


**Boral Construction Materials  
Materials Technical Services**

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**TEST REPORT**

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2019

TEST METHOD: i) AS1141 – Methods for Sampling and Testing Aggregates

FILE NO: 250/19

ii) RMS – Materials Test Methods Vol. 1

REQUEST NO: 85915

iii) ASTM D7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by  
Abrasion in the Micro-Deval Apparatus.

DATE TESTED: 16.9.19 to 4.10.19

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7<sup>th</sup> November 2014

Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		10.9.19	
Date Received:		11.9.19	
Laboratory Sample No:		226227	
Test Method:	Test:	Spec:	Results:
AS1141.11.1*	% Passing A.S. Sieve		
	9.5mm	100*1	
	6.7mm	-	
	4.75mm	90-100	100
	2.36mm	60-100	93
	1.18mm	30-100	77
	600 micron	15-100	55
	425 micron	-	38
	300 micron	5- 50	23
	150 micron	0- 20	4
AS1141.12	Material finer than 75 micron (%)	0- 5	1
AS1141.4	Uncompacted Bulk Density t/m <sup>3</sup>		1.62
	Compacted Bulk Density t/m <sup>3</sup>	Min. 1.2	1.71
RMS T262	Moisture Content (%)	4- 8	2.4
AS1141.5	Particle Density (Dry) t/m <sup>3</sup>	Min. 2.1	2.61
	Particle Density (SSD) t/m <sup>3</sup>		2.62
	Apparent Particle Density t/m <sup>3</sup>		2.64
	Water Absorption (%)	Max. 2.0	0.5
AS1141.24	Sodium Sulphate Soundness (Total Weighted % Loss)	Max. 6	0.4
	Fraction tested :		
	-4.75mm+2.36mm (% Loss)		1.1
	-2.36mm+1.18mm (% Loss)		0.6
	-1.18mm+600 µm (% Loss)		0.4
	-600 µm +300 µm (% Loss)		0.1

\*Sample washed over 75 micron sieve as per AS1141.11.1 Clause 5.6.

\*1 As per Fine Aggregate – Recommended Gradings (Table B2), AS2758.1

Page 1 of 2

Note: Test results relate only to the samples tested



Approved Signatory

Kamal Ali

Date

21.10.19

Serial No.

AGG85915.KA.1


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**Page 2 of 2****TEST REPORT**

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2019

TEST METHOD: i) AS1141 – Methods for Sampling and Testing Aggregates

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DATE TESTED: 16.9.19 to 4.10.19

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7<sup>th</sup> November 2014

Sample Description:			Coarse Sand
Location:			Maroota Quarry
Date Sampled:			10.9.19
Date Received:			11.9.19
Laboratory Sample No:			226227
Test Method:	Test:	Spec:	Results:
AS1141.25.3*	Degradation Factor Fine Aggregate The wash water after using permitted 500ml was:		98 Clear
AS1141.33	Silt Content (%)		3
AS1141.34	Organic impurities other than sugar The colour assessment was made visually using coloured reference glass	Not darker than std.	Lighter than Std
RMS T279	Method of Determining Voids Content % Voids The Mean Flow Time (Sec.)		41.2 21.6
ASTM D7428	Micro-Deval Abrasion Test % Loss The % loss of the control aggregate tested closest to the time at which the sample was tested = 19.5		4.8

\*At the end of 20 min. reading the height (*H*) of the upper surface of the flocculate column was not possible. Reading was performed after 40 min.

