.100	0.420	0.160	6.875	1.002	17/10/2003	DRL/3/007

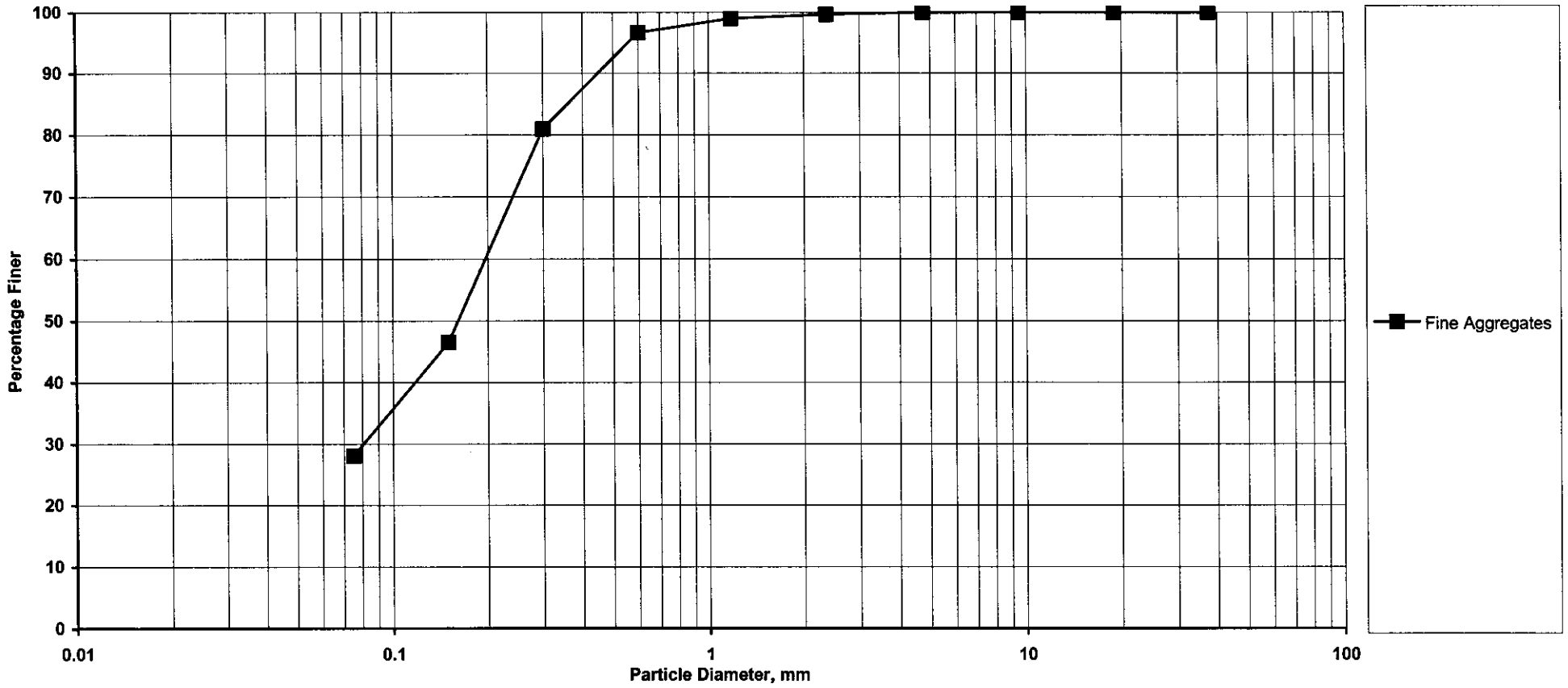
MGC	TSR	AJE	Specifications
Lab.Assistant	Lab. Technician	Lab.Engineer	BS 882 : Part 2: 1973
Tested By	Checked By	Certified By	

ENGINEERS & ARCHITECTS cecb

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11, Jawatta Road ,Colombo 05,
Sri Lanka.

Particle Size Analysis Data (sieve analysis)- Fine Aggregates

TP-4			
Sieve size mm	Mass Retained g	% Retained	% Passing
37.5	0.00	0.00	100.00
19	0.00	0.00	100.00
9.5	0.00	0.00	100.00
4.75	0.00	0.00	100.00
2.36	3.88	0.32	99.68
1.18	8.22	0.69	98.99
0.6	27.83	2.32	96.67
0.3	187.81	15.68	80.99
0.15	412.02	34.40	46.58
0.075	221.50	18.49	28.09
Pan	336.44	28.09	
Sample Weight	1197.7		



PROJECT : Broadlands Hydropower Project-Phase II								PARTICLE SIZE DISTRIBUTION CURVE BY SIEVE ANALYSIS	
			Results						
Sample	Plot	Source	ϕ 60%	ϕ 30%	ϕ 10%	C_U	C_C	Date of Test	Test Code
A030075	■	TP-4	0.190	0.081	-	-	-	17/10/2003	DRL/3/007

MGC	TSR	AJE	Specifications	ENGINEERS & ARCHITECTS ceeb	Laboratory & Site Investigation Unit
Lab.Assistant Tested By	Lab. Technician Checked By	Lab.Engineer Certified By	BS 882 : Part 2: 1973		Engineering Procurement Construction Division CENTRAL ENGINEERING CONSULTANCY BUREAU No11, Jawatta Road ,Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF FINE AGGREGATES	Our Reference
A030074		CB/EPC/LAB/04DRL
Date of Report 27-Oct-03	**Specification No:** **ASTM C128**	

PROJECT : **Broadlands Hydropower Project-Phase II**

Location of the Sample	TP-3(Fine Aggregates)
Date of Test	16-Oct-03

Sample No.			1	2	Average
Wt. in Air of Oven Dry Sample	(g)	A	480.8	481.5	
Wt. in Air of Saturated Surface Dry Sample	(g)	D	500.0	500.0	
Wt.of Picnometer Filled with Water	(g)	B	1,806.7	1,806.7	
Wt.of Picnometer Filled with Sample & Water to Calibration Mark	(g)	C	2092.1	2,100.2	
Bulk Specific Gravity $\frac{A}{B+D-C}$			2.240	2.332	2.286
Bulk Specific Gravity (Saturated-Surface-Dry) $\frac{D}{B+D-C}$			2.330	2.421	2.376
Apparent Specific Gravity $\frac{A}{B+A-C}$			2.461	2.561	2.511
Absorption % $\frac{D-A}{A}$ '100%			3.998	3.842	3.920
Remarks :					

MGC	TSR	AJE
Lab.Assistant Tested By	Lab.Technician Checked By	Engineer Certified By

ENGINEERS & ARCHITECTS ceeb
Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11,Jawatta Road,Colombo 05,
Sri Lanka.

Sample Test Code A030075	**SPECIFIC GRAVITY & WATER ABSORPTION OF FINE AGGREGATES**	Our Reference CB/EPC/LAB/04DRL
Date of Report 27-Oct-03	**Specification No:** **ASTM C128**	

PROJECT : **Broadlands Hydropower Project-Phase II**

Location of the Sample	TP-4(Fine Aggregates)
Date of Test	16-Oct-03

Sample No.			1	2	Average
Wt. in Air of Oven Dry Sample	(g)	A	461.3	463.0	
Wt. in Air of Saturated Surface Dry Sample	(g)	D	500.0	500.0	
Wt.of Picnometer Filled with Water	(g)	B	1,806.7	1,806.7	
Wt.of Picnometer Filled with Sample & Water to Calibration Mark	(g)	C	2079.1	2,102.0	
Bulk Specific Gravity $\frac{A}{B+D-C}$			2.027	2.262	2.144
Bulk Specific Gravity (Saturated-Surface-Dry) $\frac{D}{B+D-C}$			2.197	2.443	2.320
Apparent Specific Gravity $\frac{A}{B+A-C}$			2.442	2.761	2.602
Absorption % $\frac{D-A}{A}$ '100%			8.401	7.994	8.197

Remarks :

MGC	TSR	AJE	ENGINEERS & ARCHITECTS ceb — **Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No11,Jawatta Road,Colombo 05, Sri Lanka.
Lab.Assistant Tested By	Lab.Technician Checked By	Engineer Certified By	

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030074		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	TP-3
Date of Test	26-Sep-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type				
Wt in Saturated Surface Dry (g)	A	1,297.3	1,295.6	
Wt in Air of Oven Dry Sample (g)	B	1,291.3	1,288.1	
Wt of Sample in Water (g)	C	823.8	819.8	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.727	2.707	2.717
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.740	2.723	2.731
Apparent Specific Gravity $= \frac{B}{B - C}$		2.762	2.751	2.756
Absorption % $= \frac{A - B}{B} * 100\%$		0.465	0.582	0.523

Remarks :

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Test code	CLAY LUMPS AND FRIABLE PARTICLES IN AGGREGATES (Coarse Aggregates)	Our Reference
A030074		CB/EPC/LAB/04/DRL
Date of Test 19/Oct/2003	Specification No: ASTM C 142	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location Reference of the Sample :	TP-3
Description :	Aggregates (Coarse)

Size of Particles Making Up Test Sample (mm)	Dry Weight of Test Sample (g)	Size of Sieve for Removing Residue of Clay Lumps and Friable Particles (mm)	Weight of Particles Retained on Designated Sieve (g)	Percentage of Clay Lumps & Friable Particles %
4.75-9.5	1200	2.36	1035.5	13.71
9.5-19.0	2200	4.75	2126.01	3.36
19.0-38.1	3200	4.75	3096.01	3.25
>38.1	3900	4.75	3833	1.72

MGC	TSR	AJE
Lab.Assistant Tested By	Lab.Technician Checked By	Engineer Certified By

ENGINEERS & ARCHITECTS ceeb
Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11,Jawatta Road,Colombo 05,
Sri Lanka.

Test code	CLAY LUMPS AND FRIABLE PARTICLES IN AGGREGATES (Fine Aggregates)	Our Reference
A030074		CB/EPC/LAB/04/DRL
Date of Test 19/Oct/2003	Specification No: ASTM C 142	

PROJECT : Broadlands Hydropower Project-Phase II

Location Reference of the Sample :	TP-3 (Fine Aggregates)

Size of Particles Making Up Test Sample (mm)	Dry Weight of Test Sample (g)	Size of Sieve for Removing Residue of Clay Lumps and Friable Particles (mm)	Weight of Particles Retained on Designated Sieve (g)
>1.18	50	0.85	47.08

Percentage of Clay Lumps and Friable Particles = 5.84 %

MGC	TSR	AJE
Lab.Assistant Tested By	Lab.Technician Checked By	Engineer Certified By

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No11,Jawatta Road,Colombo 05,
Sri Lanka.

