

TEST REPORT

CLIENT: P.F. FORMATION

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2022

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

ii) TfNSW - Materials Test Methods Vol. 1

iii) ASTM 7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

FILE No: 250/22

REQUEST No: 103315

DATE TESTED: 20.12.22 to 3.2.23

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

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Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		6.12.22	
Date Received:		7.12.22	
Laboratory Sample No:		276953	
Test Method:	Test:	Spec	Results:
*AS1141.11.1	% Passing A.S. Sieve	100**	
	9.5mm	-	100
	6.7 mm	90-100	99
	4.75 mm	60-100	87
	2.36 mm	30-100	69
	1.18 mm	15-100	48
	600 micron	-	35
	425 micron	5-50	21
	300 micron	0-20	4
	150 micron		
AS1141.12	Material finer than 75 micron (%)	0-5	1
AS1141.4	Uncompacted Bulk Density (t/m ³)		1.68
	Compacted Bulk Density (t/m ³)	Min 1.2	1.78
T262	Moisture Content (%)		2.2
AS1141.5	Particle Density (DRY) (t/m ³)	Min 2.1	2.61
	Particle Density (SSD) (t/m ³)		2.62
	Apparent Particle Density (t/m ³)		2.64
	Water Absorption (%)	Max. 2.0	0.4
AS1141.24	Sodium Sulphate Soundness		
	Total Weighted (% Loss)	Max. 6	0.5
	Fraction tested:		
	-4.75mm+2.23mm (%Loss)		0.8
	-2.36mm+1.18mm (%Loss)		0.5
	-1.18mm+600 µm (%Loss)		0.4
	-600 µm +300µm (% Loss)		0.4
AS1141.33	Silt Content (%)		2
AS1141.34	Organic impurities other than sugar		
	The colour assessment was made visually using coloured reference glass	Not darker than std.	Lighter than Std

*Sample washed over 75 micron sieve as per AS1141.11.1 Clause 6.6.

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

Approved Signatory _____

Kamal Ali

Date _____

10.2.23

Serial No. _____

AGG103315.KA.1




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FILE No: 250/22

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DATE TESTED: 20.12.22 to 3.2.23

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		6.12.22	
Date Received:		7.12.22	
Laboratory Sample No:		276953	
Test Method:	Test:	Spec	Results:
AS1141.25.3	Degradation Factor – Fine Aggregate The wash water after using permitted 500ml was:		99 Clear
T279	Method of Determining Voids Content and Flow Time % of Voids The Mean Flow Time (sec.)		40.9 22.0
ASTM D7428	Micro-Deval Abrasion Test % Loss The % loss of the control agg. tested closest to the time at which the sample was tested = 19.5		4.7

Sample Submitted by Client.

J. Graham, QC File, File



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Method for Determining Voids Content - Flow Time
RMS T279

