

Port of **Mackay**



Appendix D

Marine Sediment Properties Report



Marine Sediment Properties Report

Port of Mackay

21/12/18

Level 31, 12 Creek St
Brisbane QLD 4000
Australia

301001-02095-00-EN-REP-0002

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Project No: 301001-02095-00-EN-REP-0002 – Marine Sediment Properties Report





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Executive summary

The purpose of this investigation was to identify and classify marine sediment materials and investigate their acid generating capacity and geotechnical properties for subsequent consideration of potential beneficial reuse options. The investigation included sampling and analysis of sediments from locations within Port of Mackay navigational areas.

Geotechnical testing

The geotechnical testing was undertaken using a phased approach. Phase 1 comprised general classification testing to determine characteristics such as particle size, moisture content, organic content, carbonate content and plasticity. From the field samples taken, 10 samples were selected for Phase 1 geotechnical analysis to ensure adequate coverage across the range of material types observed within the Port. Phase 2 testing was undertaken on a subset of samples which were selected for analysis based on the Phase 1 results, and to assess more detailed engineering properties including permeability, density, strength and consolidation.

The particle size distribution (PSD) testing (by sieve and hydrometer) was used in combination with the plasticity test results (Atterberg limits testing) to enable classification of the sediment based on Australian standards for geotechnical site investigations. The sediments encountered were predominantly fine-grained (silt/clay), with only two of the sampling locations (both within the Swing Basin and Channel area) being classified as coarse-grained soil (sand / silty sand). The fines contents at these two sites were 8% and 22%, while for all other sites the fines contents ranged from 44% to 98%, with an average fines content of 74%. The analysis by hydrometer indicated that silt and clay proportions within the sediments are approximately equal; however, the results of Atterberg limits testing show that the materials will behave in a predominantly clay-like manner.

The plasticity of the fine-grained soils at the Port was typically very high, and these sediments generally have "very high" potential for volume change. For all fine-grained samples tested, the moisture contents were found to be higher than the corresponding liquid limits, indicating these in-situ sediments are likely to be sensitive e.g. some of the fine-grained sediments may be stable in an undisturbed state but a sudden change in stress may transform them into a liquid state.

The organic content test results suggest that the fine-grained sediments at the Port include a combination of organic and inorganic materials, with organic soils being more prevalent within the Berth Pockets and Tug Berths.

The carbonate content testing indicated a range of results between 2% and 10%. Based on this, the sediments may be generally considered as "calcareous soils".

The sediment particle densities (effectively equivalent to specific gravity) ranged from 2.40 t/m³ to 2.77 t/m³ across the Port with an average of 2.59 t/m³. The particle densities and the associated moisture content results were used to approximate the in-situ bulk density of the geotechnical samples using phase relationships. The results of this estimation show a clear trend of decreasing

in-situ density with an increase in fines content and suggest that in-situ bulk densities across the majority of the site fall within the range of 1.2 t/m³ to 1.6 t/m³.

Standard compaction testing was undertaken on the combined Berth Pockets sample to provide an indication of the maximum dry density (MDD) that may be achieved during potential placement of the dredged fine-grained sediments, and the optimum moisture content (OMC) required to achieve this density. The test resulted in a MDD of 1.45 t/m³ and an OMC of 23.3%, which corresponds to a bulk / wet density of 1.79 t/m³.

Minimum / maximum dry density testing was performed on the silty sand sample from the area of the port entrance. The results suggest that the placed dry density of this material may fall in the range of 1.14 t/m³ to 1.62 t/m³ depending on the level of compaction or method of placement utilised onshore. Direct shear testing performed on this silty sand sample indicates that this material may achieve a friction angle of approximately 36° after compaction and loading. This value is within the lower end of the range generally associated with a “dense” sand deposit and suggests that the coarse-grained sediments in this area may be suitable for medium loading applications following adequate compaction.

CU triaxial testing was performed on two fine-grained (clay) samples and the results indicate average cohesion (c') values of 3 kPa to 5 kPa and average friction angles (φ') of 25° to 35° following compaction and loading. These strengths suggest that the fine-grained sediments may be suitable for low to medium loading applications following adequate drying out and compaction (noting that fine-grained material typically requires a long time to adequately drain and consolidate), with the lower end of this range applicable to those locations with highly plastic, organic sediments (e.g. Berth Pockets).

Consolidation testing was also undertaken on the two clay samples and the results indicate that, in general, the fine-grained sediments at the Port may be expected to exhibit coefficient of consolidation (c_v) values ranging from approximately 1 m²/yr to 100 m²/yr, which is within the typical range expected for clays and silts. Some of these materials may take many months to many years to consolidate, depending on the level of compaction and drainage path length, although it is noted that consolidation times can vary significantly and can be better estimated by undertaking field trials (e.g. trial embankment with wick drains and surcharge).

The permeability test results were generally within the range expected for the types of sediments tested, with “poor” drainage characteristics being reported for the two clay samples and “good” drainage characteristics for the silty sand sample.

Cement binder testing

Cement laboratory testing results indicate that:

- All three samples were shown in the XRD test to be almost 100% in crystalline mineral form, chiefly quartz. These materials would not chemically react with other materials to create a geopolymer cement in their current form.

- The XRF analyses also showed the presence of significant levels of iron and calcium which would further interfere with any geopolymer reactions.
- As expected for coastal marine sediments, significant levels of alkalis (Na_2O & K_2O) and chlorides were also detected.

Geochemical testing

Based on the Acid Sulfate Soils (ASS) analysis, Potential Acid Sulfate Soils (PASS), in concentrations greater than the relevant (QASSIT) action criteria was detected in all samples analysed.

Notwithstanding this, Acid Neutralising Capacity was detected in all samples submitted for ASS analysis, with concentrations sufficient to negate acidity. This acid buffering potential is expected to arise from the presence of carbonate within the sediments. As such, the marine sediments are unlikely to require treatment through neutralisation (e.g. using lime) dependent on the dredging and management methods applied.

All samples are considered highly saline. If sediments are placed on land without treatment, salinity will degrade the quality of terrestrial soils and may impact the quality of receiving waters. Organic Material (OM) (ranging from 1 to 5.9%) was reported for all samples analysed. This is considered inadequate to support plant growth. The highest OM (generally greater than 3%) was detected in finer textured samples with sand components less than 30%.

1 Introduction

North Queensland Bulk Ports Corporation (NQBP) has commenced work on a strategic assessment for ongoing management of marine sediments at the Port of Mackay (Figure 1-1) known as the *Port of Mackay - Sustainable Sediment Management (SSM) Assessment for Navigational Maintenance* ('The SSM Project'). As part of the SSM Project, NQBP commissioned Advisian to assess the properties of marine sediment that naturally accumulate in the navigational areas of the Port of Mackay (maintenance material) and undertake an investigation of options for beneficial reuse of the marine sediments.

Advisian's work for the SSM project has been undertaken as a two-stage approach:

1. A sampling and analysis program to assess the geotechnical engineering, Acid Sulfate Soil (ASS), salinity and organic matter of marine sediments recently deposited within the navigational areas of the Port of Mackay.
2. Comprehensive identification and analysis of beneficial reuse options for the maintenance material marine sediments.

This report provides a description of the works undertaken to complete the first stage of the program and the associated results as a factual report of marine sediment properties for the maintenance material.

1.1 Purpose

The purpose of the marine sediment properties assessment is to identify and classify marine sediment materials and to investigate their acid generating capacity, salinity, organic matter and geotechnical properties to facilitate subsequent consideration of potential beneficial reuse options.

1.2 Scope of work

The marine sediment properties assessment scope of works included the following:

- Review of historical acid sulfate and geotechnical information pertaining to the sampling areas
- Collection of sediment grabs and core samples from locations across Port of Mackay dredge areas including Channel and Swing Basin, Berth Pockets, Tug Berth (incorporating Operational Area 1) and Operational Area 2 (i.e. new tug berths)
- Description (logging), photographing and collection of sediment samples and subsequent dispatch to laboratory for analysis and testing
- Laboratory analysis of ASS, geotechnical properties, salinity and organic matter of the marine sediment
- Summary and tabulation of the results of the laboratory analysis and testing
- Preparation of this marine sediment properties report.

1.3 Guidelines and standards

The Department of Environment and Science (DES) is the custodian of comprehensive guidelines for ASS management, sampling and analysis. These guidelines also provide technical and procedural advice to avoid environmental harm and achieve best practice environmental management. They include:

- Queensland Acid Sulfate Soil Technical Manual – Legislation and Policy Guide, version 2.2 (Dear *et al.*, 2004)
- Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland 1998, version 4.0 (Ahern *et al.*, 1998)
- Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines, 2002, version 3.8 (Dear *et al.*, 2002)
- Queensland Acid Sulfate Soil Technical Manual Acid Sulfate Soils – Laboratory Methods Guidelines, 2004, version 2.1 (Ahern *et al.*, 2004).

In addition to the above the following guidelines and standards were used to inform the sediment assessment method for geotechnical assessment:

- Australian Standard (AS) 1726-2017: Geotechnical site investigations.

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Port of Mackay Sediment Investigation

**Figure 1-1:
Location of the Port of Mackay
and the navigational areas
associated with the Port**

- LEGEND**
- Berths and operational areas
 - Swing basin
 - Existing DMPA
 - 2018 Dredge area

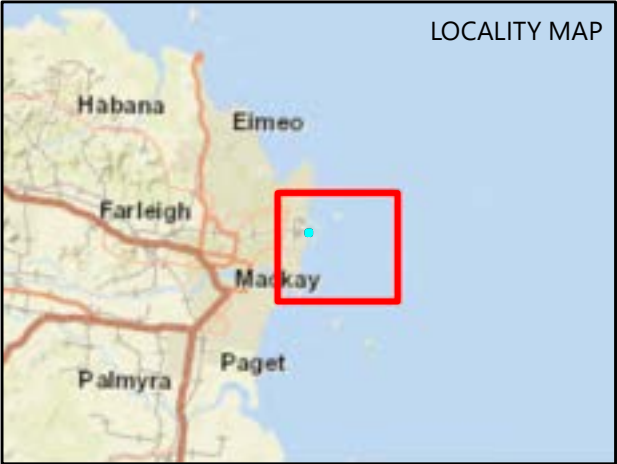
Source Information:
Port facility layout and dredge area
Provided by NQBP - Sept 2018
Imagery - Web Service
Dept of Natural Resources and Energy

While every care is taken to ensure the accuracy of this data, WorleyParsons makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

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Coordinate System: GDA 1994 MGA Zone 55
Scale at A3 - 1:25,000

0 800
Metres



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community



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2 Previous studies

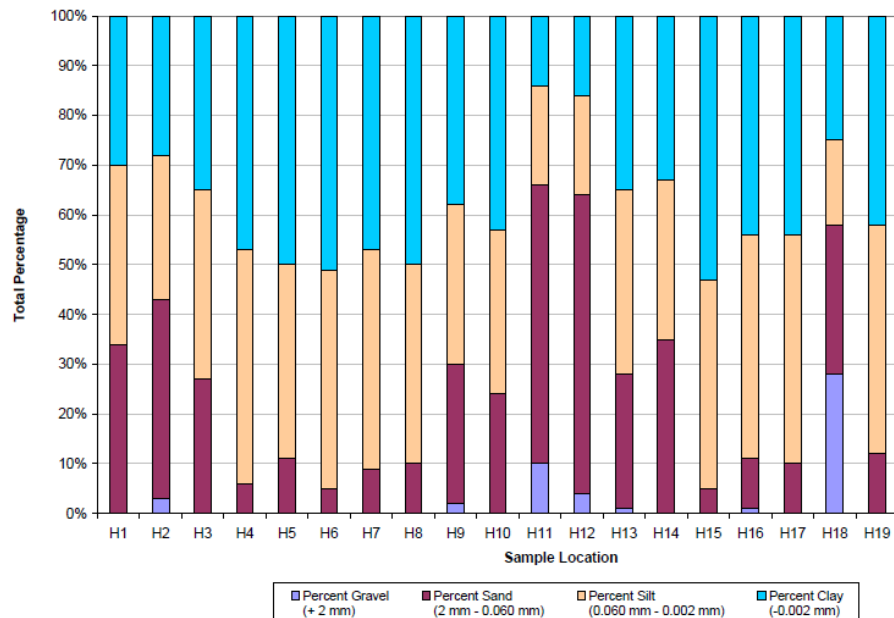
Several sediment contamination surveys for dredging operations in the Port of Mackay have been conducted over the past 11 years including studies from 2007, 2009 and 2013. These investigations have typically focused on potential contaminants in accordance with the National Assessment Guidelines for Dredging (NAGD, 2009) or previously applied guidelines (National Ocean Disposal Guidelines for Dredged Material, 2002). These studies have also included some geotechnical and geochemical analysis consisting of Particle Size Distribution (PSD) and ASS analysis. These components are relevant to the current assessment and are summarised in Table 2-1.

Table 2-1: Summary of contaminant studies information relevant to this report

Report reference	Summary of relevant information
WorleyParsons, 2007. Mackay Port Authority: Port of Mackay Harbour – Sediment Quality Assessment	The 2007 results indicated that sediments within the Channel and Swing Basin dredge area are dominated by equal portions of silt and clay fractions with some sites also containing minimal fine to medium sand particles.
WorleyParsons, 2010. NQBP Mackay Harbour and Spoil Ground 2009 Sediment Characterisation Report, document number 301001-00797-00-EN-REP-0001	<p>ASS testing was completed using the Suspension Peroxide Oxidation – Combined Acidity and Sulfate (SPOCAS) suite on four grab samples collected at a depth of 0.0-0.1m from the Berth Pockets: Berth 1, Berth 4, Berth 5 and Operational Area 1 adjacent to the Tug Berths. The results of the analysis indicated samples had no actual acidity, but contained potential acidity (a-SPOS) ranging from 135 moles H⁺/t to 227 moles H⁺/t. This is above the QASSIT guideline of 18 moles H⁺/t, however, samples contained sufficient Acid Neutralising Capacity (ANC) so that net acidity was below the laboratory limit of reporting (LOR) (i.e. no lime or treatment is required to neutralise sulfidic acidity).</p> <p>PSD data was collected for the Channel and Swing Basins (including operational area 1) and Berth 1. The results are presented in the graph below. These indicate that sediments primarily comprise clay and silt, however, samples H1, H2, H9, H10, H12, H13, H14 and H18 (all located within the Channel and Swing Basin) and H11 (Operational Area 2) had more than 20% sand. Sample H18 also had more than 20% gravel and was located in the southwest corner of the Swing Basin near the Tug Berths.</p>

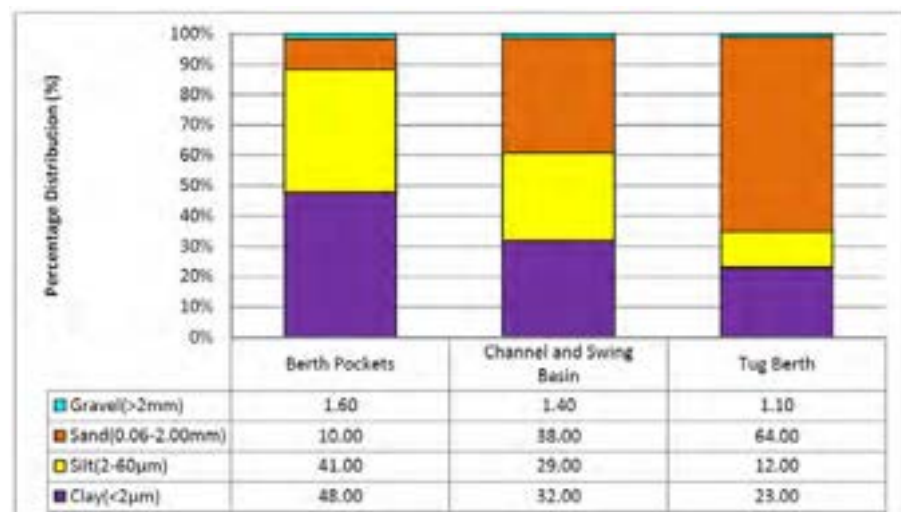
**Report
reference**

Summary of relevant information



PSD data was collected for the Channel and Swing Basin, Berth Pockets, and Tug Berth. The results are presented in the graph below. This indicates the Berth Pockets primarily comprise silt and clay. The channel and swing basin also primarily comprise silt and clay but have a greater proportion of sand. This is consistent with the 2009 results. The Tug Berth primarily comprises sand, but still has a high proportion (i.e. >30%) of fines (i.e. silt and clay).

Golder Associates
(2013). 2013
Maintenance
Dredging –
Sediment
Characterisation
Report. Report
prepared for North
Queensland Bulk
Ports



3 Site information

3.1 Location and environmental setting

The Port of Mackay is operated by NQBP and is situated approximately four kilometres north of the Pioneer River mouth at North Mackay, on the central Queensland coast. The Port commenced operations in 1939 and has continued to develop and grow since this time. There are four operational berths and associated loading/unloading facilities. The Port is located within the Great Barrier Reef World Heritage Area but falls outside of the Great Barrier Reef Marine Park. Multiple commodities pass through the Port facilities, including petroleum, bulk molasses and sugar cane, bulk raw and refined sugar, tallow, ethanol, liquid chemicals, bulk fertilisers, iron concentrates, bulk grain and general cargo. Sugar and sugar products are the major commodities exported, and petroleum (for mining and associated activities in Central Queensland) is the major imported commodity for the Port. As well as major trade items, the Port also provides access to a small craft harbour with tourist terminal, marina amenities and public access.

NQBP conducts maintenance dredging within the Port to maintain declared depths within the Channel, Swing Basin and Berth areas. Sedimentation of the port occurs naturally and is caused by the transportation of sediment from ocean currents, swell and tides, and cyclonic activity. These sediments require periodic removal from the navigational areas to maintain safe and efficient operational depths.

As set out in the Port's Long-Term Dredge Management Plan (LTDMP) (WorleyParsons, 2010), there are potentially four major dredge programs within the current 10-year dredging approval with each program removing an estimated 130,000 m³ of material. Minor dredge programs are scheduled annually between major programs as part of the routine maintenance dredging program with each removing approximately 10,000 m³ of material. The next major program is scheduled to be conducted in 2019 or 2020. The dredge material is placed at the approved Dredge Material Placement Area (DMPA) approximately 3km north-east of the Port entrance as per the conditions set out in the port's current approval.

3.2 Geology

Port of Mackay geology has been mapped by the Department of Natural Resources Mines and Water, 2006 as the 1:100,000 Mackay Sheet 8755. A portion of this map relevant to the Port is provided as Figure 3-1. As the Port itself is subtidal it has not been mapped, however, a cross section cut north of the Port indicates Early Permian age basement rock beneath the Site.

As Mackay is a mosaic of parent material, several units may contribute to the deposited sediments within the Port. These are summarised below.

- Qhd: Quaternary, Holocene – High blown-out dune sand
- Qhe_s: Quaternary, Holocene – Sand, muddy sand, mud and minor gravel; estuarine channels and intertidal sand banks and flats

- Qhh: Quaternary, Holocene – Gravel, sand and mud: man-made deposits associated with land-fill
- Pc_s: Early Permian: Lizzie Creek Volcanic Group Carmila beds – Siltstone and mudstone, volcanolithic sandstone and conglomerate; minor altered basalt and local interbedded rhyolitic to dacitic volcanic rocks; minor coal; plant fossils locally abundant; very weak magnetic domain
- Kw: Whitsunday Volcanics: Rhyolitic to andesitic volcanoclastic rocks, including ignimbrite, minor flows, conglomerate and sandstone.

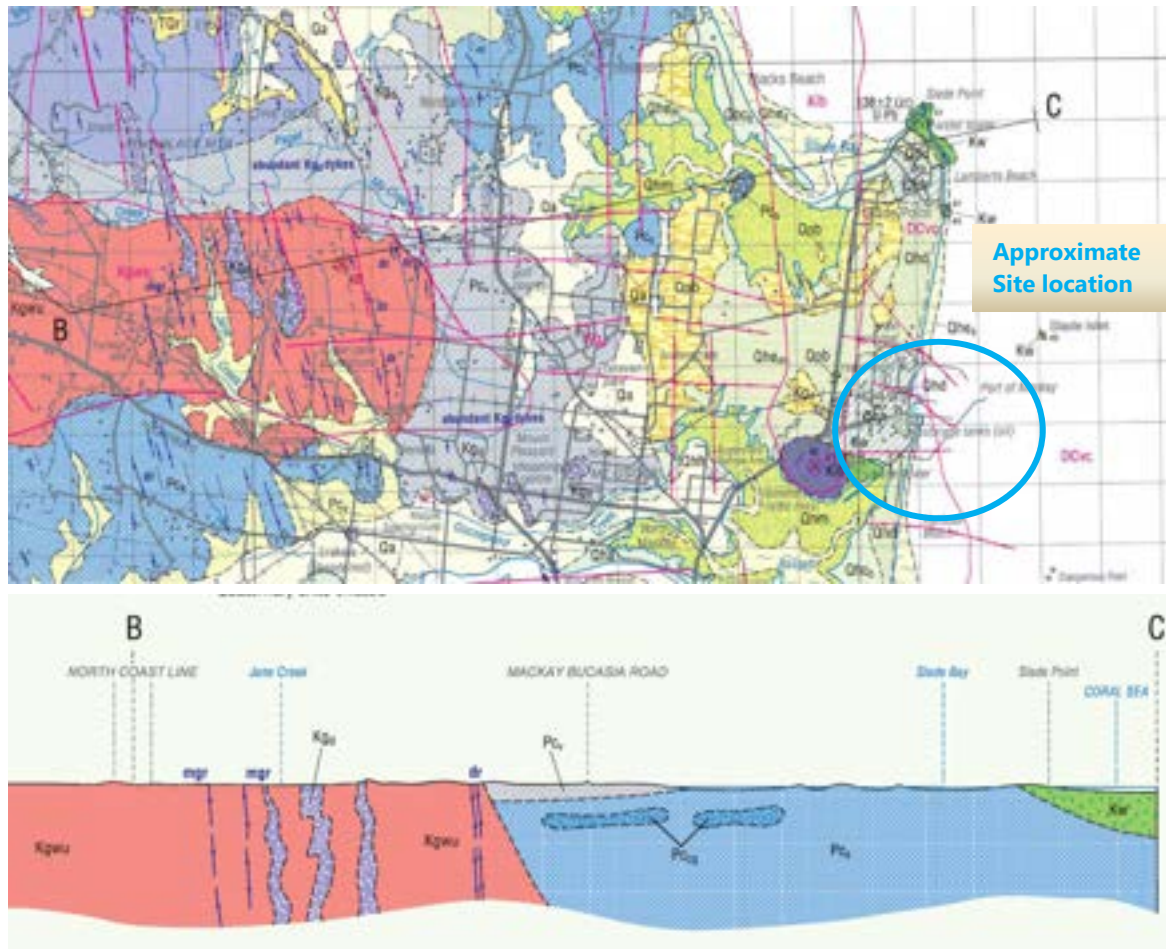


Figure 3-1 Geology of Mackay Sheet 8755, scale 1:100,000 (DNRMW, 2006)

3.3 Land use

The main land uses in the Mackay region include:

- Forest land
- Urban land associated with Mackay and surrounding townships

- Port activities at the Port of Mackay including shipping of multiple commodities, small craft harbour with tourist terminal, marina amenities and public access
- Agriculture primarily consisting of growing sugar cane, with cattle grazing being the second major activity on land not suitable to growing sugar cane and minor dairy farming and cropping (pineapples, melons and tomatoes) also undertaken (Holz and Shields, 1985)
- Quarrying
- Tourist activities including boating and fishing.

4 Method

4.1 General

The marine sediment properties assessment consisted of two components:

1. Assessment of existing information, preselection of sampling location and development of a sampling plan
2. Assessment of marine sediments including a sampling program.

The latter included grab sampling at several locations within the Channel and Swing Basin, Berth Pockets and Tug Berth, and piston core sampling within Operational Area 2. Sampling was focused on understanding the geotechnical engineering, ASS and nutrient properties of the marine sediments.

4.2 Sampling locations and intensity

The number of sampling locations was determined as a pilot study using Table 6 (Minimum number of sampling locations) of the NAGD, 2009. Although the NAGD focuses on contaminant studies, it provides a robust framework for sample program design (based on potential dredge volumes) and ensures a consistent approach with previous studies completed. Based on the NAGD approach, the sampling locations were randomly assigned within each dredge area with samples generally containing a high percentage of fines (i.e. clay and silt) selected for ASS analysis. Samples collected for geotechnical testing were selected based on an approximately even spatial distribution across each navigational area at an overall rate of one geotechnical sample (each approximately 5-8kg in weight) per three contaminant samples (noting that contaminant sampling was undertaken concurrently and is reported separately).

All total of 30 sites were sampled for environmental purposes (PSD and contamination), including:

- Eight locations in the Swing Basin and Channel
- Six locations in the Berth Pockets
- Six locations in the Tug Berth (incorporating Operational Area 1)
- Ten locations in Operational Area 2.

The contaminant analysis results are summarised in the *Port of Mackay Sediment Characterisation Report* (Advisian, 2018).

A subset of the environmental sampling locations was sampled for ASS, salinity, organic matter and geotechnical properties. The total number of ASS, nutrient and geotechnical sampling locations was 18. This number of locations is considered an appropriate intensity for the ASS, nutrient and geotechnical components of this study.

Sediment samples from three sites (one from the Tug Berth and two from the Channel and Swing Basin) were chosen for testing of potential use for cement-related purposes. A summary of the sampling locations, types and co-ordinates is provided in Table 4-1 and the test locations are shown in Figure 4-1 to Figure 4-4.

Table 4-1: Sampling and testing summary







Area	Sample ID	Depth (m)	Sample Method	Testing Undertaken							Sampling location co-ordinates			
				Contamination	Particle Size Distribution	Acid Sulfate Soils	Salinity, organic matter	Geotechnical Phase 1	Geotechnical Phase 2	Cement Testing	Easting (MGA55)	Northing (MGA55)	Longitude (GDA94)	Latitude (GDA94)
Berth Pockets	B1_02 T1	0.0-0.15	G	X	X	X	X				731554	7664151	149.2292063	-21.10913246
	B1_02 T2	0.0-0.15	G	X	X									
	B1_02 T3	0.0-0.15	G	X	X									
	B1_07	0.0-0.15	G	X	X			X	X		731404	7664191	149.2277577	-21.1087903
	B3_14	0.0-0.15	G	X	X	X	X	X	X		731293	7664470	149.2266582	-21.10629166
	B4_01	0.0-0.15	G	X	X	X	X	X	X		731156	7664516	149.2253334	-21.10589074
	B5_08	0.0-0.15	G	X	X	X	X				731541	7664783	149.2289968	-21.10342928
	B5_10	0.0-0.15	G	X	X			X	X		731341	7664808	149.2270692	-21.10322886
	B5_10 D3	0.0-0.15	G	X										
	B5_10 D4	0.0-0.15	G	X										
Swing Basin and Channel	SB_02 T1	0.0-0.15	G	X	X						731410	7664228	149.2278109	-21.10845956
	SB_02 T2	0.0-0.15	G	X	X									
	SB_02 T3	0.0-0.15	G	X	X									
	SB_02A	0.0-0.15	G		X					X				
	SB_16	0.0-0.15	G	X	X			X			731635	7664358	149.2299582	-21.10725736
	SB_40	0.0-0.15	G	X	X			X			731485	7664553	149.2284887	-21.10551575
	SB_45	0.0-0.15	G	X	X	X	X	X	X	X	731860	7664553	149.2320967	-21.10546827
	SB_50	0.0-0.15	G	X	X						731035	7664618	149.2241503	-21.10498576
	SB_52	0.0-0.15	G	X	X	X	X				731185	7664618	149.2255935	-21.10496682
	SB_58	0.0-0.15	G	X	X	X	X				731635	7664618	149.2299231	-21.10490991
	SB_79	0.0-0.15	G	X							731410	7664748	149.2277408	-21.10376465
	SB_79 D1	0.0-0.15	G	X										
	SB_79 D2	0.0-0.15	G	X										
Tug Berth	TB_02	0.0-0.15	G	X	X						731182	7664202	149.2256212	-21.10872646
	TB_05	0.0-0.15	G		X			X		X	731272	7664202	149.2264871	-21.10871509
	TB_05 T1	0.0-0.15	G	X	X									
	TB_05 T2	0.0-0.15	G	X										
	TB_05 T3	0.0-0.15	G	X										
	TB_12	0.0-0.15	G	X	X						731332	7664222	149.2270617	-21.10852693
	TB_18	0.0-0.15	G	X	X						731212	7664262	149.2259018	-21.10818095
	TB_26	0.0-0.15	G	X	X	X	X				731302	7664282	149.226765	-21.107989
	TB_29	0.0-0.15	G	X	X						731242	7664302	149.226185	-21.10781601
	TB_29 D5	0.0-0.15	G	X										
	TB_29 D6	0.0-0.15	G	X										
Operational Area 2	OP2_18	0.0-0.5	PC	X	X	X	X	X	X		731758	7664758	149.2310908	-21.10363187
	OP2_24	0.0-0.5	PC		X			X			731730	7664786	149.23081764200	21.10338261790
	OP2_21	0.0-0.5	PC	X	X						731646	7664786	149.2300095	-21.10339325
	OP2_32	0.0-0.5	PC	X	X	X	X				731730	7664814	149.2308139	-21.10312982
	OP2_33	0.0-0.5	PC	X	X						731534	7664842	149.2289243	-21.10290182
	OP2_33 D7	0.0-0.5	PC	X										
	OP2_33 D8	0.0-0.5	PC	X										
	OP2_36	0.0-0.5	PC	X	X	X	X				731618	7664842	149.2297325	-21.10289119

Area	Sample ID	Depth (m)	Sample Method	Testing Undertaken							Sampling location co-ordinates			
				Contamination	Particle Size Distribution	Acid Sulfate Soils	Salinity, organic matter	Geotechnical Phase 1	Geotechnical Phase 2	Cement Testing	Easting (MGA55)	Northing (MGA55)	Longitude (GDA94)	Latitude (GDA94)
Operational Area 2	OP2_36	0.5-1.0	PC	X	X	X	X							
	OP2_36	1.0-1.5	PC	X	X	X	X							
	OP2_38 T1	0.0-0.5	PC	X	X									
	OP2_38 T2	0.0-0.5	PC	X	X						731674	7664842	149.2302713	-21.1028841
	OP2_38 T3	0.0-0.5	PC	X	X						731590	7664870	149.2294593	-21.10264193
	OP2_42	0.0-0.5	PC	X	X									
	OP2_42	0.5-1.0	PC	X	X									
	OP2_42	1.0-1.5	PC	X	X						731646	7664870	149.2299981	-21.10263485
	OP2_44	0.0-0.5	PC	X	X									
	OP2_44	0.5-1.0	PC	X	X									
	OP2_45	0.0-0.5	PC	X	X						731674	7664870	149.2302675	-21.1026313
	OP2_45	0.5-1.0	PC	X	X									
	OP2_45	1.0-1.5	PC	X	X									
Note: MGA55: Map Grid of Australia, Zone 55 GDA94: Geocentric Datum of Australia G: Grab sample PC: Piston Core														

Port of Mackay Sediment Properties Report

Figure 4 1:
Sampling locations –
Channel and Swing Basin

LEGEND

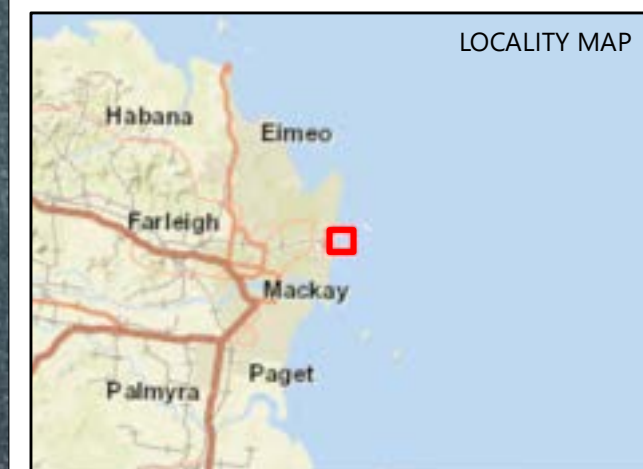
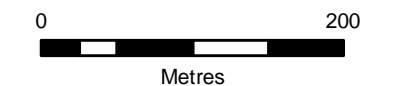
- Fixed sampling location
-  Sediment sampling location
-  Geotech and sediment sampling location
-  Sampling grid
-  Berths and operational areas
-  Swing basin
-  Swing basin and channel dredge area

Source Information:
Port facility layout
Provided by NQBP - Sept 2018
Imagery - Aug 2017
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Coordinate System: GDA 1994 MGA Zone 55
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



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Port of Mackay Sediment Properties Report

Figure 4 2:
Sampling locations –
Berth Pockets

LEGEND

-  Sediment sampling location
-  Geotech and sediment sampling location
-  Sampling grid
-  Berths and operational areas
-  Berth pocket dredge area

Source Information:

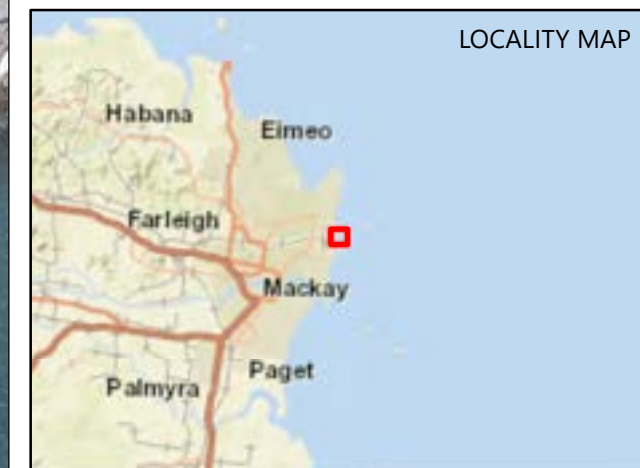
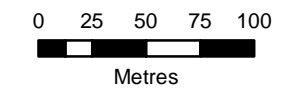
Port facility layout
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



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Figure 4 3:
Sampling locations -
Tug Berth

LEGEND

-  Sediment sampling location
-  Geotech and sediment sampling location
-  Sampling grid
-  Berths and operational areas
-  Tug berth pocket dredge area

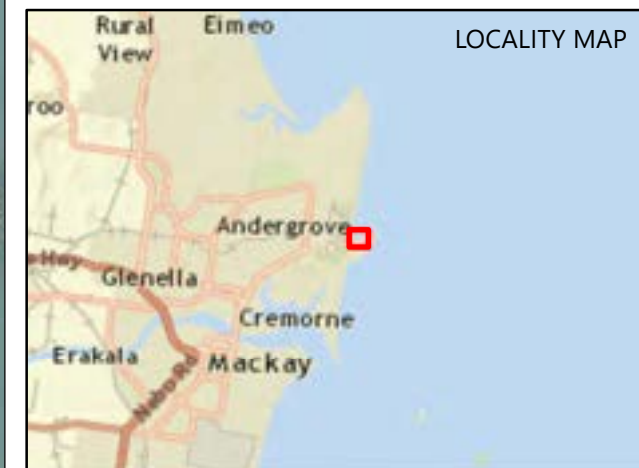
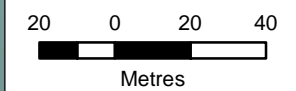
Source Information:
Port facility layout
 Provided by NQBP - Sept 2018
Imagery - Aug 2017
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Port of Mackay Sediment Properties Report

Figure 4 4:
Sampling locations –
Operational Area 2

LEGEND

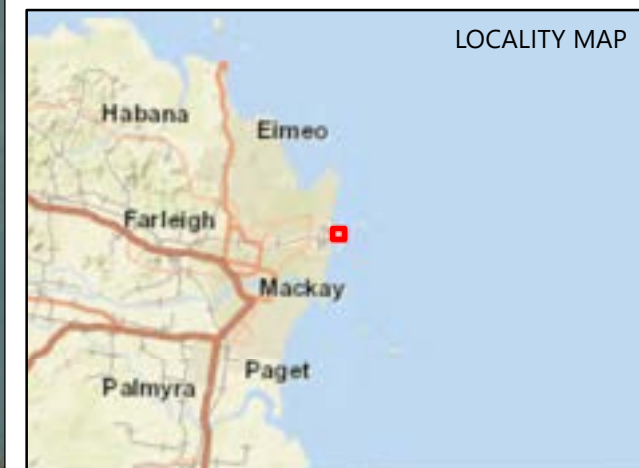
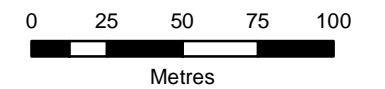
-  Sediment sampling location
-  Geotech sampling location
-  Geotech and sediment sampling location
-  Sampling grid
-  Operational area 2 dredge area
-  Berths and operational areas

Source Information:
Port facility layout
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4.3 Field method

Field sampling procedures, conforming to *Appendix F Field and laboratory quality assurance and quality control* of the NAGD (2009) and Advisian's Quality Assurance / Quality Control (QA/QC) protocols, were carried out to minimise the potential for cross contamination and preserve the sample integrity. Table 4-2 provides a summary of the sediment sampling activities undertaken.