Sample submitted by client

J. Graham, QC File, File



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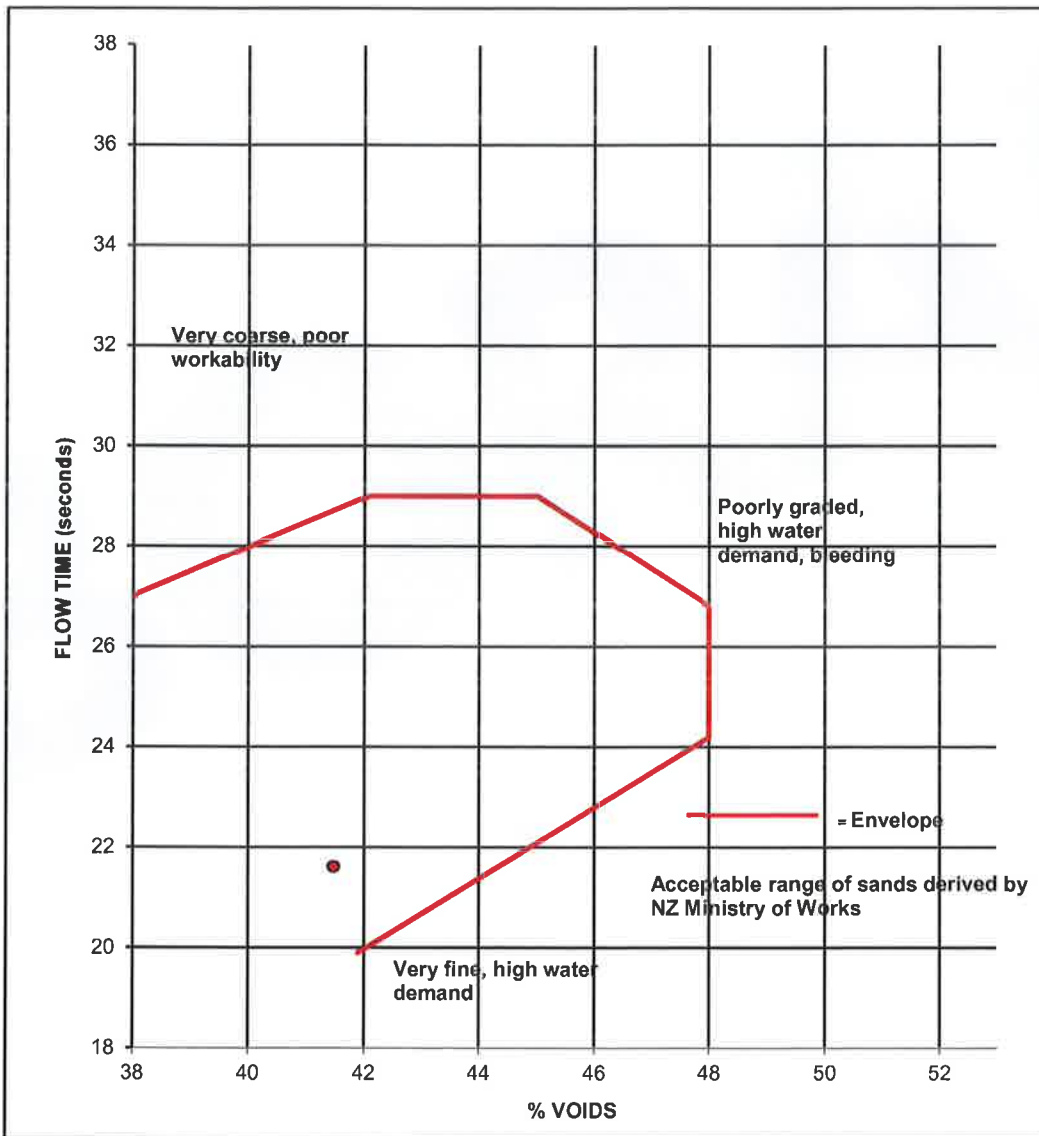
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**Method for Determining Voids Content - Flow Time**  
**RMS T279**

CLIENT: P.F. Formation  
PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2019  
LAB SAMPLE NO: 226227  
SAMPLE LOCATION: Maroota Quarry  
TEST METHOD: RMS – Materials Test Methods Vol. 1  
SAMPLE DESCRIPTION: Coarse Sand

FILE NO: 250/19  
REQUEST: 85915  
DATE SAMPLED: 10.9.18  
DATE TESTED: 27.9.19

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Sample submitted by client  
J. Graham, QC File, File

Kamal Ali   
**SECTION HEAD - AGGREGATES**  
21st October 2019



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**TEST REPORT**

CLIENT: P.F. Formation

FILE NO: 250/19

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2019

REQUEST NO: 85915

TEST PROCEDURE: TEST PROCEDURE: Texas Highway Department – Materials and Tests Division –  
TEX.402-A, Rev. Sept. 1999

Sample Description:		Coarse Sand
Location:		Maroota Quarry
Date Sampled:		10.9.19
Date Received:		11.9.19
Laboratory Sample No:		226227
<b>Test Method:</b>	<b>Test:</b>	<b>Results:</b>
TEX-402-A	Fineness Modulus of Fine Aggregate	2.48

Sample submitted by client.

