

## REMOVAL OF FILL MATERIALS FROM THE SITE AND MODIFIED HSL-A FOR ASBESTOS

### Introduction

Bonded asbestos containing materials (ACM) in the form of broken fragments of asbestos cement sheet debris was observed in fill soils at the Site during remediation. During remediation a decision was made to excavate and remove all fill materials from the Site. Examples of ACM fragments found in ash fill materials during remediation are provided in the photographs below.



Examples of ACM in fill material

The potential for generation of asbestos fines (AF) from the large (>7mm) fragments of bonded ACM observed was generally considered to be low without substantial physical damage (i.e. could not be broken or crumbled with hand pressure). Notwithstanding the presence of asbestos fines (AF) as loose fibre bundles in some of the 500 ml samples of fill material analysed, and friable asbestos (FA) as weathered fibre plaster material in one sample (HSB17, refer to Appendix C.4.2) provided a line of evidence that fill materials had the potential for weathered ACM to be present which had degraded into fibre bundles of chrysotile asbestos.

Fill materials on the Site were readily distinguishable from the underlying undisturbed natural soils materials which were described as medium to high plasticity, brown to brown/orange silty clays which are shown in the following photograph.



Plate 3: Natural soil materials comprising red/brown silty clays

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Validation works confirmed that fill materials have been removed from the Site to expose the underlying natural soil materials, and were inspected by the SQP and/or an experienced Tetra Tech Coffey environmental scientist under the supervision of the SQP. Finished excavation levels were also cleared by a Licenced Asbestos Assessor (LAA).

At the completion of the works a final clearance inspection (systematic site walkover) was undertaken for surface soils across the Site. No ACM or residual fill was observed to be present on the Site at the time of inspection so far as reasonably practicable (i.e. fill soils had been removed across the Site).

270 (500 ml) validation samples were collected from natural soil at the Site<sup>1</sup>. Asbestos was not reported in 267 of the 270 validation samples collected within the Site boundary.

The presence of asbestos was reported in three of the validation samples collected within the Site boundary. These samples were collected from a service trench which was observed to be excavated into natural materials (refer to Figure 8, Appendix A) and included:

- T02\_B which reported an estimated concentration of asbestos fines (AF) (as chrysotile loose fibre bundles) of 0.0029% w/w asbestos which exceeded the NEPM Health Screening Level (HSL) Residential A criteria of 0.001%
- T04\_W1 which reported a concentration of AF (as chrysotile loose fibre bundles) of 0.0011% which is approximately equal to the NEPM HSL-A criteria of 0.001%
- T05\_B which reported a concentration of AF (as chrysotile loose fibre bundles) of 0.00026% which was below NEPM HSL-A criteria of 0.001%.

**No free fibre (trace / respirable) asbestos was reported in any of the 270 samples analysed.**

Section 2.1.2 of NEPM Schedule B1 states:

*“Investigation and screening levels are not clean-up or response levels nor are they desirable soil quality criteria. Investigation and screening levels are intended for assessing existing contamination and to trigger consideration of an appropriate site-specific risk-based approach or appropriate risk management options when they are exceeded. The use of investigation and screening levels as default remediation criteria may result in unnecessary remediation and increased development costs, unnecessary disturbance to the site and local environment, and potential waste of valuable landfill space.”*

In reviewing the analytical results for asbestos analysis (or any laboratory analysis for that matter) it is important to consider any exceedances of criteria in the context of the conceptual site model (CSM) as opposed to just reviewing the results in isolation or adopting the NEPM HSLs as default remediation criteria. This is particularly relevant for asbestos given the uncertainties associated with the current analytical methods typically adopted by laboratories and difficulty of quantifying asbestos in soil concentrations at low levels.

With reference to analytical methods for analysis of asbestos Section 4.10 of Schedule B1 of the NEPM outlines that:

*“As yet there is no validated method, readily available in Australia, of reliably estimating the concentration of free asbestos fibres in soil. Soil contamination by free asbestos fibres should therefore be simply determined according to the presence or absence of fibres, in accordance with AS4964 – 2004: Method for the Qualitative identification of asbestos in bulk samples (Standards Australia 2004) by a laboratory accredited by NATA (or its mutual recognition agreement partners) for this method.*

*In the case of co-located bonded ACM, FA and AF, where significant asbestos may be present as fibrous asbestos or asbestos fines (greater than 10% (in total for FA and AF) of that present in the*

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<sup>1</sup> Samples were collected from a 5 x 5 m sampling grid which is double the density recommended in Section 4.1, Schedule B1 of the NEPM which recommends a 10 x 10 m sampling grid.