Table 4-2 Field activities

Activity	Details
Sampling locations	The co-ordinates of the sampling locations were uploaded onto a Garmin 76CSx Global Positioning System (GPS) unit with an accuracy of +/-5m. The Garmin was used to navigate to the locations and if required, also re-position the locations due to site conditions.
Sediment sampling and horizon	<p>Grab Sampling: Samples collected using a boat deployed van Veen grab sampler were located in Channel and Swing Basin, Berth Pockets and the Tug Berth. The grab sampler is constructed of stainless steel with an approximate grab payload of 5kg. Using a pulley system, the grab sampler was deployed from the boat and lowered to the sea floor where it would trigger shut and capture sediments ranging in depth from 10-15cm. Once collected the sample, the grab sampler was then lifted back to the surface where it was opened and sediments placed directly into stainless steel mixing bowls for processing.</p> <p>Piston coring: Samples collected using a boat-deployed stainless-steel piston corer were located in Operational Area 2. The piston corer was constructed of stainless steel with an internal barrel length of 2.2m and internal diameter of 62mm. The corer was lowered over the side of the vessel to the seabed using extension rods to collect a sediment core to a maximum depth of 2.2m or until refusal, whichever occurred first. Once a sediment core had been collected, the piston corer was retrieved to the surface and extruded manually into a plastic core tray for core logging and then directly into stainless steel mixing bowls for sample processing (i.e. homogenisation).</p>
Location log	<p>The following information was recorded at each sampling location and presented in Appendix A:</p> <ul style="list-style-type: none"> ▪ Name of client ▪ Sampling date ▪ General location of sample collection ▪ Sample identifiers assigned ▪ Name of the sample collector ▪ Type of sampler used

Activity	Details
	<ul style="list-style-type: none"> Weather conditions at the time of sampling Sea state at time of sampling General comments (e.g. Wind speed, level of shipping etc.) GPS location (easting and northing) Time of sampling Water depth Photograph of sediment sample
Sediment log	<p>A sediment log (Appendix A) was recorded for each location on a field data sheet, providing a description of the texture and composition of each sample, including the following information</p> <ul style="list-style-type: none"> Colour Sediment field texture Observed sand grain size Consistency Moisture content of sample (e.g. wet, moist, dry) Percentage of stones Presence of shell/shell grit Odour (e.g. marine, sulphurous)
Sediment sampling & storage	<p>Samples were homogenized in stainless-steel mixing bowls using powderless nitrile gloved hands. Homogenised sediment material was then placed into laboratory supplied 250ml glass jars leaving zero head space (for salinity and organic matter) and into zip lock bags (for ASS and PSD) and large geotechnical sampling bags (for phase 1 and 2 tests). Label information was completed on each sample container and the containers were stored on ice in eskies.</p>
Labelling	<p>Sample bags and jars were labelled with the date, the abbreviated project location (Mackay), the location number / depth, sampler's initials, date and time of sampling. For instance, a sample collected at SB02 at a depth of 0.0-0.5m was labelled as follows:</p> <p>SB02 GRAB (sample I.D) NB (initials of sampler) 24/09/18 (date sampled) 15:00 (time sampled)</p>
Decontamination	<p>Decontamination between samples included washing of all sampling equipment with ambient sea water and a laboratory grade phosphate free detergent (Decon 90), and successive rinsing with deionised water.</p>
Dispatch	<p>All samples were transported under chain of custody documentation to ALS's Mackay depot where they were refrigerated until being air freighted to ALS Brisbane for analysis. Blind duplicate samples were forwarded by</p>

Activity	Details
	ALS to SGS. Geotechnical samples were forwarded by ALS to Trilab for Phase 1 and some Phase 2 testing. Samples for further Phase 2 testing were forwarded to Wagners by Trilab.

4.4 Laboratory methodology

4.4.1 Geochemical analysis

The presence of potential ASS (PASS) was assessed using the chromium suite of analysis (S_{CR}). The chromium suite, along with the Suspension Peroxide Oxidation Combined Acidity and Sulfur (SPOCAS) suite, is the ASS assessment recommended by Ahern et al (2003) and the most recent guidelines, *Queensland Acid Sulfate Soil Technical Manual – Soil Management Guideline* (Dear et al., 2002).

A total of 13 sediment samples were collected for laboratory analysis. All samples collected were submitted to ALS, a National Association of Testing Authorities (NATA) laboratory, for analysis. NATA accredited analysis undertaken at the laboratory, included:

- Chromium Suite (S_{CR})
- Electrical conductivity (EC)
- Salinity (total soluble salts) (TSS)
- Salinity Chloride (Cl^-)
- Organic Matter (OM).

Additional analysis, not NATA accredited, included preliminary ASS screening field pH (pH_f) and field peroxide pH (pH_{fox}). Summary tables of the results are provided in Appendix B, while ALS laboratory documentation is provided in Appendix C.

4.4.2 Geotechnical testing

The geotechnical testing was undertaken using a phased approach. Phase 1 comprised general classification testing to determine characteristics such as particle size, moisture content, carbonate content and plasticity. A total of 10 Phase 1 samples were selected to ensure adequate coverage across the range of material types observed during the field sampling. Following Phase 1 testing, Phase 2 testing was undertaken on a total of three samples (one of which was a mixture of the four Berth Pocket samples) to assess the more detailed engineering properties of the sediment including permeability, density, strength and consolidation. The Phase 2 samples included one coarse-grained (sand) and two fine-grained (clay) materials. A summary of the geotechnical laboratory testing performed is provided in Table 4-3. The Phase 1 and 2 testing was completed by Trilab, however, the organic analysis was subcontracted by Trilab to ALS. The Trilab laboratory documentation is provided in Appendix D, while the ALS laboratory documentation is provided in Appendix C.

Table 4-3: Summary of geotechnical testing

Testing Phase	Test	Quantity
Phase 1	Particle size distribution (sieve and hydrometer)	10
	Carbonate (CaCO ₃) content	10
	Moisture content	10
	Atterberg limits and linear shrinkage	10
	Particle density (specific gravity)	10
Phase 2	Standard compaction	1
	Minimum / maximum dry density	1
	Direct shear box (100mm) – Single Stage	1
	Consolidated undrained (CU) triaxial – 3 Stage	2
	1D consolidation (8 loadings)	2
	Constant head permeability	1
	Falling head permeability	2

Note: In addition to the specified geotechnical testing, supplementary testing undertaken on a number of samples by the environmental laboratory (ALS) has been considered in the geotechnical assessment, including organic content, carbonate (CaCO₃) content and PSD testing.

Summary tables of the geotechnical test results are provided in Section 5.4. The laboratory test certificates are provided in Appendix C.

4.4.3 Cement Laboratory Testing

Cement testing was undertaken by Wagners. Following phase 1 and 2 testing, samples from Trilab were forwarded to Wagners for cement testing. The Wagner laboratory documentation is provided in Appendix E.

Table 4-4: Summary of cement laboratory testing

Test	Quantity
X-ray diffraction	3
X-ray fluorescence	3

5 Results

5.1 General

This section describes the findings from the field investigation undertaken, including the sediment materials encountered (Section 5.2) and results of laboratory analysis (Sections **Error! Reference source not found.** and 5.4). Sediment logs are presented in Appendix A, summary result tables are provided in Appendix B and the laboratory reports and QA/QC certificates, along with chain of custody and sample receipt documentation are provided in Appendix C.

5.2 Physical description

The sediment textures encountered in the field are summarised in Table 5-1. These are consistent with geology mapping (Section 3.2) for the region.

Table 5-1: General field description of sediments observed during sampling

Navigational area	General description
Channel and Swing Basin	Brown / grey / dark grey. Mixture of silty SAND to clayey silty SAND to silty sandy CLAY to silty CLAY. Most samples contain coarse sand, shell fragments and have marine / sulphur odours
Berth Pockets	Brown / grey / dark grey. Silty sandy CLAY. All samples contain shell fragments and have marine / sulphur odours
Tug Berth	Brown / grey / dark grey. Silty sandy CLAY to silty CLAY. All samples contain shell fragments and have marine / sulphur odours
Operational Area 2	Grey silty sandy CLAY with gravel to silty sandy CLAY. All samples contain shell fragments and have marine / sulphur odours.

5.3 Geochemical results

5.3.1 Acid Sulfate Soils

The *Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines* (Dear et al. 2002) provides action criteria that are used to compare the results of laboratory analysis. These action criteria are based on texture (fine, medium, coarse) with the most stringent criteria (0.03 %S or 18 mol H⁺/tonne) applied to coarse textured sediments and disturbances greater than 1000 tonnes. Although a range of textures were encountered, the 0.03 %S or 18 mol H⁺/tonne criteria is used in this report as the assumed disturbance would be greater than 1000 tonnes.

5.3.1.1 Preliminary screening

These tests are used to provide an indication of the presence of actual and potential acidity by measuring the difference between field pH (pH_F) to oxidised pH (pH_{FOX}). To obtain pH_{FOX} , hydrogen peroxide is added to the samples. This acts as a catalyst to oxidise sulfidic material causing the pH to change. Changes greater than 1 pH unit, pH_{FOX} values less than 3 and a strong reaction rate can be indicative of a PASS. The following results were reported:

- pH_F values ranged from pH 8.3 to pH 9. This indicates the sediment material selected for screening tests are strongly alkaline to very strongly alkaline and there is negligible actual acidity.
- pH_{FOX} values ranged from pH 6.3 to pH 6.8. These results indicate that PASS may not be of concern due to the high pH (>5). However, due to the shell content within a number of samples it is likely that any PASS is neutralised when the hydrogen peroxide is added and reacts with both sulfidic material and carbonates (i.e. shells) causing the pH to remain neutral through oxidation.
- Initial reactions were assessed following the addition of hydrogen peroxide. The reactions are rated by the laboratory on a scale of 1 (slight) to 4 (very high). The results ranged from 2 to 3.

Used in combination with soil profiling and other field observations, screening results can be used as a preliminary assessment of ASS. However, these results are inconclusive and further laboratory assessment using the Chromium Suite is provided in Sections 5.3.1.2 to 5.3.1.5 below.

5.3.1.2 Actual acidity

Actual acidity is assessed by the measurement of Titratable Actual Acidity (TAA). The determination of pH potassium chloride (pH_{KCl}) is a means of estimating the actual soil acidity which is used to calculate TAA.

All samples had a pH_{KCl} value >8.4 indicating strongly alkaline sediments, likely to contain properties (i.e., carbonates) in large enough quantities to neutralize any existing acidity. This correlates well with field data that identified shell content in the sediment, preliminary screening (Section 5.3.1.1) and secondary carbonate sources described in Section 5.4.3.

The TAA at all sample locations was less than the laboratory practical quantitation limit (PQL) of 2 mole H^+/t , which is also less than the QASSIT guideline of 18 mole H^+/t . This indicates all samples have very little or no actual acidity.

5.3.1.3 Retained acidity

Retained acidity is the acidity stored in largely insoluble compounds such as jarosite and other iron and aluminium sulfate minerals which are not measured by the TAA titration. Retained acidity is only measured when the pH_{KCl} is <4.5 or when yellow mottles of jarosite, natrojarosite,

schwertmannite, etc. have been noted in the sample. Retained acidity (or net acid soluble sulfur (S_{NAS})) is estimated by subtracting S_{KCl} from S_{HCl} .

As pH_{KCl} is greater than pH 4.5 in all samples analysed, retained acidity was not determined.

Note that the total extractable sulfate (S_{KCl}) result provides a measure of adsorbed and soluble sulfate, including gypsum if present i.e. both inorganic (ASS) and organic forms of sulfur and is determined during the TAA process (Section 5.3.1.2). As retained acidity was not determined, S_{KCl} data is not used to assess ASS.

5.3.1.4 Potential acidity

Potential acidity is assessed through the measurement of Chromium Reducible Sulphur (S_{CR}). All 13 samples analysed have S_{CR} concentrations greater than the QASSIT guideline of 0.03% and 18 moles H^+ / t. These samples generally contained a substantial fine fraction. These S_{CR} concentrations ranged from 0.06 to 0.256 % and 37 to 160 moles H^+ / t.

5.3.1.5 Acid Neutralising Capacity, Net Acidity and Liming

Acid neutralizing capacity (ANC) is the natural ability of soil to buffer acidity either through the dissolution of calcium and/or magnesium carbonates (i.e. shells), cation exchange reaction, reaction of organic and clay fractions or other soil minerals. The effectiveness of neutralization can be hindered somewhat depending on the available forms for acid buffering. For example, where carbonates are stored in coarse shells, acid buffering may not be readily available. In the laboratory, samples are ground therefore making any carbonates (such as shell fragments) more available for neutralisation and therefore 'over estimating' ANC. This is somewhat accounted for by 1.5 correction factor incorporated into liming rates reported with the final acid base accounting. A pH_{KCl} greater >6.5 (Section 5.3.1.2) is one attribute that indicates the presence of carbonates. The greater the pH is above 6.5, the more likely that the ANC will be effective.

Net acidity is the final measure of acidity within a sample once the acid neutralising capacity has been subtracted from the sum of all acids (actual, potential and retained) and is known as acid-base accounting (ABA). In general, the following equation describes the ABA used in ASS determination:

$$\text{Net Acidity} = \text{Potential Sulfidic Acidity} + \text{Actual Acidity} + \text{Retained Acidity} - \text{measured ANC/FF}$$

Note: FF refers to the fineness factor (generally 1.5) applied to liming rates.

Net acidity was below the laboratory PQL (10 moles H^+ /t) in all samples analysed and hence below the QASSIT guidelines of 18 moles H^+ /t. This correlates to a liming rate which is also below a laboratory PQL of 1 kg $CaCO_3$ /t, i.e. as there is no net acidity in samples, no treatment (i.e. liming) is required.

5.3.2 Salinity and Organic Matter

A range of salinity parameters and organic matter were determined for selected samples to provide an indication of the initial environmental risk to native vegetation, groundwater and surface water and rehabilitation if maintenance sediment is untreated and reused on land. Based on the analysis the following ranges were reported:

- Salinity – Total Soluble Salts (TSS) ranged from 11100 to 24600 mg/kg
- Chloride (Cl-) ranged from 8020 to 35500 mg/kg
- Electrical Conductivity (EC) ranged from 3430 to 7570 $\mu\text{S}/\text{cm}$
- Organic Matter (OM) ranged from 1 to 5.9%.

Higher salinity, Cl- and EC (i.e. >20000 mg/kg and >20000 $\mu\text{S}/\text{cm}$) are reported for samples with finer textures (i.e. silts and clays), with the highest concentrations detected in Channel and Swing Basin, Berth Pockets and Tug Berth samples.

Sandy textured sediments were reported with lower salinity, Cl- and EC values (generally <20000 mg/kg, <20000 mg/kg and <5000 $\mu\text{S}/\text{cm}$).

All samples are considered extremely saline (i.e. > 1210 $\mu\text{S}/\text{cm}$) according to Rayment and Lyons, 2011 salinity ratings.

The OM ranged from 1.0 to 5.9% with finer textured samples containing the highest (generally 3 %) OM in samples with less than 30% sand.

5.4 Geotechnical testing

5.4.1 Particle size distribution

The Phase 1 samples were subjected to PSD testing to determine the grading characteristics of the sediments and enable classification based on AS1726-2017 (Geotechnical Site Investigations). In addition to the Phase 1 geotechnical samples, PSD testing was also undertaken on samples tested for ASS, salinity and organic matter and these supplementary results were included in the PSD assessment.

It is noted the AS1726-2017 method of classification differs from the superseded AS1726-1993 standard and the Unified Soil Classification System (USCS) in that the boundary between "fine-grained" and "coarse-grained" soil is defined by a fines fraction of 35%. This is based on a behavioural approach. That is, a soil with >35% fines (<0.075 mm particle diameter) is classified as a fine-grained soil (silt / clay) as the behaviour of the soil will be predominantly controlled by the fines fraction. A soil with <35% fines is classified as a coarse-grained soil (sand / gravel) as the behaviour of this material will be predominantly controlled by the coarse fraction. A summary of the AS1726-2017 soil classification system is provided in Table 5-2.

The PSD results of the Phase 1 samples, in combination with the plasticity test results, have been used to define the classification of the Phase 1 samples in accordance with AS1726-2017, as summarised in Table 5-3.

The PSD results from the Phase 1 samples have been combined with the results from the supplementary environmental testing to provide an estimate of the average particle sizes within each area of the site. This is presented graphically in Figure 5-1 and Figure 5-2 (note the four berth pockets have been included as a single area due to the consistency of material identified at these locations). The PSD results indicate that the majority of sediments within the Port have fines contents in excess of 50%, with an average fines content of approximately 74%. Only two samples (SB_45 and SB_50) were classified as coarse-grained soil with fines contents of 22% (Silty Sand) and 8% (Sand). The areas of the site where coarse-grained sediments were identified included the western edge of the Swing Basin and Channel area near Berth 4 and close to the port entrance.

Table 5-4 provides an estimate of the total dredging volumes for each particle size based on the average PSD results within each area.

5.4.2 Organic content

Based on Table 3 of AS1726-2017, a soil may be classified as "Organic Soil" if the organic content (expressed as a percentage of the dry soil mass) is greater than 2%. A number of the Phase 1 samples were subjected to organic content testing and this was used to assist in the classification of the samples. The results of this testing are presented in Table 5-3 and indicate organic contents ranging from 1.0% ("Inorganic Soil") to 5.9% ("Organic Soil"). As described in 5.3.2, a number of environmental samples were also tested for organic matter, with these results ranging from 1.0% to 3.2%. The entire set of results suggests that the fine-grained sediments at the Port include a combination of organic and inorganic materials, with organic soils being more prevalent within the Berth Pockets and Tug Berths.

5.4.3 Carbonate (CaCO₃) content

Due to the presence of shells and secondary carbonate in the seabed sediments, carbonate (CaCO₃) content testing was undertaken on the Phase 1 samples. It is important to define this property as soils with high proportions of calcium carbonate can have high porosity and low crushing strength.

The carbonate content test results are presented in Table 5-3 and indicate a range of 5.8% to 10.4% for the Phase 1 samples. Including the supplementary environmental samples, the full range of results is 2.4% to 10.4% with an average value of 7.5%.

A soil with a carbonate content greater than 50% is generally regarded as a "carbonate soil" for the purposes of engineering design. On this basis, none of the samples from the Port would be regarded as carbonate soil, but would be referred to as "calcareous soil" due to the proportion of carbonate generally ranging from 2% to 10%.

Table 5-2: Definition of group symbols used in soil classification (reproduced from Tables 9 and 10 of AS 1726-2017)

Major divisions		Group symbol	Typical names	Laboratory classification
Coarse-grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075 mm)	GRAVEL (more than half of coarse fraction is larger than 2.36 mm)	GW	Gravel and gravel-sand mixtures, little or no fines	≤5% fines
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	≤5% fines
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	≥12% fines, fines are silty
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	≥12% fines, fines are clayey
	SAND (more than half of coarse fraction is smaller than 2.36 mm)	SW	Sand and gravel-sand mixtures, well graded, little or no fines	≤5% fines
		SP	Sand and gravel-sand mixtures, poorly graded, little or no fines	≤5% fines
		SM	Sand-silt mixtures	≥12% fines, fines are silty
		SC	Sand-clay mixtures	≥12% fines, fines are clayey
Fine-grained soil (more than 35% of soil excluding oversize fraction is less than 0.075 mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Above A line
		OL	Organic silt	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt of high plasticity	Below A line
		CH	Inorganic clay of high plasticity	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	-

Table 5-3: Summary of particle size distribution and carbonate content test results

Area	Sample ID	Group Symbol (AS1726-2017)	Particle size distribution					Organic Content	CaCO ₃ Content
			Gravel	Sand	Fines (silt & clay)	Silt	Clay		
			%	%	%	%	%		
Swing Basin & Channel	SB_16	CH-OH	0	3	97	80	17	-	7.5
	SB_40	CH-OH	1	16	83	43	40	-	8.1
	SB_45	SM	2	76	22	15	7	1.2	9.9
Berth Pockets	B1_07	OH	0	4	96	45	51	4.6	9.8
	B3_14	OH	0	4	96	48	48	4.2	10.4
	B4_01	OH	0	5	95	41	54	3.9	10.0
	B5_10	OH	0	3	97	46	51	3.3	10.2
Tug Berths	TB_05	OH	0	19	81	40	41	5.9	7.1
Operational Area 2	OP2_18	CI	5	43	52	27	25	1.0	5.8
	OP2_24	CH	0	16	84	44	40	1.8	8.8

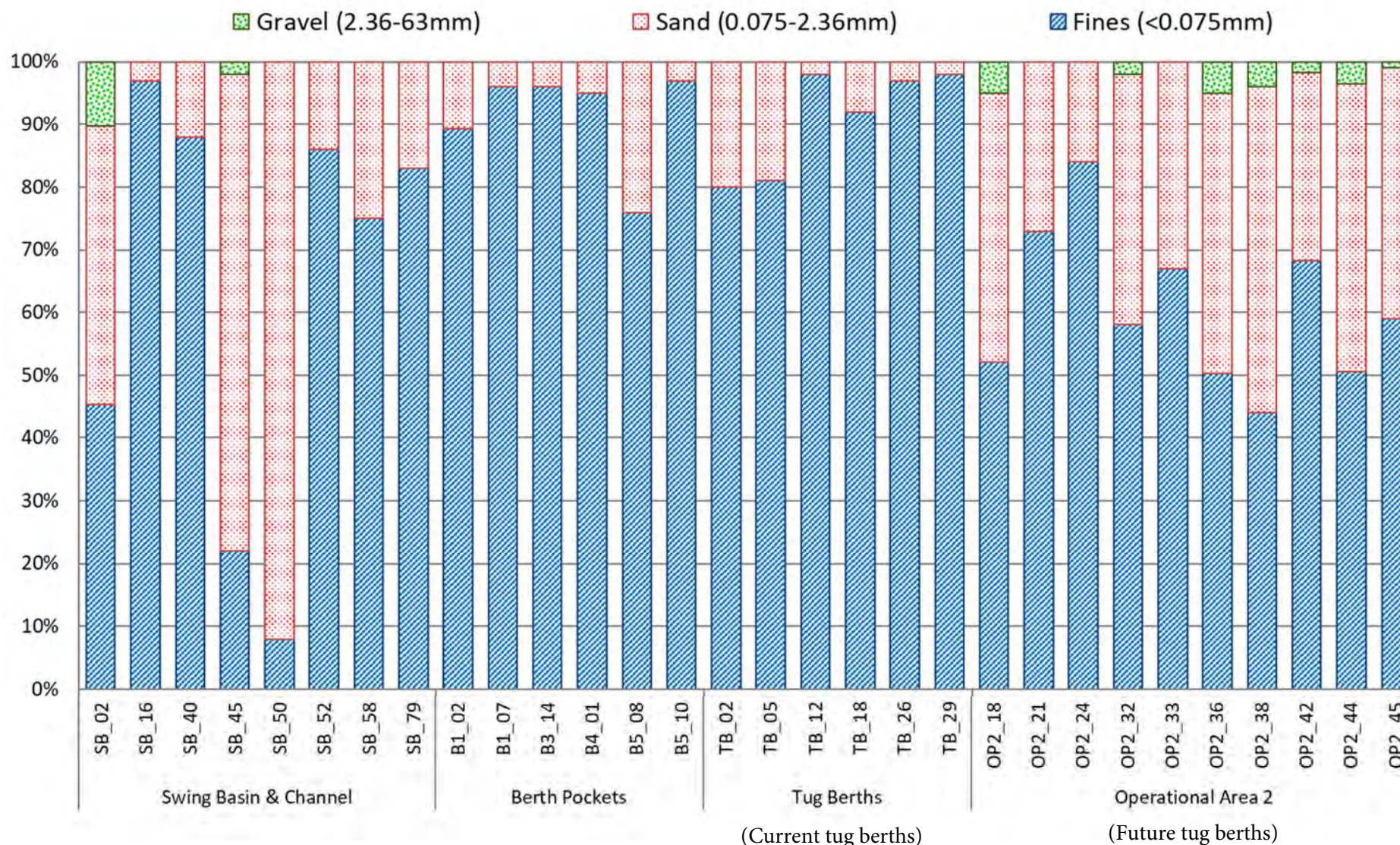


Figure 5-1: Particle Size Distribution (gravel / sand / fines proportions) by sample location

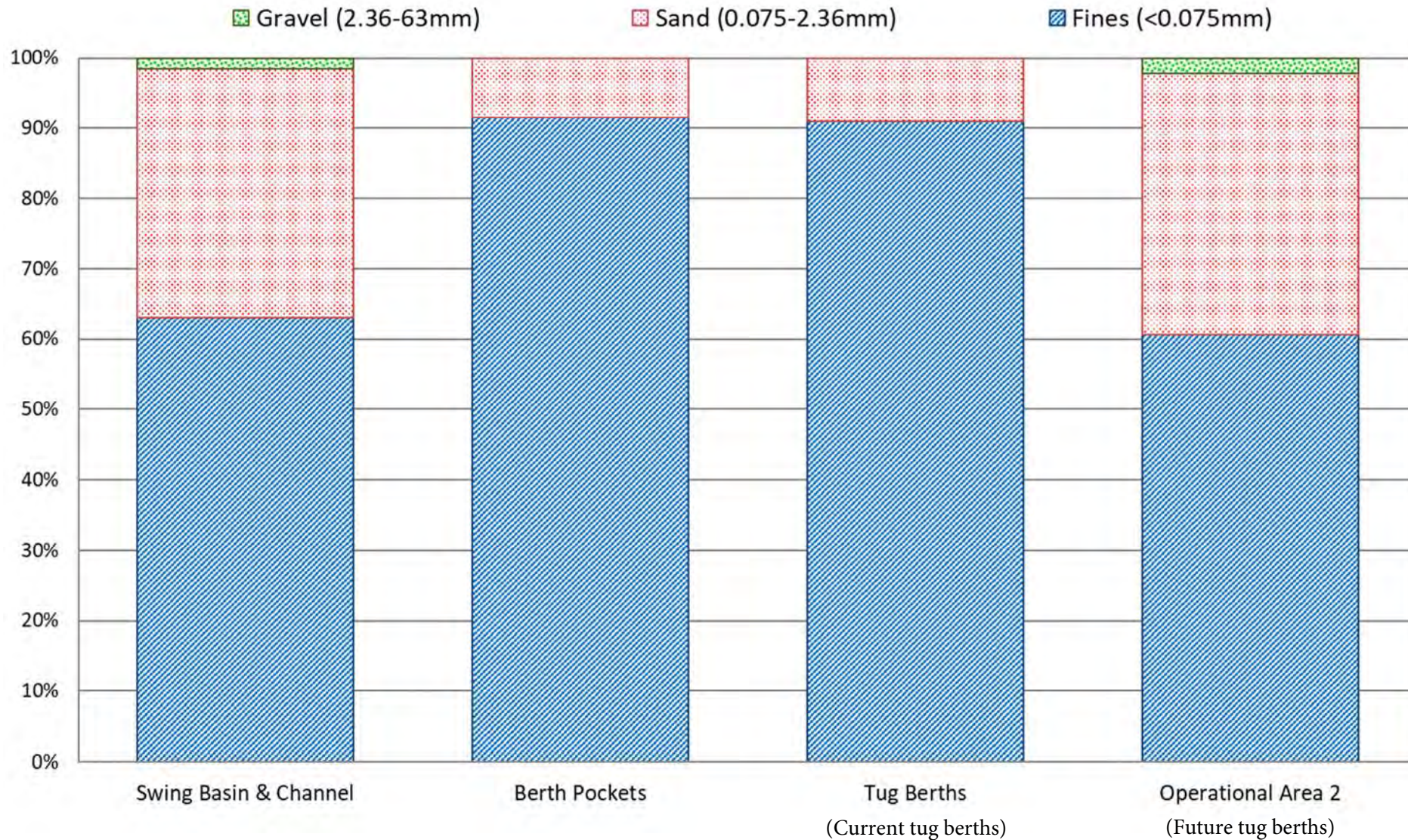


Figure 5-2: Average Particle Size Distribution (gravel / sand / fines proportions) by area

Table 5-4: Estimated dredge volumes based on average Particle Size Distribution by area

Area	Average Particle Size Distribution (%)			Approximate Total Dredge Volume Estimate ¹ (m ³)	Proportion of Total Estimated Dredging (%)	Approximate Dredge Volumes by Particle Size (m ³)		
	Fines	Sand	Gravel			Fines	Sand	Gravel
Swing Basin & Channel	63	35	2	80,000	59	50,400	28,400	1,200
Berth Pockets	92	8	0	27,000	20	24,700	2,300	-
Tug Berths	91	9	0	1,600	1	1,500	100	-
Operational Area 2	61	37	2	27,000	20	16,400	10,000	600
All areas combined²	69	30	1	135,600	100	93,000	40,800	1,800
Notes: <ol style="list-style-type: none"> 1. Approximate total dredge volumes are based on historical data provided by NQBP 2. PSD values for combined areas are weighted averages based on proportions of total dredging 								

5.4.4 Moisture content

The moisture content of a soil is defined as the ratio of the mass of water to the mass of solids. The moisture content provides an indication of the amount of effort that may be required to dry out the dredged sediment for various reuse options, for example if a particular moisture content was required to be achieved for compaction works.

The Phase 1 geotechnical samples were tested for moisture content and the results are presented in Table 5-5. The coarse-grained sample (SB_45) recorded a moisture content of 28%, whereas the fine-grained samples recorded much higher values of between 64% and 199% (mostly > 120%). The majority of these results are relatively high, but it is not clear whether this is due to mineral characteristics or sample disturbance.

It is noted there is some level of inaccuracy associated with the moisture content results due to the nature of the grab sampling method, which is carried out unseen at seabed level and causes significant sample disturbance.

5.4.5 Atterberg limits and linear shrinkage

Atterberg limits testing (liquid limit and plastic limit) is designed to reflect the influence of water content, grain size and mineral composition on the mechanical behaviour of clays and silts. The results are also used to classify soils in accordance with AS1726-2017. Refer to Table 5-2 for a summary of the AS1726-2017 soil classification system.

Atterberg limits testing was undertaken on all the Phase 1 geotechnical samples. The results are summarised in Table 5-5 and illustrated on the plasticity chart in Figure 5-3. It can be seen from Figure 5-3 that the plasticity of the fine-grained soils at the Port is generally very high, with only one of the fine-grained samples (OP2_18) recording a reading of medium plasticity, most likely due to this sample having a lower than average fines content. The silty sand sample (SB_45) was also tested and exhibited "non-plastic" behaviour. The fine-grained test results all fell above the "A-Line", meaning these materials will exhibit the engineering behaviour of a clay as opposed to a silt. For all fine-grained samples tested, the moisture contents were found to be higher than the corresponding liquid limits, indicating these in-situ sediments are likely to be sensitive. If the natural moisture content (w_N) of the soil is greater than the liquidity index ($LI = (w_N - PL) / (LL - PL)$), the soils may be stable in an undisturbed state, but a sudden change in stress may transform them into a liquid state. Based on the Phase 1 testing the natural moisture content of the fine-grained sediments is higher than the liquidity index at the Berth Pockets and Swing Basin and Channel areas, and lower than the liquidity index at the Tug Berths and Operational Area 2.