CLIENT: P.F. FORMATION

FILE NO: 250/22

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F: +61 (02) 9624 9999

LAB SAMPLE NO: 276953

REQUEST: 103315 www.boral.com.au

SPECIFICATION: AS2758.1- Concrete Agg. – Date: 7th Nov. 2014

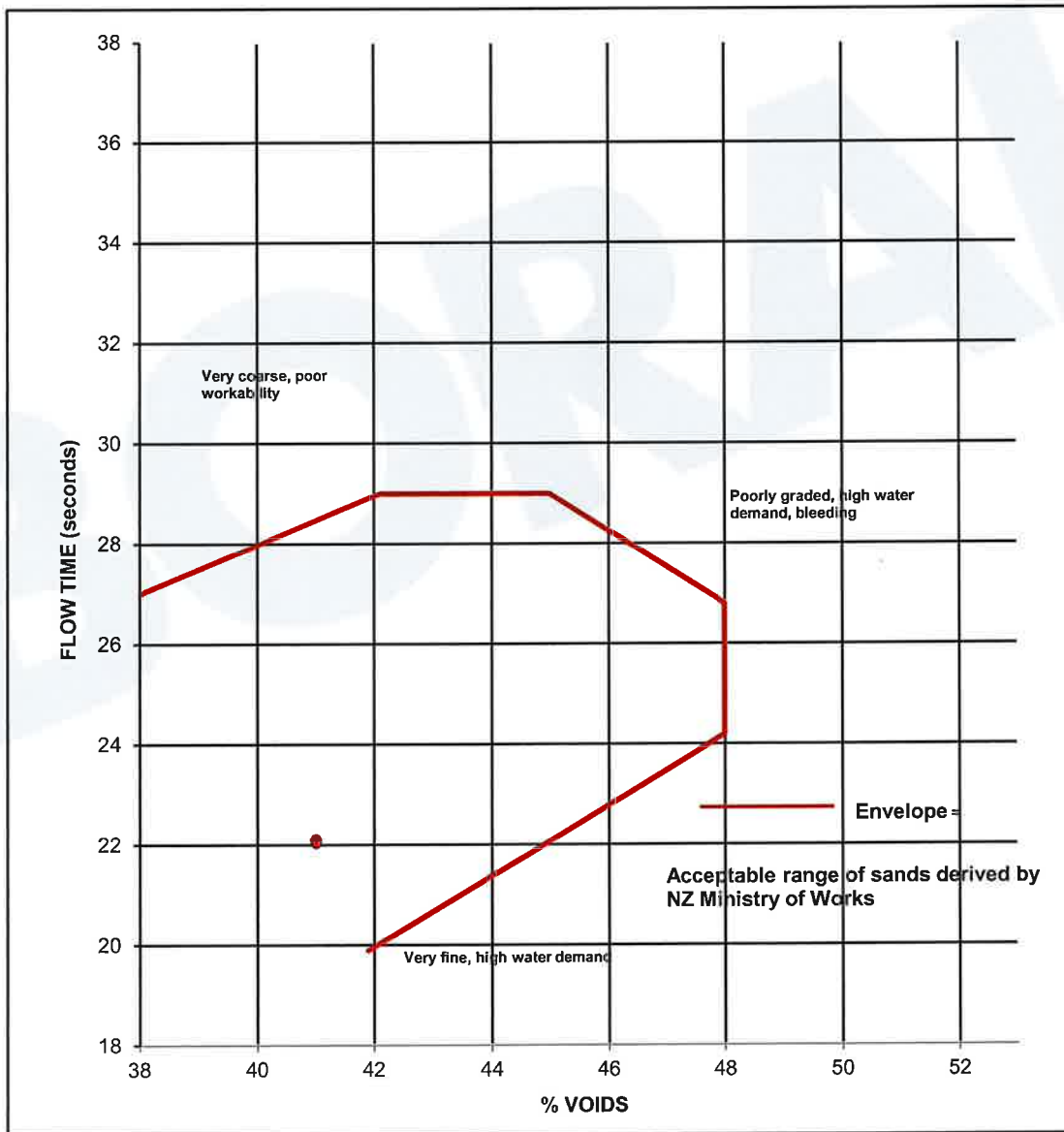
LOCATION : Maroota Quarry

TEST METHOD: TfNSW – Materials Test Methods Vol.1

DATE SAMPLED: 6.12.22

SAMPLE DESCRIPTION: Coarse Sand

DATE TESTED: 3.2.23



Material sampled by client.

Kamal Ali

SECTION HEAD – AGGREGATES

10th Feb 2023

J. Graham, QC File, File



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TEST REPORT

FILE No: 250/22

CLIENT: P.F. FORMATION

REQUEST NO: 103315

PROJECT: Quality Control– Annual Full Test of Coarse Sand ex Maroota for 2022.

DATE TESTED: 3.2.23

TEST PROCEDURE: Texas Highway Department – Materials and Tests Division – TEX.402-A, Rev. Sept. 2014

Sample Description:	Coarse Sand	
Location:	Maroota Quarry	
Date Sampled:	6.12.22	
Date Received:	7.12.22	
Laboratory Sample No:	276953	
Test Method:	Test:	Results:
TEX-402-A	Fineness Modulus of Fine Aggregate	2.77

Sample submitted by client.