	SOUNDNESS TEST OF COARSE AGGREGATES	Our Reference CB/EPC/LAB/04DRL
Date 24/Oct/2003	Specification No: ASTM C 88-90	

PROJECT : Broadlands Hydropower Project-Phase II

Type of Sample	TP 3(Coarse aggregates)

Sieve size (mm)	Grading of original sample %	Weight of test fraction before test	Percentage passing designated sieve after test	Weighted percentage loss
37.5-19.0	51.5	1502	10.0	5.2
19.0-9.5	37.4	1000	13.2	4.9

Total 10.1

Rounded off val 10
(to the nearest whole number)

Sieve Analysis

Test sieve (mm)	Mass Retained (g)	Cumulative Mass Retained (g)	Cumulative Percentage Retained	Passing Observed
37.5	150	150.0	4.11	95.89
25.0	1699	1849.0	50.70	49.30
19.0	180	2029.0	55.63	44.37
12.5	990	3019.0	82.78	17.22
9.5	374	3393.0	93.04	6.96
4.75	157	3550.0	97.34	2.66
Pan	85	3635.0	99.67	0.33

Total mass of dry sample : 3647g

Engineer
Certified By

Tested at National Building Research Organisation
Jawatte Road, Colombo 5.

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	LOS ANGELES ABRASION TEST	Our Reference
A030074		CB/EPC/LAB/04DRL
Date of Report 23/Oct/2003	**Specification No: ASTM C131/76**	

SUPPLIER: **Broadlands Hydropower Project - Phase II**

Location Reference of the Sample	TP-3
Description of sample	19mm aggregates
Type of Fraction	19.0mm-9.5mm

Passing	Retained	Weight (g)
19.0mm	12.5mm	2500
12.5mm	9.5mm	2500
No. of steel spheres used		11 nos.

ITEM	100 REVOLUTIONS	500 REVOLUTIONS
Wgt .of sample before (g)	5000.00	5000.00
Wgt. Of sample retained on 1.7mm sieve after test (g)	3930.00	2174.70
Wgt of sample passing 1.7mm sieve (g)	1070.00	2825.30
LOS ANGELES ABRASION VALUE	21.40%	56.51%

MGC	[illegible]	AJE
Lab.Assistant Tested By	Lab. Technician Checked BY	Engineer Certified BY

Date of Test 26-Sep-03		
Job Code DRL/3/007	ENGINEERS & ARCHITECTS ceeb	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No. 11, Jawatta Road,Colombo 5, Sri Lanka.

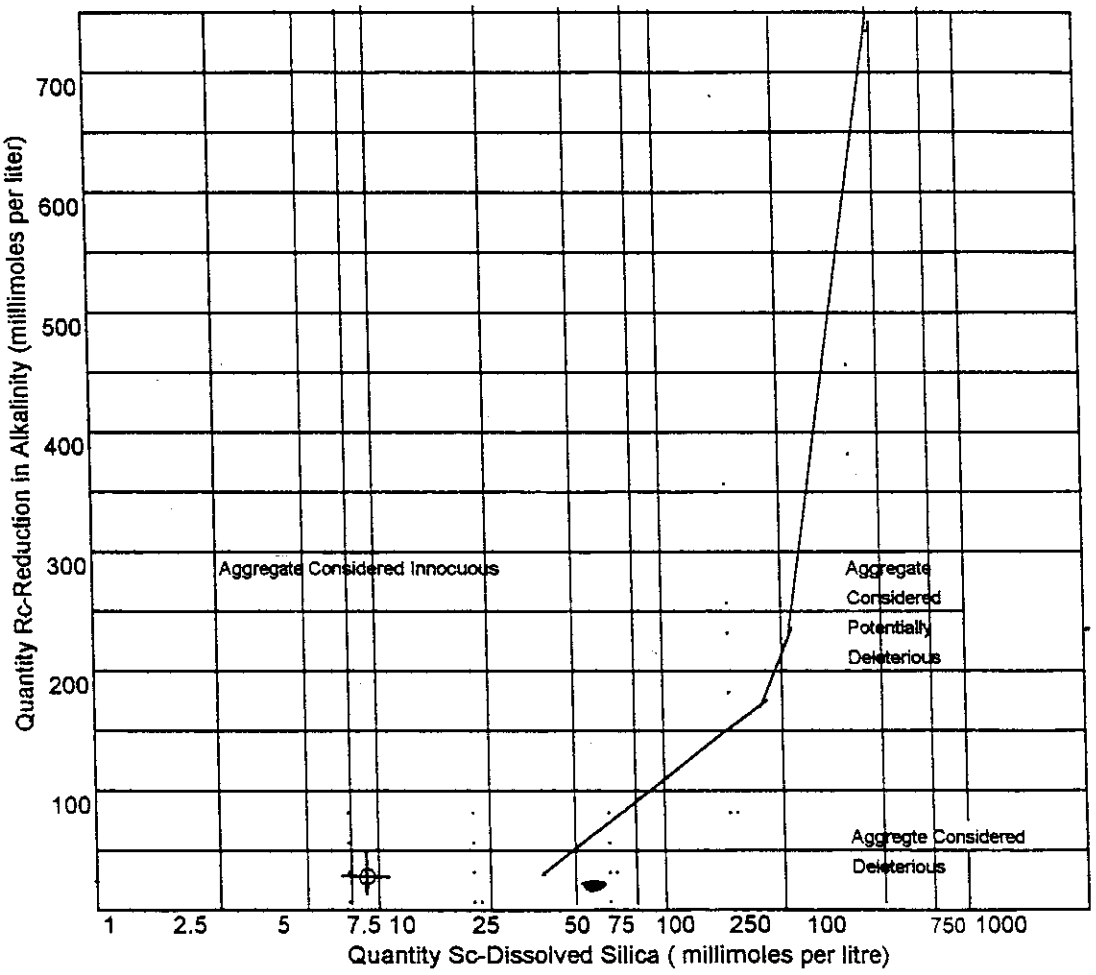
Sample Test Code	POTENTIAL ALKALI-SILICA REACTIVITY OF AGGREGATES (CHEMICAL METHOD)	Our Reference
A030074		CB/EPC/LAB/04DRL
Date 24/Oct/2003	**Specification No:** ASTM C-289	

PROJECT : **Broadlands Hydropower Project-Phase II**

Type of Sample	TP 3(<50mm size Coarse aggregate)

Scope This test method covers chemical determination of the potential reactivity of an aggregate with alkalies in portland cement concrete as indicated by the amount of reaction during 24h at 80C between 1N Sodium Hydroxide solution and aggregate that has been crushed and sieved to pass a 300mm sieve and be retained on a 150 mm sieve.

Quantity of Dissolved Silica (Sc)	8.2	mmol/l
Quantity of Reduction in Alkalinity(Rc)	35.00	mmol/l



Engineer
Certified By

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030078		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MB-5/depth 2.12-2.28m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Charnokitic gneiss		
Wt in Saturated Surface Dry (g)	A	359.0	311.7	
Wt in Air of Oven Dry Sample (g)	B	357.1	310.8	
Wt of Sample in Water (g)	C	224.5	194.0	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.655	2.641	2.648
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.669	2.648	2.658
Apparent Specific Gravity $= \frac{B}{B - C}$		2.693	2.660	2.676
Absorption % $= \frac{A - B}{B} * 100\%$		0.538	0.270	0.404
Remarks :				

	MGC	TSR	AJE
	Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030078		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MB-5/depth 2.26-3.45m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Charnokitic gneiss		
Wt in Saturated Surface Dry (g)	A	425.1	292.6	
Wt in Air of Oven Dry Sample (g)	B	423.7	291.6	
Wt of Sample in Water (g)	C	265.6	182.2	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.657	2.642	2.650
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.666	2.651	2.658
Apparent Specific Gravity $= \frac{B}{B - C}$		2.680	2.665	2.673
Absorption % $= \frac{A - B}{B} * 100\%$		0.323	0.329	0.326
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No. DRL/3/007	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030078		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MB-5/depth 3.45-3.60m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Charnokitic gneiss		
Wt in Saturated Surface Dry (g)	A	399.4	313.5	
Wt in Air of Oven Dry Sample (g)	B	398.3	312.2	
Wt of Sample in Water (g)	C	249.1	194.6	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.650	2.626	2.638
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.657	2.637	2.647
Apparent Specific Gravity $= \frac{B}{B - C}$		2.669	2.655	2.662
Absorption % $= \frac{A - B}{B} * 100\%$		0.274	0.423	0.348
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No. DRL/3/007	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030078		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MB-5/depth 5.00-5.59m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Charnokitic gneiss		
Wt in Saturated Surface Dry (g)	A	594.0	440.6	
Wt in Air of Oven Dry Sample (g)	B	592.0	439.2	
Wt of Sample in Water (g)	C	370.9	275.7	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.653	2.662	2.658
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.662	2.671	2.667
Apparent Specific Gravity $= \frac{B}{B - C}$		2.677	2.686	2.681
Absorption % $= \frac{A - B}{B} * 100\%$		0.338	0.330	0.334
Remarks :				

MGC	TSR	AJE
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Job No. DRL/3/007	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030078		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MB-5/depth 22.00-22.18m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Quartz rich garnet biotite gneiss		
Wt in Saturated Surface Dry (g)	A	451.9	350.7	
Wt in Air of Oven Dry Sample (g)	B	447.2	347.3	
Wt of Sample in Water (g)	C	278.8	218.2	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.584	2.621	2.603
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.611	2.647	2.629
Apparent Specific Gravity $= \frac{B}{B - C}$		2.656	2.690	2.673
Absorption % $= \frac{A - B}{B} * 100\%$		1.047	0.976	1.011
Remarks :				

MGC	TSR	AJE
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Job No. DRL/3/007	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030078		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MB-5/depth 22.18-22.32m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Quartz rich garnet biotite gneiss		
Wt in Saturated Surface Dry (g)	A	428.7	289.0	
Wt in Air of Oven Dry Sample (g)	B	424.4	286.0	
Wt of Sample in Water (g)	C	264.9	179.9	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.591	2.623	2.607
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.617	2.650	2.633
Apparent Specific Gravity $= \frac{B}{B - C}$		2.660	2.696	2.678
Absorption % $= \frac{A - B}{B} * 100\%$		1.011	1.035	1.023
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No.
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Laboratory & Site Investigation Unit
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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030079		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-6/depth 39.34-39.68m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Quartz rich garnet biotite gneiss		
Wt in Saturated Surface Dry (g)	A	343.2	332.9	
Wt in Air of Oven Dry Sample (g)	B	341.6	331.4	
Wt of Sample in Water (g)	C	220.9	214.6	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.791	2.799	2.795
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.805	2.812	2.809
Apparent Specific Gravity $= \frac{B}{B - C}$		2.829	2.836	2.833
Absorption % $= \frac{A - B}{B} * 100\%$		0.480	0.465	0.472
Remarks :				