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bonded ACM alone), then laboratory analysis may be necessary to assist with impact delineation. It may be possible in the initial AS4964 procedure to obtain an estimate of the weight of asbestos (such as small ACM fragments and fibre bundles) which does not pass through the 2 mm sieve. Depending on site circumstances, **this information may be useful as part of a weight-of-evidence approach to assessment of asbestos soil concentrations relative to the appropriate screening levels.**

The nominal detection limit of the AS4964 method is around 0.01%. The examination of large sample sizes (at least 500 ml is recommended) may improve the likelihood of identifying asbestos material in the greater than 2 mm fraction.

The assessment framework for asbestos in the NEPM is based on the Western Australian Department of Health (DoH) (2009) *Guidelines for the assessment, remediation and management of asbestos-contaminated sites in Western Australia* which were revised in 2021<sup>2</sup> (WA Guidelines). The WA Guidelines provide further clarification on the application of the HSLs for AF/FA.

*“The derivation of the screening level for AF was fixed for all site uses because of the difficulty quantifying fine material (especially loose fibre and fibre bundle concentrations). In other words, accurate quantification between 0.01% and 0.001% asbestos (weight/weight) is not feasible....*

*For AF, it is possible to estimate the mass of loose asbestos fibres observed under a low power stereo microscope using AS 4964 Section 8.2.3 (m). The ability of a laboratory to report a concentration of asbestos in soil will depend on the sample size, level of contamination, the representativeness and homogeneity of the sample, and sampling and analytical limitations. **It is important to remember that a sample result provides an estimate of contamination....***

*Discussion on results should include information on the impact area represented by the sample and how the sample results relate to the assessment criteria. Similar to other contaminants, decision making against criteria should be based on all the information available from the site investigation rather than on individual sample results. In some cases, statistical interpretation of data in accordance with the ASC NEPM and DWER guidelines may be useful but should be well justified.*

*In the case of AF, a few low-level concentration detects may sometimes be construed as trivial, incidental or background, especially if contamination is not suggested by site history or the main contamination contributing to the source of fibre has been removed. **The context and use of a conceptual site model that reflects the relevant exposure scenarios and the frequency and occurrence of other positive and negative results should be considered.***”

As outlined in both the NEPM and WA Guidelines, visible ACM or FA should be used as the primary measure of contamination, where conditions are met. Section 3.4.1 of the WA Guidelines states:

*If contamination is from broken asbestos cement sheeting or other bonded ACM, where the material retains its integrity, any co-located AF (smaller size fraction material) may be considered ‘trivial’ in proportion to the bulk bonded ACM source. In these circumstances, the investigation and remediation areas can be assessed and validated using bonded ACM as the primary measure of contamination.*

*The presence of other building or industrial waste material may suggest/provide evidence for the presence of asbestos contamination.*

*It may also be possible to visibly distinguish bulk FA in soil. However, FA mixed in soil may not be visible and may be best sampled as AF (see Chapter 5).*

In regard to validation sampling Section 6.8 of the WA Guidelines states:

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<sup>2</sup> Western Australia Department of Health (2021), *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*.

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*Validation will be necessary for remediation works. For all validation activities, no matter how simple or complex, the evaluation and reporting of a remediation methodology must be adequately recorded throughout the course of a project.*

*Any validation sampling should be based on the recommended sampling methods in Chapter 5. Validation to verify completion of remedial activities should be determined as part of the RAP. For example, the validation of excavated asbestos-contamination where boundaries of the waste or fill can be readily distinguished can be based on removing material until natural soils are revealed, or another change in a condition indicative of non-impacted soil is evident. The decision parameters and confirmation of remediation must be recorded.*

Tetra Tech Coffey notes that the reported laboratory validation results should be considered in this context (i.e. that the impacted fill domain has been removed across the Site to natural soil).