  
**Kamal Ali**  
**Section Head – Aggregates**

18<sup>th</sup> October 2019

J. Graham, QC File, File



Ref: 2019 226227 Coarse Sand Maroota Sand Equivalent AS PI - AFT

Page 1 of 1

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**TEST REPORT**

CLIENT: P. F. FORMATION  
 PROJECT: Quality Control - Annual Full Test - 2019  
 MATERIAL: Coarse Sand from Maroota Quarry

FILE No: 250/19  
 REQUEST No: 85915  
 DATE RECEIVED: 11.9.19  
 DATE SAMPLED: 10.9.19  
 DATE TESTED: 26.9.19 to 30.9.19

Test Method AS1289.3.7.1	Results
Determination of the Sand Equivalent of a soil using a power-operated shaker	Field Sample No. 1 Laboratory Sample No. 226227
Sand Equivalent	92
Temperature of test solution (°C)	20

AS1289 - Soil Classification Tests	Results
Determination of the Liquid Limit, Plastic Limit and Plasticity Index	Field Sample No. 1 Laboratory Sample No. 226227
AS1289.3.1.1 - Liquid Limit (%)	N/A*
AS1289.3.2.1 - Plastic Limit (%)	N/A**
AS1289.3.3.1 - Plasticity Index (%)	NP
Sample history	OD
Preparation method	WS
Method used for moisture content determination	N/App
<p>N/A* - Test is not applicable due to continual slippage in bowl. Liquid Limit could not be obtained. NP - Non-plastic.            N/A** - Unable to roll, plastic limit could not be obtained. N/App. - Not Applicable.            Sample history:- NS = Natural state, AD = Air dried, OD = Oven dried at 50°C, UN = Unknown, AR = As received            Preparation method:- WS = Wet sieved, DS = Dry sieved, AR = As received</p>	

Note: Sample provided by client.  
 Test results relate only to the sample tested.

JOSHUA GRAHAM, Q. C. FILE, FILE.

Approved Signatory Aroon Singh Aroon SinghDate 30.9.19 Serial No. SOIL85915.AS.1ACCREDITED FOR  
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**TEST REPORT**

CLIENT: P.F. Formation  
1774 Wisemans Ferry Road Maroota NSW 2756  
PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2019.

FILE No: 250 / 19  
REQUEST No: 85915

**TEST PROCEDURE:**

- AS 1141.12 – Percent Passing 75 micron
- AS 1141.13 – Material Finer than 2 micron
- AS 1141.31 – Determination of Light Particles
- AS 1141.35 – Detection of Sugar
- AS 1141.36 – Sulfur in Metallurgical Slag, Crushed Rock or Other Pavement Materials
- RMS T659 – Methylene Blue Adsorption value of Road Construction Material
- AS 1289.4.1.1 – Organic Matter content
- AS 1289.4.3.1 – Determination of the pH value of a Soil
- RMS T123 – Determination of the pH value of a Soil
- RMS T264 – Soluble Salts in Sand

Laboratory Sample No.:	226227
Date Sampled:	10.09.19
Date Received:	11.09.19
Date Tested:	18 <sup>th</sup> September to the 1 <sup>st</sup> October 2019
Sample Description:	Coarse Sand
Field No.:	1

**TEST RESULTS:**

Percent Passing 75micron (µm) (%)	1
Material Finer than 2 micron (µm) (%)	Not Applicable
Light Particles (%)	0
Sugar	Not Detected
Sulfur as S (%)	0.02
Methylene Blue Adsorption value (mg/g)	1
Methylene Blue Adsorption value for a Duplicate (mg/g)	1
Average Methylene Blue Adsorption value (mg/g)	1
Organic Matter (%)	0.1
pH (AS)	8.2
pH (RMS)	8.2
Soluble Salts (%)	< 0.3 (Free from Soluble Salts)

Sample submitted by the Client.