	MGC	TSR	AJE
	Lab.Assistant Tested By	Lab. Technician & Checked By	Engineer Certified By

Job No. DRL/3/007	ENGINEERS & ARCHITECTS cecb	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030079		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-6/depth 39.48-39.68m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Quartz rich garnet biotite gneiss		
Wt in Saturated Surface Dry (g)	A	533.9	421.0	
Wt in Air of Oven Dry Sample (g)	B	531.5	418.9	
Wt of Sample in Water (g)	C	336.1	264.7	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.688	2.681	2.684
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.700	2.694	2.697
Apparent Specific Gravity $= \frac{B}{B - C}$		2.721	2.717	2.719
Absorption % $= \frac{A - B}{B} * 100\%$		0.452	0.497	0.474
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No.
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Laboratory & Site Investigation Unit
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No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030079		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-6/depth 39.68-39.82m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Quartz rich garnet biotite gneiss		
Wt in Saturated Surface Dry (g)	A	488.0	525.4	
Wt in Air of Oven Dry Sample (g)	B	485.3	523.1	
Wt of Sample in Water (g)	C	311.8	345.6	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.754	2.909	2.832
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.769	2.922	2.846
Apparent Specific Gravity $= \frac{B}{B - C}$		2.796	2.948	2.872
Absorption % $= \frac{A - B}{B} * 100\%$		0.550	0.449	0.500
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

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Laboratory & Site Investigation Unit
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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030079		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-6/depth 39.40-39.98m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Quartz rich garnet biotite gneiss		
Wt in Saturated Surface Dry (g)	A	691.7	514.8	
Wt in Air of Oven Dry Sample (g)	B	688.7	512.3	
Wt of Sample in Water (g)	C	435.5	324.5	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.688	2.691	2.690
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.700	2.705	2.702
Apparent Specific Gravity $= \frac{B}{B - C}$		2.720	2.727	2.724
Absorption % $= \frac{A - B}{B} * 100\%$		0.430	0.492	0.461
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

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Laboratory & Site Investigation Unit
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Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030080		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-7/depth 46.18-46.31m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Biotite gneiss		
Wt in Saturated Surface Dry (g)	A	541.2	397.1	
Wt in Air of Oven Dry Sample (g)	B	539.1	395.9	
Wt of Sample in Water (g)	C	363.7	267.1	
Bulk Specific Gravity $= \frac{B}{A - C}$		3.038	3.046	3.042
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		3.050	3.055	3.052
Apparent Specific Gravity $= \frac{B}{B - C}$		3.074	3.074	3.074
Absorption % $= \frac{A - B}{B} * 100\%$		0.378	0.303	0.341
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No.	
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Laboratory & Site Investigation Unit
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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030080		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-7/depth 46.31-46.41m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Biotite gneiss		
Wt in Saturated Surface Dry (g)	A	482.1	405.5	
Wt in Air of Oven Dry Sample (g)	B	481.2	404.3	
Wt of Sample in Water (g)	C	324.9	273.7	
Bulk Specific Gravity $= \frac{B}{A - C}$		3.059	3.068	3.064
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		3.065	3.077	3.071
Apparent Specific Gravity $= \frac{B}{B - C}$		3.078	3.095	3.087
Absorption % $= \frac{A - B}{B} * 100\%$		0.202	0.282	0.242
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

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Laboratory & Site Investigation Unit
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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030081		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-8/depth 56.20-56.40m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type	Biotite gneiss			
Wt in Saturated Surface Dry (g)	A	663.6	462.0	
Wt in Air of Oven Dry Sample (g)	B	662.6	460.9	
Wt of Sample in Water (g)	C	435.0	299.2	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.899	2.831	2.865
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.903	2.838	2.870
Apparent Specific Gravity $= \frac{B}{B - C}$		2.911	2.851	2.881
Absorption % $= \frac{A - B}{B} * 100\%$		0.146	0.243	0.195
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030081		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** ASTM C127-77	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	MT-8/depth 56.40-56.60m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Biotite gneiss		
Wt in Saturated Surface Dry (g)	A	686.4	382.8	
Wt in Air of Oven Dry Sample (g)	B	685.4	381.8	
Wt of Sample in Water (g)	C	429.5	239.0	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.668	2.654	2.661
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.672	2.662	2.667
Apparent Specific Gravity $= \frac{B}{B - C}$		2.679	2.674	2.676
Absorption % $= \frac{A - B}{B} * 100\%$		0.146	0.270	0.208
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030116		CB/EPC/LAB/04DRL
Date of Report 28/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	TR-1/depth 10.16-10.49m
Date of Test	23-Oct-03
Size of Aggregates	20mm

Sample No.		1
Rock Type		Biotite gneiss
Wt in Saturated Surface Dry (g)	A	829.7
Wt in Air of Oven Dry Sample (g)	B	822.5
Wt of Sample in Water (g)	C	520.7
Bulk Specific Gravity $= \frac{B}{A - C}$		2.662
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.685
Apparent Specific Gravity $= \frac{B}{B - C}$		2.725
Absorption % $= \frac{A - B}{B} * 100\%$		0.877
Remarks :		

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

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Laboratory & Site Investigation Unit
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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030115		CB/EPC/LAB/04DRL
Date of Report 28/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	TR-1/depth 18.38-18.83m
Date of Test	23-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Biotite gneiss		
Wt in Saturated Surface Dry (g)	A	1,890.5	1,188.1	
Wt in Air of Oven Dry Sample (g)	B	1,877.7	1,179.5	
Wt of Sample in Water (g)	C	1,277.4	801.8	
Bulk Specific Gravity $= \frac{B}{A - C}$		3.063	3.053	3.058
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		3.084	3.076	3.080
Apparent Specific Gravity $= \frac{B}{B - C}$		3.128	3.123	3.125
Absorption % $= \frac{A - B}{B} * 100\%$		0.681	0.728	0.705
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No. DRL/3/007	**Laboratory & Site Investigation Unit** Engineering Procurement Construction Division **CENTRAL ENGINEERING CONSULTANCY BUREAU** No 11, Jawatta Road, Colombo 05, Sri Lanka.

Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030076		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	BQ-2/depth 16.32-16.73m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Granitic gneiss		
Wt in Saturated Surface Dry (g)	A	387.2	375.0	
Wt in Air of Oven Dry Sample (g)	B	383.5	372.3	
Wt of Sample in Water (g)	C	238.0	231.7	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.570	2.599	2.585
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.595	2.618	2.606
Apparent Specific Gravity $= \frac{B}{B - C}$		2.636	2.648	2.642
Absorption % $= \frac{A - B}{B} * 100\%$		0.973	0.712	0.842
Remarks :				

	MGC	TSR	AJE
	Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No.
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Sample Test Code	SPECIFIC GRAVITY & WATER ABSORPTION OF COARSE AGGREGATES	Our Reference
A030076		CB/EPC/LAB/04DRL
Date of Report 17/Oct/2003	**Specification No:** **ASTM C127-77**	

PROJECT : **Broadlands Hydropower Project - Phase II**

Location of the Sample	BQ-2/depth 18.00-18.39m
Date of Test	16-Oct-03
Size of Aggregates	20mm

Sample No.		1	2	Average
Rock Type		Granitic gneiss		
Wt in Saturated Surface Dry (g)	A	417.6	330.2	
Wt in Air of Oven Dry Sample (g)	B	413.5	327.5	
Wt of Sample in Water (g)	C	257.6	203.3	
Bulk Specific Gravity $= \frac{B}{A - C}$		2.584	2.580	2.582
Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{A}{A - C}$		2.610	2.601	2.606
Apparent Specific Gravity $= \frac{B}{B - C}$		2.652	2.637	2.644
Absorption % $= \frac{A - B}{B} * 100\%$		0.989	0.837	0.913
Remarks :				

MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked By	Engineer Certified By

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	COMPRESSION TEST ON ROCK SAMPLES (Soaked Samples)	Our Reference
A030097-0114, 117&118		CB/EPC/LAB/04DRL
Date of Test		
17-Oct-2003		

PROJECT : **Broadlands Hydropower Project - Phase II**

Geological Name of rock Sample	Bore Hole No. & Depth (m)	Diameter (mm)				Length of Sample (mm)				Weight of Sample Before Soaked (g)	Load at Faliure (kN)	Unconfined Compressive Strength (N/mm^2)
		1	2	3	MEAN	1	2	3	MEAN			
Quartzo feldspathic gneiss	BQ-1(17.10-17.24)	54.5	54.2	54.2	54.3	114.0	113.6	113.9	113.8	751.20	117.93	50.93
Quartzo feldspathic gneiss	BQ-1(17.39-17.75)	54.2	54.2	54.9	54.4	108.6	108.7	109.2	108.8	700.50	127.28	54.69
Impure quartzite	BQ-1(20.60-22.75)	54.2	54.3	54.4	54.3	65.1	65.2	65.3	65.2	417.69	62.26	26.88
Granitic gneiss	BQ-2(22.52-22.62)	49.8	49.9	50.5	50.1	99.2	99.8	99.9	99.6	504.15	20.06	10.19
Granitic gneiss	BQ-2(22.62-22.72)	50.0	50.0	50.0	50.0	101.3	101.5	102.0	101.6	508.03	108.60	55.31
Granitic gneiss	BQ-2(22.90-23.00)	49.9	49.9	49.9	49.9	101.5	101.5	101.6	101.5	513.40	140.40	71.79
Charnokitic gneiss	MB-5(5.73-5.83)	50.0	50.0	50.1	50.0	101.0	102.0	102.0	101.7	516.17	181.89	92.51
Charnokitic gneiss	MB-5(9.00-9.10)	49.8	49.8	49.9	49.8	101.0	101.0	101.5	101.2	519.30	146.03	74.87
Charnokitic gneiss	MB-5(9.52-9.62)	49.1	49.5	49.6	49.4	101.2	101.5	101.6	101.4	519.32	99.29	51.81
Charnokitic gneiss	MB-5(22.00-22.38)	49.7	49.7	49.7	49.7	99.8	101.0	101.1	100.6	512.89	264.10	136.13
Quartz rich garnet biotite gneiss	MT-6(39.46-39.56)	49.2	49.5	49.5	49.4	102.1	102.4	102.8	102.4	560.59	93.72	48.90
Quartz rich garnet biotite gneiss	MT-6(39.00-39.10)	49.2	49.8	49.9	49.6	101.1	101.1	100.6	100.9	607.00	164.87	85.21
Quartz rich garnet biotite gneiss	MT-6(39.68-39.78)	49.5	49.6	49.6	49.6	110.0	110.0	110.3	110.1	514.38	121.67	63.05
Quartz rich garnet biotite gneiss	MT-6(39.58-39.68)	49.6	49.7	49.9	49.7	96.0	96.3	96.3	96.2	499.79	108.60	55.90
Biotite gneiss	MT-7(46.00-46.11)	54.5	54.6	54.7	54.6	111.7	111.7	111.5	111.6	796.30	218.03	93.12
Quartz rich biotite gneiss	MT-7(29.64-29.75)	54.4	54.6	54.8	54.6	110.8	111.4	111.9	111.4	685.60	164.87	70.42
Biotite gneiss	MT-8(51.43-51.54)	54.4	54.6	54.6	54.5	111.0	111.0	111.0	111.0	800.70	250.61	107.30
Quartz rich biotite gneiss	MT-8(74.76-74.86)	54.4	54.5	54.6	54.5	91.1	91.5	92.0	91.5	563.71	162.98	69.86
Biotite gneiss	TR-1(10.00-10.15)	54.6	54.4	54.4	54.5	110.8	110.9	110.8	110.8	693.50	162.98	69.95
Biotite gneiss	TR-1(18.90-19.00)	54.3	54.3	54.4	54.3	111.0	111.1	111.2	111.1	785.30	97.43	42.02