Kamal Ali
SECTION HEAD – AGGREGATES
10th Feb 2023

J. Graham, QC File, File

TEST REPORT

CLIENT: P. F. FORMATION
 PROJECT: Quality Control - Annual Full Test for 2022
 MATERIAL: Coarse Sand from Maroota Quarry

FILE No: 250/22
 REQUEST No: 103315
 DATE RECEIVED: 7.12.22
 DATE SAMPLED: 6.12.22
 DATE TESTED: 14.12.22 to 13.2.23

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. 276953
Sand Equivalent	89
Temperature of test solution (°C)	24

AS1289 - Soil Classification Tests	Results
Determination of the Liquid Limit, Plastic Limit and Plasticity Index	Field Sample No. 1 Laboratory Sample No. 276953
AS1289.3.1.1 - Liquid Limit (%) AS1289.3.2.1 - Plastic Limit (%) AS1289.3.3.1 - Plasticity Index (%)	N/A* N/A** NP
Sample history Preparation method Method used for moisture content determination	OD WS 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.

JOSHUA GRAHAM, Q. C. FILE, FILE.

Approved Signatory Aroon Singh **Aroon Singh**
 Date 14.02.23 Serial No. SOIL103315.AS.1



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

FILE No.: 250 / 22

PROJECT: Quality Control Annual Full Tet of Coarse Sand ex. Maroota Quarry for
2022 to AS 2758.1 Specification REQUEST No.: 103315**TEST PROCEDURE:**

AS 1141.12 – Material Finer than 75 micron *

AS 1141.13 – Material Finer than 2 micron

AS 1141.36 – Sulfur in Metallurgical Slag, Crushed Rock or Other Pavement Materials

RMS T264 – Soluble Salts in Sand

RMS T659 – Methylene Blue Adsorption Value of Road Construction Material

Laboratory Sample No.:	276953
Date Sampled:	6.12.22
Date Received:	7.12.22
Date Tested:	From 15.12.22 to 12.1.23
Sample Description:	Coarse Sand
Field No.:	1

TEST RESULTS:


Material Finer than 75 micron (μm) (%) *	1
Material Finer than 2 micron (μm) (%)	Not Applicable
Sulfur as S (%)	0.02
Soluble Salts (%)	Free from Soluble Salts
Methylene Blue Value (mg/g) (RMS)	1
Methylene Blue Value for a Duplicate (mg/g)	1
Average Methylene Blue Value (mg/g)	1

Sample was provided by the Client.

* The authorised signatory for AS 1141.12 is K.Ali.

Joshua Graham, Mat.File, File.

Approved Signatory _____

K.Ali  S.Krishnamoorthy
CHEM103315.SK.1Date 17.1.23

Serial No. _____



TEST REPORTboral.com.au

CLIENT: P.F. Formation
PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2022 to AS 2758.1 Specification.

FILE No.: 250 / 22
REQUEST No.: 103315

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 Aggregates and Hardened Concrete
AS 1141.31 – Determination of Light Particles
AS 1141.35 – Detection of Sugar
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

Laboratory Sample No.: 276953
Date Sampled: 06.12.22
Date Received: 07.02.23
Date Tested: From 16.12.22 to 07.02.23
Sample Description: Coarse Sand
Field No.: 1

TEST RESULTS:

Chloride as Cl^- (Acid-Soluble) (%)	0.002
Sulfate as SO_3 (%)	0.12
Chloride as Cl^- (Water-Soluble) (%)	0.001
Light Particles (%)	0
Sugar	Not Detected
Organic Matter (%)	0.1
pH (AS)	5.9
pH (RMS)	5.9

Sample was provided by the Client.