Linear shrinkage results between 11.0% and 26.5% and plasticity index (PI) results between 28% and 106% were recorded. The weighted plasticity index (WPI) has also been calculated (refer Table 5-5) and used to estimate the Volume Change Classification based on the method proposed by Look (1994). As shown in Table 5-5, the fine-grained sediments tested suggest a generally "very high" potential for volume change, with a "low" potential for volume change indicated by the test results from OP2_18.

Table 5-5: Summary of moisture content and plasticity test results

Area	Sample ID	Group Symbol (AS1726-2017)	Moisture Content (%)	Atterberg Limits and Linear Shrinkage (%)				WPI (% passing 0.425mm x PI)	Volume Change Classification (Look, 1994)
				LL	PL	PI	LS		
Swing Basin & Channel	SB_16	CH	198.9	140	34	106	26.5	10,600	Very High
	SB_40	CH-OH	167.1	118	31	87	24.0	-	-
	SB_45	SM	28.0	NP	NP	NP	NP	-	-
Berth Pockets	B1_07	OH	176.0	128	37	91	26.5	9,009	Very High
	B3_14	OH	191.2	119	37	82	23.0	8,118	Very High
	B4_01	OH	186.6	119	35	84	22.0	8,316	Very High
	B5_10	OH	164.0	125	38	87	23.5	8,613	Very High
Tug Berths	TB_05	OH	125.5	83	32	51	15.5	4,845	High
Operational Area 2	OP2_18	CI	63.9	45	17	28	11.0	2,156	Low
	OP2_24	CH	131.0	83	29	54	18.5	5,346	Very High
	SB_16	CH	198.9	140	34	106	26.5	10,600	Very High
LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index; WPI = Weighted Plasticity Index; NP = Non-plastic									

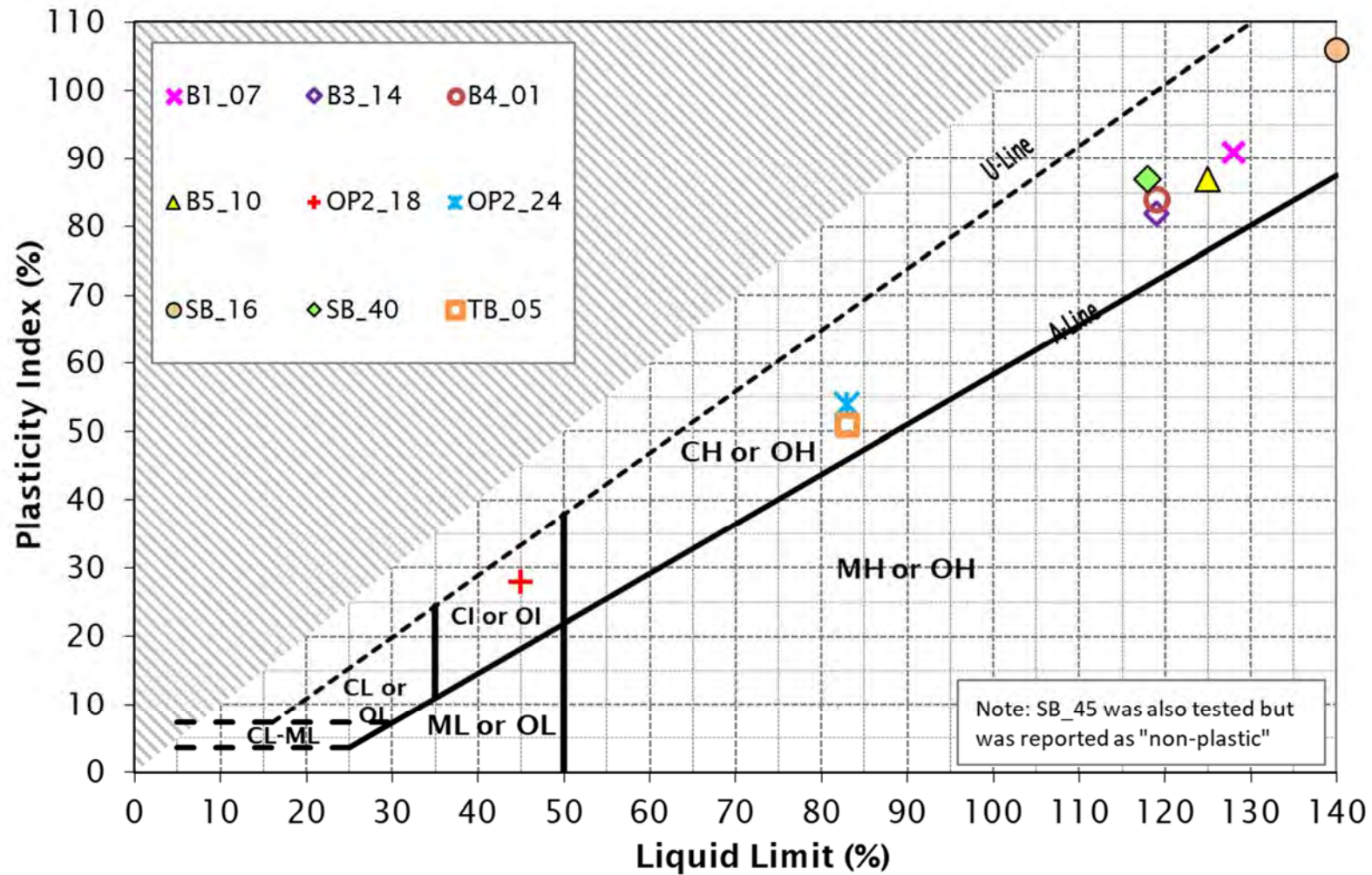


Figure 5-3: Plasticity chart showing results of Atterberg limits testing

5.4.6 Density

Several different types of density testing were carried out on the Phase 1 and Phase 2 geotechnical samples. These tests are discussed in the following sections and the results are summarised in Table 5-6. The results are also presented graphically in Figure 5-4 which shows a plot of bulk density versus fines content for a range of test methods. Note that for the purposes of this assessment "bulk density" is defined as the density of the entire soil sample including the weight / volume of all soil, water and air voids within the sample.

Particle density

Particle density (effectively equivalent to specific gravity) testing was undertaken on the Phase 1 geotechnical samples, with the testing generally only being performed on the fraction passing the 2.36 mm sieve (i.e. the combined silt, clay and sand proportions of the sample). The Phase 1 particle densities ranged between 2.49 t/m³ and 2.61 t/m³. Particle density testing was also carried out on the supplementary environmental samples with these results ranging from 2.40 t/m³ to 2.77 t/m³. The average particle density from the entire set of test results was 2.59 t/m³.

In-situ bulk density

Particle density and moisture content results can be used to approximate the in-situ bulk density of marine sediments using phase relationships. For grab sample specimens, which are collected underwater and are significantly disturbed during the sampling process, there is some degree of inaccuracy associated with this method. However, where there is a lack of undisturbed samples available it can be useful for providing indicative values of seabed density, which can then be compared with other density values such as the maximum density results obtained using the standard compaction test. The following formula has been used to estimate in-situ bulk density based on the classification test results:

$$\text{Bulk Density, } \rho = \frac{G_s(1 + w)}{1 + \frac{wG_s}{S_r}} \rho_w$$

Where:

G_s = specific gravity of the soil (obtained from particle density testing)

w = moisture content

S_r = degree of saturation (assumed as ~1 for seabed sediments)

ρ_w = density of water (~1 t/m³)

As can be seen in Table 5-6 and Figure 5-4, the results of this estimation show a clear trend of decreasing in-situ bulk density with an increase in fines content. This trend is to be expected for the types of sediments encountered at the Port. There are some relatively low values of density that have been estimated and it is possible the sampling process (which may have resulted in an overestimated moisture content) has attributed to this. However, Figure 5-4 also shows a typical range of bulk densities for soft silty clay / fresh harbour sediments (Bray, 1979), which suggests the estimated values generally fall within reasonable limits, generally within the range of 1.2 t/m³ to 1.6 t/m³.

Maximum dry density and optimum moisture content

Standard compaction testing (test method AS 1289 5.1.1) was undertaken on a single sample, which was made by combining / blending the four Berth Pocket samples. The combined sample was necessary due to the large sample quantity required for this type of testing, and the Berth Pocket samples all showed relatively similar results during the Phase 1 testing. The purpose of this test was to provide an indication of the maximum dry density (MDD) that may be achieved during future placement of the dredged fine-grained sediments and the optimum moisture content (OMC) required to achieve this density.

The standard compaction test resulted in a MDD of 1.45 t/m^3 and an OMC of 23.3%, which corresponds to a bulk / wet density of 1.79 t/m^3 . These values were used to assist in the specification of remoulding conditions for the other Phase 2 testing on this sample. The results of the compaction test are compared with the estimated in-situ bulk densities in Figure 5-4.

Minimum / Maximum Dry Density

Minimum / maximum dry density testing was performed in accordance with AS1289.5.5.1 on the silty sand sample from SB_45. The results are presented in Table 5-6 and suggest that the placed dry density of this material may fall in the range of 1.14 t/m^3 to 1.62 t/m^3 depending on the level of compaction or method of placement utilised onshore. The maximum bulk / wet density from this test is compared with the estimated in-situ bulk density in Figure 5-4.

Table 5-6 Summary of density test results

Area	Sample ID	Group Symbol (AS1726-2017)	Particle Density (<2.36 mm)	Estimated in-situ bulk density using phase relationships			Standard Compaction Test (AS 1289.5.1.1)		Minimum / Maximum Dry Density (AS1289.5.5.1)	
				Moisture content	Bulk density	Dry Density	MDD	OMC	Min	Max
			t/m ³	%	t/m ³	t/m ³	t/m ³	%	t/m ³	t/m ³
Swing Basin & Channel	SB_16	CH	2.57	198.9	1.26	0.42	-	-	-	-
	SB_40	CH-OH	2.55	167.1	1.29	0.48	-	-	-	-
	SB_45	SM	2.61	28.0	1.93	1.51	-	-	1.14	1.62
Berth Pockets	B1_07	OH	2.49	176.0	1.28	0.46	1.45	23.3	-	-
	B3_14	OH	2.56	191.2	1.26	0.43			-	-
	B4_01	OH	2.59	186.6	1.27	0.44			-	-
	B5_10	OH	2.58	164.0	1.30	0.49			-	-
Tug Berths	TB_05	OH	2.55	125.5	1.37	0.61	-	-	-	-
Operational Area 2	OP2_18	CI	2.61	63.9	1.60	0.98	-	-	-	-
	OP2_24	CH	2.56	131.0	1.36	0.59	-	-	-	-

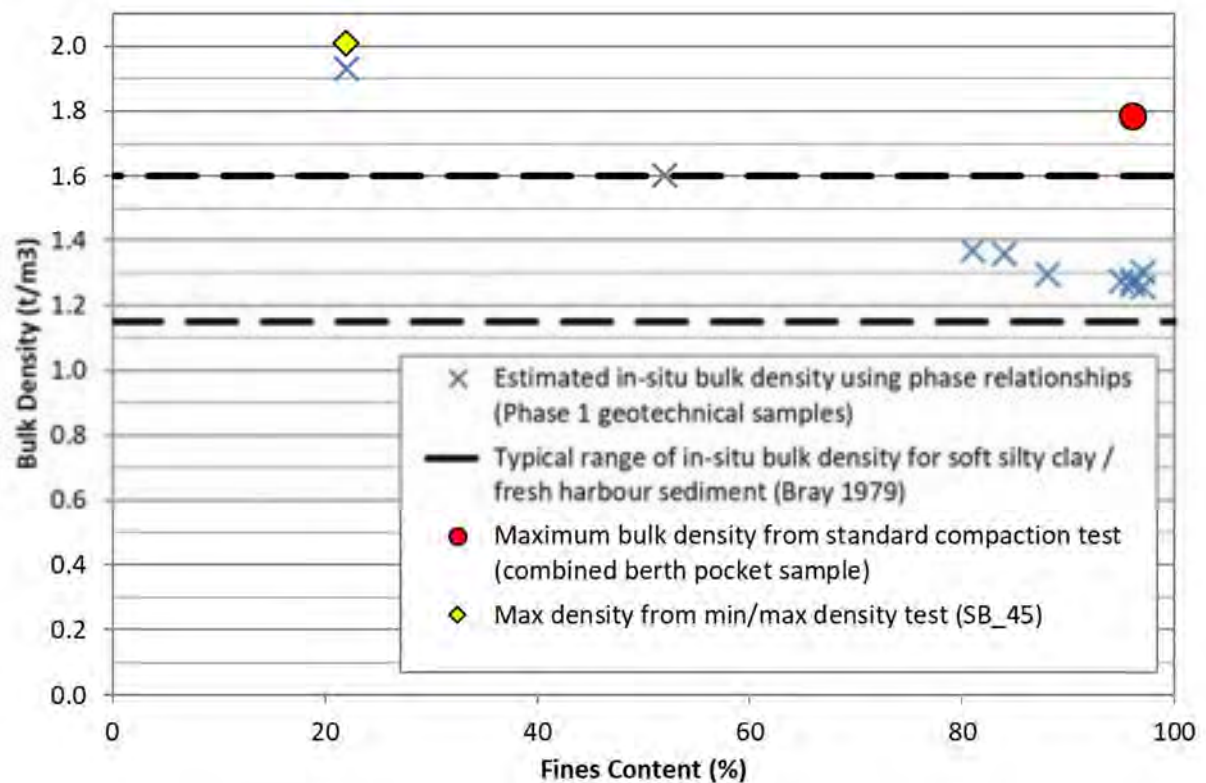


Figure 5-4: Bulk density vs. fines content

5.4.7 Strength and consolidation

Strength and consolidation tests were undertaken on remoulded and moisture conditioned samples to provide indicative parameters for the dredged materials following reworking and field placement. The sample preparation and test results are summarised below.

Direct shear

Direct shear testing (single stage) was undertaken on the silty sand sample from SB_45 to provide an indicative strength (angle of internal friction) for the coarse-grained sediment in this area. The sample was remoulded to a target relative density of 70% (based on the results of the minimum / maximum dry density testing) and sheared under a target vertical pressure of 100 kPa. The direct shear test results are summarised in Table 5-7, and indicate that this coarse-grained soil may achieve a friction angle of approximately 36° after compaction and loading. This value is within the lower end of the range generally associated with a "dense" sand deposit and suggests that the coarse-grained sediments in this area may be suitable for medium loading applications following adequate compaction.

Table 5-7 Summary of direct shear test results

Area	Sample ID	Group Symbol (AS1726-2017)	Remoulded Sample Details		Effective Friction Angle (assuming zero cohesion)	
			Moisture Content	Wet Density	Peak	Residual
			%	t/m ³	°	°
Swing Basin & Channel	SB_45	SM	24.1	1.79	36.4	35.5

CU Triaxial

Consolidated undrained (CU) triaxial testing (3 stage) was undertaken on two clay samples (including a high plasticity, organic clay and a medium plasticity, inorganic clay) to provide indicative strengths (effective cohesion and effective friction angle) for the fine-grained sediments. Prior to testing, the combined Berth Pockets sample was remoulded based on a target dry density of 95% MDD and a target moisture content of 100% OMC (using the standard compaction test results). The second sample (OP2_18) was remoulded based on a target dry density of 1.5 t/m³ and a target moisture content of 25-30%.

The CU testing was performed at target confining pressures of 50 kPa, 100 kPa and 200 kPa. The results are summarised in Table 5-8 with effective cohesion (c') and effective friction angle (ϕ') taken as average values over the three stages of the test. The highly plastic, organic clay sample from the Berth Pockets only achieved a relatively low strength ($c'=3$ kPa, $\phi'=25^\circ$) after being dried out and compacted, which suggests this material would only be suitable for low loading applications following dredging and controlled placement onshore. The medium plasticity clay sample from Operational Area 2 achieved a higher strength ($c'=5$ kPa, $\phi'=35^\circ$), likely due in part to the greater density of this sample, which suggests this material may be suitable for medium loading applications following adequate drying out and compaction.

Table 5-8 Summary of CU triaxial test results

Area	Sample ID	Group Symbol (AS1726-2017)	Remoulded Sample Details		Average Effective Cohesion, c'	Average Effective Friction Angle, ϕ'
			Moisture Content	Dry Density		
			%	t/m ³	kPa	°
Berth Pockets	B1_07, B3_14, B4_01, B5_10 (combined)	OH	22.7	1.38	3.0	25.0
Operational Area 2	OP2_18	CI	24.9	1.50	4.7	34.7

1D Consolidation (Oedometer)

The two samples selected for CU triaxial testing were also subjected to 1-dimensional consolidation (oedometer) testing to assess the consolidation parameters of the fine-grained sediments. Prior to testing, the samples were remoulded based on the same target dry density and moisture content as the CU triaxial samples. The oedometer sample was loaded, unloaded and reloaded at pressures ranging from 20 kPa to 640 kPa. The results are provided on the laboratory certificates in Appendix D and a summary of the compression index (c_c) and coefficient of consolidation (c_v) values is provided in Table 5-9.

The range of c_v values for the highly plastic, organic clay sample from the Berth Pockets was 21 m²/yr to 93 m²/yr, which is higher than expected for this material and would typically be associated with a low plasticity clay or silt. The range of c_v values for the medium plasticity clay sample from Operational Area 2 was 2 m²/yr to 23 m²/yr, which is within the expected range for this type of material. In general, the fine-grained sediments at the Port may be expected to exhibit c_v values ranging from approximately 1 m²/yr to 100 m²/yr.

Material	Approximate coefficient of consolidation, C_v (m^2/yr)	Approx. time for consolidation based on drainage path length (m)			
		0.3	1	3	10
Sands & Gravels	100,000	<1 hr	<1 hr	1 to 10 hrs	10 to 100 hrs
Sands	10,000	<1 hr	1 to 10 hrs	10 to 100 hrs	1 to 10 days
Clayey sands	1000	3 to 30 hours	10 to 100 hrs	3 to 30 days	1 to 10 mths
Silts	100	10 to 100 hours	3 to 30 days	1 to 10 mths	10 to 100 mths
CL clays	10	10 to 100 days	1 to 10 months	1 to 10 yrs	10 to 100 yrs
CH clays	1	3 to 30 months	1 to 10 yrs	30 to 100 yrs	100 to 1000 yrs

Note: The "drainage path length" is the distance that water has to travel to exit the consolidating sediment when it is under compression (e.g. in a 5 m thick clay deposit overlain and underlain by free-draining sand, the maximum drainage path length would be 2.5m). The drainage path length can be reduced by various engineering solutions such as prefabricated vertical "wick" drains.

Figure 5-5 (Look, 2007) shows some approximate drainage times associated with typical c_v values for various materials.

Table 5-9 Summary of Oedometer test results

Area	Sample ID	Group Symbol (AS1726 -2017)	Remoulded Sample Details		Compression Index (c_c) during final stage of test	Range of Coefficient of Consolidation, C_v (t_{90})
			Moisture Content	Dry Density		
			%	t/m3	(-)	m^2/yr
Berth Pockets	B1_07, B3_14, B4_01, B5_10 (combined)	OH	30.0	1.31	0.35	21 to 93
Operational Area 2	OP2_18	CI	25.3	1.50	0.15	2 to 23

Material	Approximate coefficient of consolidation, C_v (m^2/yr)	Approx. time for consolidation based on drainage path length (m)			
		0.3	1	3	10
Sands & Gravels	100,000	<1 hr	<1 hr	1 to 10 hrs	10 to 100 hrs
Sands	10,000	<1 hr	1 to 10 hrs	10 to 100 hrs	1 to 10 days
Clayey sands	1000	3 to 30 hours	10 to 100 hrs	3 to 30 days	1 to 10 mths
Silts	100	10 to 100 hours	3 to 30 days	1 to 10 mths	10 to 100 mths
CL clays	10	10 to 100 days	1 to 10 months	1 to 10 yrs	10 to 100 yrs
CH clays	1	3 to 30 months	1 to 10 yrs	30 to 100 yrs	100 to 1000 yrs

Note: The "drainage path length" is the distance that water has to travel to exit the consolidating sediment when it is under compression (e.g. in a 5 m thick clay deposit overlain and underlain by free-draining sand, the maximum drainage path length would be 2.5m). The drainage path length can be reduced by various engineering solutions such as prefabricated vertical "wick" drains.

Figure 5-5 Time required for drainage (reproduced from Look, 2007)

5.4.8 Permeability

To provide an indication of the post-compaction permeability of the dredged sediments, permeability testing was carried out on the three Phase 2 samples. The coarse-grained sample (SB-45) was remoulded in the same manner as the direct shear sample (target 70% relative density) and tested using the constant head permeability test method. The fine-grained samples were remoulded in the same manner as the CU triaxial and 1D consolidation samples and were tested using the falling head permeability test method.

The permeability test results are summarised in Table 5-10 and are generally within the range expected for the types of sediments tested, with "poor" drainage characteristics being reported for the two clay samples and "good" drainage characteristics for the silty sand sample.

Table 5-10 Summary of permeability test results

Area	Sample ID	Group Symbol (AS1726-2017)	Remoulded Sample Details		Permeability
			Moisture Content	Dry Density	
			%	t/m ³	m/s
Swing Basin & Channel	SB_45	SM	24.0	1.44	1.9×10^{-5}
Berth Pockets	B1_07, B3_14, B4_01, B5_10 (combined)	OH	23.1	1.45	1.7×10^{-10}
Operational Area 2	OP2_18	CI	25.5	1.50	2.8×10^{-10}

5.5 Cement Laboratory Testing

Sediment material testing in Wagner's Brisbane cement laboratory was undertaken using both the X-ray diffraction (XRD) and X-ray fluorescence (XRF) test methods to provide a quantitative analysis (% weight) of mineral composition and chemical element composition respectively, to assess the potential suitability as a binding agent in products including concrete, bricks and stabilised engineering fill material. Three samples (i.e. TB05 (A&B), SB-45 and SB-02A) were selected for XRD and XRF testing. The results indicate:

- All three samples were shown in the XRD test to be almost 100% in crystalline mineral form, chiefly quartz. These materials would not chemically react with other materials to create a geopolymer cement in their current form.
- The XRF analyses also showed the presence of significant levels of iron and calcium which would further interfere with any geopolymer reactions.
- As expected for coastal marine sediments, significant levels of alkalis (Na₂O & K₂O) and chlorides were also detected.

A summary of the results are provided in Table 5-11 and Table 5-12.

Table 5-11 XRD testing results

Sample	Minerals									
	Quartz	Albite	Berlinite	Aragonite	Paratellurite	Halite	Calicte	Strontioborite	Retgersite	Graphite
Units	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%	wt%
SB_45	52.43%	33.16%	4.99%	4.27%	1.44%	1.93%	1.15%	0.63%		
SB_02A	65.03%	21.92%	3.50%	2.06%	1.20%	2.75%	3.54%			
TB05 A	46.80%	29.24%	5.16%	3.04%	0.73%	3.73%	3.51%	0.49%	7.30%	
TB05 B	31.04%	5.07%	1.91%	17.55%	3.21%	4.77%	22.07%	5.57%	8.06%	0.75%

Table 5-12: XRF testing results

Sample	Loss on Ignition	Na2O eq.	Cl	SiO2	Al2O3	Fe2O3	CaO	MgO	SO3	K2O	TiO2	P2O5	Na2O	CrO3	ZnO	Mn2O3	SrO
Units	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
SB_45	6.2	4.2	0.447	69.7	11.2	3.0	5.5	1.1	0.1	1.93	0.45	0.07	2.92	0.03	0.00	0.12	0.04
SB_02A	7.6	3.6	1.286	69.3	10.8	3.5	4.6	1.1	0.4	1.72	0.51	0.07	2.42	0.03	0.01	0.11	0.02
TB_05 A	11.5	3.9	1.461	56.6	14.9	5.7	5.5	1.8	0.6	1.70	0.82	0.11	2.82	0.01	0.01	0.13	0.03
TB_05 B	11.5	4.8	2.807	52.2	14.9	5.7	5.8	2.0	0.9	1.68	0.82	0.13	3.67	0.01	0.01	0.14	0.04

6 Data Validation

This section examines the validity of the analytical data obtained in the study. It provides confidence in the results presented.

6.1 Laboratory Analysis

The Quality Control Report provided by ALS are included with laboratory analysis reports in Appendix C. Table 6-1 identifies outliers in their QA/QC analysis.

Table 6-1 QA/QC laboratory outliers summary table

QA/QC Method	Laboratory Outliers	Comments
Laboratory Duplicates	There were no laboratory duplicates breaches that impact ASS parameters	
Laboratory control spike	There were no laboratory control spike breaches that impact ASS parameters	
Surrogate Spikes	There were no surrogate spike breaches that impact ASS parameters	
Matrix Spikes	There were no matrix spike breaches that impact ASS parameters	
Holding times	<p>Holding time breaches exist for the following:</p> <ul style="list-style-type: none"> Extraction / preparation: conductivity, chloride: OP2_18 (0-0.5), OP2_32 (0-0.5), OP2_36 (0-0.5), OP2_36 (0.5-1.0), OP2_36 (1.0-1.5) 	Breaches in conductivity are not considered to impact data quality as the associated samples results are within expected ranges.

7 Conclusion

7.1 Geotechnical characteristics

The sediments encountered in the Port of Mackay navigational areas were predominantly fine-grained (silt/clay), with only two of the sampling locations (SB_45 and SB_50) being classified as coarse-grained soil with fines contents of 22% (Silty Sand) and 8% (Sand). These two sites were both located within the Swing Basin and Channel area. All other PSD test results indicate that fines contents generally range from 44% to 98%, with an average value of 74% recorded across the site. Hydrometer results suggest that silt and clay proportions within the sediments are approximately equal but Atterberg limits results indicate that the materials will behave in a predominantly clay-like manner.

The plasticity of the fine-grained soils at the Port is generally very high, with only one of the fine-grained samples (OP2_18) recording a reading of medium plasticity, most likely due to this sample having a lower than average fines content. For all fine-grained samples tested, the moisture contents were found to be higher than the corresponding liquid limits, indicating these in-situ sediments are likely to be sensitive. Based on the Phase 1 testing the natural moisture content of the fine-grained sediments was higher than the liquidity index at the Berth Pockets and Swing Basin and Channel areas, indicating that these soils may be stable in an undisturbed state but a sudden change in stress may transform them into a liquid state.

Linear shrinkage results between 11.0% and 26.5% and plasticity index (PI) results between 28% and 106% were recorded. The weighted plasticity index (WPI) values suggest a generally “very high” potential for volume change, with a “low” potential for volume change indicated by the test results from OP2_18.

The organic content of the sediments ranged from 1.0% to 5.9%, with any value greater than 2% being representative of an “Organic Soil” in accordance with AS 1726-2017. The test results suggest that the fine-grained sediments at the Port include a combination of organic and inorganic materials, with organic soils being more prevalent within the Berth Pockets and Tug Berths.

The carbonate (CaCO_3) content test results ranged from 2.4% to 10.4% with an average value of 7.5%. A soil with a carbonate content greater than 50% is generally regarded as a “carbonate soil” for the purposes of engineering design and these materials can exhibit high porosity and low crushing strength. However, none of the samples from the Port would be regarded as carbonate soil, but would be referred to as “calcareous soil” due to the proportion of carbonate generally ranging from 2% to 10%.

The recorded particle densities (effectively equivalent to specific gravity) ranged from 2.40 t/m^3 to 2.77 t/m^3 across the site with an average of 2.59 t/m^3 . The particle densities and the associated moisture content results were used to approximate the in-situ bulk density of the Phase 1 geotechnical samples using phase relationships (note there is some inaccuracy associated with the moisture content results due to the sampling process). The results of this estimation show a clear trend of decreasing in-situ density with an increase in fines content and suggest that in-situ bulk densities across the majority of the site fall within the range of 1.2 t/m^3 to 1.6 t/m^3 .

Standard compaction testing was undertaken on the combined Berth Pockets sample to provide an indication of the maximum dry density (MDD) that may be achieved during future placement of the dredged fine-grained sediments and the optimum moisture content (OMC) required to achieve this density. The test resulted in a MDD of 1.45 t/m³ and an OMC of 23.3%, which corresponds to a bulk / wet density of 1.79 t/m³.

Minimum / maximum dry density testing was performed on the silty sand sample from SB_45. The results suggest that the placed dry density of this material may fall in the range of 1.14 t/m³ to 1.62 t/m³ depending on the level of compaction or method of placement utilised onshore.

Direct shear testing performed on the silty sand sample from SB_45 indicates that this material may achieve a friction angle of approximately 36° after compaction and loading. This value is within the lower end of the range generally associated with a "dense" sand deposit and suggests that the coarse-grained sediments in this area may be suitable for medium loading applications following adequate compaction.

The CU triaxial test results indicate that the average cohesion (c') of the samples after compaction and loading ranges from 3 kPa to 5 kPa, and the average friction angle ranges from 25° to 35°. These strengths suggest that the fine-grained sediments may be suitable for low to medium loading applications following adequate drying out and compaction (noting that fine-grained material typically requires a long time to adequately drain and consolidate), with the lower end of this range applicable to those locations with highly plastic, organic sediments (e.g. Berth Pockets).

The oedometer testing results indicate that, in general, the fine-grained sediments at the Port may be expected to exhibit c_v values ranging from approximately 1 m²/yr to 100 m²/yr, which is within the typical range expected for clays and silts. Some of these materials may take many months to many years to consolidate, depending on the level of compaction and drainage path length, although it is noted that consolidation times can vary significantly and can be better estimated by undertaking field trials (e.g. trial embankment with wick drains and surcharge).

The permeability test results are generally within the range expected for the types of sediments tested, with "poor" drainage characteristics being reported for the two clay samples and "good" drainage characteristics for the silty sand sample.

7.2 Cement binder characteristics

Cement laboratory testing results indicate that:

- All three samples were shown in the XRD test to be almost 100% in crystalline mineral form, chiefly quartz. These materials would not chemically react with other materials to create a geopolymer cement in their current form.
- The XRF analyses also showed the presence of significant levels of iron and calcium which would further interfere with any geopolymer reactions.
- As expected for coastal marine sediments, significant levels of alkalis (Na₂O & K₂O) and chlorides were also detected.

7.3 Geochemical Characteristics

Based on the ASS analysis, PASS, in concentrations greater than the QASSIT action criteria was detected in all samples analysed for ASS parameters from the navigational areas of the Port of Mackay.

Acid Neutralising Capacity was detected in all samples submitted for ASS analysis with concentrations sufficient to negate acidity. This buffering potential is expected to arise from the presence of carbonate within the sediments. These data indicate that the marine sediments from the Port of Mackay are unlikely to require treatment through neutralisation using lime dependent on the dredging and management methods applied to the sediments.

All samples are considered highly saline. If sediments are placed on land without treatment, salinity will degrade the quality of terrestrial soils and may impact the quality of receiving waters.

Organic Material (OM) (ranging from 1 to 5.9%) was reported for all samples analysed. This is considered inadequate to support plant growth. The highest OM (generally greater than 3%) was detected in finer textured samples (i.e. with sand components less than 30%).