Note: Test results in this test report relate only to the samples tested.

Joshua Graham, Q.C.File, Mat.File, File.



Approved Signatory:   
Date: 2-10-19 Serial No. CHEM85915.FG.1

KAMAL ALI  
FRANK GRIMA

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**TEST REPORT**

CLIENT: P.F.FORMATION  
1774 Wisemans Ferry Road,  
Maroota, NSW 2756

FILE No: 250 / 19

PROJECT: Quality Control Annual Full test of Coarse Sand ex. Maroota for  
2019.

REQUEST No: 85915

**TEST PROCEDURE:**

AS 1012.20.1 – Determination of Chloride and Sulfate in Hardened Concrete and Aggregates – Nitric Acid  
Extraction Method

AS1012.20.2 – Determination of Water-Soluble Chloride in Hardened Concrete and Concrete Aggregates

Laboratory Sample No.:	226227
Date Sampled:	10.09.19
Date Received:	11.09.19
Date Tested:	25.09.19
Sample Description:	Coarse Sand Maroota Quarry

Field No.: 1

**TEST RESULTS:**

Sulfate as SO <sub>3</sub> (%)	0.03
Chloride as Cl <sup>-</sup> (Acid) (%)	0.004
Chloride as Cl <sup>-</sup> (Water) (%)	0.002

.Note:Test results relate only to the samples tested.

Sample submitted by the Client.  
Joshua Graham, Mat .File, File.

Approved Signatory  
30.09.2019

Otilia Costache  
CHEM85915.OC.1

Date \_\_\_\_\_ Serial No. \_\_\_\_\_



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**TEST REPORT**

CLIENT: P.F. Formation  
1774 Wisemans Ferry Road Maroota NSW 2756

FILE No: 250 / 19

PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2019  
to AS 2758.1 Specification.

REQUEST No: 85915

**TEST METHOD:**

AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)

Tex- 612 - J - Acid Insoluble Residue For Fine Aggregate

Laboratory Sample No.: 226227  
Date Sampled: 10.09.2019  
Sample Description: Coarse Sand  
Field No.: 1

**TEST RESULTS:**

CO<sub>2</sub> by Loss on Ignition (%) < 0.1  
Calcium Carbonate as CaCO<sub>3</sub> (%) 0.1  
Acid Insoluble Residue (%) 98

Sample submitted by the Client.

A handwritten signature in black ink, appearing to read "Otilia Costache".

Otilia Costache  
Environmental Scientist  
Technical Officer  
30<sup>rd</sup> September 2019

Joshua Graham, Q.C.File, Mat.File, File.





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**TEST REPORT**

CLIENT: P.F. FORMATION  
1774 Wisemans Ferry Road Maroota, N.S.W. 2756

FILE No: 250 / 19

PROJECT: Quality Control annual Full Test of Coarse Sand from Maroota for 2019. REQUEST No: 85915

**TEST PROCEDURE: Boral In house Method 34 – Determination of metal oxides by XRF Flux (66:34) Fusion Bead and analysed using XRF**

Laboratory Sample No.: 226227  
Date Sampled: 10.09.19  
Date Received: 11.09.19  
Date Tested: 1.10.19  
Sample Description: Coarse Sand from  
Maroota Quarry  
Field No.: 1

**TEST RESULTS**

Silicon as SiO<sub>2</sub> (%) 98.4

Sample submitted by the Client.

Note: Test results in this test report relate only to the samples tested.

Nanthini S

Analytical Chemist

01<sup>st</sup> October 2019.

J.Graham, Mat. File, File.