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

Approved Signatory  Otilia Costache
Date 09.02.2023 Serial No. CHEM103315.OC.1





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FILE No: 250/22

TEST REPORT

CLIENT: P.F.FORMATION

1774 Wisemans Ferry Road, Maroota, NSW 2756.

PROJECT: Quality Control Annual Full Test of Fine Washed Sand ex Maroota for
2022.

REQUEST No: 103315

TEST PROCEDURE: Boral In House Method 7 – Based on AS2350.2 using XRF.

Laboratory Sample No.:	276953
Date Sampled:	02/09/2022
Date Received :	07/12/2022
Date Tested :	13/01/23
Sample Description:	Coarse Sand

TEST RESULTS

Silicon as SiO ₂ (%)	98.9
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Note:

- Sample was provided by the Client
- Test results relate only to the sample tested
- This report shall not be reproduced except in full without the approval of the Boral MTS Laboratory.

Nanthini Selvadurai

Analytical Chemist

16th January 2023.

J.Graham, Q.C.File, Mat.File, File.



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TEST REPORT

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

FILE No.: 250 / 22

PROJECT: Quality Control Annual Full Test of Coarse Sand ex Maroota for 2022 REQUEST No.: 103315

TEST METHOD:

AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)
Tex- 612 - J - Acid Insoluble Residue for Fine Aggregate

Laboratory Sample No.: 276953
Date Sampled: 06.12.2022
Date Received: 07.12.2022
Date Tested: 17.01.2023
Sample Description: Coarse Sand
Field No.: 1

TEST RESULTS:

Calcium Carbonate as CaCO₃ (%) 0.1
Acid Insoluble Residue (%) 98

Notes:

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- Test results in this Test Report relate only to the samples tested.

A handwritten signature in black ink, appearing to read "Shibu Abraham".

Shibu Abraham
9th February 2023

Joshua Graham, Mat.File, File.

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Test Report
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Client: P.F. FORMATION
Address: 1774 Wisemans Ferry Road Maroota, NSW 2756
Date Received: Dec. 2022
Project: Quality Control Annual Full Test of Coarse Sand ex Maroota for 2022.
Test Method: Accelerated Mortar Bar Test for AAR Assessment - RMS T363

File No: 250/22
Req. No: 103315
Date Sampled: 6/12/2022

Lab Sample No	Sample Description	Location
276953	Coarse Sand	Maroota Quarry
N/A	Boral GP / SL Cement	Berrima

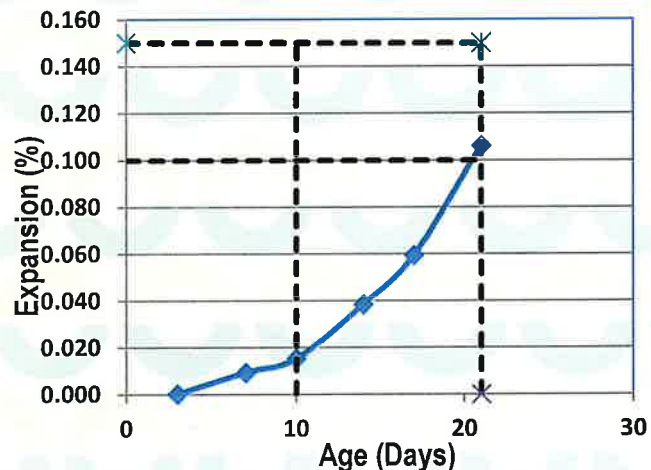
Results:

Flow (%): 12

W/C Ratio: 0.35

Date Mixed: 10/01/2023

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.000
7	0.009
10	0.015
14	0.038
17	0.059
21	0.106



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.