8 References

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Appendix A Field Survey Sheets and Logs

General Location of Sampling				Port of Mackay – Swing Basin							
Site Number				SB_02 (T1)							
Date/Sample Time				24/09/18, 1500							
Water Depth at Site				~11m							
Type of Core Sampler				Grab							
Depth Retained				0.1m							
Weather Conditions				S-E Winds 15-20kts							
Comments											
PSD (%)											
Gravel (19)			Sand (52)			Silt & Clay (29)					
Strata Change (m)		Colour	Field Texture		Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1		Dark Grey	Clayey SAND		Wet	Soft	Coarse	Unknown due to saturation	5%	5-10%	Marine/Faint Sulphur
General Location of Sampling				Port of Mackay – Swing Basin							
Site Number				SB_02 (T2)							
Date/Sample Time				24/09/18, 1500							
Water Depth at Site				~11m							
Type of Core Sampler				Grab							
Depth Retained				0.1m							
Weather Conditions				S-E Winds 15-20kts							
Comments											
PSD (%)											
Gravel (15)			Sand (42)			Silt & Clay (43)					
Strata Change (m)		Colour	Field Texture		Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1		Dark Grey	Sandy CLAY		Wet	Soft	Fine to Coarse	Unknown due to saturation	1%	5-10%	Marine/Faint Sulphur


General Location of Sampling				Port of Mackay – Swing Basin							
Site Number				SB_02 (T3)							
Date/Sample Time				24/09/18, 1500							
Water Depth at Site				~11m							
Type of Core Sampler				Grab							
Depth Retained				0.1m							
Weather Conditions				S-E Winds 15-20kts							
Comments											
PSD (%)											
Gravel (6)			Sand (37)			Silt & Clay (57)					
Strata Change (m)		Colour	Field Texture		Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1		Dark Grey	Sandy CLAY		Wet	Soft	Fine to Coarse	Unknown due to saturation	1%	5-10%	Marine/Faint Sulphur
General Location of Sampling				Port of Mackay – Swing Basin							
Site Number				SB_16							
Date/Sample Time				24/09/18, 1530							
Water Depth at Site				~11m							
Type of Core Sampler				Grab							
Depth Retained				0.1m							
Weather Conditions				S-E Winds 15-20kts							
Comments											
PSD (%)											
Gravel (<1)			Sand (8)			Silt & Clay (92)					
Strata Change (m)		Colour	Field Texture		Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1		Dark Grey	Silty CLAY		Wet	Soft	Fine	Unknown due to saturation	0.5%	<10%	Marine/Faint Sulphur


General Location of Sampling		Port of Mackay – Swing Basin							
Site Number		SB_40							
Date/Sample Time		24/09/18, 1600							
Water Depth at Site		~11m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, S-E Winds 15-20kts							
Comments									
PSD (%)									
Gravel (1)		Sand (16)		Silt & Clay (83)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Dark Grey	Silty CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling		Port of Mackay – Swing Basin							
Site Number		SB_45							
Date/Sample Time		24/09/18, 1630							
Water Depth at Site		~11m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, S-E Winds 15-20kts							
Comments									
PSD (%)									
Gravel (3)		Sand (86)		Silt & Clay (11)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Dark Grey	Clayey Silty SAND	Wet	Soft	Fine/Medium	Unknown due to saturation	Nil	20-40%	Marine/Faint Sulphur

General Location of Sampling		Port of Mackay – Swing Basin							
Site Number		SB_50							
Date/Sample Time		24/09/18, 1710							
Water Depth at Site		~8m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, S-E Winds 15-20kts							
Comments									
PSD (%)									
Gravel (<1%)		Sand (95%)		Silt & Clay (5%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Sand	Silty SAND	Moist	Loose	Fine/Medium	Unknown due to saturation	Nil	10%	Marine/Faint Sulphur

General Location of Sampling		Port of Mackay – Swing Basin							
Site Number		SB_52							
Date/Sample Time		24/09/18, 1745							
Water Depth at Site		~8m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, S-E Winds 15-20kts							
Comments									
PSD (%)									
Gravel (<1)		Sand (24)		Silt & Clay (76)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey	Silty sandy CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling		Port of Mackay – Swing Basin							
Site Number		SB_58							
Date/Sample Time		24/09/18, 1815							
Water Depth at Site		~8m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, S-E Winds 15-20kts							
Comments									
PSD (%)									
Gravel (<1%)		Sand (34%)		Silt & Clay (66%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey and brown	Silty CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	Organics, 5-10% shells	Marine/Faint Sulphur

General Location of Sampling		Port of Mackay – Swing Basin							
Site Number		SB_79							
Date/Sample Time		24/09/18, 1830							
Water Depth at Site		~8m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, Wind 10-15kts							
Comments									
PSD (%)									
Gravel (<1)		Sand (23)		Silt & Clay (77)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey and brown	Silty CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling	Port of Mackay – Tug Berth
Site Number	TB_02
Date/Sample Time	25/09/18, 0830
Water Depth at Site	~6m
Type of Core Sampler	Grab
Depth Retained	0.1m
Weather Conditions	Wind 10-15kts
Comments	



PSD (%)		
Gravel (1%)	Sand (29%)	Silt & Clay (70%)

Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur



General Location of Sampling	Port of Mackay – Tug Berth
Site Number	TB_05 (T1)
Date/Sample Time	25/09/18, 0830
Water Depth at Site	~6m
Type of Core Sampler	Grab
Depth Retained	0.1m
Weather Conditions	Wind 10-15kts
Comments	



PSD (%)		
Gravel (2%)	Sand (24%)	Silt & Clay (74%)

Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Dark grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur



General Location of Sampling		Port of Mackay – Tug Berth																												
Site Number		TB_05 (T2)																												
Date/Sample Time		25/09/18, 1015																												
Water Depth at Site		~6m																												
Type of Core Sampler		Grab																												
Depth Retained		0.1m																												
Weather Conditions		Wind 15-20kts																												
Comments																														
PSD (%)																														
Gravel (NT)		Sand (NT)		Silt & Clay (NT)																										
<table><tr><th>Strata Change (m)</th><th>Colour</th><th>Field Texture</th><th>Moist.</th><th>Consist.</th><th>Sand Grain Size</th><th>Plasticity</th><th>% Stones</th><th>Shell/Grit/Biota</th><th>Odour</th></tr><tr><td>0 – 0.1</td><td>Dark grey</td><td>Silty sandy CLAY</td><td>Wet</td><td>Soft</td><td>Fine</td><td>Unknown due to saturation</td><td>Nil</td><td>5-10%</td><td>Marine/Faint Sulphur</td></tr></table>											Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour	0 – 0.1	Dark grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour																					
0 – 0.1	Dark grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur																					
General Location of Sampling		Port of Mackay – Tug Berth																												
Site Number		TB_05 (T3)																												
Date/Sample Time		25/09/18, 1015																												
Water Depth at Site		~6m																												
Type of Core Sampler		Grab																												
Depth Retained		0.1m																												
Weather Conditions		Wind 15-20kts																												
Comments		Large amount of sand compared to T1 & T2																												
PSD (%)																														
Gravel (NT)		Sand (NT)		Silt & Clay (NT)																										
<table><tr><th>Strata Change (m)</th><th>Colour</th><th>Field Texture</th><th>Moist.</th><th>Consist.</th><th>Sand Grain Size</th><th>Plasticity</th><th>% Stones</th><th>Shell/Grit/Biota</th><th>Odour</th></tr><tr><td>0 – 0.1</td><td>Dark grey</td><td>Silty sandy CLAY</td><td>Wet</td><td>Soft</td><td>Fine</td><td>Unknown due to saturation</td><td>Nil</td><td>5-10%</td><td>Marine/Faint Sulphur</td></tr></table>											Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour	0 – 0.1	Dark grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour																					
0 – 0.1	Dark grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur																					

General Location of Sampling	Port of Mackay – Slipway
Site Number	H-3
Date/Sample Time	25/09/18, 1015
Water Depth at Site	~6m
Type of Core Sampler	Grab
Depth Retained	0.1m
Weather Conditions	Wind 15-20kts
Comments	

PSD (%)

Gravel (<1%)	Sand (60%)	Silt & Clay (40%)
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Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Dark grey and brown	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	<10%	Marine/Faint Sulphur

General Location of Sampling	Port of Mackay – Tug Berth
Site Number	TB_12
Date/Sample Time	25/09/18, 1100
Water Depth at Site	~1m
Type of Core Sampler	Grab
Depth Retained	0.1m
Weather Conditions	Wind 10-15kts
Comments	

PSD (%)

Gravel (<1%)	Sand (12%)	Silt & Clay (88%)
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Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey and brown	Silty CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	<10%	Marine/Faint Sulphur



General Location of Sampling	Port of Mackay – Tug Berth	
Site Number	TB_18	
Date/Sample Time	25/09/18, 1120	
Water Depth at Site	~12m	
Type of Core Sampler	Grab	
Depth Retained	0.1m	
Weather Conditions	Wind 15-20kts	
Comments		
PSD (%)		
Gravel (<1%)	Sand (13%)	Silt & Clay (87%)



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey and brown	Silty CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling	Port of Mackay – Tug Berth	
Site Number	TB_26	
Date/Sample Time	25/09/18, 1210	
Water Depth at Site	~11m	
Type of Core Sampler	Grab	
Depth Retained	0.1m	
Weather Conditions	Wind 10-15kts	
Comments		
PSD (%)		
Gravel (<1%)	Sand (4%)	Silt & Clay (96%)



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey	Silty CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling	Port of Mackay – Tug Berth
Site Number	TB_29
Date/Sample Time	25/09/18, 1300
Water Depth at Site	~10m
Type of Core Sampler	Grab
Depth Retained	0.1m
Weather Conditions	Wind 15-20kts
Comments	

PSD (%)

Gravel (<1%)	Sand (11%)	Silt & Clay (89%)
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Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey	Silty CLAY	Wet	Soft	Nil	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling	Port of Mackay – Berth No. 1
Site Number	B1_07
Date/Sample Time	25/09/18, 1400
Water Depth at Site	~13.9m
Type of Core Sampler	Grab
Depth Retained	0.1m
Weather Conditions	Calm-slightly choppy, fine weather
Comments	


PSD (%)


Gravel (3%)	Sand (27%)	Silt & Clay (70%)
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Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	1%	5-10%	Marine/Faint Sulphur




General Location of Sampling		Port of Mackay – Berth No. 1							
Site Number		B1_02 (T1)							
Date/Sample Time		26/09/18, 0900							
Water Depth at Site		~13.9m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, Wind 11kts							
Comments									
PSD (%)									
Gravel (1%)		Sand (36%)		Silt & Clay (63%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey	Silty Sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	1%	5-10%	Marine/Faint Sulphur


General Location of Sampling		Port of Mackay – Berth No. 1							
Site Number		B1_02 (T2)							
Date/Sample Time		26/09/18, 0900							
Water Depth at Site		~13.9m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, Wind 11kts							
Comments									
PSD (%)									
Gravel (<1%)		Sand (11%)		Silt & Clay (89%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.1	Grey	Silty Sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	1%	5-10%	Marine/Faint Sulphur


General Location of Sampling		Port of Mackay – Berth No. 1							
Site Number		B1_02 (T3)							
Date/Sample Time		26/09/18, 0900							
Water Depth at Site		~13.9m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, Wind 11kts							
Comments									
PSD (%)									
Gravel (<1%)		Sand (11%)		Silt & Clay (89%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey	Silty Sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	1%	5-10%	Marine/Faint Sulphur
General Location of Sampling		Port of Mackay – Berth No. 3							
Site Number		B3_14							
Date/Sample Time		26/09/18, 1115							
Water Depth at Site		~17m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, Wind 7-11kts							
Comments									
PSD (%)									
Gravel (<1%)		Sand (17%)		Silt & Clay (83%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey and brown	Silty Sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling		Port of Mackay – Berth No. 4							
Site Number		B4_01							
Date/Sample Time		26/09/18, 1155							
Water Depth at Site		~17m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, Wind 10-15kts							
Comments									
PSD (%)									
Gravel (<1%)		Sand (11%)		Silt & Clay (89%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey	Silty Sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	5-10%	Marine/Faint Sulphur

General Location of Sampling		Port of Mackay – Berth No. 5							
Site Number		B5_10							
Date/Sample Time		26/09/18, 1255							
Water Depth at Site		~16m							
Type of Core Sampler		Grab							
Depth Retained		0.1m							
Weather Conditions		Choppy, Wind 15-20kts							
Comments									
PSD (%)									
Gravel (<1%)		Sand (26%)		Silt & Clay (74%)					
Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey	Silty Sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	Nil	<10%	Sulphur/marine



General Location of Sampling		Port of Mackay – Berth No. 5								
Site Number		B5_08								
Date/Sample Time		26/09/18, 1315								
Water Depth at Site		~12m								
Type of Core Sampler		Grab								
Depth Retained		0.1m								
Weather Conditions		Choppy, Wind 15-20kts								
Comments										
PSD (%)										
Gravel (1%)		Sand (27%)		Silt & Clay (72%)						
Strata Change (m)	Colour	Field Texture		Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.1	Grey	Silty sandy CLAY		Wet	Soft	Fine	Unknown due to saturation	Nil	20-40%	Sulphur/marine

General Location of Sampling		Port of Mackay – Operational Area 2								
Site Number		OP2_18								
Date/Sample Time		28/09/18, 1210								
Water Depth at Site		~8m								
Type of Core Sampler		Piston core								
Depth Retained		0.5m								
Weather Conditions / sea state		Wind 4kts / glass								
Comments										
PSD (%)										
Strata Change (m)		Gravel (%)	Sand (%)	Silt & Clay (%)						
0 – 0.5		4	40	56						
Strata Change (m)	Colour	Field Texture		Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5	Grey	Sandy CLAY		Moist	Fine	Fine	Unknown due to saturation	NIL	5-10%	Sulphur/marine

General Location of Sampling	Port of Mackay – Operational Area 2
Site Number	OP2_21
Date/Sample Time	28/09/18, 1120
Water Depth at Site	~9m
Type of Core Sampler	Piston core
Depth Retained	0.5m
Weather Conditions / sea state	Still
Comments	Refusal at 0.5m

PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5	2%	31%	67%

Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5	Grey	Sandy CLAY	Moist	Firm	Fine	Unknown due to saturation	NIL	<5%	Sulphur/marine



General Location of Sampling		Port of Mackay – Operational Area 2		<div>No photo</div>						
Site Number		OP2_24								
Date/Sample Time		28/09/18								
Water Depth at Site		~4.7m								
Type of Core Sampler		Piston core								
Depth Retained		0.5m								
Weather Conditions / sea state		Wind 8kts / glass								
Comments		Refusal at 0.5m								
PSD (%)										
Strata Change (m)		Gravel (%)	Sand (%)							Silt & Clay (%)
0 – 0.5		0%	16%	84%						
Strata Change (m)	Colour	Field Texture		Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5	Grey	Silty sandy CLAY		Moist	Soft	Very coarse	Unknown due to saturation	1%	10%	Sulphur/marine
Refusal										

General Location of Sampling	Port of Mackay – Operational Area 2		
Site Number	OP2_32		
Date/Sample Time	28/09/18, 0800		
Water Depth at Site	~4.7m		
Type of Core Sampler	Piston core		
Depth Retained	0.5m		
Weather Conditions / sea state	Wind 8kts / glass		
Comments	Refusal at 0.5m		
PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5	3	47	50
Strata Change (m)	Colour	Field Texture	Moist.
0 – 0.5	Grey	Silty sandy CLAY	Moist
Refusal			



Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
Soft	Very coarse	Unknown due to saturation	1%	10%	Sulphur/marine

General Location of Sampling	Port of Mackay – Operational Area 2		
Site Number	OP2_33		
Date/Sample Time	28/09/18, 0715		
Water Depth at Site	~7m		
Type of Core Sampler	Piston core		
Depth Retained	0.5m		
Weather Conditions / sea state	Wind 8kts / glass		
Comments	Refusal at 0.5m		
PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5	2	44	54
Strata Change (m)	Colour	Field Texture	Moist.
0 – 0.5	Grey	Silty sandy CLAY	Wet



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/ Biota	Odour
0 – 0.5	Grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	1%	<5%	Sulphur/marine

General Location of Sampling	Port of Mackay – Operational Area 2
Site Number	OP2_36
Date/Sample Time	28/09/18, 1000
Water Depth at Site	~9m
Type of Core Sampler	Piston core
Depth Retained	1.5m
Weather Conditions / sea state	Wind 4kts / glass
Comments	Refusal at 1.5m

PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5	2	52	40
0.5 – 1.0	8	52	35
1.0 – 1.5	13	36	63



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5	Grey	Silty sandy CLAY	Moist	Soft	Fine to coarse	Unknown due to saturation	5%	5-10%	Sulphur/marine
0.5 – 1.0	Grey	Silty sandy CLAY	Moist	Soft-firm	Fine to coarse	Unknown due to saturation	5%	5-10%	Sulphur/marine
1.0 – 1.5	Grey	Sandy CLAY	Moist	Soft-firm	Fine to coarse	Unknown due to saturation	1%	1%	Sulphur/marine

General Location of Sampling	Port of Mackay – Operational Area 2
Site Number	OP2_38 (T1, T2, T3)
Date/Sample Time	28/09/18, 1300
Water Depth at Site	~8m
Type of Core Sampler	Piston core
Depth Retained	0.5m
Weather Conditions / sea state	Still
Comments	Refusal at 0.5m

PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5 (T1)	6%	52%	42%
0 – 0.5 (T2)	4%	56%	40%
0 – 0.5 (T3)	9%	56%	35%



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5 (T1)	Grey	Silty sandy CLAY	Moist	Soft	Fine to coarse	Unknown due to saturation	NIL	5-10%	Sulphur/marine
0 – 0.5 (T2)	Grey	Silty sandy CLAY	Moist	Soft	Fine to coarse	Unknown due to saturation	NIL	5-10%	Sulphur/marine
0 – 0.5 (T3)	Grey	Silty sandy CLAY	Moist	Soft	Fine to coarse	Unknown due to saturation	NIL	5-10%	Sulphur/marine
Refusal									

General Location of Sampling	Port of Mackay – Operational Area 2
Site Number	OP2_42
Date/Sample Time	27/09/18, 1430
Water Depth at Site	~9m
Type of Core Sampler	Piston core
Depth Retained	1.5m
Weather Conditions / sea state	Wind 4kts / glass
Comments	Refusal at 1.5m

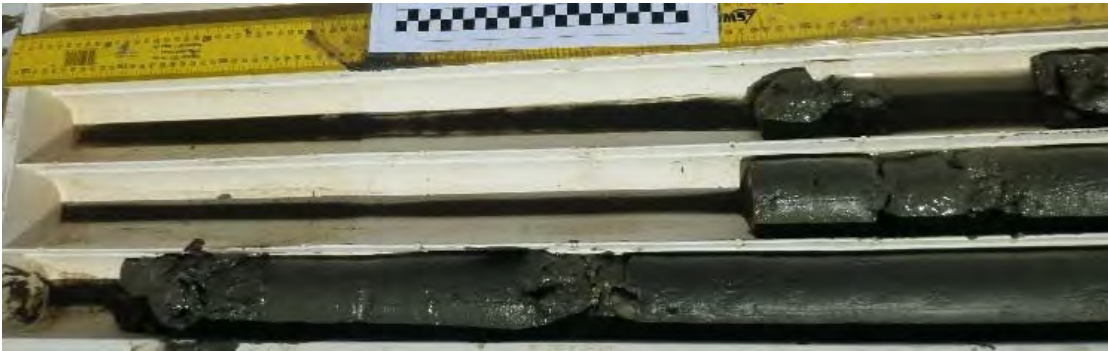
PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5	8	56	36
0.5 – 1.0	1	22	77
1.0 – 1.5	1	35	64



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5	Grey	Silty sandy CLAY	Wet	Soft	Coarse	Unknown due to saturation	5%	10%	Sulphur/marine
0.5 – 1.0	Grey	Sandy CLAY	Wet	Firm	Coarse	Unknown due to saturation	NIL	<5%	Sulphur/marine
1.0 – 1.5	Grey	Sandy CLAY	Wet	Firm	Coarse	Unknown due to saturation	NIL	<5%	Sulphur/marine
Refusal									

General Location of Sampling	Port of Mackay – Operational Area 2
Site Number	OP2_44
Date/Sample Time	28/09/18, 0930
Water Depth at Site	~8m
Type of Core Sampler	Piston core
Depth Retained	1.0m
Weather Conditions / sea state	Wind 4kts / glass
Comments	Refusal at 1.0m

PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5	7	54	39
0.5 – 1.0	3	44	53



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5	Grey	Silty sandy CLAY with gravel	Wet	Soft	Fine to coarse	Unknown due to saturation	8%	5%	Sulphur/marine
0.5 – 1.0	Grey	Silty sandy CLAY with gravel	Wet	Soft	Fine to coarse	Unknown due to saturation	8%	5%	Sulphur/marine
Refusal									

General Location of Sampling	Port of Mackay – Operational Area 2
Site Number	OP2_45
Date/Sample Time	28/09/18, 0745
Water Depth at Site	~4.7m
Type of Core Sampler	Piston core
Depth Retained	1.5m
Weather Conditions / sea state	Wind 4kts / glass
Comments	Refusal at 1.5m

PSD (%)			
Strata Change (m)	Gravel (%)	Sand (%)	Silt & Clay (%)
0 – 0.5	1	54	45
0.5 – 1.0	4	41	55
1.0 – 1.5	1	44	55



Strata Change (m)	Colour	Field Texture	Moist.	Consist.	Sand Grain Size	Plasticity	% Stones	Shell/Grit/Biota	Odour
0 – 0.5	Grey	Silty sandy CLAY	Wet	Soft	Fine	Unknown due to saturation	NIL	20%	Sulphur/marine
0.5 – 1.0	Grey	Silty sandy CLAY	Wet	Moderate	Large	Unknown due to saturation	NIL	30%	Sulphur/marine
1.0 – 1.5	Grey	Silty sandy CLAY	Wet	Moderate	Large	Unknown due to saturation	NIL	30%	Sulphur/marine
Refusal									

Appendix B Summary of ASS results

Table 1: Acid Sulfate Soils Results

Sample	Sample type	Date	Screening Analysis				Actual Acidity			Potential Acidity		Acid Neutralising Capacity			Acid Base Accounting						
			pH (F)	pH (Fox)	Change in pH(F) and pH (Fox)	Reaction Rate	pH KCl	sulfidic - Titratable Actual Acidity	Titratable Actual Acidity	Chromium Reducible Sulfur	acidity - Chromium Reducible Sulfur	Acid Neutralising Capacity	acidity - Acid Neutralising Capacity (a-19A2)	sulfidic - Acid Neutralising Capacity	ANC Fineness Factor	Net Acidity (sulfur units)	Net Acidity (acidity units)	Liming Rate	Net Acidity excluding ANC (acidity units)	Net Acidity excluding ANC (sulfur units)	Liming Rate excluding ANC
			pH Unit	pH Unit	pH Unit	-	pH Unit	% pyrite S	mole H+ / t	% S	mole H+ / t	% CaCO3	mole H+ / t	% pyrite S		% S	mole H+ / t	kg CaCO3/t	mole H+ / t	% S	kg CaCO3/t
Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998 - Action Criteria (> 1000 tonnes disturbed)			-	-	-	-	-	0.03	18	0.03	18	-	-	-	-	0.03	18	-	-	-	-
Laboratory Detection Limit - ALS			0.1	0.1	0.1		0.1	0.01	5	0.005	3	0.05	10	0.05	0.5	0.02	10	1	10	0.02	1
SB_45	Piston core	24/09/2018	8.6	6.3	2.3	2	8.4	<2	<0.02	0.06	37	7.38	1480	2.36	1.5	<0.02	<10	<1	0.06	37	3
SB_52	Piston core	24/09/2018	8.5	6.5	2	2	8.6	<2	<0.02	0.104	65	8.44	1690	2.7	1.5	<0.02	<10	<1	0.1	65	5
SB_58	Piston core	24/09/2018	8.7	6.4	2.3	2	8.8	<2	<0.02	0.14	88	8.07	1610	2.58	1.5	<0.02	<10	<1	0.14	88	6
B1_02 (T1)	Piston core	26/09/2018	8.4	6.6	1.8	2	8.9	<2	<0.02	0.108	68	8.66	1730	2.77	1.5	<0.02	<10	<1	0.11	68	5
B3_14	Piston core	26/09/2018	8.4	6.6	1.8	2	8.8	<2	<0.02	0.149	93	8.75	1750	2.8	1.5	<0.02	<10	<1	0.15	93	7
B4_01	Piston core	26/09/2018	8.6	6.8	1.8	2	8.7	<2	<0.02	0.167	104	8.94	1780	2.86	1.5	<0.02	<10	<1	0.17	104	8
B5_08	Piston core	26/09/2018	8.6	6.5	2.1	2	8.8	<2	<0.02	0.194	121	7.65	1530	2.45	1.5	<0.02	<10	<1	0.19	121	9
TB_26	Piston core	25/09/2018	8.3	6.5	1.8	2	8.8	<2	<0.02	0.146	91	9.42	1880	3.02	1.5	<0.02	<10	<1	0.14	91	7
OP2_18 (0-0.5)	Piston core	26/09/2018	8.8	6.5	2.3	2	9	<0.02	<2	0.256	160	4.23	846	1.36	1.5	<0.02	<10	<1	160	0.26	12
OP2_32 (0-0.5)	Piston core	28/09/2018	8.8	6.5	2.3	3	9	<0.02	<2	0.204	127	5.65	1130	1.81	1.5	<0.02	<10	<1	127	0.2	10
OP2_36 (0-0.5)	Piston core	28/09/2018	9	6.5	2.5	3	9.2	<0.02	<2	0.147	92	3.11	621	1	1.5	<0.02	<10	<1	92	0.15	7
OP2_36 (0.5-1.0)	Piston core	28/09/2018	8.8	6.6	2.2	2	9.1	<0.02	<2	0.14	88	2.38	475	0.76	1.5	<0.02	<10	<1	88	0.14	6
OP2_36 (1.0-1.5)	Piston core	28/09/2018	8.8	6.6	2.2	3	9.1	<0.02	<2	0.21	131	4.38	875	1.4	1.5	<0.02	<10	<1	131	0.21	10
OP2_33 (0-0.5)	Piston core	28/09/2018																			
OP2_21 (0-0.5)	Piston core	28/09/2018																			
OP2_38 (0-0.5) T1	Piston core	28/09/2018																			
OP2_44 (0-0.5)	Piston core	28/09/2018																			
OP2_44 (0.5-1.0)	Piston core	28/09/2018																			
OP2-45 (0-0.5)	Piston core	28/09/2018																			
OP2-45 (0.5-1.0)	Piston core	28/09/2018																			
OP2-45 (1.0-1.5)	Piston core	28/09/2018																			
Min			8.3	6.3	1.8	2	8.4			0.06	37	2.38	475	0.76					0.06	0.14	3
Max			9	6.8	2.5	3	9.2			0.256	160	9.42	1880	3.02					160	121	12
Mean			8.6	6.5	2.1	2.2	8.9			0.2	97.3	6.7	1338.2	2.1					46.1	51.4	7.3

Notes

- Denotes no criteria for that parameter

Results with a yellow background and highlighted in red indicate concentrations exceeding guidelines.

Not tested

Reaction rate is a subjective assessment of the strength of the reaction to hydrogen peroxide: slight (minor bubbling = score of 1) to very high (violent with frothing and heat produced = score of 4)

Table 2: Salinity and Organic Matter results

Sample	Sample type	Date	Salinity and Organic Matter					Texture (ALS results)				
			Total Soluble Salts	Chloride	Electrical Conductivity @ 25°C	Organic Matter (ALS)	Organic Matter (Trilab/ALS)	Clay	Silt	Sand	Gravel	Cobbles
			mg/kg	mg/kg	µS/cm	%	%	%	%	%	%	%
Laboratory Detection Limit - ALS			5	10	1	0.5	0.5	1	1	1	1	1
SB_02	Piston core	24/09/2018						16	13	52	19	<1
SB_16	Piston core	24/09/2018						17	75	8	<1	<1
SB_40	Piston core	24/09/2018						40	43	16	1	<1
SB_45	Piston core	24/09/2018	13200	8410	4050	1.4	1.2	5	6	86	3	<1
SB_50	Piston core	24/09/2018						4	1	95	<1	<1
SB_52	Piston core	24/09/2018	22600	25000	6950	2.9		34	42	24	<1	<1
SB_58	Piston core	24/09/2018	22100	21600	6810	3		36	30	34	<1	<1
SB_79	Piston core	24/09/2018						36	41	23	<1	<1
B1_02 (T1)	Piston core	26/09/2018	21700	22200	6690	2.4		28	35	36	1	<1
B1_07	Piston core	26/09/2018					4.6	46	24	27	3	<1
B3_14	Piston core	26/09/2018	24200	28100	7450	3	4.2	40	43	17	<1	<1
B4_01	Piston core	26/09/2018	24600	32500	7570	3.2	3.9	37	52	11	<1	<1
B5_08	Piston core	26/09/2018	21500	21100	6610	2.7		43	29	27	1	<1
B5_10	Piston core	26/09/2018					3.3	42	32	26	<1	<1
TB_02	Piston core	25/09/2018						34	36	29	1	<1
TB_05	Piston core	25/09/2018					5.9	40	34	24	2	<1
TB_12	Piston core	25/09/2018						46	42	12	<1	<1
TB_18	Piston core	25/09/2018						34	53	13	<1	<1
TB_26	Piston core	25/09/2018	24400	35500	7500	3		44	52	4	<1	<1
TB_29	Piston core	25/09/2018						36	53	11	<1	<1
OP2_18 (0-0.5)	Piston core	26/09/2018	13400	9570	4110	1.5	1	34	22	40	4	<1
OP2_21 (0-0.5)	Piston core	28/09/2018						37	30	31	2	<1
OP2_24 (0-0.5)	Piston core	28/09/2018					1.8	40	44	16	0	
OP2_32 (0-0.5)	Piston core	28/09/2018	13700	10800	4220	1.6		31	19	47	3	<1
OP2_33 (0-0.5)	Piston core	28/09/2018						29	25	44	2	<1
OP2_36 (0-0.5)	Piston core	28/09/2018	11100	8020	3430	1		24	16	52	8	<1
OP2_36 (0.5-1.0)	Piston core	28/09/2018	14200	11900	4360	1.4		24	11	52	13	<1
OP2_36 (1.0-1.5)	Piston core	28/09/2018	13300	10200	4080	1.5		34	29	36	1	<1
OP2_38 (0-0.5) T1	Piston core	28/09/2018						25	17	52	6	<1
OP2_38 (0-0.5) T2	Piston core	28/09/2018						23	17	56	4	<1
OP2_38 (0-0.5) T3	Piston core	28/09/2018						20	15	56	9	<1
OP2_44 (0-0.5)	Piston core	28/09/2018						21	18	54	7	<1
OP2_44 (0.5-1.0)	Piston core	28/09/2018						28	25	44	3	<1
OP2-45 (0-0.5)	Piston core	28/09/2018						24	21	54	1	<1
OP2-45 (0.5-1.0)	Piston core	28/09/2018						32	23	41	4	<1
OP2-45 (1.0-1.5)	Piston core	28/09/2018						29	26	44	1	<1
OP2_42 / 0.0-0.5	Piston core	27/09/2018						15	21	56	8	<1
OP2_42 / 0.5-1.0	Piston core	27/09/2018						27	50	22	1	<1
OP2_42 / 1.0-1.5	Piston core	27/09/2018						30	34	35	1	<1
Min			11100	8020	3430	1.0	1.0	4	1	4	<1	<1
Max			24600	35500	7570	3.2	5.9	46	53	95	13	<1
Mean			18462	18838	5679	2.2	3.2	31	30	37	4	<1

Notes

Organic matter testing scheduled with Trilab was subcontracted to ALS, i.e. all organic matter results determined by ALS

Not tested

Geotechnical lab result

Appendix C **ALS Laboratory documentation**

CERTIFICATE OF ANALYSIS

Work Order	: EB1823888	Page	: 1 of 20
Amendment	: 3		
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Caroline Hill
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 03-Oct-2018 09:10
Order number	:	Date Analysis Commenced	: 08-Oct-2018
C-O-C number	: ----	Issue Date	: 29-Nov-2018 08:21
Sampler	: NICHOLAS BANTON		
Site	:		
Quote number	: BN/185/18		
No. of samples received	: 19		
No. of samples analysed	: 19		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Sarah Ashworth	Laboratory Manager - Brisbane	Brisbane Organics, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Tom Maloney	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG020-SD (Total Metals in Sediments by ICP-MS): Samples EB1823888-004 (OP2_44 (0-0.5)) and -014 (OP2_36 (0.5-1.0)) show poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.
- EP090 Organotin: Sample 'D7' shows poor matrix spike recovery for MBT due to matrix interference.
- **Specialty Organics analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5
- Amendment (30/10/2018): This report has been amended and re-released to allow the reporting of additional As analytical data.
- Amendment (2/11/2018): This report has been amended and re-released to allow the reporting of additional Chloride analytical data.
- Amendment (21/11/2018): This report has been amended and re-released to allow samples 'OP2_42...' to be added to this workorder from EB1823470.
- EA151: Due to limited sample volume settleability results were unable to be reported for samples 20-22.
- EP090 Organotin: Sample 'OP2_44 (0.5-1.0)' required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly.
- EP090 Organotin: Sample 'OP2_44 (0.5-1.0)' shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP090 Organotin: Sample 'OP2_42 / 0.5-1.0' shows poor matrix spike recovery for MBT due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP090 Organotin: High LCS recovery deemed acceptable as all associated analyte results are less than LOR
- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO₃) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m³ in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m³'.
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.
- EA151: ALS does not hold NATA accreditation for Settleability.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_44 (0-0.5)	OP2_44 (0.5-1.0)	OP2-45 (0-0.5)	OP2-45 (0.5-1.0)	OP2-45 (1.0-1.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-004	EB1823888-005	EB1823888-006	EB1823888-007	EB1823888-008
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		32.0	36.7	39.6	37.9	48.1
EA150: Particle Sizing									
+75µm	----	1	%		58	41	46	38	39
+150µm	----	1	%		46	29	28	29	25
+300µm	----	1	%		34	17	15	20	11
+425µm	----	1	%		29	14	10	16	8
+600µm	----	1	%		23	11	6	12	5
+1180µm	----	1	%		12	5	2	7	2
+2.36mm	----	1	%		5	2	<1	3	<1
+4.75mm	----	1	%		2	1	<1	1	<1
+9.5mm	----	1	%		<1	<1	<1	<1	<1
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		21	28	24	32	29
Silt (2-60 µm)	----	1	%		18	25	21	23	26
Sand (0.06-2.00 mm)	----	1	%		54	44	54	41	44
Gravel (>2mm)	----	1	%		7	3	1	4	1
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		1.39	1.27	1.24	1.21	1.22
∅ Underflow Solids	----	0.1	%		40.0	32.9	31.7	29.6	31.5
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		3.80	2.20	2.80	2.20	2.40
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.200	0.050	0.067	0.058	0.017
∅ Clarity	----	-	-		Clear	Clear	Clear	Clear	Clear
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		1.36	1.32	1.29	1.25	1.31
∅ Underflow Solids	----	0.1	%		43.4	37.0	36.8	34.7	36.4
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		1.20	0.800	0.800	0.400	1.20
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		0.033	0.008	0.008	0.009	0.008
∅ Clarity	----	-	-		Clear	Clear	Clear	Clear	Clear
EA152: Soil Particle Density									
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.67	2.67	2.77	2.67	2.66



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_44 (0-0.5)	OP2_44 (0.5-1.0)	OP2-45 (0-0.5)	OP2-45 (0.5-1.0)	OP2-45 (1.0-1.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-004	EB1823888-005	EB1823888-006	EB1823888-007	EB1823888-008
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		4.88	6.31	5.44	6.36	9.96
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg		14.4	17.7	15.8	19.2	26.0
Copper	7440-50-8	1.0	mg/kg		11.7	22.0	13.9	15.5	16.8
Lead	7439-92-1	1.0	mg/kg		16.1	10.2	9.1	11.7	13.2
Nickel	7440-02-0	1.0	mg/kg		9.1	10.0	8.8	10.9	15.9
Zinc	7440-66-6	1.0	mg/kg		38.8	47.2	39.6	45.6	45.8
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.01	0.02	0.01	0.02	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.43	0.80	0.82	0.67	0.90
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	2	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		1	26	1	2	2
Tributyltin	56573-85-4	0.5	µgSn/kg		3.6	148	1.9	2.2	3.2
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		102	126	111	110	82.9