MGC		AJE
Lab.Assistant Tested By	Lab.Technician Checked By	Lab. Engineer Certified By

Date of Test	ENGINEERS & ARCHITECTS ceeb	Laboratory & Site Investigation Unit Engineering Procurement Construction Division CENTRAL ENGINEERING CONSULTANCY BUREAU No. 11, Jawatta Road,Colombo 5, Sri Lanka.
20-Oct-2003		
Job No. DRL/3/007		

	DETERMINATION OF ULTRASONIC PULSE VELOCITY OF ROCK CORE SAMPLES	Our Reference CB/EPC/LAB/04DRL
Date of Report 23/Jan/2003	Specification No: ASTM D 2845-1983	

PROJECT : Broadlands Hydropower Project-Phase II

No.	Identification		Diameter (mm)	Length (mm)	Ultrasonic Pulse Velocity (km/s)
	Bore Hole No.	Depth (m)			
1	MB 5	5.73-5.83	49.80	99.92	6.891
2	MB 5	9.00-9.10	49.62	101.20	7.845
3	MB 5	9.52-9.62	49.72	101.28	7.558
4	MB 5	22.00-22.38	49.62	100.58	7.396
5	MT 6	39.00-39.10	50.00	100.92	8.010
6	MT 6	39.46-39.56	49.62	102.62	7.029
7	MT 6	39.58-39.68	49.60	96.80	5.500
8	MT 6	39.68-39.78	49.52	100.22	4.494
9	MT 7	29.64-29.75	54.72	111.00	6.000
10	MT 7	46.00-46.11	54.40	111.80	7.260
11	MT 8	51.43-51.54	54.30	111.10	7.032
12	MT 8	74.76-74.86	54.42	92.00	6.301
13	BQ 1	17.10-17.24	54.42	114.20	6.880
14	BQ 1	17.39-17.50	54.40	109.00	6.566
15	BQ 1	20.60-22.75	54.38	65.20	7.581
16	BQ 2	22.52-22.62	49.80	100.20	3.976
17	BQ 2	22.62-22.72	50.30	100.82	4.272
18	BQ 2	22.90-23.00	49.96	101.54	3.982

Tested at : University of Moratuwa
Department of Civil Engineering
Moratuwa, Sri Lanka
Ref : CE/GA/17/ST/2003/128

Engineer
Certified By

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

	SOUNDNESS TEST OF COARSE AGGREGATES	Our Reference CB/EPC/LAB/04DRL
Date 24/Oct/2003	Specification No: ASTM C 88-90	

PROJECT : Broadlands Hydropower Project-Phase II

Type of Sample	BQ 2(Coarse aggregates)

Sieve size (mm)	Grading of original sample %	Weight of test fraction before test	Percentage passing designated sieve after test	Weighted percentage loss
37.5-19.0	53.9	1500	0.10	0.1
19.0-9.5	42.9	1000	0.80	0.3

Total 0.4

Rounded off val 0
(to the nearest whole number)

Sieve Analysis

Test sieve (mm)	Mass Retained (g)	Cumulative Mass Retained (g)	Cumulative Percentage Retained	Passing Observed
37.5	-	-	-	-
25.0	1451	1451	44.67	55.33
19.0	301	1752	53.94	46.06
12.5	1017	2769	85.25	14.75
9.5	374	3143	96.77	3.23
4.75	85	3228	99.38	0.62
Pan	12	3240	99.75	0.25

Total mass of dry sample : 3248g

Engineer
Certified By

Tested at National Building Research Organisation
Jawatte Road, Colombo 5.

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

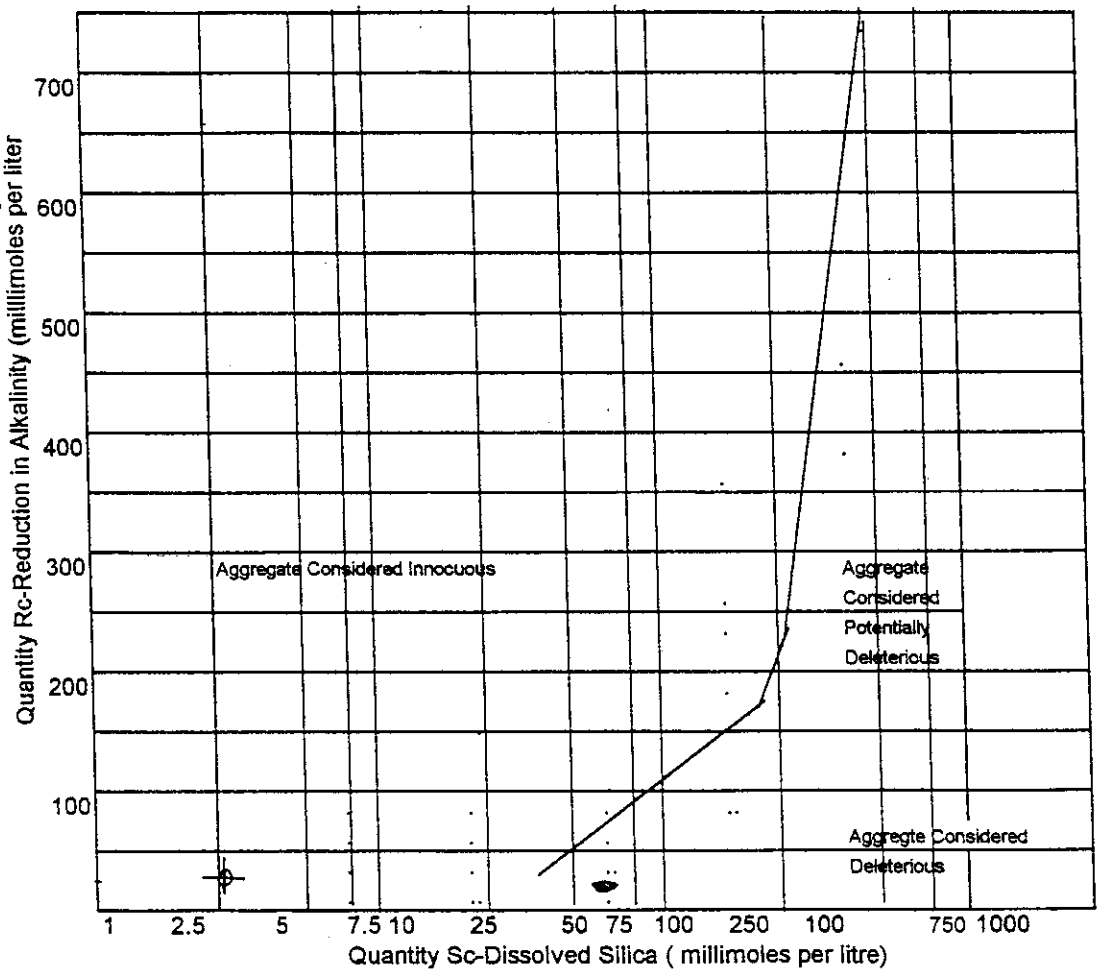
	POTENTIAL ALKALI-SILICA REACTIVITY OF AGGREGATES (CHEMICAL METHOD)	Our Reference CB/EPC/LAB/04DRL
Date 24/Oct/2003	Specification No: ASTM C-289	

PROJECT : **Broadlands Hydropower Project-Phase II**

Type of Sample	BQ 2(<50mm size Coarse aggregate)

Scope This test method covers chemical determination of the potential reactivity of an aggregate with alkalies in portland cement concrete as indicated by the amount of reaction during 24h at 80C between 1N Sodium Hydroxide solution and aggregate that has been crushed and sieved to pass a 300mm sieve and be retained on a 150 mm sieve.

Quantity of Dissolved Silica (Sc)	2.57	mmol/l
Quantity of Reduction in Alkalinity(Rc)	26.00	mmol/l



Engineer
Certified By

Tested at : Engineering & Laboratory Services (Pvt) Ltd.
Boralesgamuwa, Sri Lanka.

Job No.
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No 11, Jawatta Road, Colombo 05,
Sri Lanka.

Sample Test Code	LOS ANGELES ABRASION TEST	Our Reference
A030076		CB/EPC/LAB/04DRL
Date of Report 23/Oct/2003	**Specification No: ASTM C131/76**	

SUPPLIER: **Broadlands Hydropower Project - Phase II**

Location Reference of the Sample	BQ-2
Description of sample	19mm aggregates
Type of Fraction	19.0mm-9.5mm

Passing	Retained	Weight (g)
19.0mm	12.5mm	2500
12.5mm	9.5mm	2500
No. of steel spheres used		11 nos.