## **Site Specific Criteria**

Both the NEPM and WA Guidelines reference the adoption of a tier 2 (site specific) assessment of risks should be undertaken where exceedances of tier 1 screening levels (NEPM HSLs) are reported (or a conservative management approach adopted).

Based on the reported results exceeding the NEPM HSLs being limited to single exceedance (the result for T04\_W1 should be considered as equal to 0.001%) and considering the remediation approach adopted (removal of impacted domain), in accordance with the NEPM and WA guidelines, Tetra Tech Coffey do not consider that a detailed site specific risk assessment is required to support that the risks posed to future site users are acceptably low. However, further consideration of site-specific conditions is provided below as part of adopting a multiple lines of evidence approach.

Section 3.9 of the WA Guidelines recognises that in certain circumstances the derivation of site-specific clean up levels (SSCLs) may be appropriate with consideration to site specific parameters that will not change with time such as soil character (soil type). Additional guidance on adopting SSCLs is provided in Appendix three of the WA Guidelines.

Appendix 3 of the WA Guidelines 2021 outlines that soil character (soil type) in conjunction with the mineralogical form of asbestos can be considered in the derivation of SSCLs:

*The basis for the soil character mitigating potential for asbestos fibre release is primarily related to moisture content and also the presence of clay or silt. When present at sufficient levels, clay and silt have been shown by Addison (1998) and separately by Swartjes and Tromp (2008) to reduce the fibre releasability by factors of 10 or more depending on their order of magnitude.*

*The sandy and often dry soils of many WA urban centres, especially on the coast, do not meet these conditions and hence the basis for applying an adjustment factor in the derivation of the screening criteria<sup>3</sup>.*

*If it can be demonstrated that soil will maintain the moisture content of 10% or more into perpetuity and there is substantial clay/silt content for the area impacted by asbestos, then this soil mitigation feature will be considered to be met. A soil moisture probe capable of reporting within  $\pm 5\%$  would be sufficient. The moisture content may be difficult to prove in the longer term, especially with projected climate changes, but features such as substantial year-round rainfall or depth of contamination may be of assistance.*

*For clay/silt content, this feature will be deemed to be achieved if the impacted soil can be classified as Fine Grain Soils – Silts and Clays under the AS 1726:2019 (more than 35% of soil, excluding oversize fraction, is less than 0.075mm).*

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<sup>3</sup> WA DoH has taken a more conservative approach (by a factor of 10) than Swartjes & Tromp (2008) to take account of the greater dryness and dust-generating potential of many local soils and the practice of treating all forms of asbestos (e.g. crocidolite, amosite, chrysotile and actinolite) as equivalent in terms of human health risk.

*Regarding the mineral form of asbestos, amphiboles, particularly crocidolite, have been reported to have higher potency for mesothelioma. For many contaminated sites, mixed fibre types are found. The practicality of demonstrating that only chrysotile is present is likely to limit the usefulness of this modifying factor, hence why it was excluded in the derivation of screening levels.*

Field observations during validation sampling indicated that natural soils at the site comprised high plasticity, brown to brown/orange CLAY. This observation is consistent with natural materials observed in the Tetra Tech Coffey (2022) *114 Newdegate Street Greenslopes Remediation Planning - Supplementary Investigation*, 11 May 2022 which described natural materials as red/brown, low plasticity silty CLAYs to medium plasticity orange/brown silty CLAYs.

Three bulk samples representative of undisturbed natural materials were collected from the Site from 0.2 m below ground surface (bgs) on the 4 April 2024 by an experienced environmental scientist. Sample locations are shown in Attachment A. Photographs of the samples are provided in Attachment B.

A description of the samples is provided below in Table A.

**Table A - Sample Descriptions**

Sample	Description
PSD 001	Dark red-brown medium to high plasticity CLAY with trace medium to coarse grain gravel.
PSD 002	Red-brown medium to high plasticity CLAY, with trace fine to medium grain gravel
PSD 003	Dark red-brown medium to high plasticity CLAY with trace medium to coarse grain gravel.

Soil samples were submitted to the NATA accredited laboratory ALS Environmental for Particle Size Distribution (PSD) analysis in accordance with AS1289.3.6.2 *Soil classification tests — Determination of the particle size distribution of a soil—Analysis by sieving in combination with hydrometer analysis*.