Joshua Graham, Mat. File, File

Approved Signatory

Muans Abdulnebe

Date 28-02-2023

Serial No. CEM103315.MA.1





GEOCHEMPET SERVICES

ABN 25 065 630 506

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Clontarf, QLD 4019

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Email: info@geochempet.com
www.geochempet.com

PETROGRAPHIC REPORT ON A COARSE SAND SAMPLE (276953) FROM MAROOTA QUARRY

prepared for

BORAL RESOURCES (NSW) PTY LTD
MATERIALS TECHNICAL SERVICES

Purchase Order: 6632049
Invoice Number: G2301527
Client Ref: Kamal Ali

Issued by

K. H. Lynn
BSc. (Hons)
27 January 2023

Reviewed by

A. G. Christy
MA PhD FMinSoc
27 January 2023

January 2023

Bo230103

Page 1 of 6

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GEOCHEMPET SERVICES, BRISBANE

Sample ID: 276953 **Date Sampled:** 06/12/2022
Geochempet ID: G22120092 **Date Supplied:** 07/12/2022
Product Type: Coarse Sand **Date Received:** 19/12/2022
Sample Source: Maroota Quarry **Client:** P. F. Formation

Work Requested Petrographic analysis in relation to suitability for use as concrete sand; petrographic assessment of potential for alkali-silica reactivity

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 Medium to coarse quartz sand

Description The sample consisted of about 1 kg of free flowing, clean, damp, moderate greyish-orange sand, composed of water-worn, sub-rounded to sub-angular quartz grains with a large variety in grain size.



Figure 1: Digital image of a subsample from supplied sand.

GEOCHEMPET SERVICES, BRISBANE

Sieve fractions

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

Sieve Size	Weight Percentage
Coarse (>1.18mm)	33.8%
Medium (>0.3mm)	47.8%
Fine (>0.075mm)	18.0%
Silt (<0.075mm)	0.4%

Upon binocular microscopic inspection of the coarse fraction, it was revealed to primarily consist of a greyish-orange, clean, subangular to rounded, water worn grains of quartz with some very minor partial limonite coatings and clay cemented fragments. The fragments range up to 0.8cm in diameter.

When a subsample was swirled in a beaker of water, a moderate greyish-orange, quick settling turbidity was produced, with no observed argillaceous scum or plant fragments.