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_32 (0-0.5)	OP2_38 (0-0.5) T1	OP2_38 (0-0.5) T2	OP2_38 (0-0.5) T3	OP2_36 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-009	EB1823888-010	EB1823888-011	EB1823888-012	EB1823888-013
					Result	Result	Result	Result	Result
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		4220	----	----	----	3430
EA014 Total Soluble Salts									
Total Soluble Salts	----	5	mg/kg		13700	----	----	----	11100
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		9.0	----	----	----	9.2
Titrateable Actual Acidity (23F)	----	2	mole H+ / t		<2	----	----	----	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	----	----	----	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.204	----	----	----	0.147
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		127	----	----	----	92
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		5.65	----	----	----	3.11
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		1130	----	----	----	621
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		1.81	----	----	----	1.00
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	----	----	----	1.5
Net Acidity (sulfur units)	----	0.02	% S		<0.02	----	----	----	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	----	----	----	<10
Liming Rate	----	1	kg CaCO3/t		<1	----	----	----	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.20	----	----	----	0.15
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		127	----	----	----	92
Liming Rate excluding ANC	----	1	kg CaCO3/t		10	----	----	----	7
EA037: Ass Field Screening Analysis									
ø pH (F)	----	0.1	pH Unit		8.8	----	----	----	9.0
ø pH (Fox)	----	0.1	pH Unit		6.5	----	----	----	6.5
ø Reaction Rate	----	1	-		3	----	----	----	3
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		40.2	31.4	30.4	35.8	28.9
EA150: Particle Sizing									
+75µm	----	1	%		----	53	55	60	----
+150µm	----	1	%		----	42	41	46	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_32 (0-0.5)	OP2_38 (0-0.5) T1	OP2_38 (0-0.5) T2	OP2_38 (0-0.5) T3	OP2_36 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-009	EB1823888-010	EB1823888-011	EB1823888-012	EB1823888-013
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+300µm	----	1	%	----	30	32	34	----	----
+425µm	----	1	%	----	24	27	29	----	----
+600µm	----	1	%	----	19	19	22	----	----
+1180µm	----	1	%	----	10	9	12	----	----
+2.36mm	----	1	%	----	4	1	7	----	----
+4.75mm	----	1	%	----	2	<1	4	----	----
+9.5mm	----	1	%	----	<1	<1	<1	----	----
+19.0mm	----	1	%	----	<1	<1	<1	----	----
+37.5mm	----	1	%	----	<1	<1	<1	----	----
+75.0mm	----	1	%	----	<1	<1	<1	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%	----	25	23	20	----	----
Silt (2-60 µm)	----	1	%	----	17	17	15	----	----
Sand (0.06-2.00 mm)	----	1	%	----	52	56	56	----	----
Gravel (>2mm)	----	1	%	----	6	4	9	----	----
Cobbles (>6cm)	----	1	%	----	<1	<1	<1	----	----
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3	----	1.34	1.26	1.40	----	----
∅ Underflow Solids	----	0.1	%	----	37.3	31.8	39.5	----	----
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	----	2.60	2.20	3.20	----	----
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	----	0.117	0.067	0.117	----	----
∅ Clarity	----	-	-	----	Clear	Clear	Clear	----	----
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3	----	1.36	1.29	1.38	----	----
∅ Underflow Solids	----	0.1	%	----	40.8	36.9	42.8	----	----
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	----	1.20	1.00	1.00	----	----
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	----	0.008	0.009	0.008	----	----
∅ Clarity	----	-	-	----	Clear	Clear	Clear	----	----
EA152: Soil Particle Density									
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	2.68	2.68	2.69	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg	10800	----	----	----	8020	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg	7.58	5.50	4.67	4.79	4.52	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_32 (0-0.5)	OP2_38 (0-0.5) T1	OP2_38 (0-0.5) T2	OP2_38 (0-0.5) T3	OP2_36 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-009	EB1823888-010	EB1823888-011	EB1823888-012	EB1823888-013
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS - Continued									
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg		16.6	14.6	13.1	12.8	12.9
Copper	7440-50-8	1.0	mg/kg		23.3	11.9	11.1	9.7	11.0
Lead	7439-92-1	1.0	mg/kg		10.9	12.8	7.7	7.1	7.2
Nickel	7440-02-0	1.0	mg/kg		9.4	8.4	7.4	7.2	7.6
Zinc	7440-66-6	1.0	mg/kg		51.7	37.2	30.1	27.3	29.3
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	0.01	0.01	0.01	0.01
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.64	0.40	0.64	0.49	0.49
EP004: Organic Matter									
Organic Matter	----	0.5	%		1.6	----	----	----	1.0
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		1	1	2	1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		2.4	1.5	4.4	3.3	2.7
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		108	108	110	94.8	91.2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_36 (0.5-1.0)	OP2_36 (1.0-1.5)	OP2_33 (0-0.5)	D7	OP2_21 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-014	EB1823888-015	EB1823888-016	EB1823888-017	EB1823888-018
					Result	Result	Result	Result	Result
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		4360	4080	----	----	----
EA014 Total Soluble Salts									
Total Soluble Salts	----	5	mg/kg		14200	13300	----	----	----
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		9.1	9.1	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	----	----	----
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.140	0.210	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		88	131	----	----	----
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		2.38	4.38	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		475	875	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		0.76	1.40	----	----	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	----	----	----
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	----	----	----
Liming Rate	----	1	kg CaCO3/t		<1	<1	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.14	0.21	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		88	131	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t		6	10	----	----	----
EA037: Ass Field Screening Analysis									
ø pH (F)	----	0.1	pH Unit		8.8	8.8	----	----	----
ø pH (Fox)	----	0.1	pH Unit		6.6	6.6	----	----	----
ø Reaction Rate	----	1	-		2	3	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		40.0	38.3	38.1	36.1	34.4
EA150: Particle Sizing									
+75µm	----	1	%		----	----	----	----	27
+150µm	----	1	%		----	----	----	----	17



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_36 (0.5-1.0)	OP2_36 (1.0-1.5)	OP2_33 (0-0.5)	D7	OP2_21 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-014	EB1823888-015	EB1823888-016	EB1823888-017	EB1823888-018
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+300µm	----	1	%		----	----	----	----	11
+425µm	----	1	%		----	----	----	----	9
+600µm	----	1	%		----	----	----	----	7
+1180µm	----	1	%		----	----	----	----	3
+2.36mm	----	1	%		----	----	----	----	<1
+4.75mm	----	1	%		----	----	----	----	<1
+9.5mm	----	1	%		----	----	----	----	<1
+19.0mm	----	1	%		----	----	----	----	<1
+37.5mm	----	1	%		----	----	----	----	<1
+75.0mm	----	1	%		----	----	----	----	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	----	----	----	37
Silt (2-60 µm)	----	1	%		----	----	----	----	30
Sand (0.06-2.00 mm)	----	1	%		----	----	----	----	31
Gravel (>2mm)	----	1	%		----	----	----	----	2
Cobbles (>6cm)	----	1	%		----	----	----	----	<1
EA151: Settleability 10%									
∅ Underflow Density	----	0.01	g/cm3		----	----	----	----	1.24
∅ Underflow Solids	----	0.1	%		----	----	----	----	33.7
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		----	----	----	----	0.400
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		----	----	----	----	0.017
∅ Clarity	----	-	-		----	----	----	----	Clear
EA151: Settleability 20%									
∅ Underflow Density	----	0.01	g/cm3		----	----	----	----	1.31
∅ Underflow Solids	----	0.1	%		----	----	----	----	38.1
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min		----	----	----	----	1.60
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min		----	----	----	----	0.009
∅ Clarity	----	-	-		----	----	----	----	Clear
EA152: Soil Particle Density									
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	----	----	----	2.66
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		11900	10200	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		7.44	7.40	6.72	7.46	6.27



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_36 (0.5-1.0)	OP2_36 (1.0-1.5)	OP2_33 (0-0.5)	D7	OP2_21 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-014	EB1823888-015	EB1823888-016	EB1823888-017	EB1823888-018
				Result	Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS - Continued									
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg		22.2	21.1	18.6	20.0	19.1
Copper	7440-50-8	1.0	mg/kg		19.1	17.9	23.1	29.5	15.4
Lead	7439-92-1	1.0	mg/kg		12.7	12.3	11.4	11.1	11.5
Nickel	7440-02-0	1.0	mg/kg		12.7	12.2	10.5	11.3	11.2
Zinc	7440-66-6	1.0	mg/kg		53.5	50.7	47.2	54.3	43.9
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	0.02	0.02	0.02	0.02
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.36	0.59	0.56	0.51	0.54
EP004: Organic Matter									
Organic Matter	----	0.5	%		1.4	1.5	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		----	----	<3	<3	----
>C16 - C34 Fraction	----	3	mg/kg		----	----	10	4	----
>C34 - C40 Fraction	----	5	mg/kg		----	----	<5	<5	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		----	----	10	4	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		----	----	<3	<3	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		----	----	<3	<3	----
C10 - C14 Fraction	----	3	mg/kg		----	----	<3	<3	----
C15 - C28 Fraction	----	3	mg/kg		----	----	5	<3	----
C29 - C36 Fraction	----	5	mg/kg		----	----	6	<5	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg		----	----	11	<3	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		----	----	<3	<3	----
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		----	----	<3.0	<3.0	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	----	<0.2	<0.2	----
Toluene	108-88-3	0.2	mg/kg		----	----	<0.2	<0.2	----
Ethylbenzene	100-41-4	0.2	mg/kg		----	----	<0.2	<0.2	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		----	----	<0.2	<0.2	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_36 (0.5-1.0)	OP2_36 (1.0-1.5)	OP2_33 (0-0.5)	D7	OP2_21 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-014	EB1823888-015	EB1823888-016	EB1823888-017	EB1823888-018
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
ortho-Xylene	95-47-6	0.2	mg/kg		----	----	<0.2	<0.2	----
^ Total Xylenes	----	0.5	mg/kg		----	----	<0.5	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg		----	----	<0.2	<0.2	----
Naphthalene	91-20-3	0.2	mg/kg		----	----	<0.2	<0.2	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		2	2	<1	<1	2
Tributyltin	56573-85-4	0.5	µgSn/kg		3.4	11.4	<0.5	<0.5	3.4
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.50	µg/kg		----	----	<0.50	<0.50	----
alpha-BHC	319-84-6	0.50	µg/kg		----	----	<0.50	<0.50	----
beta-BHC	319-85-7	0.50	µg/kg		----	----	<0.50	<0.50	----
delta-BHC	319-86-8	0.50	µg/kg		----	----	<0.50	<0.50	----
4.4`-DDD	72-54-8	0.50	µg/kg		----	----	<0.50	<0.50	----
4.4`-DDE	72-55-9	0.50	µg/kg		----	----	<0.50	<0.50	----
4.4`-DDT	50-29-3	0.50	µg/kg		----	----	<0.50	<0.50	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.50	µg/kg		----	----	<0.50	<0.50	----
Dieldrin	60-57-1	0.50	µg/kg		----	----	<0.50	<0.50	----
alpha-Endosulfan	959-98-8	0.50	µg/kg		----	----	<0.50	<0.50	----
beta-Endosulfan	33213-65-9	0.50	µg/kg		----	----	<0.50	<0.50	----
Endosulfan sulfate	1031-07-8	0.50	µg/kg		----	----	<0.50	<0.50	----
^ Endosulfan (sum)	115-29-7	0.50	µg/kg		----	----	<0.50	<0.50	----
Endrin	72-20-8	0.50	µg/kg		----	----	<0.50	<0.50	----
Endrin aldehyde	7421-93-4	0.50	µg/kg		----	----	<0.50	<0.50	----
Endrin ketone	53494-70-5	0.50	µg/kg		----	----	<0.50	<0.50	----
Heptachlor	76-44-8	0.50	µg/kg		----	----	<0.50	<0.50	----
Heptachlor epoxide	1024-57-3	0.50	µg/kg		----	----	<0.50	<0.50	----
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg		----	----	<0.50	<0.50	----
gamma-BHC	58-89-9	0.25	µg/kg		----	----	<0.25	<0.25	----
Methoxychlor	72-43-5	0.50	µg/kg		----	----	<0.50	<0.50	----
cis-Chlordane	5103-71-9	0.50	µg/kg		----	----	<0.50	<0.50	----
trans-Chlordane	5103-74-2	0.50	µg/kg		----	----	<0.50	<0.50	----
^ Total Chlordane (sum)	----	0.50	µg/kg		----	----	<0.50	<0.50	----
Oxychlordane	27304-13-8	0.50	µg/kg		----	----	<0.50	<0.50	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_36 (0.5-1.0)	OP2_36 (1.0-1.5)	OP2_33 (0-0.5)	D7	OP2_21 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-014	EB1823888-015	EB1823888-016	EB1823888-017	EB1823888-018
				Result	Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued									
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg	----	----	----	<0.50	<0.50	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg	----	----	----	<5	<5	----
2-Methylnaphthalene	91-57-6	5	µg/kg	----	----	----	<5	<5	----
Acenaphthylene	208-96-8	4	µg/kg	----	----	----	<4	6	----
Acenaphthene	83-32-9	4	µg/kg	----	----	----	<4	<4	----
Fluorene	86-73-7	4	µg/kg	----	----	----	<4	<4	----
Phenanthrene	85-01-8	4	µg/kg	----	----	----	12	16	----
Anthracene	120-12-7	4	µg/kg	----	----	----	<4	5	----
Fluoranthene	206-44-0	4	µg/kg	----	----	----	37	67	----
Pyrene	129-00-0	4	µg/kg	----	----	----	38	58	----
Benz(a)anthracene	56-55-3	4	µg/kg	----	----	----	25	36	----
Chrysene	218-01-9	4	µg/kg	----	----	----	22	30	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	----	----	----	26	28	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	----	----	----	15	12	----
Benzo(e)pyrene	192-97-2	4	µg/kg	----	----	----	15	20	----
Benzo(a)pyrene	50-32-8	4	µg/kg	----	----	----	26	36	----
Perylene	198-55-0	4	µg/kg	----	----	----	9	12	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	----	----	----	16	23	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	----	----	----	4	5	----
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	----	----	----	15	20	----
Coronene	191-07-1	5	µg/kg	----	----	----	<5	6	----
^ Sum of PAHs	----	4	µg/kg	----	----	----	260	380	----
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%	----	----	----	87.1	95.2	----
Toluene-D8	2037-26-5	0.2	%	----	----	----	98.1	98.7	----
4-Bromofluorobenzene	460-00-4	0.2	%	----	----	----	108	107	----
EP090S: Organotin Surrogate									
Tripopyltin	----	0.5	%	102	124	90.8	89.4	128	
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%	----	----	80.3	67.1	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%	----	----	79.3	91.3	----	----
Anthracene-d10	1719-06-8	10	%	----	----	88.6	83.5	----	----

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 Work Order : EB1823888 Amendment 3
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_36 (0.5-1.0)	OP2_36 (1.0-1.5)	OP2_33 (0-0.5)	D7	OP2_21 (0-0.5)
Client sampling date / time					28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit		EB1823888-014	EB1823888-015	EB1823888-016	EB1823888-017	EB1823888-018
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		----	----	76.3	79.2	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_18 (0-0.5)	OP2_42 / 0.0-0.5	OP2_42 / 0.5-1.0	OP2_42 / 1.0-1.5	----
Client sampling date / time					26-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	----
Compound	CAS Number	LOR	Unit		EB1823888-019	EB1823888-020	EB1823888-021	EB1823888-022	-----
					Result	Result	Result	Result	----
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		4110	----	----	----	----
EA014 Total Soluble Salts									
Total Soluble Salts	----	5	mg/kg		13400	----	----	----	----
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		9.0	----	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	----	----	----	----
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.256	----	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		160	----	----	----	----
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		4.23	----	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		846	----	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		1.36	----	----	----	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S		<0.02	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t		<10	----	----	----	----
Liming Rate	----	1	kg CaCO3/t		<1	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.26	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		160	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t		12	----	----	----	----
EA037: Ass Field Screening Analysis									
ø pH (F)	----	0.1	pH Unit		8.8	----	----	----	----
ø pH (Fox)	----	0.1	pH Unit		6.5	----	----	----	----
ø Reaction Rate	----	1	-		2	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		39.6	28.2	38.8	43.0	----
EA150: Particle Sizing									
+75µm	----	1	%		----	60	13	22	----
+150µm	----	1	%		----	51	9	15	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_18 (0-0.5)	OP2_42 / 0.0-0.5	OP2_42 / 0.5-1.0	OP2_42 / 1.0-1.5	----
Client sampling date / time					26-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	----
Compound	CAS Number	LOR	Unit		EB1823888-019	EB1823888-020	EB1823888-021	EB1823888-022	-----
					Result	Result	Result	Result	----
EA150: Particle Sizing - Continued									
+300µm	----	1	%		----	44	6	10	----
+425µm	----	1	%		----	39	4	8	----
+600µm	----	1	%		----	33	2	6	----
+1180µm	----	1	%		----	15	1	2	----
+2.36mm	----	1	%		----	5	<1	<1	----
+4.75mm	----	1	%		----	<1	<1	<1	----
+9.5mm	----	1	%		----	<1	<1	<1	----
+19.0mm	----	1	%		----	<1	<1	<1	----
+37.5mm	----	1	%		----	<1	<1	<1	----
+75.0mm	----	1	%		----	<1	<1	<1	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	15	27	30	----
Silt (2-60 µm)	----	1	%		----	21	50	34	----
Sand (0.06-2.00 mm)	----	1	%		----	56	22	35	----
Gravel (>2mm)	----	1	%		----	8	1	1	----
Cobbles (>6cm)	----	1	%		----	<1	<1	<1	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	2.61	2.58	2.63	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		9570	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		7.18	3.65	6.55	7.58	----
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	----
Chromium	7440-47-3	1.0	mg/kg		18.1	10.2	16.7	21.0	----
Copper	7440-50-8	1.0	mg/kg		25.1	8.2	15.7	17.0	----
Lead	7439-92-1	1.0	mg/kg		23.9	6.3	12.8	14.4	----
Nickel	7440-02-0	1.0	mg/kg		10.4	6.2	10.5	12.4	----
Zinc	7440-66-6	1.0	mg/kg		223	21.7	42.7	44.5	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS (Low Level)									
Mercury	7439-97-6	0.01	mg/kg		----	<0.01	0.02	0.05	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.56	0.24	0.55	0.76	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_18 (0-0.5)	OP2_42 / 0.0-0.5	OP2_42 / 0.5-1.0	OP2_42 / 1.0-1.5	----
Client sampling date / time					26-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	----
Compound	CAS Number	LOR	Unit		EB1823888-019	EB1823888-020	EB1823888-021	EB1823888-022	-----
					Result	Result	Result	Result	----
EP004: Organic Matter									
Organic Matter	----	0.5	%		1.5	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		----	<3	<3	3	----
>C16 - C34 Fraction	----	3	mg/kg		----	6	9	12	----
>C34 - C40 Fraction	----	5	mg/kg		----	<5	6	5	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		----	6	15	20	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		----	<3	<3	3	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		----	<3	<3	<3	----
C10 - C14 Fraction	----	3	mg/kg		----	<3	<3	3	----
C15 - C28 Fraction	----	3	mg/kg		----	4	6	8	----
C29 - C36 Fraction	----	5	mg/kg		----	<5	6	7	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg		----	4	12	18	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		----	<3	<3	<3	----
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		----	<3.0	<3.0	<3.0	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
Ethylbenzene	100-41-4	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
ortho-Xylene	95-47-6	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
^ Total Xylenes	----	0.5	mg/kg		----	<0.5	<0.5	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
Naphthalene	91-20-3	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	----
Dibutyltin	1002-53-5	1	µgSn/kg		2	1	1	<1	----
Tributyltin	56573-85-4	0.5	µgSn/kg		3.4	6.0	0.9	<0.5	----
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
alpha-BHC	319-84-6	0.50	µg/kg		----	<0.50	<0.50	<0.50	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_18 (0-0.5)	OP2_42 / 0.0-0.5	OP2_42 / 0.5-1.0	OP2_42 / 1.0-1.5	----
Client sampling date / time					26-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	----
Compound	CAS Number	LOR	Unit		EB1823888-019	EB1823888-020	EB1823888-021	EB1823888-022	-----
					Result	Result	Result	Result	----
EP131A: Organochlorine Pesticides - Continued									
beta-BHC	319-85-7	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
delta-BHC	319-86-8	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
4,4'-DDD	72-54-8	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
4,4'-DDE	72-55-9	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
4,4'-DDT	50-29-3	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Dieldrin	60-57-1	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
alpha-Endosulfan	959-98-8	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
beta-Endosulfan	33213-65-9	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Endosulfan sulfate	1031-07-8	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
^ Endosulfan (sum)	115-29-7	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Endrin	72-20-8	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Endrin aldehyde	7421-93-4	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Endrin ketone	53494-70-5	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Heptachlor	76-44-8	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Heptachlor epoxide	1024-57-3	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
gamma-BHC	58-89-9	0.25	µg/kg		----	<0.25	<0.25	<0.25	----
Methoxychlor	72-43-5	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
cis-Chlordane	5103-71-9	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
trans-Chlordane	5103-74-2	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
^ Total Chlordane (sum)	----	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
Oxychlordane	27304-13-8	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg		----	<0.50	<0.50	<0.50	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		----	<5	7	10	----
2-Methylnaphthalene	91-57-6	5	µg/kg		----	<5	<5	<5	----
Acenaphthylene	208-96-8	4	µg/kg		----	<4	9	11	----
Acenaphthene	83-32-9	4	µg/kg		----	<4	8	<4	----
Fluorene	86-73-7	4	µg/kg		----	<4	6	<4	----
Phenanthrene	85-01-8	4	µg/kg		----	5	39	18	----
Anthracene	120-12-7	4	µg/kg		----	<4	6	7	----
Fluoranthene	206-44-0	4	µg/kg		----	10	116	62	----
Pyrene	129-00-0	4	µg/kg		----	11	103	62	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	OP2_18 (0-0.5)	OP2_42 / 0.0-0.5	OP2_42 / 0.5-1.0	OP2_42 / 1.0-1.5	----
Client sampling date / time					26-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	27-Sep-2018 00:00	----
Compound	CAS Number	LOR	Unit		EB1823888-019	EB1823888-020	EB1823888-021	EB1823888-022	-----
					Result	Result	Result	Result	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benz(a)anthracene	56-55-3	4	µg/kg		----	7	72	44	----
Chrysene	218-01-9	4	µg/kg		----	5	56	28	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		----	6	71	33	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		----	<4	34	19	----
Benzo(e)pyrene	192-97-2	4	µg/kg		----	4	40	20	----
Benzo(a)pyrene	50-32-8	4	µg/kg		----	6	75	44	----
Perylene	198-55-0	4	µg/kg		----	5	21	19	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		----	5	44	26	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		----	<4	10	<4	----
Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg		----	4	40	22	----
Coronene	191-07-1	5	µg/kg		----	<5	9	5	----
^ Sum of PAHs	----	4	µg/kg		----	68	766	430	----
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		----	76.5	87.3	87.1	----
Toluene-D8	2037-26-5	0.2	%		----	69.3	80.4	78.0	----
4-Bromofluorobenzene	460-00-4	0.2	%		----	78.4	85.9	86.5	----
EP090S: Organotin Surrogate									
Tripopyltin	----	0.5	%		113	127	83.4	102	----
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		----	75.9	62.7	50.7	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	81.9	80.8	119	----
Anthracene-d10	1719-06-8	10	%		----	112	124	112	----
4-Terphenyl-d14	1718-51-0	10	%		----	77.2	85.2	86.8	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	51	145
Toluene-D8	2037-26-5	42	144
4-Bromofluorobenzene	460-00-4	58	142
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	119
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	55	135
Anthracene-d10	1719-06-8	70	136
4-Terphenyl-d14	1718-51-0	57	127

QUALITY CONTROL REPORT

Work Order : **EB1823888**

Page : 1 of 19

Amendment : **3**

Client : **ADVISIAN PTY LTD**

Laboratory : Environmental Division Brisbane

Contact : **MR BILL BOYLSON**

Contact : Caroline Hill

Address : **LEVEL 3 60 ALBERT STREET
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Address : 2 Byth Street Stafford QLD Australia 4053

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Telephone : +61 7 3552 8662

Project : 301001.02018 - Port of Mackay Sediment Sampling

Date Samples Received : 03-Oct-2018

Order number :

Date Analysis Commenced : 08-Oct-2018

C-O-C number : ----

Issue Date : 29-Nov-2018

Sampler : **NICHOLAS BAINTON**

Site :

Quote number : **BN/185/18**

No. of samples received : 19

No. of samples analysed : 19



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
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Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Tom Maloney	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 1968797)									
EB1823888-016	OP2_33 (0-0.5)	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.00	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 1968837)									
EB1823888-004	OP2_44 (0-0.5)	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.01	0.01	0.00	0% - 20%
EB1823888-014	OP2_36 (0.5-1.0)	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.00	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 2049807)									
EB1823888-020	OP2_42 / 0.0-0.5	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 1968828)									
EB1823888-019	OP2_18 (0-0.5)	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	4110	4110	0.00	0% - 20%
EB1823844-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	115	130	11.8	0% - 20%
EA033-A: Actual Acidity (QC Lot: 2004237)									
EB1823888-009	OP2_32 (0-0.5)	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.0	9.1	1.10	0% - 20%
EA033-B: Potential Acidity (QC Lot: 2004237)									
EB1823888-009	OP2_32 (0-0.5)	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.204	0.202	0.985	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	127	126	1.17	0% - 50%
EA033-C: Acid Neutralising Capacity (QC Lot: 2004237)									
EB1823888-009	OP2_32 (0-0.5)	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	5.65	5.61	0.728	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	1.81	1.80	0.720	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1130	1120	0.717	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 1971291)									



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA037: Ass Field Screening Analysis (QC Lot: 1971291) - continued									
EB1823534-016	Anonymous	EA037: pH (F)	----	0.1	pH Unit	8.2	8.1	1.23	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	5.7	5.6	1.77	0% - 20%
EB1823534-026	Anonymous	EA037: pH (F)	----	0.1	pH Unit	7.9	7.8	1.27	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	8.8	8.8	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1968805)									
EB1823888-016	OP2_33 (0-0.5)	EA055: Moisture Content	----	0.1	%	38.1	38.5	0.985	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1968841)									
EB1823844-001	Anonymous	EA055: Moisture Content	----	0.1	%	20.5	20.7	0.942	0% - 20%
EB1823888-008	OP2-45 (1.0-1.5)	EA055: Moisture Content	----	0.1	%	48.1	48.2	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2049813)									
EB1823888-020	OP2_42 / 0.0-0.5	EA055: Moisture Content	----	0.1	%	28.2	29.0	2.86	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2019038)									
EB1823888-009	OP2_32 (0-0.5)	ED045G: Chloride	16887-00-6	10	mg/kg	10800	10500	2.28	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1968796)									
EB1823888-016	OP2_33 (0-0.5)	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	6.72	6.77	0.694	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	18.6	18.9	1.36	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	23.1	24.4	5.54	0% - 20%
		EG020-SD: Lead	7439-92-1	1	mg/kg	11.4	9.8	15.6	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	10.5	11.0	4.77	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	47.2	47.6	0.969	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1968836)									
EB1823888-004	OP2_44 (0-0.5)	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	4.88	4.93	1.10	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	14.4	13.5	6.53	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	11.7	11.2	4.57	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	16.1	# 8.4	62.5	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	9.1	7.7	17.0	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	38.8	# 61.6	45.5	0% - 20%
EB1823888-014	OP2_36 (0.5-1.0)	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	7.44	7.20	3.26	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	22.2	21.5	3.12	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	19.1	19.4	1.71	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	12.7	13.4	5.01	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	12.7	12.4	2.18	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	53.5	# 66.9	22.3	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2049806)									
EB1823888-020	OP2_42 / 0.0-0.5	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	3.65	4.01	9.27	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2049806) - continued									
EB1823888-020	OP2_42 / 0.0-0.5	EG020-SD: Chromium	7440-47-3	1	mg/kg	10.2	10.2	0.00	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	8.2	8.8	7.13	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	6.3	6.4	2.16	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	6.2	6.3	0.00	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	21.7	25.6	16.5	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1985740)									
EB1823888-004	OP2_44 (0-0.5)	EP003: Total Organic Carbon	----	0.02	%	0.43	0.44	0.00	0% - 20%
EB1823888-014	OP2_36 (0.5-1.0)	EP003: Total Organic Carbon	----	0.02	%	0.36	0.39	8.70	0% - 50%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2056778)									
EB1823888-020	OP2_42 / 0.0-0.5	EP003: Total Organic Carbon	----	0.02	%	0.24	0.24	0.00	0% - 50%
EP004: Organic Matter (QC Lot: 1968422)									
EB1823888-009	OP2_32 (0-0.5)	EP004: Organic Matter	----	0.5	%	1.6	1.5	0.00	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1968790)									
EB1823888-016	OP2_33 (0-0.5)	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1968804)									
EB1823888-016	OP2_33 (0-0.5)	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	5	<3	54.6	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	11	<3	114	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	6	<5	24.4	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 2049809)									
EB1823888-020	OP2_42 / 0.0-0.5	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	4	4	0.00	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	4	4	0.00	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 2049811)									
EB1823888-020	OP2_42 / 0.0-0.5	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 1968790)									
EB1823888-016	OP2_33 (0-0.5)	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 1968804)									
EB1823888-016	OP2_33 (0-0.5)	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	10	3	97.8	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	10	3	108	No Limit
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 2049809)									
EB1823888-020	OP2_42 / 0.0-0.5	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	6	6	0.00	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	6	6	0.00	No Limit
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 2049811)									
EB1823888-020	OP2_42 / 0.0-0.5	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.00	No Limit
EP080-SD: BTEXN (QC Lot: 1968790)									
EB1823888-016	OP2_33 (0-0.5)	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		106-42-3							
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
EP080-SD: BTEXN (QC Lot: 2049811)									
EB1823888-020	OP2_42 / 0.0-0.5	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		106-42-3							
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
EP090: Organotin Compounds (QC Lot: 1968803)									
EB1823888-016	OP2_33 (0-0.5)	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.00	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.00	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.00	No Limit
EP090: Organotin Compounds (QC Lot: 1968838)									
EB1823888-004	OP2_44 (0-0.5)	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	3.6	1.9	59.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.00	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	1	1	0.00	No Limit
EB1823888-014	OP2_36 (0.5-1.0)	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	3.4	3.6	6.13	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.00	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	2	2	0.00	No Limit
EP090: Organotin Compounds (QC Lot: 2049812)									
EB1823888-020	OP2_42 / 0.0-0.5	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	6.0	3.9	42.3	0% - 50%
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.00	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	1	1	0.00	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 1972855)									
EB1823888-016	OP2_33 (0-0.5)	EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	0.00	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.50	<0.50	0.00	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP131A: Organochlorine Pesticides (QC Lot: 1972855) - continued									
EB1823888-016	OP2_33 (0-0.5)	EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 2050937)									
EB1823888-020	OP2_42 / 0.0-0.5	EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	0.00	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	<0.50	0.00	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP131A: Organochlorine Pesticides (QC Lot: 2050937) - continued									
EB1823888-020	OP2_42 / 0.0-0.5	EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
		EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	<0.50	0.00	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1972856)									
EB1823888-016	OP2_33 (0-0.5)	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	12	13	0.00	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	37	50	29.5	0% - 50%
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	38	45	17.2	0% - 50%
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	25	32	25.2	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	22	25	10.1	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	26	29	11.7	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	15	21	31.9	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	15	18	13.4	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	26	30	13.4	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	9	10	0.00	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	16	19	14.9	No Limit
		EP132B-SD: Dibenzo(a,h)anthracene	53-70-3	4	µg/kg	4	4	0.00	No Limit
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	15	17	14.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	260	313	18.5	0% - 20%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.00	No Limit
		EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2050948)							
EB1823888-020	OP2_42 / 0.0-0.5	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	5	<4	26.7	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	10	9	11.6	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	11	9	11.9	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	7	7	0.00	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	5	6	21.2	No Limit

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 Work Order : EB1823888 Amendment 3
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2050948) - continued									
EB1823888-020	OP2_42 / 0.0-0.5	EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	6	10	41.1	No Limit
			205-82-3						
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	4	5	29.7	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	6	8	21.8	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	5	4	0.00	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	5	6	20.3	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	4	5	27.4	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	68	69	1.46	0% - 50%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1968797)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.0555 mg/kg	98.5	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1968837)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.0555 mg/kg	94.6	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2049807)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.0555 mg/kg	97.3	70	130
EA010: Conductivity (1:5) (QCLot: 1968828)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.8	97	103
EA033-A: Actual Acidity (QCLot: 2004237)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.6 pH Unit	95.6	70	130
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	17.7 mole H+ / t	108	70	130
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 2004237)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.25483 % S	90.2	70	130
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 2004237)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	104	70	130
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
ED045G: Chloride by Discrete Analyser (QCLot: 2019038)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	50 mg/kg	104	83	119
				<10	5000 mg/kg	105	83	119
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1968796)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	116 mg/kg	104	80	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	102	87	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.5 mg/kg	99.6	79	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	52.9 mg/kg	97.1	85	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	66.3 mg/kg	97.0	86	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	101	77	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	183 mg/kg	71.7	71	127
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1968836)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	116 mg/kg	110	80	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	104	87	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.5 mg/kg	114	79	129



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1968836) - continued								
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	52.9 mg/kg	104	85	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	66.3 mg/kg	100	86	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	110	77	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	183 mg/kg	73.5	71	127
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2049806)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	116 mg/kg	98.6	80	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	101	87	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.5 mg/kg	105	79	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	52.9 mg/kg	100	85	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	66.3 mg/kg	116	86	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	99.1	77	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	112 mg/kg	118	71	127
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1985740)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	17.6 %	100	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2056778)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.44 %	100	70	130
EP004: Organic Matter (QCLot: 1968422)								
EP004: Organic Matter	----	0.5	%	<0.5	80 %	100	83	115
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1968790)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	16 mg/kg	98.4	66	120
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1968804)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	157 mg/kg	95.4	43	126
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	245 mg/kg	108	66	140
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2049809)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	157 mg/kg	107	43	126
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	245 mg/kg	108	66	140
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2049811)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	16 mg/kg	75.8	66	120
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1968790)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	18.5 mg/kg	98.3	66	119
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1968804)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	227 mg/kg	100.0	40	134
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	162 mg/kg	110	66	136