Laboratory results are provided in Attachment C and summarised below in Table B.

**Table B - Summary of PSD Data for Fine Fraction**

Fraction	PSD 001	PSD 002	PSD 003
Fines (<75 µm)	64%	71%	76%

The PSD laboratory results were consistent with site observations in previous investigation and during validation works which identified fine grain materials at the Site (clays), and that the fine grain fraction is substantially more than 35% of the soil material (recommended threshold for fine grain soils in WA Guidelines).

Review of the validation sampling laboratory analysis results (and historical laboratory analysis for site investigation works) indicates that chrysotile asbestos is the only mineral form of asbestos that has been reported in soil.

Considering the above rationale (and in accordance with the methodology outlined in the WA Guidelines), Tetra Tech Coffey considers that it is reasonable to modify the NEPM **HSL-A by a factor of 10 to 0.01% w/w asbestos**.

The AF concentrations reported in soil at T02\_B, T04\_W1 and T05\_B were less than the modified HSL-A criteria.

## Closing

As outlined in the WA Guidelines, the validation of ACM contamination where boundaries of the waste or fill can be readily distinguished, can be based on removing material until natural soils are revealed.

This approach of removal of the entirety of the impacted domain (which was undertaken for the remediation of the Site), is particularly important for asbestos given the difficulties with delineating impacts where it may be

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associated with historically imported / buried fill, as is the case with the site, and due to the inherent uncertainties associated with validating removal via laboratory analysis.

Risks posed by asbestos in soil are associated with disturbance of the soils/asbestos such that potentially respirable asbestos fibres may be generated that pose a risk to on-site receptors (human health). The removal of the entirety of the impacted domain (to natural soil) provides a high level of confidence that the potential future risks to on-site receptors are acceptably low (negligible) and can be readily verified by visual inspection of the Site (i.e. where natural soils are clearly distinguishable from the fill). This approach also provides confidence that no isolated 'hot spots' of impacted material may remain that may pose a risk.

Both the extent of any asbestos contamination and the total amount of asbestos that may be present are a consideration for any risk assessment (i.e. impact on the potential likelihood that asbestos may be disturbed in the future). Removal of the entirety of the impacted domain (to the site boundaries) and the laboratory analysis of a large number of soil validation samples reporting no asbestos provides a high level of confidence in the absence of asbestos in soil at concentrations that may pose a risk to future on-site receptors.

Notwithstanding the above, Tetra Tech Coffey considers that adopting a modified (site specific) criteria for asbestos in soil (0.01%) for the remaining natural soils is appropriate in accordance with the WA Guidelines methodology. All validation results were less than this criteria which provides a further line of evidence that risks at the site posed by asbestos are low and acceptable.

Accordingly the detection of asbestos in T02\_B, T04\_W1 and T05\_B are not considered to pose an unacceptable risk to human health and not preclude the Site as being assessed as suitable for any use.

In assessing the Site as suitable for any use it is noted that the remediation of the Site (as confirmed by validation works) removed fill materials from the Site which was the source of ACM on the Site which required remediation.

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## **ATTACHMENT A – SAMPLE LOCATIONS**

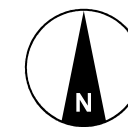




#### LEGEND

- × Excavation Floor Validation Point
- Headfort Street Boundary Validation Point
- Newdegate Street Boundary Validation Point
- Northern Boundary Validation Point
- Eastern Boundary Validation Point
- Horizontal Extent of Excavation
- Manhole Cover
- Surveyed Property Boundary
- PSD sample location

SOURCE  
Site boundary and investigation locations from Tetra Tech Coffey.  
Aerial imagery from Nearmap (capture date: 31/10/2023)



0 2.5 5 m

SCALE 1:200  
PAGE SIZE: A3  
PROJECTION: GDA 1994 MGA Zone 56

DEPARTMENT OF VETERAN AFFAIRS

DVA GREENSLOPES  
114 NEWDEGATE STREET, GREENSLOPES, QLD

ATTACHMENT A **DRAFT**  
PSD Samples



DATE: 08.01.24 PROJECT: 754-BNEEN282781 FILE: 282781\_VAL\_F008\_GIS



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## ATTACHMENT B – SAMPLE PHOTOGRAPHS