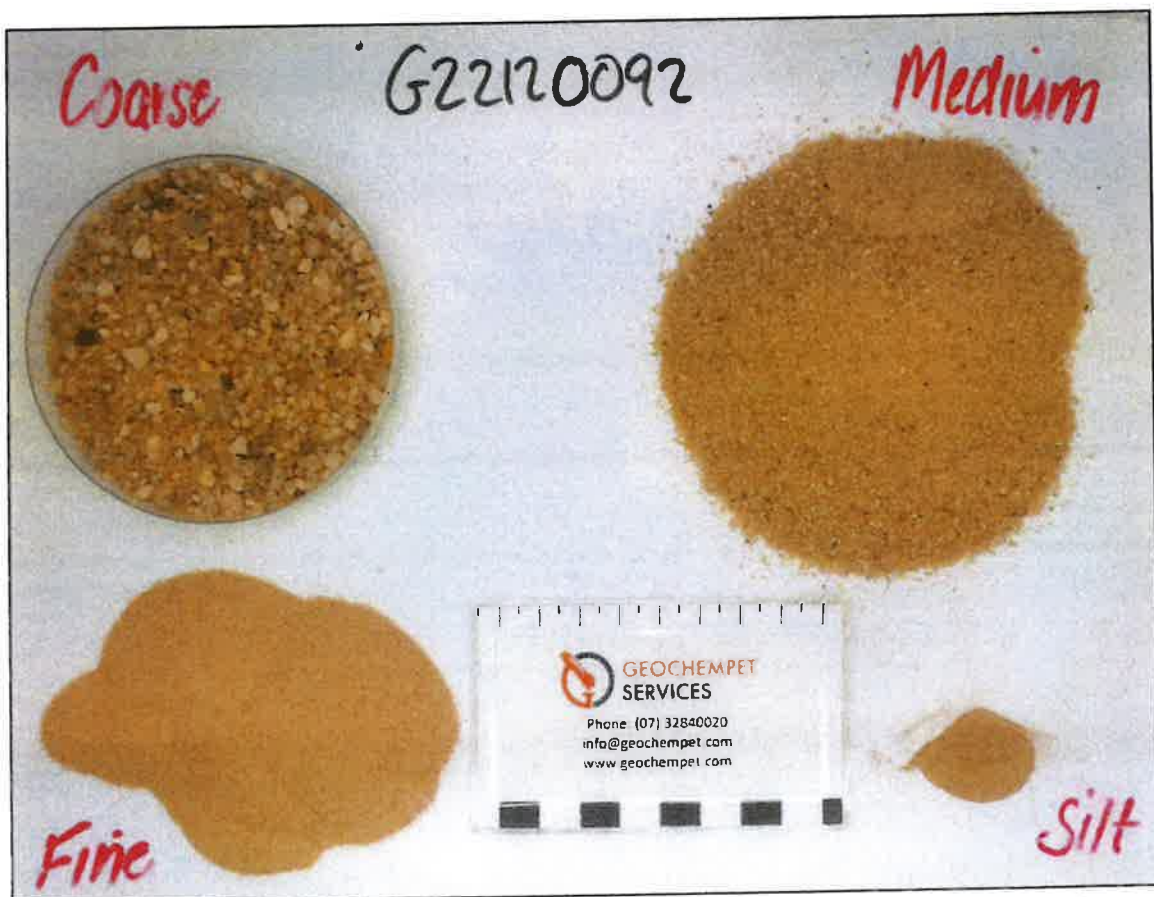


Figure 2: Digital image of sieve fractions as recorded above.

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Figure 3: Digital image of coarse sieve fraction as recorded above; the view pictured is roughly 3.5 cm across.

Mineralogy

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:

- 54% quartz as single, free, unstrained to mildly strained grains (48%) or as simple composite crystalline aggregates of quartz grains (6%)
- 26% quartz as moderately strained single (23%) or simple crystalline composite grains (3%)
- 9% vein quartz (highly strained)
- 6% quartzite (moderately strained)
- 2% quartz as highly strained single or crystalline composite grains

- <1% feldspar grains (orthoclase)
- <1% other free mineral grains (including epidote, zircon, hematite/goethite, and opaque oxide)

- 1% lithic clasts of arenite (1% unstrained quartz)
- <1% lithic clasts of felsic volcanic rock (<1% microcrystalline quartz)
- <1% lithic clasts of intermediate volcanic rock
- <1% lithic clasts of ferricrete

- 2% secondary iron coatings
- trace plant fragments

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Thin section description

The free silica content (or total quartz plus chert content) of the sand is 98%, comprised of 82% free quartz grains or simple crystalline composite grains, 16% quartz locked within lithic fragments of quartzite, vein quartz, and sandstone 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 48% quartz as single, free, unstrained to mildly strained grains, 6% quartz as unstrained simple composite crystalline aggregates of quartz grains, and 26% quartz as moderately strained single or crystalline composite grains. The grains carry minor iron oxide trapped in surface indents (2%), sometimes with finer grains of quartz silt trapped within the oxide material. Siliceous fragments amount to 16%, comprising 9% vein quartz and 6% quartzite.

Variable weathered sericitized and kaolinized feldspar grains amount to less than 1%. Other free mineral grains also amount to <1%, comprising epidote, zircon, hematite/goethite, and opaque oxides.

Lithic clasts amount to 1% of the sand sample, comprising lithic clasts of quartzose arenite amounting to 1%, and <1% of felsic and intermediate volcanic rock. The arenite fragments are comprised of mildly to moderately strained quartz grains cemented by sericite cements. Trace plant fragments were also noted.

Comments and Interpretations

The supplied coarse sand sample (labelled 276953) from the Maroota Quarry is considered to be a fairly clean quartz sand, which may be described broadly for engineering purposes as medium to coarse sand.