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1968804) - continued								
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2049809)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	227 mg/kg	106	40	134
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	162 mg/kg	112	66	136
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2049811)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	18.5 mg/kg	73.2	66	119
EP080-SD: BTEXN (QCLot: 1968790)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	95.0	73	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	100	73	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	99.6	67	104
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2 mg/kg	94.6	66	106
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	101	68	105
EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	1 mg/kg	95.6	72	115
EP080-SD: BTEXN (QCLot: 2049811)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	81.1	73	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	77.7	73	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	76.2	67	104
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2 mg/kg	77.0	66	106
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	77.7	68	105
EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	1 mg/kg	80.1	72	115
EP090: Organotin Compounds (QCLot: 1968803)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	110	36	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	92.5	42	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	71.3	52	139
EP090: Organotin Compounds (QCLot: 1968838)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	125	36	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	125	42	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	103	52	139
EP090: Organotin Compounds (QCLot: 2049812)								



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP090: Organotin Compounds (QCLot: 2049812) - continued								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	# 156	36	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	127	42	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	112	52	139
EP131A: Organochlorine Pesticides (QCLot: 1972855)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	77.9	38	139
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	91.9	18	136
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	85.0	31	131
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	119	37	140
EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	54.1	26	141
EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	66.7	35	129
EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	94.7	23	138
EP131A: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	107	30	140
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	81.4	38	140
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	92.4	32	152
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	125	36	155
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	142	26	158
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	94.2	20	118
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	81.9	13	135
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	114	39	155
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	78.2	34	148
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	49.4	26	152
EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	5 µg/kg	67.0	31	137
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	148	36	152
EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	5 µg/kg	52.9	36	142
EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	5 µg/kg	74.0	30	138
EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.25	----	----	----	----
EP131A: Organochlorine Pesticides (QCLot: 2050937)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	50.8	38	139
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	50.2	18	136
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	56.6	31	131
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	56.2	37	140
EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	29.8	26	141
EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	41.2	35	129
EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	67.3	23	138
EP131A: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.5	µg/kg	<0.50	----	----	----	----



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EP131A: Organochlorine Pesticides (QCLot: 2050937) - continued								
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	52.3	30	140
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	52.6	38	140
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	53.4	32	152
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	64.6	36	155
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	68.0	26	158
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	60.7	20	118
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	51.7	13	135
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	60.1	39	155
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	54.7	34	148
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	33.5	26	152
EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	5 µg/kg	47.2	31	137
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	88.6	36	152
EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	5 µg/kg	38.5	36	142
EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	5 µg/kg	44.5	30	138
EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.25	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1972856)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	97.0	63	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	121	64	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	94.7	65	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	92.5	68	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	92.7	68	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	89.7	64	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	91.4	65	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	89.8	64	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	88.7	67	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	96.6	62	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	88.6	65	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	90.7	68	120
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	87.3	61	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	86.6	63	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	90.7	66	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	89.0	69	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	93.2	66	120
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	91.8	64	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	92.9	64	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	94.8	68	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
Method: Compound	CAS Number	LOR	Unit	Result				
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 2050948)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	83.8	63	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	97.1	64	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	100	65	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	97.4	68	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	98.9	68	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	104	64	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	92.3	65	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	98.6	64	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	98.9	67	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	100	62	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	101	65	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	104	68	120
	205-82-3							
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	100.0	61	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	107	63	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	109	66	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	103	69	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	102	66	120
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	94.6	64	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	97.6	64	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	89.4	68	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1968797)							
EB1823888-017	D7	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	83.2	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 1968837)							
EB1823888-005	OP2_44 (0.5-1.0)	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	90.8	70	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2049807)							
EB1823888-021	OP2_42 / 0.5-1.0	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	92.6	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1968796)							
EB1823888-017	D7	EG020-SD: Arsenic	7440-38-2	50 mg/kg	94.6	70	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1968796) - continued							
EB1823888-017	D7	EG020-SD: Cadmium	7440-43-9	25 mg/kg	91.8	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	109	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	96.4	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	98.7	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	96.4	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	87.0	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1968836)							
EB1823888-005	OP2_44 (0.5-1.0)	EG020-SD: Arsenic	7440-38-2	50 mg/kg	104	70	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	97.5	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	118	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	105	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	110	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	104	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	127	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2049806)							
EB1823888-021	OP2_42 / 0.5-1.0	EG020-SD: Arsenic	7440-38-2	50 mg/kg	94.2	70	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	96.8	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	105	70	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	102	70	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	128	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	103	70	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	85.5	70	130
EP004: Organic Matter (QCLot: 1968422)							
EB1823888-013	OP2_36 (0-0.5)	EP004: Organic Matter	----	2 %	78.5	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1968790)							
EB1823888-017	D7	EP080-SD: C6 - C9 Fraction	----	8 mg/kg	71.5	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1968804)							
EB1823888-017	D7	EP071-SD: C10 - C14 Fraction	----	157 mg/kg	94.7	70	130
		EP071-SD: C15 - C28 Fraction	----	245 mg/kg	102	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2049809)							
EB1823888-021	OP2_42 / 0.5-1.0	EP071-SD: C10 - C14 Fraction	----	157 mg/kg	100	70	130
		EP071-SD: C15 - C28 Fraction	----	245 mg/kg	106	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 2049811)							
EB1823888-021	OP2_42 / 0.5-1.0	EP080-SD: C6 - C9 Fraction	----	8 mg/kg	82.0	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1968790)							
EB1823888-017	D7	EP080-SD: C6 - C10 Fraction	C6_C10	8 mg/kg	72.4	70	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 1968804)							
EB1823888-017	D7	EP071-SD: >C10 - C16 Fraction	----	227 mg/kg	97.2	70	130
		EP071-SD: >C16 - C34 Fraction	----	162 mg/kg	104	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2049809)							
EB1823888-021	OP2_42 / 0.5-1.0	EP071-SD: >C10 - C16 Fraction	----	227 mg/kg	101	70	130
		EP071-SD: >C16 - C34 Fraction	----	162 mg/kg	112	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 2049811)							
EB1823888-021	OP2_42 / 0.5-1.0	EP080-SD: C6 - C10 Fraction	C6_C10	8 mg/kg	83.4	70	130
EP080-SD: BTEXN (QCLot: 1968790)							
EB1823888-017	D7	EP080-SD: Benzene	71-43-2	2 mg/kg	71.9	70	130
		EP080-SD: Toluene	108-88-3	2 mg/kg	74.8	70	130
EP080-SD: BTEXN (QCLot: 2049811)							
EB1823888-021	OP2_42 / 0.5-1.0	EP080-SD: Benzene	71-43-2	2 mg/kg	77.0	70	130
		EP080-SD: Toluene	108-88-3	2 mg/kg	73.6	70	130
EP090: Organotin Compounds (QCLot: 1968803)							
EB1823888-017	D7	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 27.0	35	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	104	20	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	90.7	20	130
EP090: Organotin Compounds (QCLot: 1968838)							
EB1823888-005	OP2_44 (0.5-1.0)	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 7.90	35	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	# Not Determined	20	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	20	130
EP090: Organotin Compounds (QCLot: 2049812)							
EB1823888-021	OP2_42 / 0.5-1.0	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 18.4	35	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	81.0	20	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	63.8	20	130
EP131A: Organochlorine Pesticides (QCLot: 1972855)							
EB1823888-016	OP2_33 (0-0.5)	EP131A: Aldrin	309-00-2	5 µg/kg	65.6	23	153
		EP131A: alpha-BHC	319-84-6	5 µg/kg	81.7	18	156
		EP131A: beta-BHC	319-85-7	5 µg/kg	66.4	25	153
		EP131A: delta-BHC	319-86-8	5 µg/kg	103	25	147
		EP131A: 4,4'-DDD	72-54-8	5 µg/kg	46.1	26	150
		EP131A: 4,4'-DDE	72-55-9	5 µg/kg	83.7	31	125
		EP131A: 4,4'-DDT	50-29-3	5 µg/kg	99.4	23	163
		EP131A: Dieldrin	60-57-1	5 µg/kg	68.3	30	140



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP131A: Organochlorine Pesticides (QCLot: 1972855) - continued							
EB1823888-016	OP2_33 (0-0.5)	EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	74.2	29	135
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	91.2	23	141
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	117	16	156
		EP131A: Endrin	72-20-8	5 µg/kg	136	18	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	61.6	20	116
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	95.0	13	151
		EP131A: Heptachlor	76-44-8	5 µg/kg	87.0	24	170
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	59.8	28	140
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	54.0	18	144
		EP131A: gamma-BHC	58-89-9	5 µg/kg	74.9	22	158
		EP131A: Methoxychlor	72-43-5	5 µg/kg	154	24	158
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	48.2	27	139
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	49.9	30	138
EP131A: Organochlorine Pesticides (QCLot: 2050937)							
EB1823888-020	OP2_42 / 0.0-0.5	EP131A: Aldrin	309-00-2	5 µg/kg	61.1	23	153
		EP131A: alpha-BHC	319-84-6	5 µg/kg	52.8	18	156
		EP131A: beta-BHC	319-85-7	5 µg/kg	54.2	25	153
		EP131A: delta-BHC	319-86-8	5 µg/kg	67.9	25	147
		EP131A: 4,4'-DDD	72-54-8	5 µg/kg	65.0	26	150
		EP131A: 4,4'-DDE	72-55-9	5 µg/kg	55.5	31	125
		EP131A: 4,4'-DDT	50-29-3	5 µg/kg	49.8	23	163
		EP131A: Dieldrin	60-57-1	5 µg/kg	65.5	30	140
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	59.9	29	135
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	81.2	23	141
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	63.9	16	156
		EP131A: Endrin	72-20-8	5 µg/kg	82.2	18	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	99.1	20	116
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	60.6	13	151
		EP131A: Heptachlor	76-44-8	5 µg/kg	57.3	24	170
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	58.4	28	140
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	42.3	18	144
		EP131A: gamma-BHC	58-89-9	5 µg/kg	53.8	22	158
		EP131A: Methoxychlor	72-43-5	5 µg/kg	65.5	24	158
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	55.2	27	139
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	63.7	30	138
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1972856)							
EB1823888-016	OP2_33 (0-0.5)	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	86.2	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	110	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	94.2	70	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1972856) - continued							
EB1823888-016	OP2_33 (0-0.5)	EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	84.9	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	85.1	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	70.2	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	85.3	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	71.7	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	94.2	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	91.6	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	98.6	70	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	84.6	70	130
			205-82-3				
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	96.9	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	90.7	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	79.4	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	109	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	105	70	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	120	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	109	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	110	70	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 2050948)							
EB1823888-020	OP2_42 / 0.0-0.5	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	101	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	92.5	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	115	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	95.2	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	102	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	100	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	109	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	128	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	110	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	103	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	81.4	70	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	107	70	130
			205-82-3				
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	89.4	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	97.5	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	123	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	99.7	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	109	70	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	96.4	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	112	70	130



Sub-Matrix: SOIL

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 2050948) - continued							
EB1823888-020	OP2_42 / 0.0-0.5	EP132B-SD: Coronene	191-07-1	25 µg/kg	104	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EB1823888**

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Amendment : **3**

Client : **ADVISIAN PTY LTD**

Laboratory : Environmental Division Brisbane

Contact : **MR BILL BOYLSON**

Telephone : +61 7 3552 8662

Project : 301001.02018 - Port of Mackay Sediment Sampling

Date Samples Received : 03-Oct-2018

Site :

Issue Date : 29-Nov-2018

Sampler : **NICHOLAS BAINTON**

No. of samples received : 19

Order number :

No. of samples analysed : 19

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- Duplicate outliers exist - please see following pages for full details.
- Laboratory Control outliers exist - please see following pages for full details.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EG020-SD: Total Metals in Sediments by ICPMS	EB1823888--004	OP2_44 (0-0.5)	Lead	7439-92-1	62.5 %	0% - 50%	RPD exceeds LOR based limits
EG020-SD: Total Metals in Sediments by ICPMS	EB1823888--004	OP2_44 (0-0.5)	Zinc	7440-66-6	45.5 %	0% - 20%	RPD exceeds LOR based limits
EG020-SD: Total Metals in Sediments by ICPMS	EB1823888--014	OP2_36 (0.5-1.0)	Zinc	7440-66-6	22.3 %	0% - 20%	RPD exceeds LOR based limits
Laboratory Control Spike (LCS) Recoveries							
EP090: Organotin Compounds	QC-2049812-002	----	Monobutyltin	78763-54-9	156 %	36-128%	Recovery greater than upper control limit
Matrix Spike (MS) Recoveries							
EP090: Organotin Compounds	EB1823888--017	D7	Monobutyltin	78763-54-9	27.0 %	35-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	EB1823888--005	OP2_44 (0.5-1.0)	Monobutyltin	78763-54-9	7.90 %	35-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	EB1823888--021	OP2_42 / 0.5-1.0	Monobutyltin	78763-54-9	18.4 %	35-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	EB1823888--005	OP2_44 (0.5-1.0)	Dibutyltin	1002-53-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EP090: Organotin Compounds	EB1823888--005	OP2_44 (0.5-1.0)	Tributyltin	56573-85-4	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA010: Conductivity (1:5)						
Soil Glass Jar - Unpreserved OP2_18 (0-0.5)	09-Oct-2018	03-Oct-2018	6	----	----	----
Soil Glass Jar - Unpreserved OP2_32 (0-0.5), OP2_36 (0.5-1.0), OP2_36 (1.0-1.5)	09-Oct-2018	05-Oct-2018	4	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	----	----	21-Nov-2018	11-Oct-2018	41
ED045G: Chloride by Discrete Analyser						
Soil Glass Jar - Unpreserved OP2_18 (0-0.5)	06-Nov-2018	24-Oct-2018	13	----	----	----

[illegible]



Matrix: **SOIL**

Method Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP132B: Polynuclear Aromatic Hydrocarbons - Analysis Holding Time Compliance						
Soil Glass Jar - Unpreserved OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	29-Oct-2018	11-Oct-2018	18	----	----	----

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010: Conductivity (1:5)							
Soil Glass Jar - Unpreserved (EA010) OP2_18 (0-0.5)	26-Sep-2018	09-Oct-2018	03-Oct-2018	✖	09-Oct-2018	06-Nov-2018	✓
Soil Glass Jar - Unpreserved (EA010) OP2_32 (0-0.5), OP2_36 (0.5-1.0), OP2_36 (1.0-1.5)	28-Sep-2018	09-Oct-2018	05-Oct-2018	✖	09-Oct-2018	06-Nov-2018	✓
EA033-A: Actual Acidity							
Snap Lock Bag - frozen (EA033) OP2_18 (0-0.5)	26-Sep-2018	26-Oct-2018	26-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
Snap Lock Bag - frozen (EA033) OP2_32 (0-0.5), OP2_36 (0.5-1.0), OP2_36 (1.0-1.5)	28-Sep-2018	26-Oct-2018	28-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
EA033-B: Potential Acidity							
Snap Lock Bag - frozen (EA033) OP2_18 (0-0.5)	26-Sep-2018	26-Oct-2018	26-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
Snap Lock Bag - frozen (EA033) OP2_32 (0-0.5), OP2_36 (0.5-1.0), OP2_36 (1.0-1.5)	28-Sep-2018	26-Oct-2018	28-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
EA033-C: Acid Neutralising Capacity							
Snap Lock Bag - frozen (EA033) OP2_18 (0-0.5)	26-Sep-2018	26-Oct-2018	26-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
Snap Lock Bag - frozen (EA033) OP2_32 (0-0.5), OP2_36 (0.5-1.0), OP2_36 (1.0-1.5)	28-Sep-2018	26-Oct-2018	28-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-D: Retained Acidity							
Snap Lock Bag - frozen (EA033) OP2_18 (0-0.5)	26-Sep-2018	26-Oct-2018	26-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
Snap Lock Bag - frozen (EA033) OP2_32 (0-0.5), OP2_36 (0.5-1.0),	28-Sep-2018	26-Oct-2018	28-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
OP2_36 (0.5-1.0),	OP2_36 (0-0.5), OP2_36 (1.0-1.5)						
EA033-E: Acid Base Accounting							
Snap Lock Bag - frozen (EA033) OP2_18 (0-0.5)	26-Sep-2018	26-Oct-2018	26-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
Snap Lock Bag - frozen (EA033) OP2_32 (0-0.5), OP2_36 (0.5-1.0),	28-Sep-2018	26-Oct-2018	28-Sep-2019	✓	26-Oct-2018	24-Jan-2019	✓
OP2_36 (0.5-1.0),	OP2_36 (0-0.5), OP2_36 (1.0-1.5)						
EA037: Ass Field Screening Analysis							
Snap Lock Bag - frozen (EA037) OP2_18 (0-0.5)	26-Sep-2018	10-Oct-2018	25-Mar-2019	✓	10-Oct-2018	25-Mar-2019	✓
Snap Lock Bag - frozen (EA037) OP2_32 (0-0.5), OP2_36 (0.5-1.0),	28-Sep-2018	10-Oct-2018	27-Mar-2019	✓	10-Oct-2018	27-Mar-2019	✓
OP2_36 (0.5-1.0),	OP2_36 (0-0.5), OP2_36 (1.0-1.5)						
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) OP2_18 (0-0.5)	26-Sep-2018	----	----	----	08-Oct-2018	10-Oct-2018	✓
Soil Glass Jar - Unpreserved (EA055) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	27-Sep-2018	----	----	----	21-Nov-2018	11-Oct-2018	✗
Soil Glass Jar - Unpreserved (EA055) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3, OP2_36 (0.5-1.0), OP2_33 (0-0.5), OP2_21 (0-0.5)	28-Sep-2018	----	----	----	08-Oct-2018	12-Oct-2018	✓
OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T2, OP2_36 (0-0.5), OP2_36 (1.0-1.5), D7,							
EA150: Particle Sizing							
Snap Lock Bag (EA150H) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	27-Sep-2018	----	----	----	27-Nov-2018	26-Mar-2019	✓
Snap Lock Bag (EA150H) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T2, OP2_21 (0-0.5)	28-Sep-2018	----	----	----	19-Oct-2018	27-Mar-2019	✓
OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3,							



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	----	----	----	27-Nov-2018	26-Mar-2019	✓
Snap Lock Bag (EA150H) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T2, OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3,	28-Sep-2018	----	----	----	19-Oct-2018	27-Mar-2019	✓
EA151: Settleability 10%								
Snap Lock Bag (EA151-10) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T2, OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3,	28-Sep-2018	----	----	----	19-Oct-2018	27-Mar-2019	✓
EA151: Settleability 20%								
Snap Lock Bag (EA151-20) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T2, OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3,	28-Sep-2018	----	----	----	19-Oct-2018	27-Mar-2019	✓
EA152: Soil Particle Density								
Snap Lock Bag (EA152) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	----	----	----	27-Nov-2018	26-Mar-2019	✓
Snap Lock Bag (EA152) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T2, OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3,	28-Sep-2018	----	----	----	19-Oct-2018	27-Mar-2019	✓
ED045G: Chloride by Discrete Analyser								
Soil Glass Jar - Unpreserved (ED045G) OP2_18 (0-0.5)		26-Sep-2018	06-Nov-2018	24-Oct-2018	✖	06-Nov-2018	04-Dec-2018	✓
Soil Glass Jar - Unpreserved (ED045G) OP2_32 (0-0.5), OP2_36 (0.5-1.0),	OP2_36 (0-0.5), OP2_36 (1.0-1.5)	28-Sep-2018	06-Nov-2018	26-Oct-2018	✖	06-Nov-2018	04-Dec-2018	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020-SD: Total Metals in Sediments by ICPMS								
Soil Glass Jar - Unpreserved (EG020-SD) OP2_18 (0-0.5)		26-Sep-2018	08-Oct-2018	25-Mar-2019	✓	08-Oct-2018	25-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	23-Nov-2018	26-Mar-2019	✓	28-Nov-2018	26-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3, OP2_36 (0.5-1.0), OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_32 (0-0.5), OP2_38 (0-0.5) T2, OP2_36 (0-0.5), OP2_36 (1.0-1.5),	28-Sep-2018	08-Oct-2018	27-Mar-2019	✓	08-Oct-2018	27-Mar-2019	✓
Soil Glass Jar - Unpreserved (EG020-SD) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	27-Mar-2019	✓	09-Oct-2018	27-Mar-2019	✓
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T-LL) OP2_18 (0-0.5)		26-Sep-2018	08-Oct-2018	24-Oct-2018	✓	08-Oct-2018	24-Oct-2018	✓
Soil Glass Jar - Unpreserved (EG035T-LL) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3, OP2_36 (0.5-1.0), OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_32 (0-0.5), OP2_38 (0-0.5) T2, OP2_36 (0-0.5), OP2_36 (1.0-1.5),	28-Sep-2018	08-Oct-2018	26-Oct-2018	✓	08-Oct-2018	26-Oct-2018	✓
Soil Glass Jar - Unpreserved (EG035T-LL) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	26-Oct-2018	✓	09-Oct-2018	26-Oct-2018	✓
EG035T: Total Recoverable Mercury by FIMS (Low Level)								
Soil Glass Jar - Unpreserved (EG035T-LL) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	23-Nov-2018	25-Oct-2018	✗	28-Nov-2018	25-Oct-2018	✗



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003) OP2_18 (0-0.5)		26-Sep-2018	17-Oct-2018	24-Oct-2018	✓	17-Oct-2018	24-Oct-2018	✓
Pulp Bag (EP003) OP2_42 / 0.5-1.0,	OP2_42 / 1.0-1.5	27-Sep-2018	26-Nov-2018	25-Oct-2018	✗	26-Nov-2018	25-Oct-2018	✗
Pulp Bag (EP003) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3, OP2_36 (0.5-1.0), OP2_33 (0-0.5), OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_32 (0-0.5), OP2_38 (0-0.5) T2, OP2_36 (0-0.5), OP2_36 (1.0-1.5), D7,	28-Sep-2018	17-Oct-2018	26-Oct-2018	✓	17-Oct-2018	26-Oct-2018	✓
Snap Lock Bag (EP003) OP2_42 / 0.0-0.5		27-Sep-2018	26-Nov-2018	25-Oct-2018	✗	26-Nov-2018	25-Oct-2018	✗
EP004: Organic Matter								
Soil Glass Jar - Unpreserved (EP004) OP2_18 (0-0.5)		26-Sep-2018	10-Oct-2018	24-Oct-2018	✓	10-Oct-2018	24-Oct-2018	✓
Soil Glass Jar - Unpreserved (EP004) OP2_32 (0-0.5), OP2_36 (0.5-1.0),	OP2_36 (0-0.5), OP2_36 (1.0-1.5)	28-Sep-2018	10-Oct-2018	26-Oct-2018	✓	10-Oct-2018	26-Oct-2018	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Soil Glass Jar - Unpreserved (EP071-SD) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	23-Oct-2018	11-Oct-2018	✗	24-Oct-2018	02-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP071-SD) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	12-Oct-2018	✓	10-Oct-2018	17-Nov-2018	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080-SD) OP2_42 / 0.0-0.5		27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	11-Oct-2018	✖
Soil Glass Jar - Unpreserved (EP071-SD) OP2_42 / 0.0-0.5		27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	02-Dec-2018	✔
Soil Glass Jar - Unpreserved (EP080-SD) OP2_42 / 0.5-1.0		27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	11-Oct-2018	✖
Soil Glass Jar - Unpreserved (EP071-SD) OP2_42 / 0.5-1.0		27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	02-Dec-2018	✔
Soil Glass Jar - Unpreserved (EP080-SD) OP2_42 / 1.0-1.5		27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	11-Oct-2018	✖
Soil Glass Jar - Unpreserved (EP071-SD) OP2_42 / 1.0-1.5		27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	02-Dec-2018	✔
Soil Glass Jar - Unpreserved (EP080-SD) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	12-Oct-2018	✔	08-Oct-2018	12-Oct-2018	✔
Soil Glass Jar - Unpreserved (EP071-SD) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	12-Oct-2018	✔	10-Oct-2018	17-Nov-2018	✔
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080-SD) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	11-Oct-2018	✖
Soil Glass Jar - Unpreserved (EP080-SD) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	12-Oct-2018	✔	08-Oct-2018	12-Oct-2018	✔
EP080-SD: BTEXN								
Soil Glass Jar - Unpreserved (EP080-SD) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	23-Oct-2018	11-Oct-2018	✖	24-Oct-2018	11-Oct-2018	✖
Soil Glass Jar - Unpreserved (EP080-SD) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	12-Oct-2018	✔	08-Oct-2018	12-Oct-2018	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved (EP090) OP2_18 (0-0.5)		26-Sep-2018	08-Oct-2018	10-Oct-2018	✓	16-Oct-2018	17-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP090) OP2_42 / 0.5-1.0		27-Sep-2018	01-Nov-2018	11-Oct-2018	✗	01-Nov-2018	11-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP090) OP2_42 / 0.0-0.5,	OP2_42 / 1.0-1.5	27-Sep-2018	23-Oct-2018	11-Oct-2018	✗	25-Oct-2018	02-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP090) OP2_33 (0-0.5),	D7	28-Sep-2018	08-Oct-2018	12-Oct-2018	✓	10-Oct-2018	17-Nov-2018	✓
Soil Glass Jar - Unpreserved (EP090) OP2_44 (0-0.5), OP2-45 (0-0.5), OP2-45 (1.0-1.5), OP2_38 (0-0.5) T1, OP2_38 (0-0.5) T3, OP2_36 (0.5-1.0), OP2_21 (0-0.5)	OP2_44 (0.5-1.0), OP2-45 (0.5-1.0), OP2_32 (0-0.5), OP2_38 (0-0.5) T2, OP2_36 (0-0.5), OP2_36 (1.0-1.5),	28-Sep-2018	08-Oct-2018	12-Oct-2018	✓	16-Oct-2018	17-Nov-2018	✓
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved (EP131A) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	30-Oct-2018	11-Oct-2018	✗	23-Nov-2018	09-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP131A) OP2_33 (0-0.5),	D7	28-Sep-2018	10-Oct-2018	12-Oct-2018	✓	15-Oct-2018	19-Nov-2018	✓
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP132B-SD) OP2_42 / 0.0-0.5, OP2_42 / 1.0-1.5	OP2_42 / 0.5-1.0,	27-Sep-2018	29-Oct-2018	11-Oct-2018	✗	23-Nov-2018	08-Dec-2018	✓
Soil Glass Jar - Unpreserved (EP132B-SD) OP2_33 (0-0.5),	D7	28-Sep-2018	11-Oct-2018	12-Oct-2018	✓	15-Oct-2018	20-Nov-2018	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride Soluble By Discrete Analyser	ED045G	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	4	27	14.81	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	2	9	22.22	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	4	19	21.05	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	5	40.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	4	19	21.05	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	4	19	21.05	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	23	13.04	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	5	40.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	2	5	40.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	5	40.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	2	9	22.22	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	3	19	15.79	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	5	40.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	19	15.79	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	3	19	15.79	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	5	40.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	2	5	40.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organic Matter	EP004	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	2	9	22.22	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	3	19	15.79	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	5	40.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	19	15.79	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **SOIL** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Method Blanks (MB) - Continued							
Total Metals in Sediments by ICPMS	EG020-SD	3	19	15.79	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	23	8.70	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	5	40.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	2	5	40.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organic Matter	EP004	1	5	20.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	2	9	22.22	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	3	19	15.79	5.00	✔	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	5	40.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	19	15.79	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	3	19	15.79	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	5	40.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	2	5	40.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Total Soluble Salts	EA014	SOIL	In house: The concentration of Total Soluble Salts in a soil is calculated from the Electrical conductivity of a water extract. This method is compliant with NEPM (2013) Schedule B(3) (Method 104)
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
ASS Field Screening Analysis	* EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines, version 2.1 June 2004. As received samples are tested for pH field and pH fox and assessed for a reaction rating.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Settleability 10%	* EA151-10	SOIL	In house: Determination of the settling rate of sediment or sludge in 10% solids slurries in seawater
Settleability 20%	* EA151-20	SOIL	In house: Determination of the settling rate of sediment or sludge in 20% solids slurries in seawater
Soil Particle Density	* EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Chloride Soluble By Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500-Cl- E. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
Organic Matter	EP004	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3).



Analytical Methods	Method	Matrix	Method Descriptions
TPH - Semivolatile Fraction	EP071-SD	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
TRH Volatiles/BTEX in Sediments	EP080-SD	SOIL	In house: Referenced to USEPA SW 846 - 8260B Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270D Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quantified against an established calibration curve.
Organochlorine Pesticides (Ultra-trace)	EP131A	SOIL	In house: Referenced to USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/μECD/μECD) This technique is compliant with NEPM (2013) Schedule B(3)
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	In house: Referenced to USEPA 8270D GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.
Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Organic Matter	EP004-PR	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3) (Method 105)
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids/ Sample Cleanup	ORG17A-UTP	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na2SO4 and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EB1823888****Amendment : 3**

Client : ADVISIAN PTY LTD
Contact : MR BILL BOYLSON
Address : LEVEL 3 60 ALBERT STREET
BRISBANE QLD, AUSTRALIA 4000

Laboratory : Environmental Division Brisbane
Contact : Caroline Hill
Address : 2 Byth Street Stafford QLD Australia
4053

E-mail : bill.boylson@advisian.com
Telephone : ----
Facsimile : ----

E-mail : Caroline.Hill@Alsglobal.com
Telephone : +61 7 3552 8662
Facsimile : +61-7-3243 7218

Project : 301001.02018 - Port of Mackay
Sediment Sampling

Page : 1 of 4

Order number :

Quote number : EB2018ADVISI0003 (BN/185/18)

C-O-C number : ----

QC Level : NEPM 2013 B3 & ALS QC Standard

Site :

Sampler : NICHOLAS BANTON

Dates

Date Samples Received : 03-Oct-2018 09:10

Issue Date : 21-Nov-2018

Client Requested Due Date : 28-Nov-2018

Scheduled Reporting Date : 28-Nov-2018

Delivery Details

Mode of Delivery : Carrier

Security Seal : Intact.