PSD 01



PSD 02



PSD 03

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## ATTACHMENT C - LABORATORY RESULTS



# Certificate of Analysis

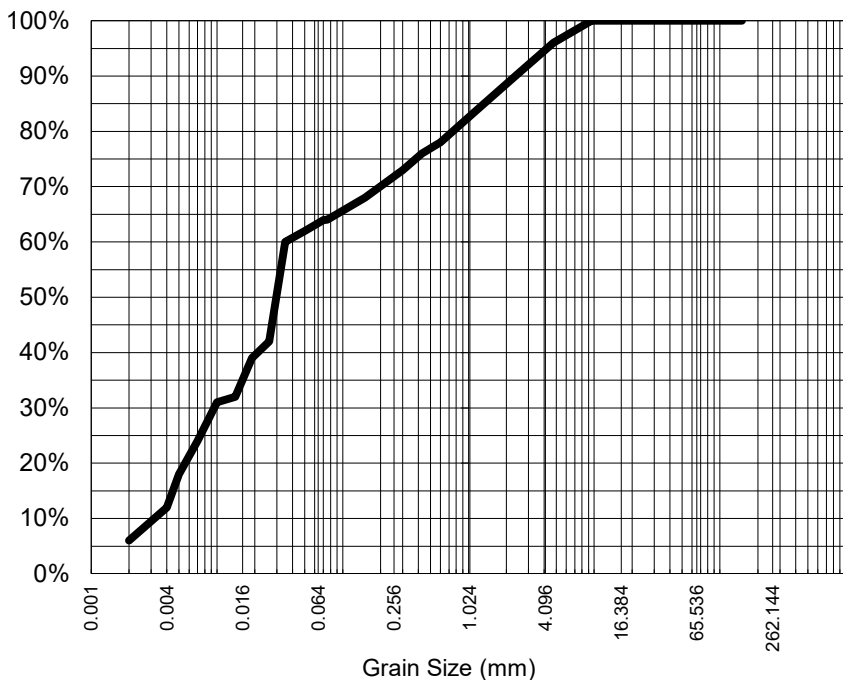
ALS Laboratory Group Pty Ltd  
2 Byth Street  
Stafford, QLD 4053  
pH 07 3243 7222  
samples.brisbane@alsenviro.com

**ALS Environmental**  
**Brisbane QLD**



**CLIENT:** JEREMY WICKS  
**DATE REPORTED:** 10-Apr-2024  
**COMPANY:** TETRA TECH COFFEY PTY LTD  
**DATE RECEIVED:** 4-Apr-2024  
**ADDRESS:** Level 5  
12 Creek Street  
Brisbane Qld, Australia  
**REPORT NO:** EB2411175-007 / PSD  
**PROJECT:**  
**SAMPLE ID:** PSD 001 - 240404

## Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	96%
2.36	90%
1.18	84%
0.600	78%
0.425	76%
0.300	73%
0.150	68%
0.075	64%
Particle Size (microns)	
50	62%
35	60%
26	42%
19	39%
14	32%
10	31%
7	24%
5	18%
2	6%

## Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.030
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## Sample Comments:

**Analysed:** 8-Apr-24

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

## Sample Description:

**Dispersion Method** Shaker

**Test Method:** AS1289.3.6.2/AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.65

**NATA Accreditation: 825 Site: Brisbane**  
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**Satish Trivedi**  
Soil Senior Chemist  
**Authorised Signatory**