ITEM	100 REVOLUTIONS	500 REVOLUTIONS
Wgt .of sample before (g)	5000.00	5000.00
Wgt. Of sample retained on 1.7mm sieve after test (g)	4389.30	2597.80
Wgt of sample passing 1.7mm sieve (g)	610.70	2402.20
LOS ANGELES ABRASION VALUE	12.21%	48.04%

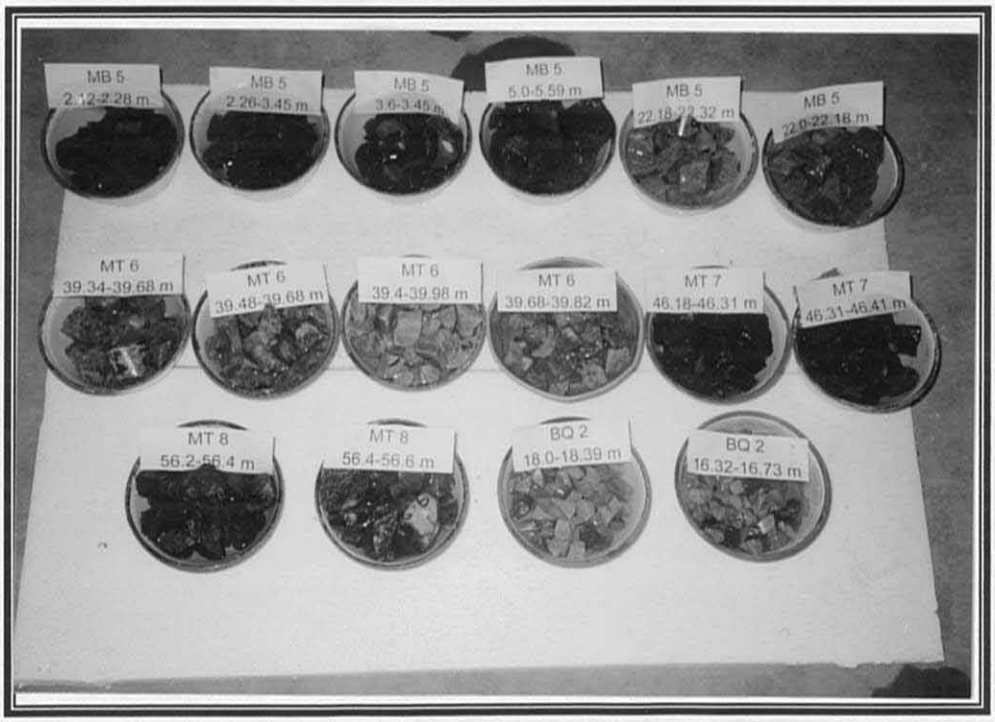
MGC	TSR	AJE
Lab.Assistant Tested By	Lab. Technician Checked BY	Engineer Certified BY

Date of Test
17-Oct-03

Job Code
DRL/3/007

Laboratory & Site Investigation Unit
Engineering Procurement Construction Division
CENTRAL ENGINEERING CONSULTANCY BUREAU
No. 11, Jawatta Road,Colombo 5,
Sri Lanka.

Photograph 7: Coarse and Fine Aggregate samples from TP4



Photograph 8: Core samples used for testing 'specific gravity and water Absorption'

Photograph 9: Core samples used for testing 'unconfined compression' and 'ultra sound wave velocity'

TEST PIT LOG

ENGINEERS & ARCHITECTS cecb

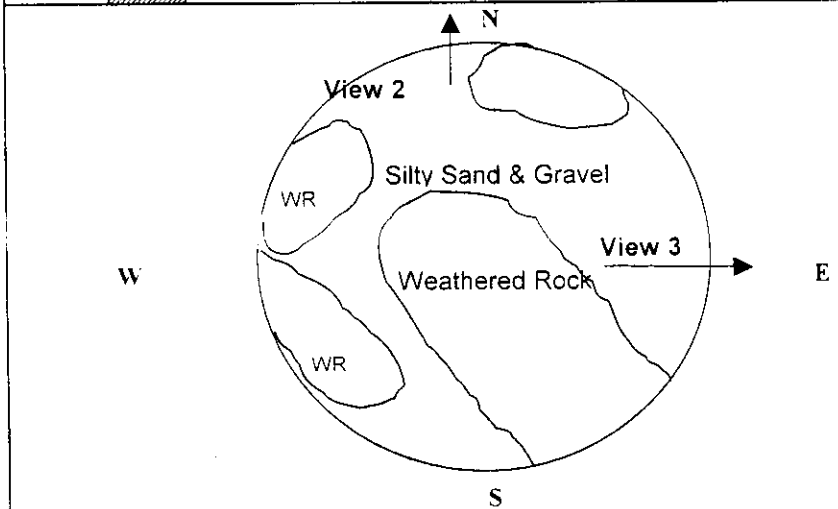
LABORATORY & SITE INVESTIGATION UNIT
CENTRAL ENGINEERING CONSULTANCY BUREAU

TEST PIT NO:	TP 1

PROJECT : **Geotechnical Investigations for the Broadlands Hydropower Project**

Location:		Coordinates:			
as given ; Kithulgala		Eastern E:	164535	Date Started:	11-Nov-02
Reduced level:		Northern N:	197920	Date Finished:	17/11/2002

Depth	Mosaic Log	Soil Profile of the Northern Direction	Description
0.55m			Relatively loose, yellowish brown and brown silty sand, sand mixture with some gravel; many roots
		WR	Moderately decomposed sub angular and rounded 0.5m to 0.75m diameter boulders with gravel. Deposits seems to be old river bed deposit.
		WR	
		WR	
1.8m			
2.1m			Moderately decomposed large boulders embedded in soil; diameter exceeds 1.2m



Photographs

Fig 1- Back ground of TP 1

Fig. 2- TP1 - View 2

Fig. 3- TP1 - View 2

Fig. 4- TP1 - View 3

Legend:		Logged by:	Checked by:
	Sand, sandy soil, silt etc.	AAVD	BMAPM
	Gravel, sandy gravel including boulders		
	Clayey sand, clay etc.		
	Highly - moderately weathered rock boulder zone	SHEET NO : 1 of 2	
	Fresh rock		

TEST PIT LOG

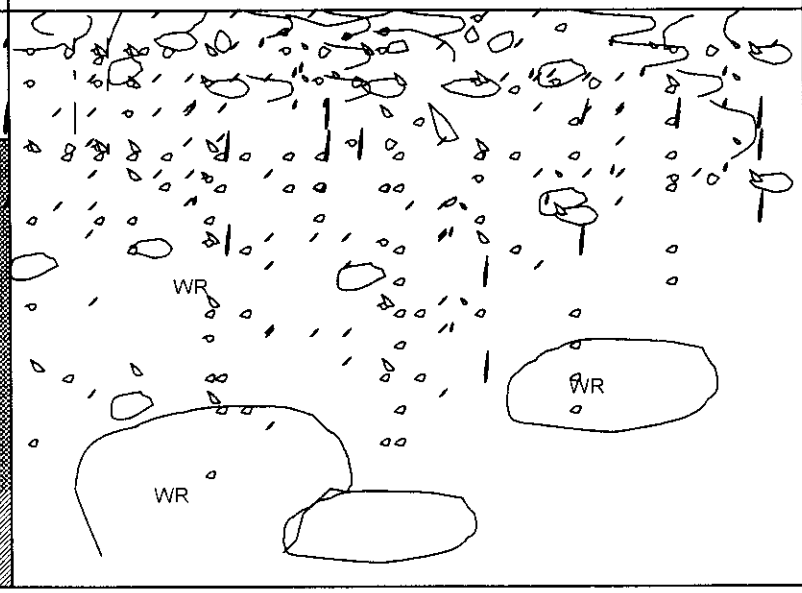
ENGINEERS & ARCHITECTS cecb

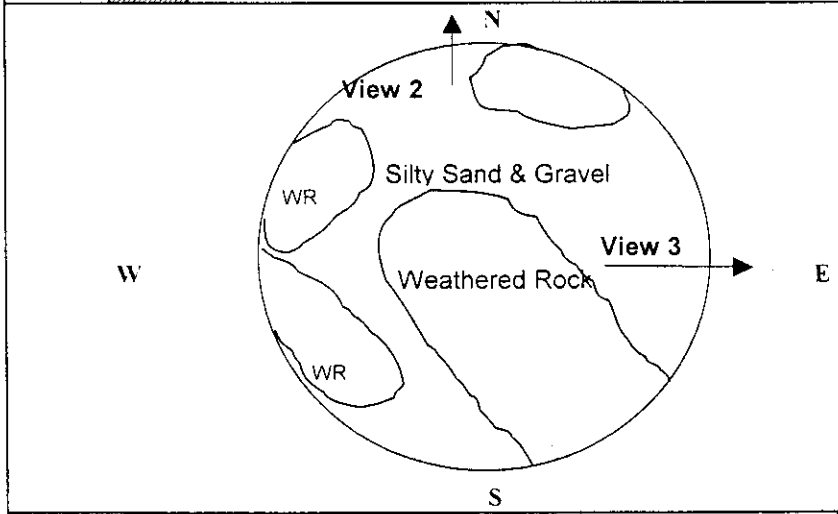
LABORATORY & SITE INVESTIGATION UNIT
CENTRAL ENGINEERING CONSULTANCY BUREAU

TEST PIT NO:	TP 1

PROJECT : **Geotechnical Investigations for the Broadlands Hydropower Project**

Location:		Coordinates:			
as given ; Kithulgala		Eastern E:	164535	Date Started:	11-Nov-02
Reduced level:		Northern N:	197920	Date Finished:	17/11/2002

Depth	Mosaic Log	Soil Profile of the Eastern Direction	Description
0.55m			Relatively loose, yellowish brown and brown silty sand, sand mixture with some gravel; many roots Moderately decomposed sub angular and rounded 0.5m to 0.75m diameter boulders with gravel. Deposits seems to be old river bed deposit.
1.8m			
2.1m			Moderately decomposed large boulders embedded in soil: diameter exceeds 1.2m



Photographs

Fig 1- Back ground of TP 1

Fig. 2- TP1 - View 2

Fig. 3- TP1 - View 2

Fig. 4- TP1 - View 3

Legend:		Logged by:	Checked by:
	Sand, sandy soil, silt etc. Gravel, sandy gravel including boulders Clayey sand, clay etc. Highly / moderately weathered rock boulder zone Fresh rock	AAVD	BMAPM
		SHEET NO : 2 of 2	

TEST PIT LOG

ENGINEERS & ARCHITECTS cecb

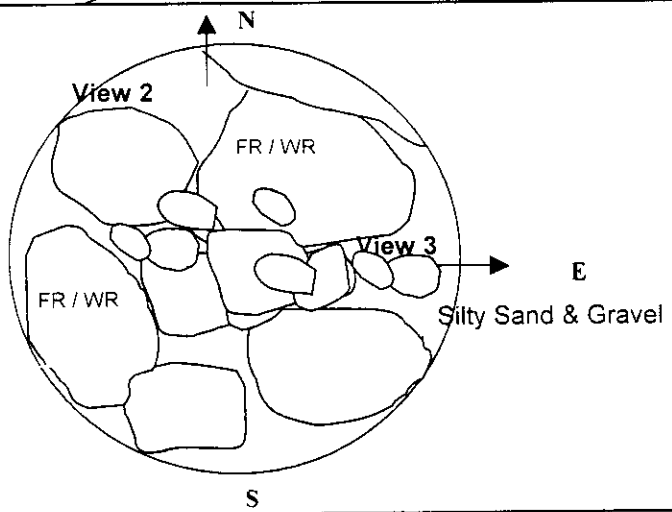
LABORATORY & SITE INVESTIGATION UNIT
CENTRAL ENGINEERING CONSULTANCY BUREAU

TEST PIT NO:	TP 2

PROJECT : **Geotechnical Investigations for the Broadlands Hydropower Project**

Location:	Coordinates:			
as given : Kithulgala	Eastern E:	164527	Date Started:	11-Nov-02
Reduced level:	Northern N:	197937	Date Finished:	17/11/2002