The **free silica content** of the sand is **about 98%** comprised of 82% free quartz grains or simple crystalline composite grains, 16% quartz locked within lithic fragments of quartzite, vein quartz, and sandstone 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**.

Regarding alkali-silica reactivity, the supplied sand carries about 32% moderately stained quartz (as free grains or simple composite grains, and in quartzite), and 11% highly strained quartz within vein material and as free grains, with a further <1% microcrystalline quartz locked within fragments of felsic volcanic rock. It is therefore predicted to have **potential for mild or slow deleterious alkali-silica reactivity** in concrete.

Thus, sand of the type represented in the supplied sample is interpreted to be **suitable for use in concrete** provided that appropriate precautions are taken in mix and engineering design to take account of its **perceived potentially slowly reactive alkali-silica reactivity**.

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*.

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Free Silica Content

The free silica content of the supplied sand is about 98%.

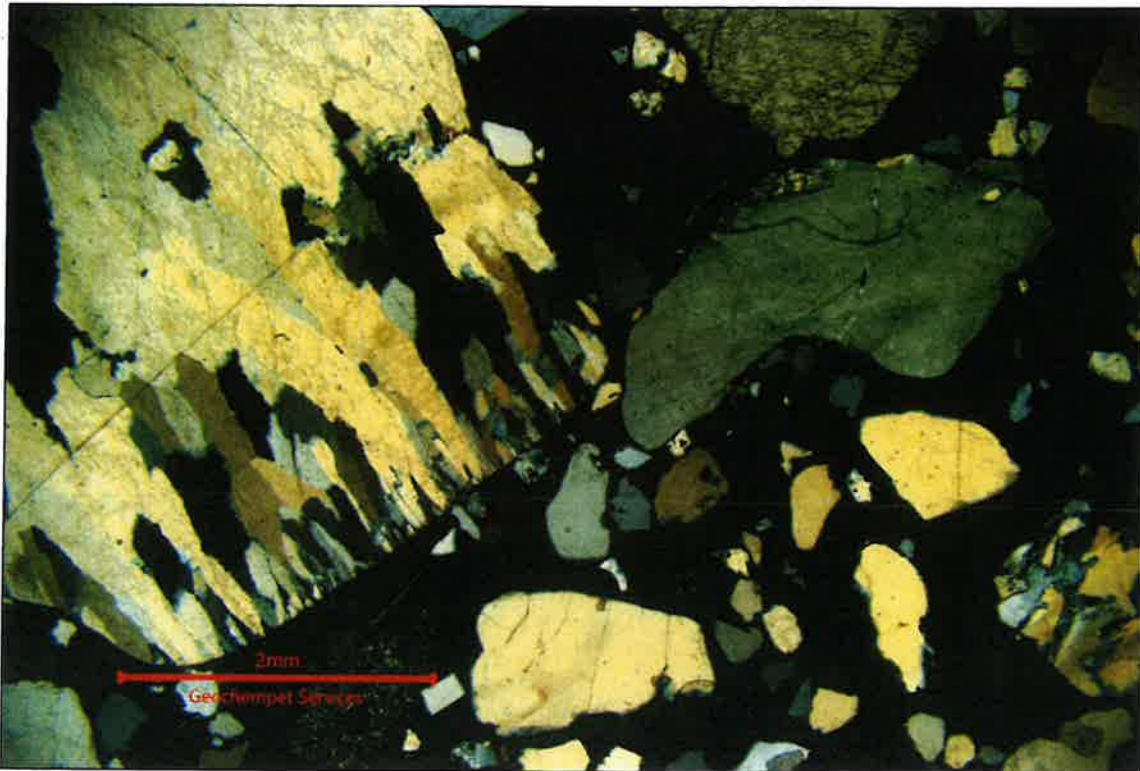


Figure 4: Micrograph of supplied sand sample, taken at low magnification under transmitted cross polarised light. The image displays a variety of siliceous clast types, with a large vein quartz fragment pictured on the left side of the image, a small felsic volcanic clast below it, and quartz grains scattered throughout.