No. of coolers/boxes : 8

Temperature : <6.0°C - Ice present

Receipt Detail : MEDIUM ESKY

No. of samples received / analysed : 19 / 19

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **Please be advised, 1x glass jar for sample ""OP2_45 (1.0-1.5)"" was broken in transit.**
- **25/10/2018: SRN has been resent to acknowledge Cr suite added to samples 9, 13-15, 19 and due date adjusted.**
- **2/11/2018: SRN has been resent to acknowledge Chloride added to samples, as per COC.**
- **21/11/2018: SRN has been resent to acknowledge samples 'OP2_42...' have been added to this workorder from EB1823470, as per email from Alex 20/11/2018.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Particle Sizing analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- **Specialty Organics analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EA150H Particle Size Analysis by Hydrometer. AS1289	SOIL - EA151-20 Settability 20%	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG035T-LL Total Mercury by FIMS - Low Level (SOLID)	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP090 (solids) Organotins
EB1823888-004	28-Sep-2018 00:00	OP2_44 (0-0.5)	✓	✓	✓	✓	✓	✓	✓
EB1823888-005	28-Sep-2018 00:00	OP2_44 (0.5-1.0)	✓	✓	✓	✓	✓	✓	✓
EB1823888-006	28-Sep-2018 00:00	OP2-45 (0-0.5)	✓	✓	✓	✓	✓	✓	✓
EB1823888-007	28-Sep-2018 00:00	OP2-45 (0.5-1.0)	✓	✓	✓	✓	✓	✓	✓
EB1823888-008	28-Sep-2018 00:00	OP2-45 (1.0-1.5)	✓	✓	✓	✓	✓	✓	✓
EB1823888-009	28-Sep-2018 00:00	OP2_32 (0-0.5)	✓			✓	✓	✓	✓
EB1823888-010	28-Sep-2018 00:00	OP2_38 (0-0.5) T1	✓	✓	✓	✓	✓	✓	✓
EB1823888-011	28-Sep-2018 00:00	OP2_38 (0-0.5) T2	✓	✓	✓	✓	✓	✓	✓
EB1823888-012	28-Sep-2018 00:00	OP2_38 (0-0.5) T3	✓	✓	✓	✓	✓	✓	✓
EB1823888-013	28-Sep-2018 00:00	OP2_36 (0-0.5)	✓			✓	✓	✓	✓
EB1823888-014	28-Sep-2018 00:00	OP2_36 (0.5-1.0)	✓			✓	✓	✓	✓
EB1823888-015	28-Sep-2018 00:00	OP2_36 (1.0-1.5)	✓			✓	✓	✓	✓
EB1823888-016	28-Sep-2018 00:00	OP2_33 (0-0.5)	✓			✓	✓	✓	✓
EB1823888-017	28-Sep-2018 00:00	D7	✓			✓	✓	✓	✓
EB1823888-018	28-Sep-2018 00:00	OP2_21 (0-0.5)	✓	✓	✓	✓	✓	✓	✓
EB1823888-019	26-Sep-2018 00:00	OP2_18 (0-0.5)	✓			✓	✓	✓	✓
EB1823888-020	21-Nov-2018 00:00	OP2_42 / 0.0-0.5	✓	✓		✓	✓	✓	✓
EB1823888-021	21-Nov-2018 00:00	OP2_42 / 0.5-1.0	✓	✓		✓	✓	✓	✓
EB1823888-022	21-Nov-2018 00:00	OP2_42 / 1.0-1.5	✓	✓		✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA010 (solids): Electrical Conductivity (1:5)	SOIL - EA014 Total Soluble Salts	SOIL - EA033 Chromium Suite for Acid Sulphate Soils	SOIL - EA037 ASS Field Screening Analysis	SOIL - EA151-10 Settability 10%	SOIL - EA152 Soil Particle Density for Hydrometer Analysis	SOIL - EP004 Organic Matter in Soil (Walkley Black)
EB1823888-004	28-Sep-2018 00:00	OP2_44 (0-0.5)					✓	✓	
EB1823888-005	28-Sep-2018 00:00	OP2_44 (0.5-1.0)					✓	✓	
EB1823888-006	28-Sep-2018 00:00	OP2-45 (0-0.5)					✓	✓	
EB1823888-007	28-Sep-2018 00:00	OP2-45 (0.5-1.0)					✓	✓	
EB1823888-008	28-Sep-2018 00:00	OP2-45 (1.0-1.5)					✓	✓	

Matrix: SOIL			SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - EP071 - SD TRH ultra trace in sediments	SOIL - EP080-SD TRH(V)/BTEXN in Sediments	SOIL - EP131A OC Pesticides (Ultratrace)	SOIL - EP132B-SD Ultra-trace PAHs in Sediments
Laboratory sample ID	Client sampling date / time	Client sample ID					
EB1823888-009	28-Sep-2018 00:00	OP2_32 (0-0.5)	✓				
EB1823888-013	28-Sep-2018 00:00	OP2_36 (0-0.5)	✓				
EB1823888-014	28-Sep-2018 00:00	OP2_36 (0.5-1.0)	✓				
EB1823888-015	28-Sep-2018 00:00	OP2_36 (1.0-1.5)	✓				
EB1823888-016	28-Sep-2018 00:00	OP2_33 (0-0.5)		✓	✓	✓	✓
EB1823888-017	28-Sep-2018 00:00	D7		✓	✓	✓	✓
EB1823888-019	26-Sep-2018 00:00	OP2_18 (0-0.5)	✓				
EB1823888-020	21-Nov-2018 00:00	OP2_42 / 0.0-0.5		✓	✓	✓	✓
EB1823888-021	21-Nov-2018 00:00	OP2_42 / 0.5-1.0		✓	✓	✓	✓
EB1823888-022	21-Nov-2018 00:00	OP2_42 / 1.0-1.5		✓	✓	✓	✓

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
Client Sample ID(s)	Container						
EA010: Electrical Conductivity (1:5)							



OP2_18 (0-0.5)	Soil Glass Jar - Unpreserved	03-Oct-2018	06-Nov-2018	03-Oct-2018	✓	04-Oct-2018	✗
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Requested Deliverables

ALEX KOCHNIEFF

- *AU Certificate of Analysis - NATA (COA)	Email	alex.kochnieff@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	alex.kochnieff@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	alex.kochnieff@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	alex.kochnieff@advisian.com
- Chain of Custody (CoC) (COC)	Email	alex.kochnieff@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	alex.kochnieff@advisian.com
- EDI Format - XTab (XTAB)	Email	alex.kochnieff@advisian.com

BILL BOYLSON

- *AU Certificate of Analysis - NATA (COA)	Email	bill.boylson@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bill.boylson@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bill.boylson@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bill.boylson@advisian.com
- A4 - AU Tax Invoice (INV)	Email	bill.boylson@advisian.com
- Attachment - Report (SUBCO)	Email	bill.boylson@advisian.com
- Chain of Custody (CoC) (COC)	Email	bill.boylson@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	bill.boylson@advisian.com
- EDI Format - XTab (XTAB)	Email	bill.boylson@advisian.com

NICHOLAS BANTON

- *AU Certificate of Analysis - NATA (COA)	Email	nicholas.bainton@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	nicholas.bainton@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	nicholas.bainton@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	nicholas.bainton@advisian.com
- Attachment - Report (SUBCO)	Email	nicholas.bainton@advisian.com
- Chain of Custody (CoC) (COC)	Email	nicholas.bainton@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	nicholas.bainton@advisian.com
- EDI Format - XTab (XTAB)	Email	nicholas.bainton@advisian.com



CHAIN OF CUSTODY

ALS Laboratory please tick

1. PREPARED BY: [Name]
2. PREPARED BY: [Name]
3. PREPARED BY: [Name]
4. PREPARED BY: [Name]
5. PREPARED BY: [Name]

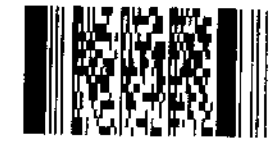
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3. PREPARED BY: [Name]
4. PREPARED BY: [Name]
5. PREPARED BY: [Name]


CLIENT: Advision Pty Ltd		TURNAROUND REQUIREMENTS:		FOR LABORATORY USE ONLY (ICRM)	
OFFICE: Lvl 31, 12 Creek Street, Brisbane 4000		Standard TAT (List due date):		Customary Soil Inert?	
PROJECT: Port of Mackay Sediment Sampling		Non Standard or urgent TAT (List due date):		Free land / form / on blocks present upon receipt?	
PROJECT NO.: 301001/02015		ALS QUOTE NO.:		Random Sample Temperature on Receipt:	
ORDER NUMBER:		COUNTRY OF ORIGIN:		Other comment:	
PURCHASE ORDER NO.:		CONTACT PH: 0437006129		RECEIVED BY:	
PROJECT MANAGER: Bill Boylson		SAMPLER MOBILE: 0427407332		RECEIVED BY:	
SAMPLER: Nicholas Bainton		RELINQUISHED BY: Nicholas Bainton		RECEIVED BY:	
COC Emailed to ALS? (YES / NO)		EDD FORMAT (or default):		DATE/TIME:	
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME: 28.09.18 @ 16:15		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME:		DATE/TIME:	

Environmental Division
Brisbane
Work Order Reference
EB1823888



Telephone : + 61-7-3243 7222

ALS USE ONLY		SAMPLE DETAILS MATRIX: Solid(S) Water(W)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (Nil Suite Codes need be listed in client's suite code) <small>When Metals are requested specify Total (optional) or Dissolved (Nil if not requested)</small>										Comments on likely contamination levels, dilution, etc.	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <small>(refer to codes below)</small>	TOTAL BOTTLES	TDC and Minipure	Metals / Organics	THURAH	OCF	Fullmetallic	PHD & well log data	ASS (Bag)	ECOC/Abundant/EN				
SNR 1	OP2_42 (0-0.5)	27.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1	1					1 Jar HOLD, 1 bag HOLD			
SNR 2	OP2_42 (0.5-1.0)	27.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1	1		1			1 Jar HOLD, 1 bag HOLD			
SNR 3	OP2_42 (1.0-1.5)	27.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1	1	1		1			1 Jar HOLD, 1 bag HOLD			
4	OP2_44 (0-0.5)	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1				1			1 Jar HOLD, NO HOLD BAG			
5	OP2_44 (0.5-1.0)	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1				1			1 Jar HOLD, NO HOLD BAG			
6	OP2_45 (0-0.5)	28.09.18	S	None	3 x 250ml Jar 1 x Bag		1				1			1 Jar HOLD, NO HOLD BAG			
7	OP2_45 (0.5-1.0)	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1							1 Jar HOLD, NO HOLD BAG			
8	OP2_45 (1.0-1.5)	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1				1			1 Jar HOLD, NO HOLD BAG			
9	OP2_32 (0-0.5)	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1					1	1	1 Jar HOLD, 1 ASS/EC BAG, NO HOLD BAG			
10	OP2_38 (0-0.5) 11	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1				1			1 Jar HOLD, NO HOLD BAG			
11	OP2_38 (0-0.5) 12	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1				1			1 Jar HOLD, NO HOLD BAG			
12	OP2_38 (0-0.5) 13	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1				1			1 Jar HOLD, NO HOLD BAG			
13	OP2_36 (0-0.5)	28.09.18	S	None	3 x 250ml Jar 2 x Bag		1					1	1	1 Jar HOLD, 1 ASS/EC BAG, NO HOLD BAG			
14	OP2_36 (0.5-1.0)	28.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1					1	1	1 Jar HOLD, 1 ASS/EC BAG, NO HOLD BAG			
15	OP2_36 (1.0-1.5)	28.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1					1	1	1 Jar HOLD, 1 ASS/EC BAG, NO HOLD BAG			
16	OP2_35 (0-0.5)	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1	1	1					1 Jar HOLD, 1 bag HOLD			
17	Dr	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1	1	1					1 Jar HOLD, 1 bag HOLD			
18	Dr	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1	1	1					1 Jar HOLD, 1 bag HOLD - PLEASE FORWARD ALL DB SAMPLES TO SGS FOR ANALYSIS			
19	OP2_27 (0-0.5)	28.09.18	S	None	3 x 250ml Jar 1 x Bag	1	1							1 Jar HOLD, NO HOLD BAG			
20	OP2_28 (0-0.5)	28.09.18	S	None	3 x 250ml Jar 2 x Bag	1	1					1	1	1 Jar HOLD, 1 ASS/EC BAG, NO HOLD BAG			
TOTAL																	



Telephone : + 61-7-3243 7222

Water Container Codes: F - Unpreserved Plastic, N - Nitrite Preserved Plastic, ORC - Nitrite Preserved Plastic, S - Sodium Hydroxide Preserved Plastic, A - Amber Glass Unpreserved, AP - Airtight Unpreserved Plastic
V - VOA Volatile Preserved, VB - VOA Volatile Preserved, VS - VOA Volatile Preserved, AV - Airtight Unpreserved, VSG - Sulfuric Preserved, Amber Glass, H - HCl Preserved Plastic, PS - HCl Preserved Plastic, SP - Sulfuric Preserved Plastic, F - Formaldehyde Preserved Glass
2 - Zinc Arsenite Preserved Bottle, C - EDTA Preserved Bottle, B - Blank Bottle, ASS - Plastic Bag for Acid Sulphate Salts, B - Unpreserved Bag, L1 - Lugs, Solid Preserved Bottles, S11 - Strain Sodium, Lugs, Solid Preserved Bottles

CERTIFICATE OF ANALYSIS

Work Order	: EB1827308	Page	: 1 of 3
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Caroline Hill
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 09-Nov-2018 13:01
Order number	: ----	Date Analysis Commenced	: 15-Nov-2018
C-O-C number	: ----	Issue Date	: 21-Nov-2018 12:19
Sampler	: NICHOLAS BAINTON		
Site	: ----		
Quote number	: BN/185/18		
No. of samples received	: 4		
No. of samples analysed	: 1		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB_02A	----	----	----	----
Client sampling date / time					24-Sep-2018 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1827308-004	-----	-----	-----	-----
				Result	----	----	----	----	----
EA150: Particle Sizing									
+75µm	----	1	%		50	----	----	----	----
+150µm	----	1	%		48	----	----	----	----
+300µm	----	1	%		44	----	----	----	----
+425µm	----	1	%		41	----	----	----	----
+600µm	----	1	%		35	----	----	----	----
+1180µm	----	1	%		22	----	----	----	----
+2.36mm	----	1	%		12	----	----	----	----
+4.75mm	----	1	%		7	----	----	----	----
+9.5mm	----	1	%		<1	----	----	----	----
+19.0mm	----	1	%		<1	----	----	----	----
+37.5mm	----	1	%		<1	----	----	----	----
+75.0mm	----	1	%		<1	----	----	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		33	----	----	----	----
Silt (2-60 µm)	----	1	%		16	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%		36	----	----	----	----
Gravel (>2mm)	----	1	%		15	----	----	----	----
Cobbles (>6cm)	----	1	%		<1	----	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.56	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: EB1827308	Page	: 1 of 3
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Caroline Hill
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 09-Nov-2018
Order number	:	Date Analysis Commenced	: 15-Nov-2018
C-O-C number	: ----	Issue Date	: 21-Nov-2018
Sampler	: NICHOLAS BAINTON		
Site	: ----		
Quote number	: BN/185/18		
No. of samples received	: 4		
No. of samples analysed	: 1		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1827308	Page	: 1 of 4
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 09-Nov-2018
Site	: ----	Issue Date	: 21-Nov-2018
Sampler	: NICHOLAS BAINTON	No. of samples received	: 4
Order number	:	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing							
Snap Lock Bag (EA150H) SB_02A	24-Sep-2018	----	----	----	20-Nov-2018	23-Mar-2019	✔
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H) SB_02A	24-Sep-2018	----	----	----	20-Nov-2018	23-Mar-2019	✔
EA152: Soil Particle Density							
Snap Lock Bag (EA152) SB_02A	24-Sep-2018	----	----	----	20-Nov-2018	23-Mar-2019	✔



Quality Control Parameter Frequency Compliance

- No Quality Control data available for this section.



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Preparation Methods	Method	Matrix	Method Descriptions
Sample Compositing	EN020	SOIL	Equal weights of each original soil are taken, then mixed and homogenised. The combined mixture is labelled as a new sample.

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EB1827308**

Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Customer Services EB
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: bill.boylson@advisian.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: ----	Telephone	: +61-7-3243 7222
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Page	: 1 of 2
Order number	: ----	Quote number	: EB2018ADVISI0002 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: NICHOLAS BANTON		

Dates

Date Samples Received	: 09-Nov-2018 13:01	Issue Date	: 12-Nov-2018
Client Requested Due Date	: 21-Nov-2018	Scheduled Reporting Date	: 21-Nov-2018

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 4 / 1

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- This workorder has been created to rebatch samples from EB1823470.
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

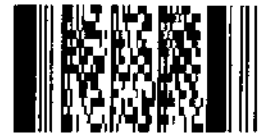
EB1827308-003 : [24-Sep-2018] : SB_02 (T3) - EB1823470 003

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - E Particle	SOIL - E Sample
EB1827308-001	24-Sep-2018 00:00	SB_02 (T1) EB182347...		✓
EB1827308-002	24-Sep-2018 00:00	SB_02 (T2) EB182347...		✓
EB1827308-003	24-Sep-2018 00:00	SB_02 (T3) EB182347...		✓
EB1827308-004	24-Sep-2018 00:00	SB_02A	✓	

- *AU Certificate of Analysis - NATA (COA)	Email	bill.boylson@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bill.boylson@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bill.boylson@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bill.boylson@advisian.com
- Chain of Custody (CoC) (COC)	Email	bill.boylson@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	bill.boylson@advisian.com
- EDI Format - XTab (XTAB)	Email	bill.boylson@advisian.com

From: Kochnieff, Alex (Brisbane) [<mailto:ALEX.KOCHNIEFF@advisian.com>]
Sent: Friday, 9 November 2018 1:01 PM
To: Caroline Hill <caroline.hill@ALSGlobal.com>
Subject: RE: EB1823470 - Port of Mackay



Telephone : + 61-7-3243 7222

Hi Caroline,

Thanks for providing these volumes. So we can undertake specialised geotechnical analysis at Wagners Cement we need to gather as much volume as possible. Therefore can I request the following:


1. ALS to mix / homogenise SB_02 (T1), SB_02 (T2), and SB_02 (T3) and label as SB_02A
2. Sub-sample SB_02A so that PSD analysis can be completed by ALS....only take the minimum volume required
3. Forward remaining SB_02A and SB_45 to Wagners Cement: 47 Pamela Street, Pinkenba QLD 4008 (ph: 07 3621 1111) / Contact: Russell Genrich, EFC R&D Laboratory Manager (Ph: 0474 042 189)

Please feel free to contact me to discuss.

Kind regards,

Alex Kochnieff
Senior Environmental Engineer

Level 31, 12 Creek St | Brisbane City, QLD 4000
P +61 7 3319 3940 | **M** +61 468 660 301
E alex.kochnieff@advisian.com

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CERTIFICATE OF ANALYSIS

Work Order	: EB1828301	Page	: 1 of 6
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Caroline Hill
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 21-Nov-2018 16:50
Order number	: ----	Date Analysis Commenced	: 21-Nov-2018
C-O-C number	: ----	Issue Date	: 28-Nov-2018 15:25
Sampler	: ----		
Site	:		
Quote number	: BN/185/18		
No. of samples received	: 8		
No. of samples analysed	: 8		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was unable to be performed on samples 8, 13, 17, 18, 19 as insufficient sample was supplied by the client. Typical sediment SPD values used for calculations and consequently NATA endorsement does not apply to hydrometer results.
- ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO₃) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m³ in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m³'.
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB_45	SB_52	SB_58	B1_02 (T1)	B3_14
Client sampling date / time				21-Nov-2018 00:00	21-Nov-2018 00:00	21-Nov-2018 00:00	21-Nov-2018 00:00	21-Nov-2018 00:00	
Compound	CAS Number	LOR	Unit	EB1828301-006	EB1828301-008	EB1828301-009	EB1828301-013	EB1828301-017	
				Result	Result	Result	Result	Result	
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm	4050	6950	6810	6690	7450	
EA014 Total Soluble Salts									
Total Soluble Salts	----	5	mg/kg	13200	22600	22100	21700	24200	
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit	8.4	8.6	8.8	8.9	8.8	
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2	
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02	
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.060	0.104	0.140	0.108	0.149	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	37	65	88	68	93	
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	7.38	8.44	8.07	8.66	8.75	
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1480	1690	1610	1730	1750	
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	2.36	2.70	2.58	2.77	2.80	
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02	
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10	
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.06	0.10	0.14	0.11	0.15	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	37	65	88	68	93	
Liming Rate excluding ANC	----	1	kg CaCO3/t	3	5	6	5	7	
EA037: Ass Field Screening Analysis									
ø pH (F)	----	0.1	pH Unit	8.6	8.5	8.7	8.4	8.4	
ø pH (Fox)	----	0.1	pH Unit	6.3	6.5	6.4	6.6	6.6	
ø Reaction Rate	----	1	-	2	2	2	2	2	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%	35.3	63.1	58.5	59.7	65.0	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg	8410	25000	21600	22200	28100	
EP004: Organic Matter									

Page : 4 of 6
 Work Order : EB1828301
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB_45	SB_52	SB_58	B1_02 (T1)	B3_14
Client sampling date / time					21-Nov-2018 00:00	21-Nov-2018 00:00	21-Nov-2018 00:00	21-Nov-2018 00:00	21-Nov-2018 00:00
Compound	CAS Number	LOR	Unit		EB1828301-006	EB1828301-008	EB1828301-009	EB1828301-013	EB1828301-017
					Result	Result	Result	Result	Result
EP004: Organic Matter - Continued									
Organic Matter	----	0.5	%		1.4	2.9	3.0	2.4	3.0

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID		B4_01		B5_08		TB_26		----		----	
Client sampling date / time				21-Nov-2018 00:00		21-Nov-2018 00:00		21-Nov-2018 00:00		----		----			
Compound		CAS Number	LOR	Unit		EB1828301-018		EB1828301-019		EB1828301-029		-----		-----	
				Result		Result		Result		----		----			
EA010: Conductivity (1:5)															
Electrical Conductivity @ 25°C		----	1	µS/cm		7570		6610		7500		----		----	
EA014 Total Soluble Salts															
Total Soluble Salts		----	5	mg/kg		24600		21500		24400		----		----	
EA033-A: Actual Acidity															
pH KCl (23A)		----	0.1	pH Unit		8.7		8.8		8.8		----		----	
Titratable Actual Acidity (23F)		----	2	mole H+ / t		<2		<2		<2		----		----	
sulfidic - Titratable Actual Acidity (s-23F)		----	0.02	% pyrite S		<0.02		<0.02		<0.02		----		----	
EA033-B: Potential Acidity															
Chromium Reducible Sulfur (22B)		----	0.005	% S		0.167		0.194		0.146		----		----	
acidity - Chromium Reducible Sulfur (a-22B)		----	10	mole H+ / t		104		121		91		----		----	
EA033-C: Acid Neutralising Capacity															
Acid Neutralising Capacity (19A2)		----	0.01	% CaCO3		8.94		7.65		9.42		----		----	
acidity - Acid Neutralising Capacity (a-19A2)		----	10	mole H+ / t		1780		1530		1880		----		----	
sulfidic - Acid Neutralising Capacity (s-19A2)		----	0.01	% pyrite S		2.86		2.45		3.02		----		----	
EA033-E: Acid Base Accounting															
ANC Fineness Factor		----	0.5	-		1.5		1.5		1.5		----		----	
Net Acidity (sulfur units)		----	0.02	% S		<0.02		<0.02		<0.02		----		----	
Net Acidity (acidity units)		----	10	mole H+ / t		<10		<10		<10		----		----	
Liming Rate		----	1	kg CaCO3/t		<1		<1		<1		----		----	
Net Acidity excluding ANC (sulfur units)		----	0.02	% S		0.17		0.19		0.14		----		----	
Net Acidity excluding ANC (acidity units)		----	10	mole H+ / t		104		121		91		----		----	
Liming Rate excluding ANC		----	1	kg CaCO3/t		8		9		7		----		----	
EA037: Ass Field Screening Analysis															
ø pH (F)		----	0.1	pH Unit		8.6		8.6		8.3		----		----	
ø pH (Fox)		----	0.1	pH Unit		6.8		6.5		6.5		----		----	
ø Reaction Rate		----	1	-		2		2		2		----		----	
EA055: Moisture Content (Dried @ 105-110°C)															
Moisture Content		----	0.1	%		69.4		58.2		65.7		----		----	
ED045G: Chloride by Discrete Analyser															
Chloride		16887-00-6	10	mg/kg		32500		21100		35500		----		----	
EP004: Organic Matter															

Page : 6 of 6
 Work Order : EB1828301
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B4_01	B5_08	TB_26	----	----
				Client sampling date / time	21-Nov-2018 00:00	21-Nov-2018 00:00	21-Nov-2018 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1828301-018	EB1828301-019	EB1828301-029	-----	-----
					Result	Result	Result	----	----
EP004: Organic Matter - Continued									
Organic Matter	----	0.5	%		3.2	2.7	3.0	----	----

QUALITY CONTROL REPORT

Work Order	: EB1828301	Page	: 1 of 3
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Caroline Hill
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 21-Nov-2018
Order number	: ----	Date Analysis Commenced	: 21-Nov-2018
C-O-C number	: ----	Issue Date	: 28-Nov-2018
Sampler	: ----		
Site	: ----		
Quote number	: BN/185/18		
No. of samples received	: 8		
No. of samples analysed	: 8		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA010: Conductivity (1:5) (QC Lot: 2049814)									
EB1828301-006	SB_45	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	4050	4140	2.20	0% - 20%
EA033-A: Actual Acidity (QC Lot: 2049944)									
EB1828301-006	SB_45	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.4	8.6	2.35	0% - 20%
EA033-B: Potential Acidity (QC Lot: 2049944)									
EB1828301-006	SB_45	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.060	0.063	5.16	0% - 50%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	37	39	5.16	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 2049944)									
EB1828301-006	SB_45	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	7.38	7.36	0.247	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	2.36	2.36	0.00	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1480	1470	0.247	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 2049942)									
EB1828301-006	SB_45	EA037: pH (F)	----	0.1	pH Unit	8.6	8.6	0.00	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	6.3	6.3	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2049816)									
EB1828301-006	SB_45	EA055: Moisture Content	----	0.1	%	35.3	35.3	0.00	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2049815)									
EB1828301-006	SB_45	ED045G: Chloride	16887-00-6	10	mg/kg	8410	8410	0.00	0% - 20%



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound		CAS Number	LOR		Unit	Result	Spike Concentration	Spike Recovery (%) LCS
EA010: Conductivity (1:5) (QCLot: 2049814)								
EA010: Electrical Conductivity @ 25°C		----	1	µS/cm	<1	1412 µS/cm	99.9	97103
EA033-A: Actual Acidity (QCLot: 2049944)								
EA033: pH KCl (23A)		----	----	pH Unit	----	4.5 pH Unit	100	70130
EA033: Titratable Actual Acidity (23F)		----	2	mole H+ / t	<2	24.6 mole H+ / t	78.9	70130
EA033: sulfidic - Titratable Actual Acidity (s-23F)		----	0.02	% pyrite S	<0.02	----	----	----
EA033-B: Potential Acidity (QCLot: 2049944)								
EA033: Chromium Reducible Sulfur (22B)		----	0.005	% S	<0.005	0.23483 % S	99.5	70130
EA033: acidity - Chromium Reducible Sulfur (a-22B)		----	10	mole H+ / t	<10	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 2049944)								
EA033: Acid Neutralising Capacity (19A2)		----	0.01	% CaCO3	<0.01	10 % CaCO3	106	70130
EA033: acidity - Acid Neutralising Capacity (a-19A2)		----	10	mole H+ / t	<10	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)		----	0.01	% pyrite S	<0.01	----	----	----
ED045G: Chloride by Discrete Analyser (QCLot: 2049815)								
ED045G: Chloride		16887-00-6	10	mg/kg	<10	50 mg/kg	100	83119
					<10	5000 mg/kg	100	83119

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1828301	Page	: 1 of 5
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 21-Nov-2018
Site	:	Issue Date	: 28-Nov-2018
Sampler	: ----	No. of samples received	: 8
Order number	: ----	No. of samples analysed	: 8

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010: Conductivity (1:5)								
Soil Glass Jar - Unpreserved (EA010) SB_45, SB_58, B3_14, B5_08, SB_52, B1_02 (T1), B4_01, TB_26		21-Nov-2018	23-Nov-2018	28-Nov-2018	✔	23-Nov-2018	21-Dec-2018	✔
EA033-A: Actual Acidity								
Snap Lock Bag - frozen (EA033) SB_45, SB_58, B3_14, B5_08, SB_52, B1_02 (T1), B4_01, TB_26		21-Nov-2018	22-Nov-2018	21-Nov-2019	✔	23-Nov-2018	20-Feb-2019	✔
EA033-B: Potential Acidity								
Snap Lock Bag - frozen (EA033) SB_45, SB_58, B3_14, B5_08, SB_52, B1_02 (T1), B4_01, TB_26		21-Nov-2018	22-Nov-2018	21-Nov-2019	✔	23-Nov-2018	20-Feb-2019	✔
EA033-C: Acid Neutralising Capacity								
Snap Lock Bag - frozen (EA033) SB_45, SB_58, B3_14, B5_08, SB_52, B1_02 (T1), B4_01, TB_26		21-Nov-2018	22-Nov-2018	21-Nov-2019	✔	23-Nov-2018	20-Feb-2019	✔
EA033-D: Retained Acidity								
Snap Lock Bag - frozen (EA033) SB_45, SB_58, B3_14, B5_08, SB_52, B1_02 (T1), B4_01, TB_26		21-Nov-2018	22-Nov-2018	21-Nov-2019	✔	23-Nov-2018	20-Feb-2019	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-E: Acid Base Accounting								
Snap Lock Bag - frozen (EA033)		21-Nov-2018	22-Nov-2018	21-Nov-2019	✔	23-Nov-2018	20-Feb-2019	✔
SB_45,	SB_52,							
SB_58,	B1_02 (T1),							
B3_14,	B4_01,							
B5_08,	TB_26							
EA037: Ass Field Screening Analysis								
Snap Lock Bag - frozen (EA037)		21-Nov-2018	23-Nov-2018	20-May-2019	✔	23-Nov-2018	20-May-2019	✔
SB_45,	SB_52,							
SB_58,	B1_02 (T1),							
B3_14,	B4_01,							
B5_08,	TB_26							
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)		21-Nov-2018	----	----	----	21-Nov-2018	05-Dec-2018	✔
SB_45,	SB_52,							
SB_58,	B1_02 (T1),							
B3_14,	B4_01,							
B5_08,	TB_26							
ED045G: Chloride by Discrete Analyser								
Soil Glass Jar - Unpreserved (ED045G)		21-Nov-2018	23-Nov-2018	19-Dec-2018	✔	28-Nov-2018	21-Dec-2018	✔
SB_45,	SB_52,							
SB_58,	B1_02 (T1),							
B3_14,	B4_01,							
B5_08,	TB_26							
EP004: Organic Matter								
Soil Glass Jar - Unpreserved (EP004)		21-Nov-2018	28-Nov-2018	19-Dec-2018	✔	28-Nov-2018	19-Dec-2018	✔
SB_45,	SB_52,							
SB_58,	B1_02 (T1),							
B3_14,	B4_01,							
B5_08,	TB_26							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride Soluble By Discrete Analyser	ED045G	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3)
Total Soluble Salts	EA014	SOIL	In house: The concentration of Total Soluble Salts in a soil is calculated from the Electrical conductivity of a water extract. This method is compliant with NEPM (2013) Schedule B(3) (Method 104)
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
ASS Field Screening Analysis	* EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines, version 2.1 June 2004. As received samples are tested for pH field and pH fox and assessed for a reaction rating.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Chloride Soluble By Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500-Cl- E. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.
Organic Matter	EP004	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3).

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Organic Matter	EP004-PR	SOIL	In house: Referenced to AS1289.4.1.1 - 1997. Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3) (Method 105)

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EB1828301**

Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Caroline Hill
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: bill.boylson@advisian.com	E-mail	: Caroline.Hill@Alsglobal.com
Telephone	: ----	Telephone	: +61 7 3552 8662
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Page	: 1 of 2
Order number	: ----	Quote number	: EB2018ADVISI0003 (BN/185/18)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	:		
Sampler	:		

Dates

Date Samples Received	: 21-Nov-2018 16:50	Issue Date	: 21-Nov-2018
Client Requested Due Date	: 28-Nov-2018	Scheduled Reporting Date	: 28-Nov-2018

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 8 / 8

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- Sample results in this workorder have been transcribed from EB1823470.
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Particle Sizing analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA010 (solids): Electrical Conductivity (1:5)	SOIL - EA014 Total Soluble Salts	SOIL - EA033 Chromium Suite for Acid Sulphate Soils	SOIL - EA037 ASS Field Screening Analysis	SOIL - EA055-103 Moisture Content	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - EP004 Organic Matter in Soil (Walkley Black)
EB1828301-006	21-Nov-2018 00:00	SB_45	✓	✓	✓	✓	✓	✓	✓
EB1828301-008	21-Nov-2018 00:00	SB_52	✓	✓	✓	✓	✓	✓	✓
EB1828301-009	21-Nov-2018 00:00	SB_58	✓	✓	✓	✓	✓	✓	✓
EB1828301-013	21-Nov-2018 00:00	B1_02 (T1)	✓	✓	✓	✓	✓	✓	✓
EB1828301-017	21-Nov-2018 00:00	B3_14	✓	✓	✓	✓	✓	✓	✓
EB1828301-018	21-Nov-2018 00:00	B4_01	✓	✓	✓	✓	✓	✓	✓
EB1828301-019	21-Nov-2018 00:00	B5_08	✓	✓	✓	✓	✓	✓	✓
EB1828301-029	21-Nov-2018 00:00	TB_26	✓	✓	✓	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ALEX KOCHNIEFF

- *AU Certificate of Analysis - NATA (COA)	Email	alex.kochnieff@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	alex.kochnieff@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	alex.kochnieff@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	alex.kochnieff@advisian.com
- A4 - AU Tax Invoice (INV)	Email	alex.kochnieff@advisian.com
- Chain of Custody (CoC) (COC)	Email	alex.kochnieff@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	alex.kochnieff@advisian.com
- EDI Format - XTab (XTAB)	Email	alex.kochnieff@advisian.com

BILL BOYLSON

- *AU Certificate of Analysis - NATA (COA)	Email	bill.boylson@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bill.boylson@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bill.boylson@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bill.boylson@advisian.com
- A4 - AU Tax Invoice (INV)	Email	bill.boylson@advisian.com
- Chain of Custody (CoC) (COC)	Email	bill.boylson@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	bill.boylson@advisian.com
- EDI Format - XTab (XTAB)	Email	bill.boylson@advisian.com

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EB1828853

<p>Client : ADVISIAN PTY LTD</p> <p>Contact : MR BILL BOYLSON</p> <p>Address : LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000</p> <p>E-mail : bill.boylson@advisian.com</p> <p>Telephone : ----</p> <p>Facsimile : ----</p> <p>Project : 301001.02018 - Port of Mackay Sediment Sampling</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : NICHOLAS BANTON</p>	<p>Laboratory : Environmental Division Brisbane</p> <p>Contact : Caroline Hill</p> <p>Address : 2 Byth Street Stafford QLD Australia 4053</p> <p>E-mail : Caroline.Hill@Alsglobal.com</p> <p>Telephone : +61 7 3552 8662</p> <p>Facsimile : +61-7-3243 7218</p> <p>Page : 1 of 3</p> <p>Quote number : EB2018ADVISI0003 (BN/185/18)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 22-Nov-2018 13:06	Issue Date : 26-Nov-2018
Client Requested Due Date : 06-Dec-2018	Scheduled Reporting Date : 06-Dec-2018

Delivery Details

Mode of Delivery : Samples On Hand	Security Seal : Not Available
No. of coolers/boxes : ----	Temperature : <6.0°C
Receipt Detail : REBATCH	No. of samples received / analysed : 15 / 15

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **This work order has been created to rebatch samples from EB1823470 & EB1823888.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**

From: Kochnieff, Alex (Brisbane) [mailto:ALEX.KOCHNIEFF@advisian.com]
Sent: Thursday, 22 November 2018 1:06 PM
To: Caroline Hill <caroline.hill@ALSGlobal.com>
Subject: EB1823470, EB1823888

Good afternoon Caroline,

As discussed, we require additional PSD and settling rate analysis on the following samples:

Workorder	ALS sample #	Volume Remaining			Advisian Sample ID
		250mL Soil Jar	ASS Bag	Porewater Bag	Units LOR
1 EB1823470	5	1	1	-	SB_40
2 EB1823470	7	2	2	-	SB_50
3 EB1823470	9	2.5	1	-	SB_58
4 EB1823470	16	1	2	-	B1_07
5 EB1823470	19	1.5	1	-	B5_08
6 EB1823470	24	1.75	2	-	TB_05 (T1)
7 EB1823470	27	1.75	2	1	TB_12
8 EB1823470	29	2.75	3	1	TB_26
9 EB1823470	35	0.5	-	-	REF_03
10 EB1823470	39	3.5	2	-	H-3
11 EB1823888	9	2-3	Maybe 1	Unknown	OP2_32 (0-0.5)
12 EB1823888	13	2-3	Maybe 2	Unknown	OP2_36 (0-0.5)
13 EB1823888	14	2-3	Maybe 2	Unknown	OP2_36 (0.5-1.0)
14 EB1823888	15	2-3	Maybe 2	Unknown	OP2_36 (1.0-1.5)
15 EB1823888	16	2	1	Unknown	OP2_33 (0-0.5)
	19	3	Maybe 1	Unknown	OP2_18 (0-0.5)

Please let me know if this is possible.