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**Test Report**

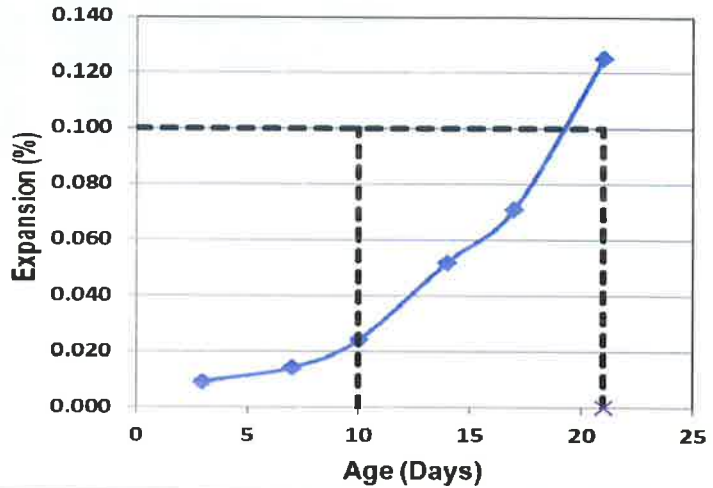
<b>Client:</b>	P. F. FORMATION	<b>File No:</b>	250/19
<b>Address:</b>	1774 Wisemans Ferry Road Maroota, NSW 2756	<b>Req. No:</b>	85915
<b>Date Received:</b>	September 2019	<b>Date Sampled:</b>	10/09/2019
<b>Project:</b>	Quality Control Annual Full Test of Coarse Sand ex Maroota for 2019.		
<b>Test Method:</b>	Accelerated Mortar Bar Test for AAR Assessment - RMS T363		

Lab Sample No	Sample Description	Location
226227	Coarse Sand	Maroota Quarry
N/A	Boral GP / SL Cement	Berrima

**Results:**

**Flow (%):** 9                                      **W/C Ratio:** 0.39                                      **Date Mixed:** 17/09/2019

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.009
7	0.014
10	0.024
14	0.052
17	0.071
21	0.125



Mortar Bar Expansion (E) %	Duration of Specimens in 1mol/L NaOH at 80°C	RMS T363 Aggregate Reactivity Classification
	10 Days      21 Days	
< 0.1*	< 0.1*	Non-Reactive
< 0.1*	≥ 0.1*	Slowly Reactive
≥ 0.1*	>> 0.1*	Reactive

\* 0.15% for naturally occurring fine aggregates

**Notes:**

- Sample submitted by the Client.
- Test results in this Test Report relate only to samples tested.

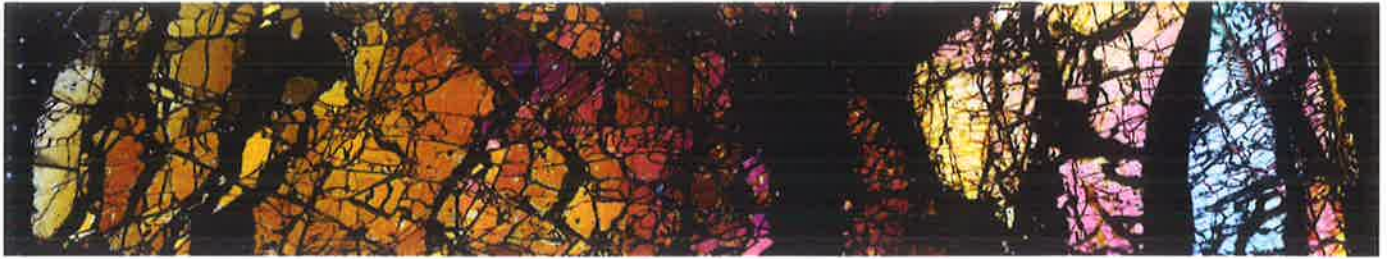
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Approved Signatory Safwan Fawal  
Date 15/10/2019 Serial No. CEM85915.SF.1