Depth	Mosaic Log	Soil Profile of the Northern Direction	Description
0.16m			loose, yellowish brown and brown silty sand, sand mixture with some gravel; many roots
0.46m		WR	Moderately to Fresh rock; sub angular and rounded 0.5m to 0.75m diameter boulders with gravel. Deposits seems to be old river bed deposit.
1.6m		WR	Fresh rock boulders embedded in soil; diameter exceeds 1.2m



Photographs

Fig 15- Back ground of TP 2

Fig. 6- TP2 - View 2

Fig. 7- TP2 - View 2

Fig. 8- TP2 - View 3

Legend:	
	Sand, sandy soil, silt etc.
	Gravel, sandy gravel including boulders
	Clayey sand, clay etc.
	Highly / moderately weathered rock boulder zone
	Fresh rock

Logged by:	Checked by:
AAVD	BMAPM

SHEET NO : 1 of 2

TEST PIT LOG

ENGINEERS & ARCHITECTS cecb

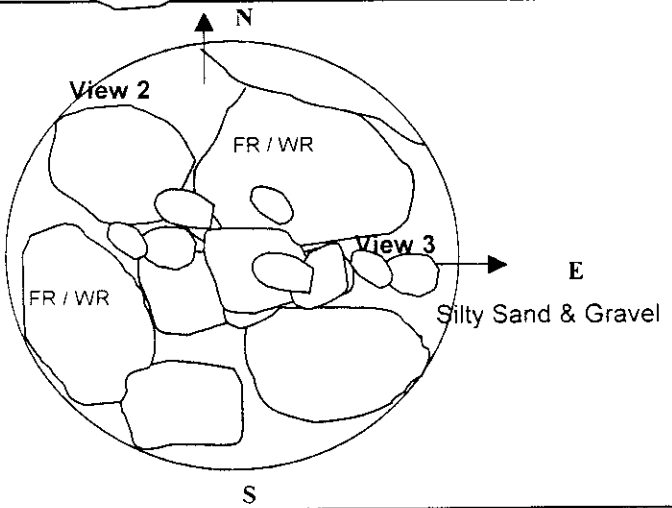
LABORATORY & SITE INVESTIGATION UNIT
CENTRAL ENGINEERING CONSULTANCY BUREAU

TEST PIT NO:	TP 2

PROJECT : **Geotechnical Investigations for the Broadlands Hydropower Project**

Location:		Coordinates:			
as given ; Kitulgala		Eastern E:	164527	Date Started:	11-Nov-02
Reduced level:		Northern N:	197937	Date Finished:	17/11/2002

Depth	Mosaic Log	Soil Profile of the Eastern Direction	Description
0.16m			loose, yellowish brown and brown silty sand, sand mixture with some gravel; many roots
0.57m			Moderately to Fresh rock; sub angular and rounded 0.5m to 0.75m diameter boulders with gravel. Deposits seems to be old river bed deposit.
1.6m		WR	Fresh rock boulders embedded in soil; diameter exceeds 1.2m



Photographs

Fig 15- Back ground of TP 2

Fig. 6- TP2 - View 2

Fig. 7- TP2 - View 2

Fig. 8- TP2 - View 3

Legend:		
		Sand, sandy soil, silt etc.
		Gravel, sandy gravel including boulders
		Clayey sand, clay etc.
		Highly / moderately weathered rock boulder zone
		Fresh rock

Logged by:	Checked by:
AAVD	BMAPM

SHEET NO : 2 of 2

TEST PIT LOG

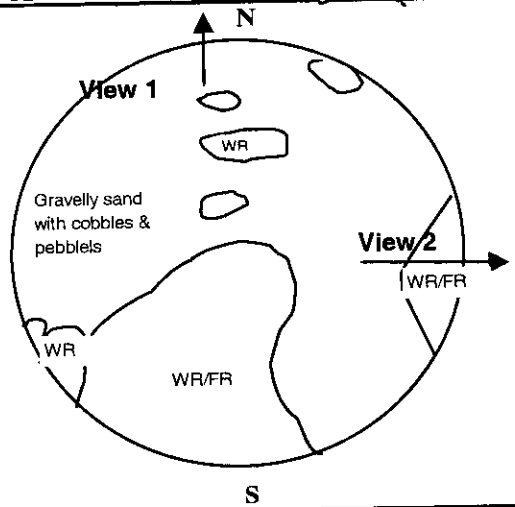
LABORATORY & SITE
INVESTIGATION UNIT
CENTRAL ENGINEERING
CONSULTANCY BUREAU

TEST PIT NO: TP 3

FEATURE / PROJECT : Geotechnical Investigations for the Broadlands Hydropower Project

Location:		Coordinates:			
as given ; Kalugala		Eastern E:	164471.608m	Date Started:	9-Sep-03
Reduced level:	105m	Northern N:	197932.447m	Date Finished:	12-Sep-03

Depth	Mosaic Log	Soil Profile of the Northern Direction	Description
0.32			Fine to medium grained yellowish brown sand (10% of coarse grains available)
0.45			Medium to coarse grained yellowish brown sand (high% of coarse grains & Quartz particles rich)
0.57			Fine to medium grained brown sand (5% of coarse grains and tree roots available)
1.01			Medium to coarse grained yellowish brown sand (high% of coarse grains & Quartz particles rich)
1.36			Fine to very coarse grained brown sand (high% of coarse grains & tree roots available)
1.50			Fine to medium grained brown sand (5% of coarse grains and tree roots available)
2.00		WR	Fine to very coarse grained brown sand with gravels, cobbles,pebbles & tree roots available.(Fresh to moderately weathered boulders embeded in soil) (Max. diameter of boulder is 30 cm& angular shaped)



Photographs

Photograph -1- Back ground of TP 3

Photograph-2 TP3 - View 1

Photograph-3 TP3 - View 2

Legend:		Logged by:	Checked by:
	Sand, sandy soil, silt etc.	RMLKR	SRMS
	Gravel, sandy gravel including boulders		
	Clayey sand, clay etc.		
	Highly / moderately weathered rock boulder zone	SHEET NO	1 of 2
	Fresh rock		

TEST PIT LOG

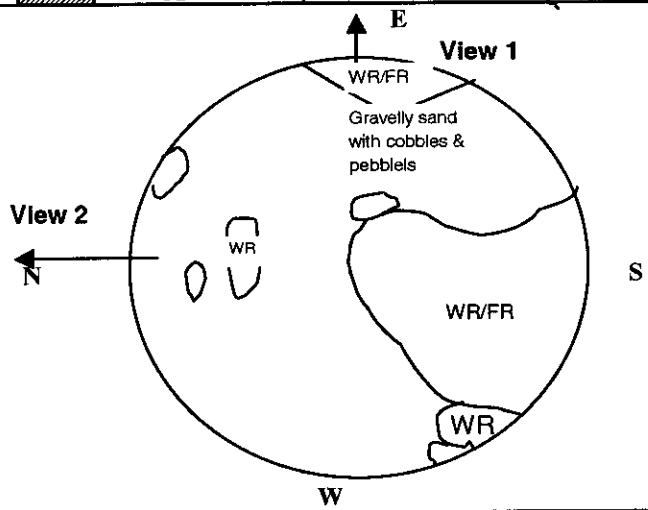
LABORATORY & SITE INVESTIGATION UNIT
CENTRAL ENGINEERING CONSULTANCY BUREAU

TEST PIT NO:	TP 3

FEATURE / PROJECT : Geotechnical Investigations for the Broadlands Hydropower Project

Location:		Coordinates:			
as given ; Kalugala		Eastern E:	164471.608m	Date Started:	9-Sep-03
Reduced level:	105m	Northern N:	197932.447m	Date Finished:	12-Sep-03

Depth	Mosaic Log	Soil Profile of the E-W Direction	Description
0.38			Fine to medium grained yellowish brown sand (10% of coarse grains available)
0.52			Medium to coarse grained yellowish brown sand (high% of coarse grains & Quartz particles rich)
1.01			Fine to medium grained brown sand (5% of coarse grains and tree roots available)
1.36			Fine to very coarse grained brown sand (high% of coarse grains & tree roots available)
1.75			Fine to medium grained brown sand (5% of coarse grains and tree roots available)
2.00		WR/FR	Fine to very coarse grained brown sand with gravels, cobbles,pebbles & tree roots available.(Fresh to moderately weathered boulders embeded in soil) (Max. diameter of boulder is 80 cm& angular shaped)



Photographs

Photograph 1- Back ground of TP 3

Photograph-3 TP3 - View 1

Photograph-2 TP3 - View 2

Legend:		Logged by:	Checked by:
Sand, sandy soil, silt etc.		RMLKR	SRMS
Gravel, sandy gravel including boulders			
Clayey sand, clay etc.			
Highly / moderately weathered rock boulder zone		SHEET N 2 of 2	
Fresh rock			

TEST PIT LOG

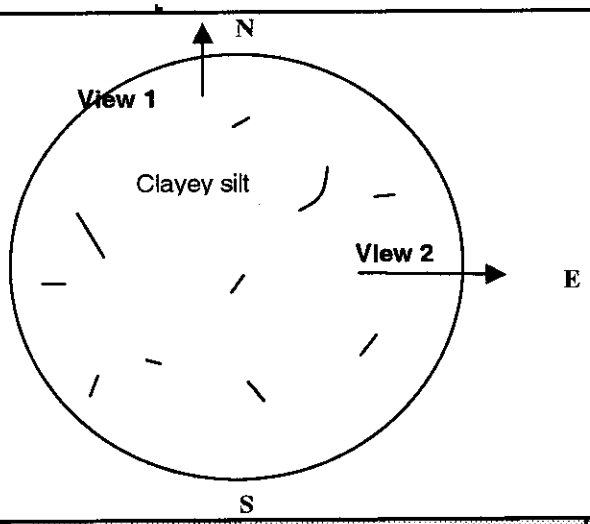
LABORATORY & SITE INVESTIGATION UNIT
CENTRAL ENGINEERING CONSULTANCY BUREAU

TEST PIT NO:	TP 4

FEATURE / PROJECT : Geotechnical Investigations for the Broadlands Hydropower Project