# Certificate of Analysis

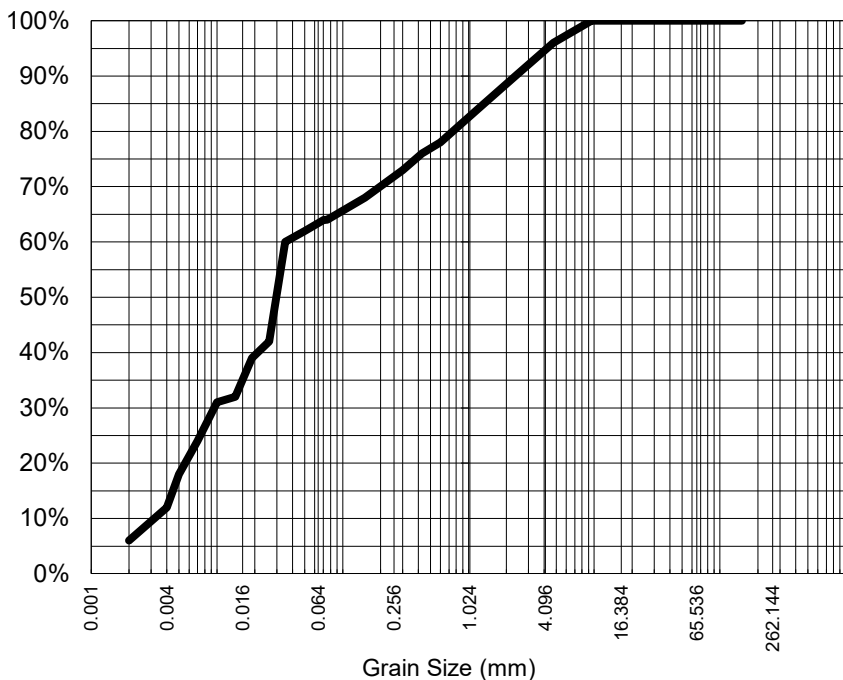
ALS Laboratory Group Pty Ltd  
2 Byth Street  
Stafford, QLD 4053  
pH 07 3243 7222  
samples.brisbane@alsenviro.com

**ALS Environmental**  
**Brisbane QLD**



**CLIENT:** JEREMY WICKS  
**DATE REPORTED:** 10-Apr-2024  
**COMPANY:** TETRA TECH COFFEY PTY LTD  
**DATE RECEIVED:** 4-Apr-2024  
**ADDRESS:** Level 5  
12 Creek Street  
Brisbane Qld, Australia  
**REPORT NO:** EB2411175-007DUP / PSD  
**PROJECT:**  
**SAMPLE ID:** PSD 001 - 240404

## Particle Size Distribution



## Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	96%
2.36	90%
1.18	84%
0.600	78%
0.425	76%
0.300	73%
0.150	68%
0.075	64%
Particle Size (microns)	
50	62%
35	60%
26	42%
19	39%
14	32%
10	31%
7	24%
5	18%
2	6%

Median Particle Size (mm)*	0.030
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 8-Apr-24

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

## Sample Description:

**Dispersion Method** Shaker

**Test Method:** AS1289.3.6.2/AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.65

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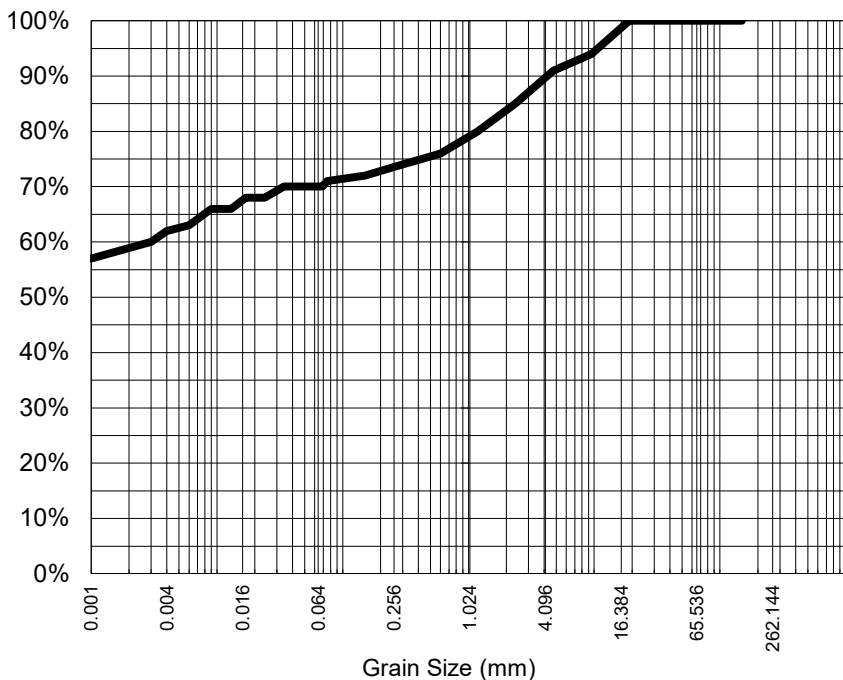
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Stafford, QLD 4053  
pH 07 3243 7222  
samples.brisbane@alsenviro.com