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Number: 547



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ABN 25 065 630 506

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## PETROGRAPHIC REPORT ON A COARSE SAND SAMPLE (226227) FROM MAROOTA QUARRY

prepared for

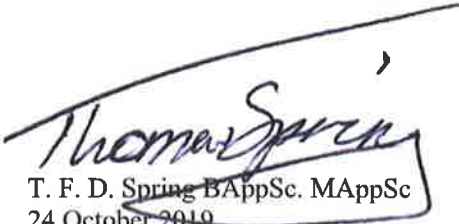
**BORAL RESOURCES (NSW) PTY LTD  
MATERIALS TECHNICAL SERVICES**

Purchase Order:

Invoice Number: G2010552

Client Ref: Kamal Ali

Issued by

  
T. F. D. Spring BAppSc. MAppSc  
24 October 2019

October, 2019

Bo191018

Page 1 of 6

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# GEOCHEMPET SERVICES, BRISBANE

**Sample Number:** 226227 **Date Sampled:** 10/09/2019

**Product Type:** Coarse Sand **Date Supplied:** 11/09/2019

**Sample Source:** Maroota Quarry **Date Received:** 30/09/2019

**Location:** P. F. Formation

**Work Requested** Petrographic analysis in relation to suitability for use as concrete sand

**Methods** Account taken of ASTM C 295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete*, the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)*, the AS1141 Standard Guide for the *Method for sampling and testing aggregates*, of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

**Identification** Quartz sand

## **Description**

The sample consisted of about 0.5 kg of free flowing, reddish orange, clean sand, composed of water-worn, sub-rounded and sub-angular quartz grains and minor lithic fragments.