Location:		Coordinates:			
as given ; Kalugala		Eastern E:	164335.926m	Date Started:	9-Sep-03
Reduced level:	103m	Northern N:	198024.552m	Date Finished:	12-Sep-03

Depth	Mosaic Log	Soil Profile of the Northern Direction	Description
0.20			Fine grained,brown,clayey silty sand with some organic matters
0.48			Medium grained light brown silty sand (High % of quartz grains & tree roots avilable)
0.63			Fine to medium grained yellowish red silty sand with some tree roots
0.85			Very fine to medium grained yellowish red silty sand with some tree roots
			Fine to medium grained orange red silty sand with some tree roots
1.25			
1.50			Fine grained,brown,clayey silt with some tree roots
1.90			Fine to medium grained brown silty sand with some tree roots
2.00			Fine grained,reddish brown,clayey silt (Deposit seems to be old river deposit)



Photographs

Photograph 4- Back ground of TP 4

Photograph 5- TP4 - View 1

Photograph 6- TP4 - View 2

Legend:	
	Sand, sandy soil, silt etc.
	Gravel, sandy gravel including boulders
	Clayey sand, clay etc.
	Highly / moderately weathered rock boulder zone
	Fresh rock

Logged by:	Checked by:
RMLKR	SRMS

SHEET NO : 1 of 2

TEST PIT LOG

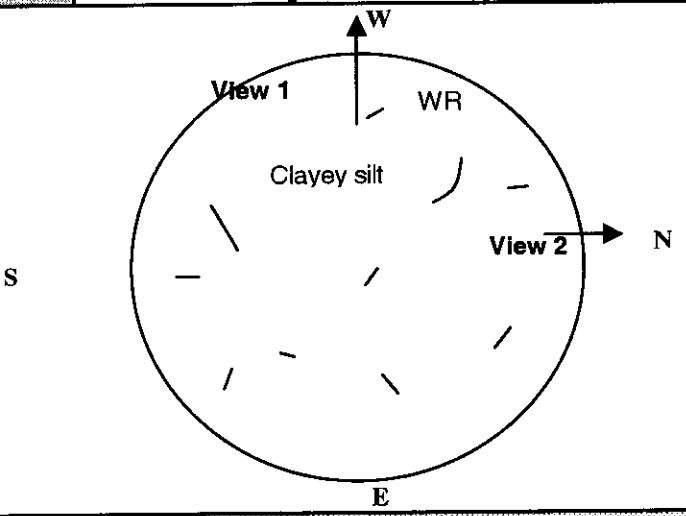
LABORATORY & SITE INVESTIGATION UNIT
CENTRAL ENGINEERING CONSULTANCY BUREAU

TEST PIT NO:	TP 4

FEATURE / PROJECT : Geotechnical Investigations for the Broadlands Hydropower Project

Location:		Coordinates:			
as given ; Kalugala		Eastern E:	164335.926m	Date Started:	9-Sep-03
Reduced level:	103m	Northern N:	198024.552m	Date Finished:	12-Sep-03

Depth	Mosaic Log	Soil Profile of the E-W Direction	Description
0.20			Fine grained,brown,clayey silty sand with some organic matters
0.49			Medium grained light brown silty sand (High % of quartz grains & tree roots avilable)
0.62			Fine to medium grained yellowish red silty sand with some tree roots
0.83			Very fine to medium grained yellowish red silty sand with some tree roots
1.23			Fine to medium grained orange red silty sand with some tree roots
1.50			Fine grained,brown,clayey silt with some tree roots
1.85			Fine to medium grained brown silty sand with some tree roots
2.00			Fine grained,reddish brown,clayey silt (Deposit seems to be old river deposit)



Photographs

Photograph 4- Back ground of TP 4

Photograph 6- TP4 - View 1

Photograph 5- TP4 - View 2

Legend:		Logged by:	Checked by:
Sand, sandy soil, silt etc		RML,KR	SRMS
Gravel, sandy gravel including boulders			
Clayey sand, clay etc.			
Highly / moderately weathered rock boulder zone		SHEET NO : 2 of 2	
Fresh rock			