**ALS Environmental**  
**Brisbane QLD**



**CLIENT:** JEREMY WICKS  
**DATE REPORTED:** 10-Apr-2024  
**COMPANY:** TETRA TECH COFFEY PTY LTD  
**DATE RECEIVED:** 4-Apr-2024  
**ADDRESS:** Level 5  
12 Creek Street  
Brisbane Qld, Australia  
**REPORT NO:** EB2411175-008 / PSD  
**PROJECT:**  
**SAMPLE ID:** PSD 002 - 240404

## Particle Size Distribution



## Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
19.0	100%
9.50	94%
4.75	91%
2.36	85%
1.18	80%
0.600	76%
0.425	75%
0.300	74%
0.150	72%
0.075	71%
Particle Size (microns)	
48	70%
34	70%
24	68%
17	68%
13	66%
9	66%
6	63%
4	62%
1	57%

Median Particle Size (mm)*	<0.006
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Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 8-Apr-24

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

## Sample Description:

**Dispersion Method** Shaker

**Test Method:** AS1289.3.6.2/AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.63

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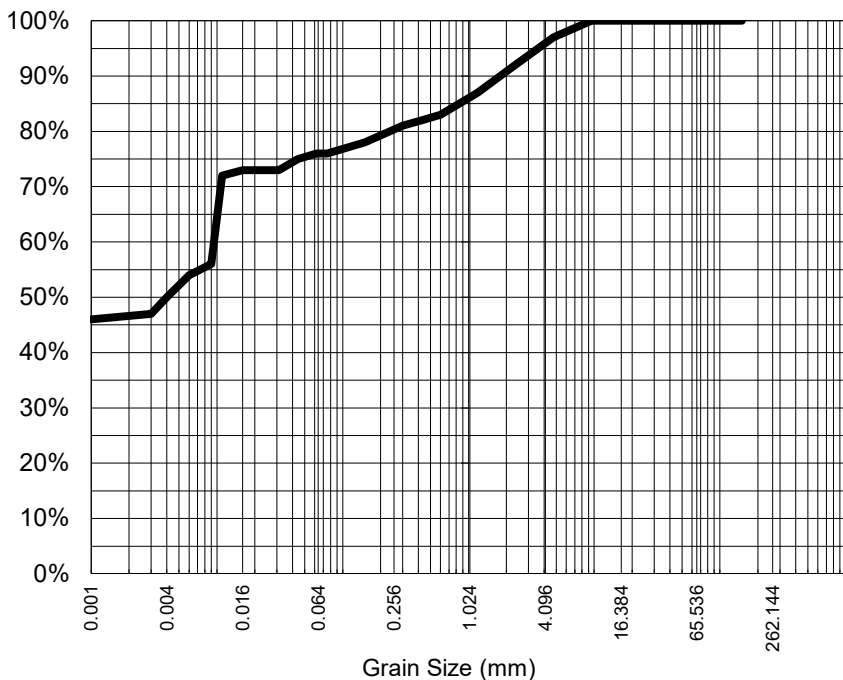
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**DATE REPORTED:** 10-Apr-2024  
**COMPANY:** TETRA TECH COFFEY PTY LTD  
**DATE RECEIVED:** 4-Apr-2024  
**ADDRESS:** Level 5  
12 Creek Street  
Brisbane Qld, Australia  
**REPORT NO:** EB2411175-009 / PSD  
**PROJECT:**  
**SAMPLE ID:** PSD 003 - 240404

## Particle Size Distribution



## Analysis Notes

Samples analysed as received.

Particle Size (mm)	% Passing
9.50	100%
4.75	97%
2.36	92%
1.18	87%
0.600	83%
0.425	82%
0.300	81%
0.150	78%
0.075	76%
Particle Size (microns)	
44	75%
31	73%
22	73%
16	73%
11	72%
9	56%
6	54%
4	50%
1	46%

Median Particle Size (mm)*	<0.006
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Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 8-Apr-24

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

## Sample Description:

**Dispersion Method** Shaker

**Test Method:** AS1289.3.6.2/AS1289.3.6.3

**Soil Particle Density (<2.36mm)** 2.79

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