**Figure 1:** Digital image of sub-sample from supplied sample 226227

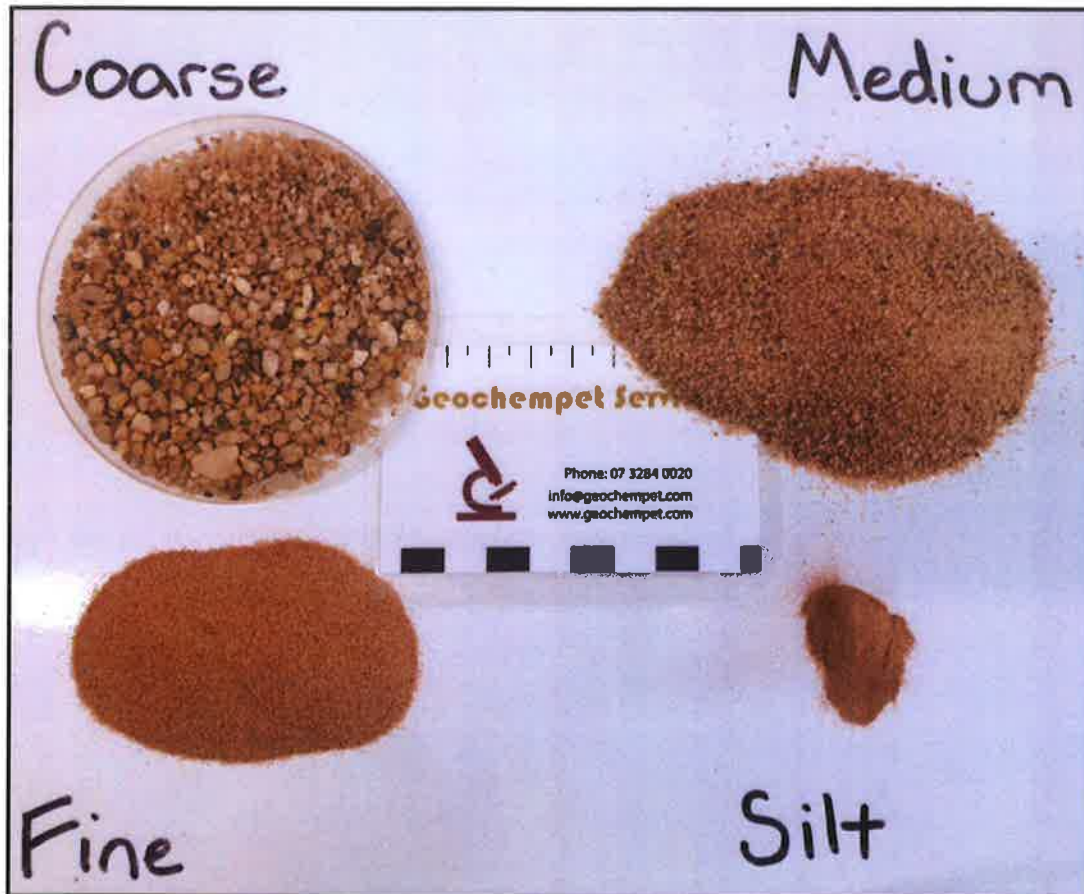
# GEOCHEMPET SERVICES, BRISBANE

In a crude, dry sieving test of small subsample these results were tabulated:

Sieve Size	Wt % of sample
Coarse (>1.18mm)	25.8%
Medium (>0.3mm)	54.6%
Fine (>0.075mm)	19.0%
Silt (<0.075mm)	0.6%

The coarse fraction consists of quartz grains and minor lithic fragments of variably ferruginized sandstone clasts which are difficult to break by hand. There are no apparent deleterious grain coatings; benign secondary iron oxide occurs as minor grain coatings and within surficial indents.

When a subsample was swirled in water, a very pale turbidity was noted, which cleared rapidly suggesting minor silt and clay within the sample.



**Figure 2:** Digital image of sieve fractions as recorded above.

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**Figure 3:** Digital image of coarse sieve fraction as recorded above. Note the secondary iron oxide in indents.

A thin section was prepared for microscopic examination in transmitted polarized light. A count of 100 widely spaced points falling within sectioned clasts gave the following composition:

- 70% quartz as single, free, unstrained to mildly strained grains (59%) or as simple composite crystalline aggregates of quartz grains (11%)
- 16% quartz as moderately strained single or more commonly crystalline composite grains
- 5% quartzite (4% moderately strained)
- 2% vein quartz (heavily strained)
- 3% feldspar grains (orthoclase)
- <1% heavy mineral grains (including epidote, zircon, haematite/goethite, hornblende and opaque oxide)
- <1% free mica flakes
- 2% lithic clasts of acid volcanics (<1% microcrystalline quartz)
- <1% lithic clasts of quartz sandstone (<1% quartz)
- 1% lithic clasts of intermediate volcanics
- <1% ferruginous fragments (<1% quartz)
- <1% sericitized fragments
- 1% secondary iron coating on free quartz grains

The free silica content (or total quartz plus chert content) of the sand is 93% comprised of 86% free quartz grains or simple crystalline composite grains, and 7% quartz locked within lithic

October, 2019

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Page 4 of 6

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# GEOCHEMPET SERVICES, BRISBANE

fragments of quartzite, quartz sandstone and ferruginous fragments and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

In thin section, the sand is seen to consist very largely of quartz, comprising 59% quartz as single, free, unstrained to mildly strained grains, 11% quartz as simple composite crystalline aggregates of quartz grains, and 16% quartz as moderately strained single or crystalline composite grains. The grains carry minor iron trapped in surface indentations, but the amount is very small (apparently 1%). Siliceous fragments of quartzite amount to about 5% and a further 2% of vein quartz.

Variable weathered sericitized and kaolinized feldspar grains amount to about 3%. Small heavy mineral grains are conspicuous and amount to less than 1%, comprising epidote, zircon, haematite/goethite, hornblende and opaque oxide.

Lithic clasts amount to 3% of the sample and consist of 2% acid volcanic/tuffaceous fragments (<1% finely crystalline quartz in groundmass), <1% quartz sandstone (consisting of quartz and subordinate feldspars suspended in a ferruginous matrix) and 1% intermediate volcanics.

Ferruginous fragments amount to less than 1% with sericitized clasts amounting to less than 1% as well.

## Comments and Interpretations

The supplied coarse sand sample (labelled 226227) from the Maroota Quarry is considered to be fairly clean quartz sand which may be described broadly for engineering purposes as fairly evenly graded.