Fig 01 : Back ground of TP1

Fig 02 : TP 1 – View 1

Fig 03 : TP 1 - View 2

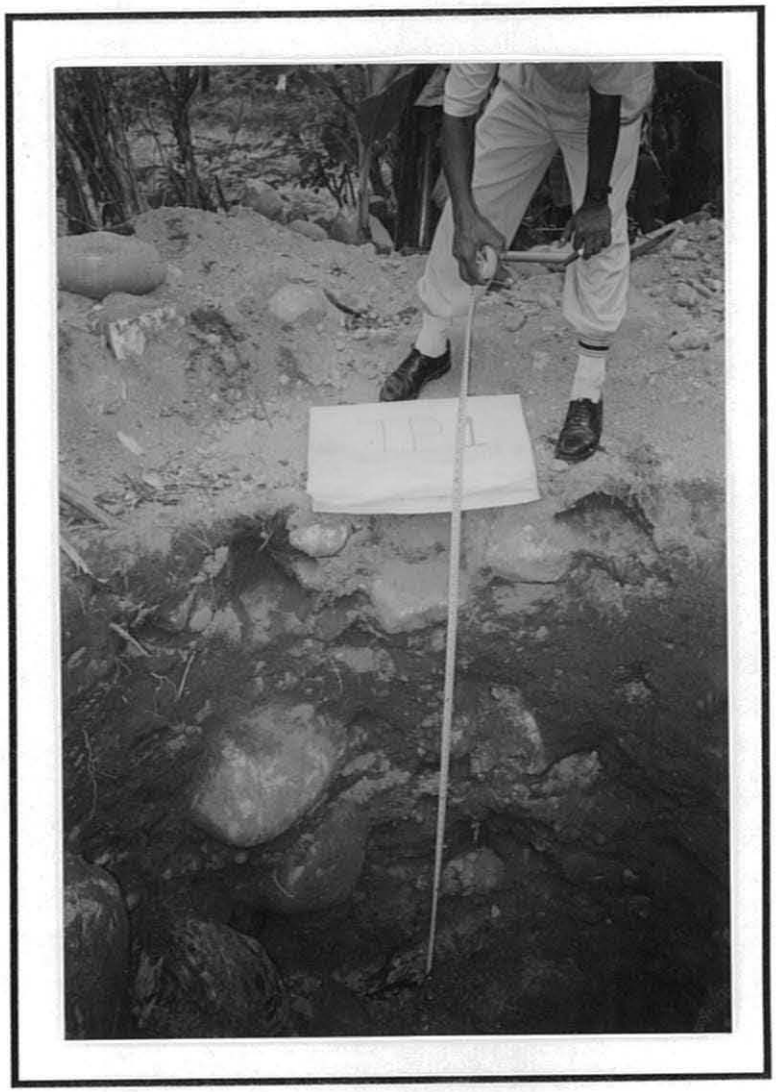


Fig 04 : TP 1 - View 3

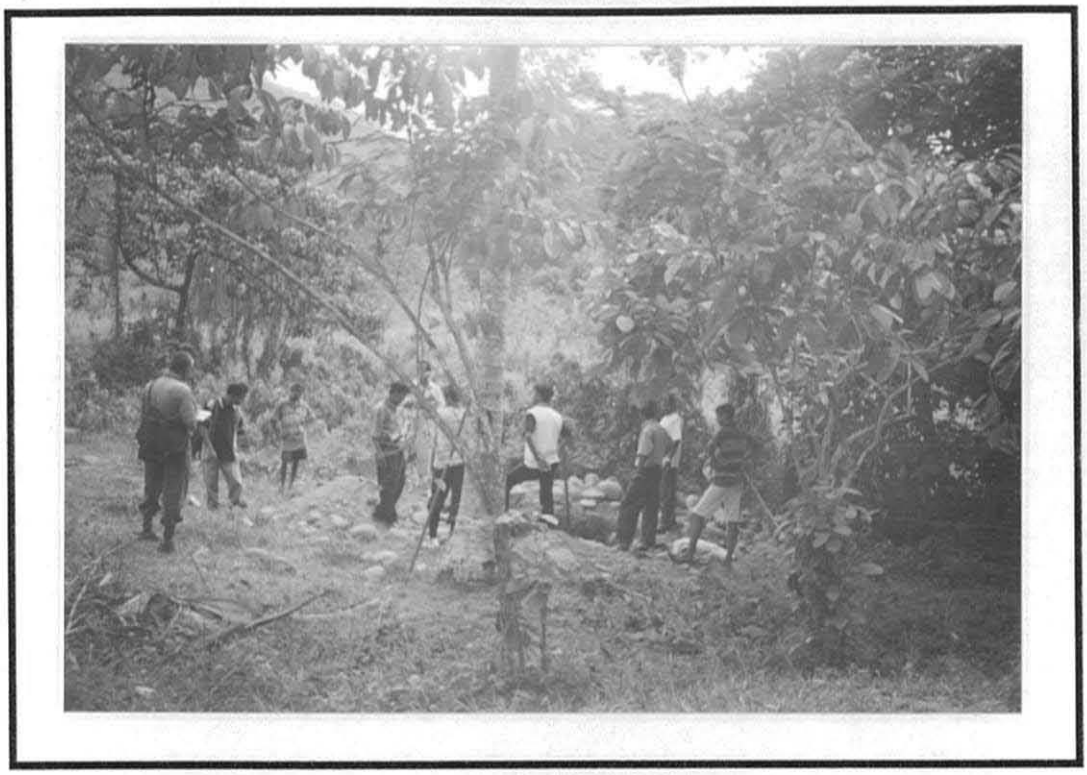


Fig 05 : Back ground of TP 2

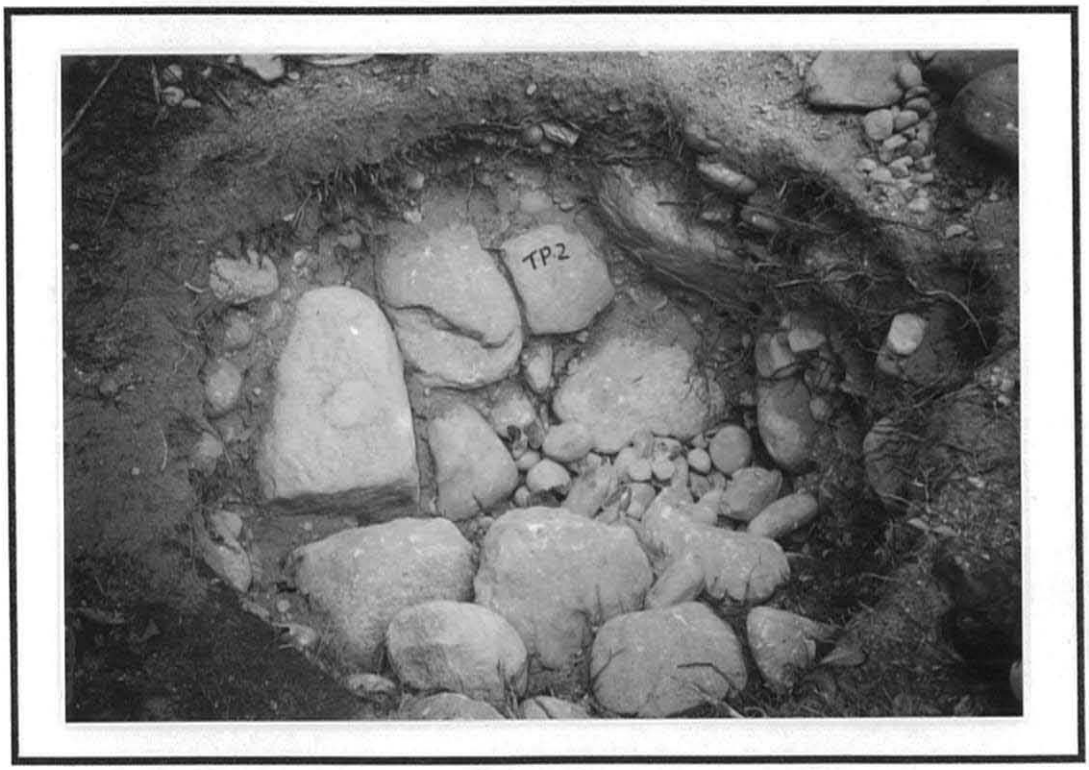


Fig 06 : TP 2 – View 2

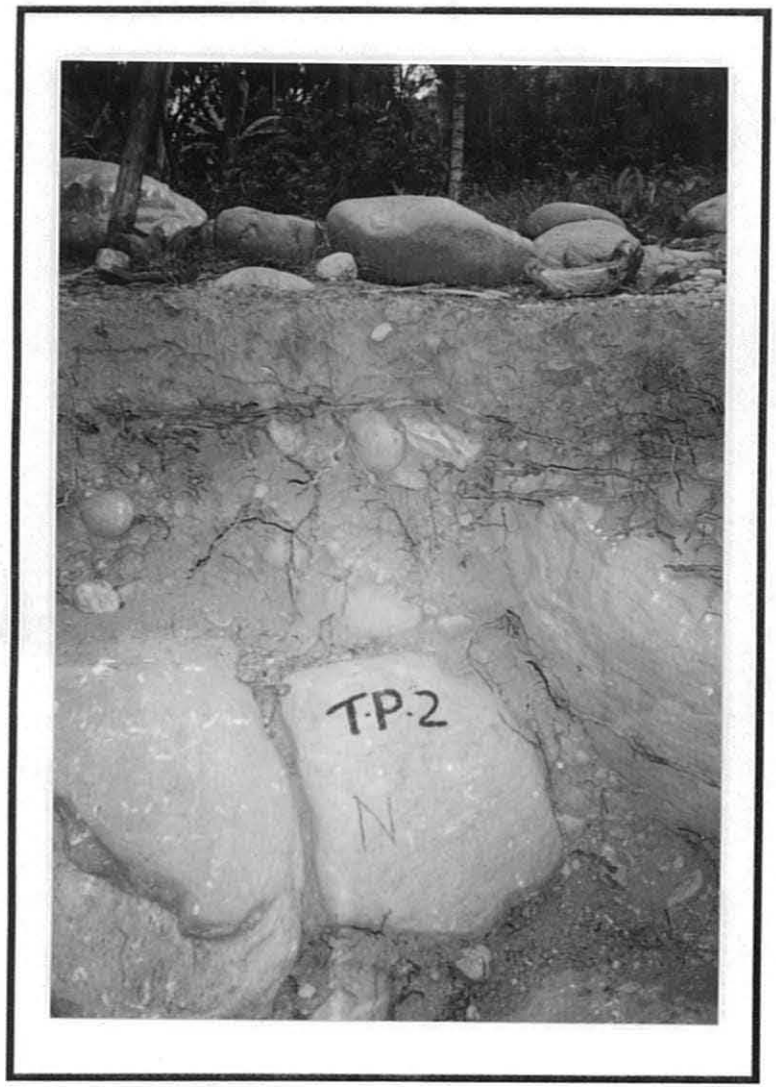


Fig 07 : TP 2 - View 2

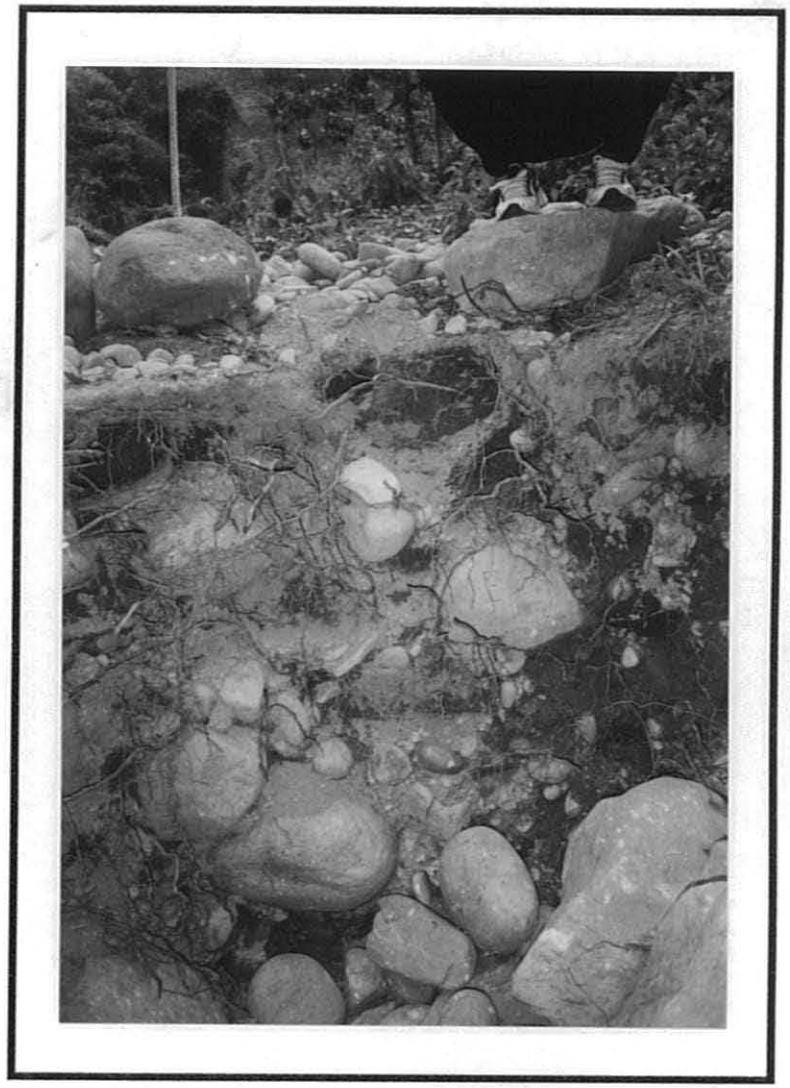


Fig 08 : TP 2 - View 3

Fig 09 : Coarse Aggregates from TP1

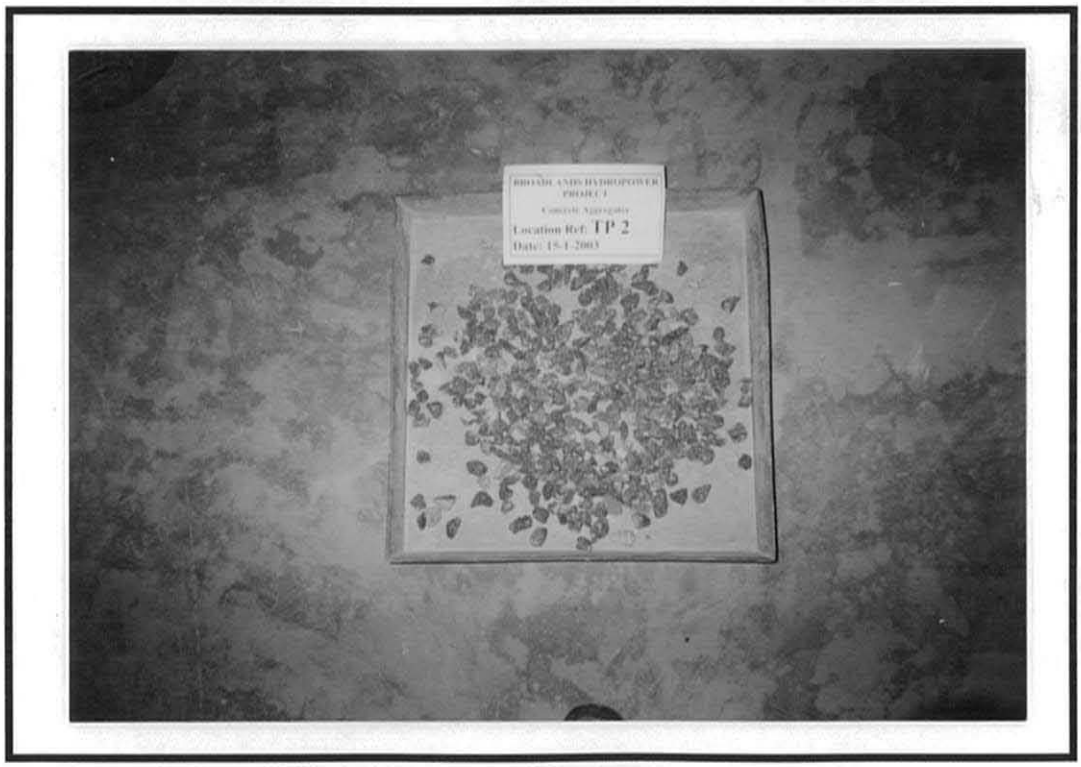


Fig 10 : Coarse Aggregates from TP2

96

Fig 11 : Collection of River Sand

17

Photograph 1: Back ground of TP3

Photograph 2: View of TP3 in N-S direction

Photograph 3: View of TP3 in E-W direction

Photograph 4: Back ground of TP4

Photograph 5: View of TP4 in N-S direction

Photograph 6: View of TP4 in E-W direction