The **free silica content** of the sand is **about 93%**, comprised of 86% free quartz grains or simple crystalline composite grains, and 7% quartz locked within lithic fragments of quartzite, quartz sandstone and ferruginous fragments and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

Being composed largely of sub-rounded and sub-angular grains of quartz, the sand is interpreted to be **physically suitable for use as concrete sand**.

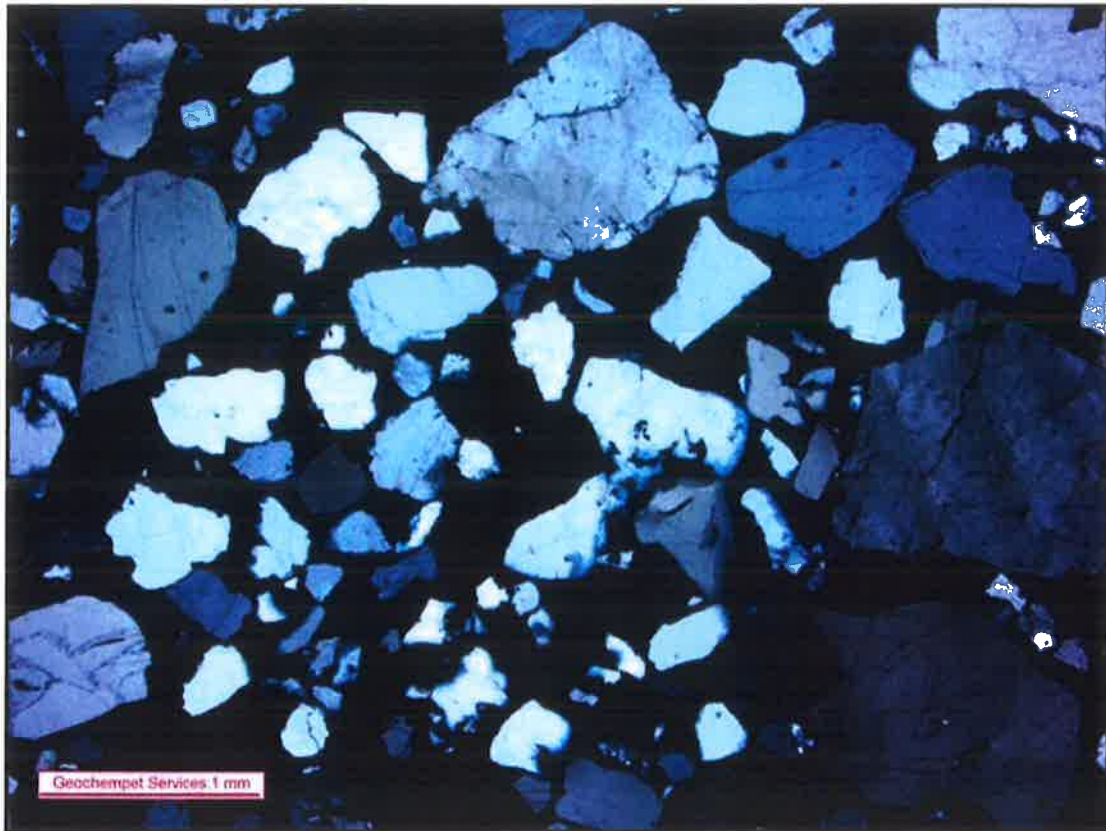
The sand as a whole is predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete**. It carries about 20% of moderately stained quartz (as free grains or simple composite grains, and in quartzite), and 2% heavily strained quartz within vein material and a further <1% microcrystalline quartz in lithic clasts of acid volcanic/tuffaceous rock.

Guidance can be obtained from the 2015 joint publication of the *Cement and Concrete Association of Australia* and *Standards Australia*, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*.

## Free Silica Content

The free silica content is about 93%.

## GEOCHEMPET SERVICES, BRISBANE



**Figure 4:** Micrograph of supplied sand sample 226227, taken at low magnification under transmitted cross polarised light. Image shows a typical view of the sample, dominated by sub-angular to sub-rounded quartz showing a range of straining extinctions, along with minor lithic clasts of quartzite.