Kind regards,

Alex Kochnieff
Senior Environmental Engineer

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Environmental Division
Brisbane
Work Order Reference
EB1828853



Telephone : + 61-7-3243 7222



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA150H Particle Size Analysis by Hydrometer. AS1289	SOIL - EA151-10 Settability 10%	SOIL - EA151-20 Settability 20%	SOIL - EA152 Soil Particle Density for Hydrometer Analysis
EB1828853-001	24-Sep-2018 00:00	SB_40	✓	✓	✓	✓
EB1828853-002	24-Sep-2018 00:00	SB_50	✓	✓	✓	✓
EB1828853-003	24-Sep-2018 00:00	SB_58	✓	✓	✓	✓
EB1828853-004	26-Sep-2018 00:00	B1_07	✓	✓	✓	✓
EB1828853-005	26-Sep-2018 00:00	B5_08	✓	✓	✓	✓
EB1828853-006	25-Sep-2018 00:00	TB_05 (T1)	✓	✓	✓	✓
EB1828853-007	25-Sep-2018 00:00	TB_12	✓	✓	✓	✓
EB1828853-008	25-Sep-2018 00:00	TB_26	✓	✓	✓	✓
EB1828853-009	25-Sep-2018 00:00	H-3	✓	✓	✓	✓
EB1828853-010	28-Sep-2018 00:00	OP2_32 (0-0.5)	✓	✓	✓	✓
EB1828853-011	28-Sep-2018 00:00	OP2_36 (0-0.5)	✓	✓	✓	✓
EB1828853-012	28-Sep-2018 00:00	OP2_36 (0.5-1.0)	✓	✓	✓	✓
EB1828853-013	28-Sep-2018 00:00	OP2_36 (1.0-1.5)	✓	✓	✓	✓
EB1828853-014	28-Sep-2018 00:00	OP2_33 (0-0.5)	✓	✓	✓	✓
EB1828853-015	26-Sep-2018 00:00	OP2_18 (0-0.5)	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.



Requested Deliverables

ALEX KOCHNIEFF

- *AU Certificate of Analysis - NATA (COA)	Email	alex.kochnieff@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	alex.kochnieff@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	alex.kochnieff@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	alex.kochnieff@advisian.com
- Attachment - Report (SUBCO)	Email	alex.kochnieff@advisian.com
- Chain of Custody (CoC) (COC)	Email	alex.kochnieff@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	alex.kochnieff@advisian.com
- EDI Format - XTab (XTAB)	Email	alex.kochnieff@advisian.com

BILL BOYLSON

- *AU Certificate of Analysis - NATA (COA)	Email	bill.boylson@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bill.boylson@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bill.boylson@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bill.boylson@advisian.com
- A4 - AU Tax Invoice (INV)	Email	bill.boylson@advisian.com
- Attachment - Report (SUBCO)	Email	bill.boylson@advisian.com
- Chain of Custody (CoC) (COC)	Email	bill.boylson@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	bill.boylson@advisian.com
- EDI Format - XTab (XTAB)	Email	bill.boylson@advisian.com

NICHOLAS BANTON

- *AU Certificate of Analysis - NATA (COA)	Email	nicholas.bainton@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	nicholas.bainton@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	nicholas.bainton@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	nicholas.bainton@advisian.com
- Attachment - Report (SUBCO)	Email	nicholas.bainton@advisian.com
- Chain of Custody (CoC) (COC)	Email	nicholas.bainton@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	nicholas.bainton@advisian.com
- EDI Format - XTab (XTAB)	Email	nicholas.bainton@advisian.com

STEPHEN NEALE

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- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	stephen.neale@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	stephen.neale@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	stephen.neale@advisian.com
- Attachment - Report (SUBCO)	Email	stephen.neale@advisian.com
- Chain of Custody (CoC) (COC)	Email	stephen.neale@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	stephen.neale@advisian.com
- EDI Format - XTab (XTAB)	Email	stephen.neale@advisian.com

CERTIFICATE OF ANALYSIS

Work Order : EB1828853 Client : ADVISIAN PTY LTD Contact : MR BILL BOYLSON Address : LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000 Telephone : ---- Project : 301001.02018 - Port of Mackay Sediment Sampling Order number : ---- C-O-C number : ---- Sampler : NICHOLAS BAINTON Site : ---- Quote number : BN/185/18 No. of samples received : 15 No. of samples analysed : 15	Page : 1 of 5 Laboratory : Environmental Division Brisbane Contact : Caroline Hill Address : 2 Byth Street Stafford QLD Australia 4053 Telephone : +61 7 3552 8662 Date Samples Received : 22-Nov-2018 13:06 Date Analysis Commenced : 05-Dec-2018 Issue Date : 06-Dec-2018 10:27
---	--



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150H: The matrix of samples fell outside the scope of the method. They contained extremely high dissolved salts which were unable to be removed from the sample without the loss of fine soil particles. Particle size results were calculated using an electrical conductivity correction consistent with the blank dispersant solution. Results should be scrutinised accordingly.
- EA151: ALS does not hold NATA accreditation for Settleability.



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				SB_40	SB_50	SB_58	B1_07	B5_08
Client sampling date / time				24-Sep-2018 00:00	24-Sep-2018 00:00	24-Sep-2018 00:00	26-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit	EB1828853-001	EB1828853-002	EB1828853-003	EB1828853-004	EB1828853-005
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
+75µm	----	1	%	12	92	25	28	24
+150µm	----	1	%	8	85	6	25	14
+300µm	----	1	%	5	56	2	21	10
+425µm	----	1	%	4	28	2	17	8
+600µm	----	1	%	3	8	1	12	6
+1180µm	----	1	%	1	<1	<1	5	2
+2.36mm	----	1	%	<1	<1	<1	1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	40	4	36	46	43
Silt (2-60 µm)	----	1	%	43	1	30	24	29
Sand (0.06-2.00 mm)	----	1	%	16	95	34	27	27
Gravel (>2mm)	----	1	%	1	<1	<1	3	1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA151: Settleability 10%								
∅ Underflow Density	----	0.01	g/cm3	1.12	1.54	1.21	1.15	1.19
∅ Underflow Solids	----	0.1	%	19.8	59.1	25.8	22.9	25.5
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	0.267	24.4	2.20	2.00	2.80
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.030	1.80	0.067	0.021	0.058
∅ Clarity	----	-	-	Clear	Clear	Clear	Clear	Clear
EA151: Settleability 20%								
∅ Underflow Density	----	0.01	g/cm3	1.13	1.49	1.18	1.18	1.15
∅ Underflow Solids	----	0.1	%	23.2	58.4	24.1	24.1	24.9
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	0.017	14.4	0.016	0.033	0.016
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.010	0.200	0.016	0.010	0.016
∅ Clarity	----	-	-	Clear	Clear	Clear	Clear	Clear
EA152: Soil Particle Density								
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.65	2.63	2.61	2.58	2.62



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				TB_05 (T1)	TB_12	TB_26	H-3	OP2_32 (0-0.5)
Client sampling date / time				25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	25-Sep-2018 00:00	28-Sep-2018 00:00
Compound	CAS Number	LOR	Unit	EB1828853-006	EB1828853-007	EB1828853-008	EB1828853-009	EB1828853-010
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
+75µm	----	1	%	21	2	3	54	42
+150µm	----	1	%	15	<1	1	25	30
+300µm	----	1	%	10	<1	<1	14	20
+425µm	----	1	%	7	<1	<1	6	16
+600µm	----	1	%	5	<1	<1	2	12
+1180µm	----	1	%	4	<1	<1	<1	5
+2.36mm	----	1	%	<1	<1	<1	<1	2
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	40	46	44	26	31
Silt (2-60 µm)	----	1	%	34	42	52	14	19
Sand (0.06-2.00 mm)	----	1	%	24	12	4	60	47
Gravel (>2mm)	----	1	%	2	<1	<1	<1	3
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA151: Settleability 10%								
∅ Underflow Density	----	0.01	g/cm3	1.16	1.06	1.05	1.21	1.21
∅ Underflow Solids	----	0.1	%	26.1	20.0	20.2	30.6	31.7
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	2.80	0.267	0.267	1.80	3.80
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.075	0.036	0.032	0.083	0.067
∅ Clarity	----	-	-	Clear	Clear	Clear	Clear	Clear
EA151: Settleability 20%								
∅ Underflow Density	----	0.01	g/cm3	1.15	1.11	1.14	1.32	1.27
∅ Underflow Solids	----	0.1	%	24.1	22.9	21.5	36.1	37.5
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	0.017	0.009	0.017	1.00	2.60
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.002	0.009	0.004	0.025	0.033
∅ Clarity	----	-	-	Clear	Clear	Clear	Clear	Clear
EA152: Soil Particle Density								
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.55	2.55	2.41	2.52	2.62



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				OP2_36 (0-0.5)	OP2_36 (0.5-1.0)	OP2_36 (1.0-1.5)	OP2_33 (0-0.5)	OP2_18 (0-0.5)
Client sampling date / time				28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	28-Sep-2018 00:00	26-Sep-2018 00:00
Compound	CAS Number	LOR	Unit	EB1828853-011	EB1828853-012	EB1828853-013	EB1828853-014	EB1828853-015
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
+75µm	----	1	%	58	61	30	33	38
+150µm	----	1	%	50	55	20	20	28
+300µm	----	1	%	43	48	16	13	21
+425µm	----	1	%	38	44	13	11	17
+600µm	----	1	%	30	37	9	9	13
+1180µm	----	1	%	15	20	2	4	7
+2.36mm	----	1	%	5	10	<1	<1	3
+4.75mm	----	1	%	2	8	<1	<1	2
+9.5mm	----	1	%	<1	6	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	24	24	34	29	34
Silt (2-60 µm)	----	1	%	16	11	29	25	22
Sand (0.06-2.00 mm)	----	1	%	52	52	36	44	40
Gravel (>2mm)	----	1	%	8	13	1	2	4
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA151: Settleability 10%								
∅ Underflow Density	----	0.01	g/cm3	1.21	1.27	1.18	----	1.18
∅ Underflow Solids	----	0.1	%	35.2	40.3	31.4	----	30.2
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	4.00	3.40	2.40	----	2.00
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.067	0.050	0.067	----	0.075
∅ Clarity	----	-	-	Clear	Clear	Clear	----	Clear
EA151: Settleability 20%								
∅ Underflow Density	----	0.01	g/cm3	1.31	1.34	1.25	----	1.23
∅ Underflow Solids	----	0.1	%	40.1	44.0	35.6	----	35.4
∅ Settling Rate @ 50% of Settlement	----	0.001	mm/min	3.00	2.80	0.400	----	0.600
∅ Settling Rate @ 90% of Settlement	----	0.001	mm/min	0.025	0.025	0.011	----	0.009
∅ Clarity	----	-	-	Clear	Clear	Clear	----	Clear
EA152: Soil Particle Density								
∅ Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.64	2.63	2.66	2.64	2.63

Certificate of Analysis

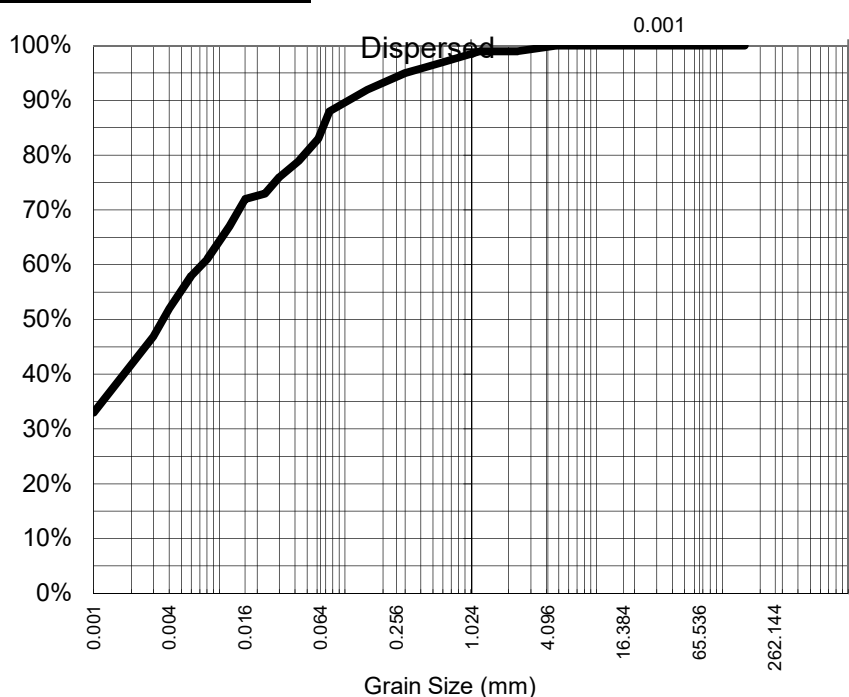
ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-001 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** SB_40
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	99%
0.600	97%
0.425	96%
0.300	95%
0.150	92%
0.075	88%
Particle Size (microns)	
43	79%
30	76%
23	73%
16	72%
12	67%
8	61%
6	58%
4	52%
1	33%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.006
----------------------------	--------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65


Dianne Blane
Laboratory Coordinator
Authorised Signatory

NATA Accreditation: 825 Site: Newcastle
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Certificate of Analysis

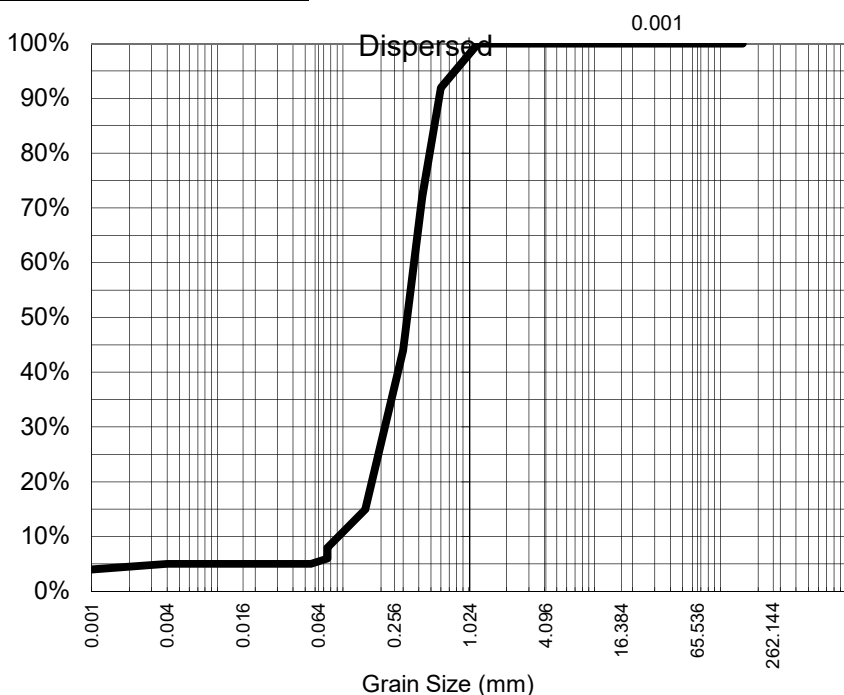
ALS Laboratory Group Pty Ltd
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Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-002 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** SB_50
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	92%
0.425	72%
0.300	44%
0.150	15%
0.075	8%
Particle Size (microns)	
55	5%
39	5%
27	5%
19	5%
14	5%
10	5%
7	5%
5	5%
1	4%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.327
----------------------------	-------

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

Sample Comments: AS1289.3.6.3 states that hydrometer analysis is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.63

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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Certificate of Analysis

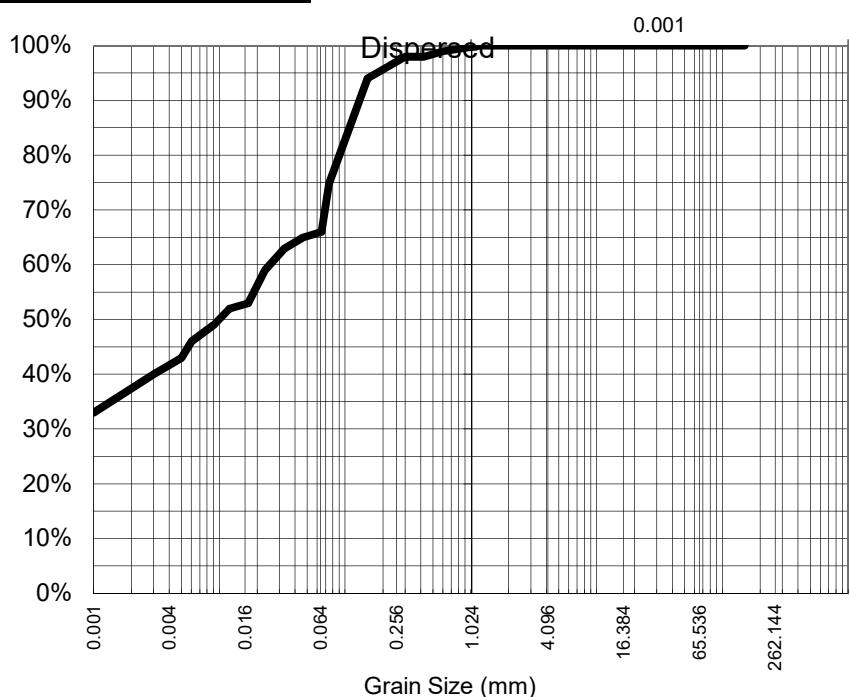
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5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-003 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** SB_58
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	98%
0.300	98%
0.150	94%
0.075	75%
Particle Size (microns)	
46	65%
33	63%
23	59%
17	53%
12	52%
9	49%
6	46%
5	43%
1	33%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.010
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

D Blane

Dianne Blane
Laboratory Coordinator
Authorised Signatory



NATA Accreditation: 825 Site: Newcastle
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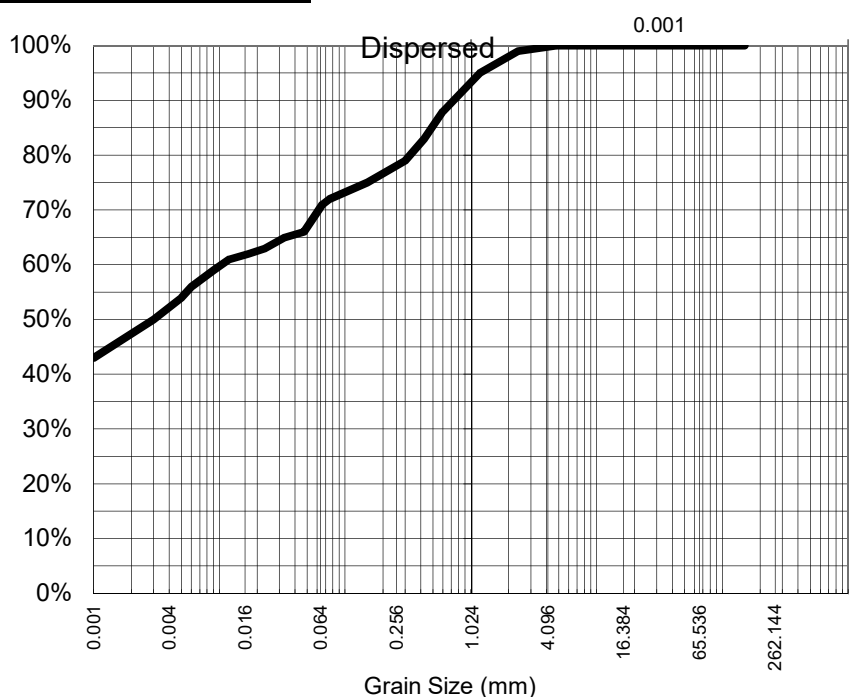
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5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-004 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** B1_07
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	95%
0.600	88%
0.425	83%
0.300	79%
0.150	75%
0.075	72%
Particle Size (microns)	
47	66%
33	65%
23	63%
17	62%
12	61%
9	59%
6	56%
5	54%
1	43%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.006
----------------------------	--------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.58

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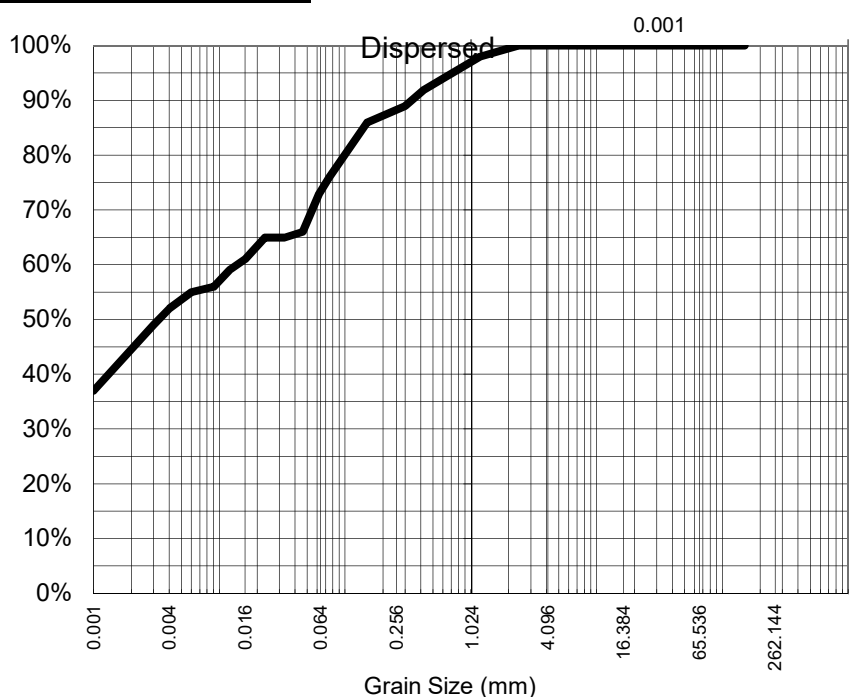
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pH 02 4014 2500
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-005 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** B5_08
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	98%
0.600	94%
0.425	92%
0.300	89%
0.150	86%
0.075	76%
Particle Size (microns)	
46	66%
33	65%
23	65%
16	61%
12	59%
9	56%
6	55%
4	52%
1	37%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.006
----------------------------	--------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.62


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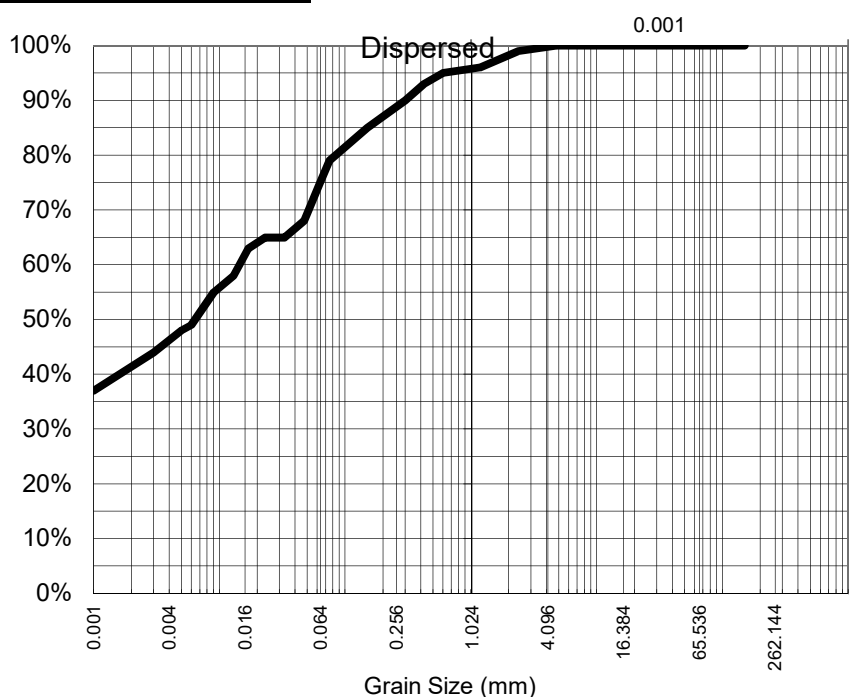
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-006 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** TB_05 (T1)
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	96%
0.600	95%
0.425	93%
0.300	90%
0.150	85%
0.075	79%
Particle Size (microns)	
47	68%
33	65%
23	65%
17	63%
13	58%
9	55%
6	49%
5	48%
1	37%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.007
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.55


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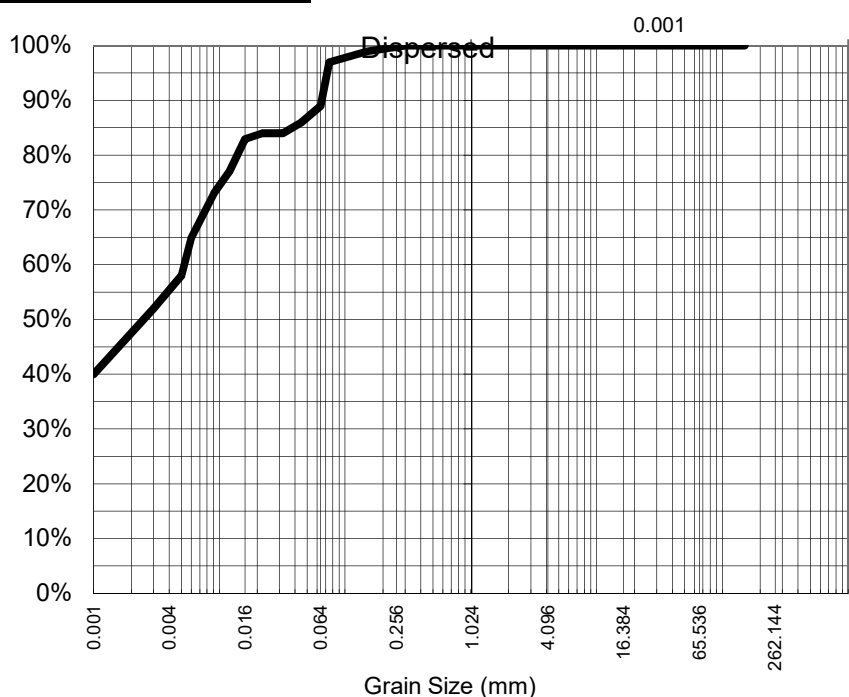
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-007 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** TB_12
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	97%
Particle Size (microns)	
45	86%
32	84%
22	84%
16	83%
12	77%
9	73%
6	65%
5	58%
1	40%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.006
----------------------------	--------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.55

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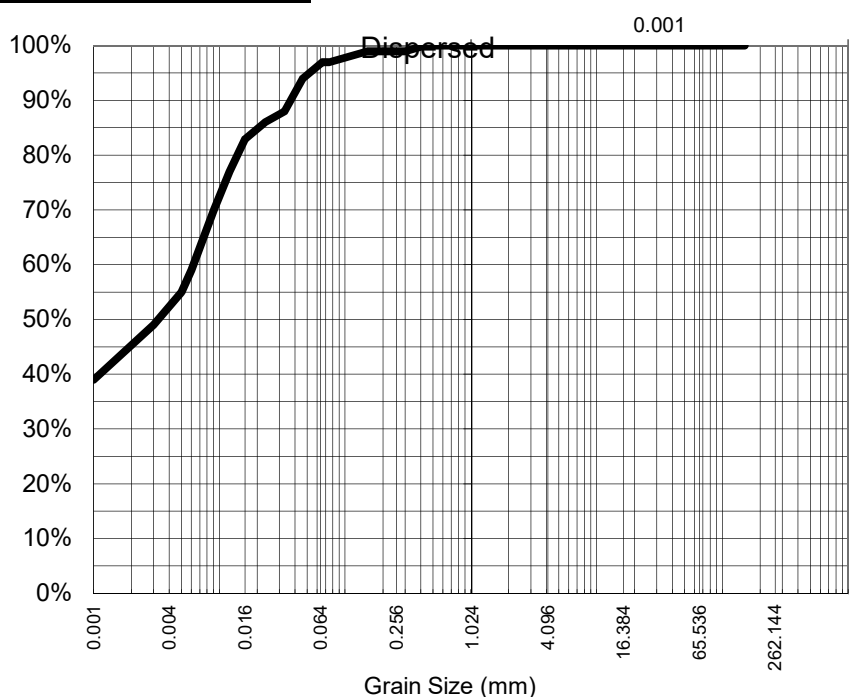
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-008 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** TB_26
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
0.425	100%
0.300	99%
0.150	99%
0.075	97%
Particle Size (microns)	
46	94%
33	88%
23	86%
16	83%
12	77%
9	70%
6	59%
5	55%
1	39%

Analysis Notes

Samples analysed as received.

* Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

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

Median Particle Size (mm)*	<0.006
----------------------------	--------

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.41 (2.45)*

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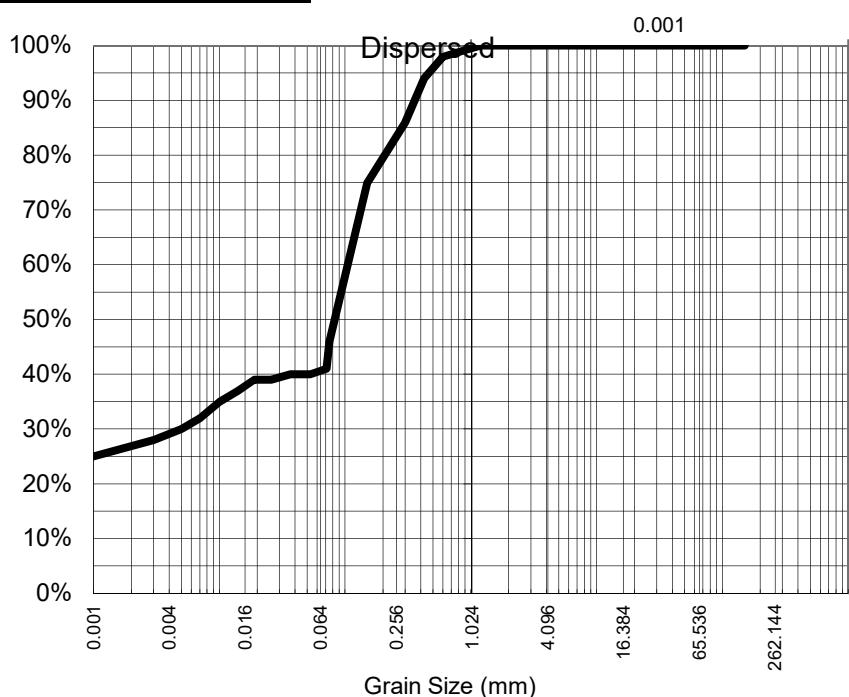
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COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-009 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** H-3
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	98%
0.425	94%
0.300	86%
0.150	75%
0.075	46%
Particle Size (microns)	
53	40%
37	40%
26	39%
19	39%
14	37%
10	35%
7	32%
5	30%
1	25%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.085
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.52


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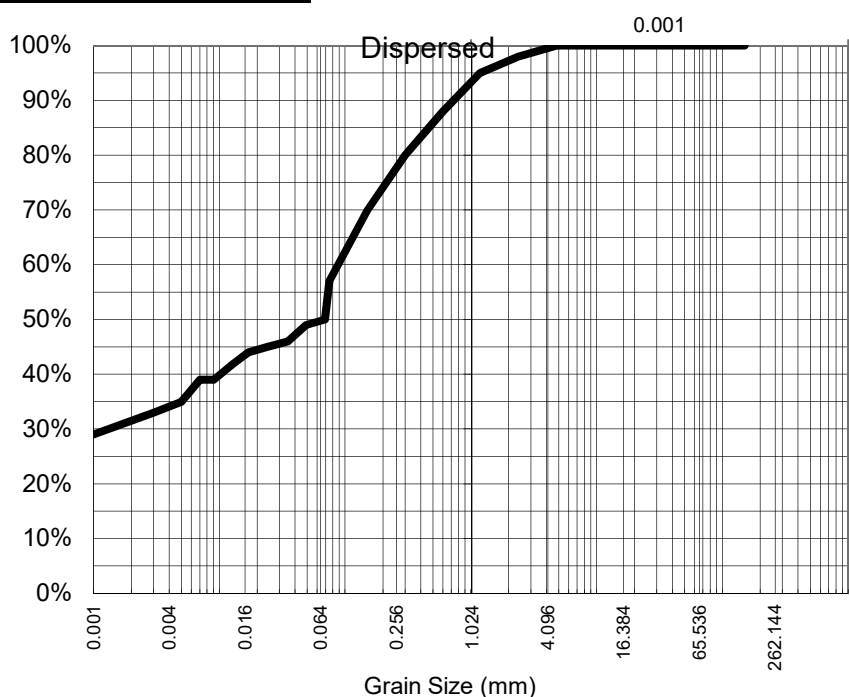
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-010 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** OP2_32 (0-0.5)
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	98%
1.18	95%
0.600	88%
0.425	84%
0.300	80%
0.150	70%
0.075	57%
Particle Size (microns)	
49	49%
35	46%
24	45%
17	44%
13	42%
9	39%
7	39%
5	35%
1	29%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.069
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.62

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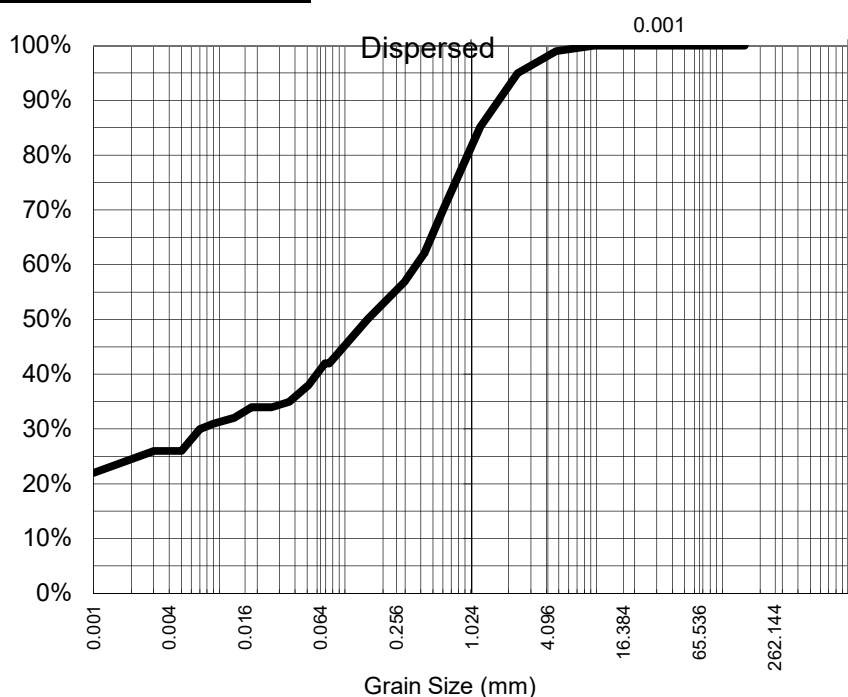
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-011 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** OP2_36 (0-0.5)
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	95%
1.18	85%
0.600	70%
0.425	62%
0.300	57%
0.150	50%
0.075	42%
Particle Size (microns)	
51	38%
36	35%
26	34%
18	34%
13	32%
9	31%
7	30%
5	26%
1	22%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.150
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.64


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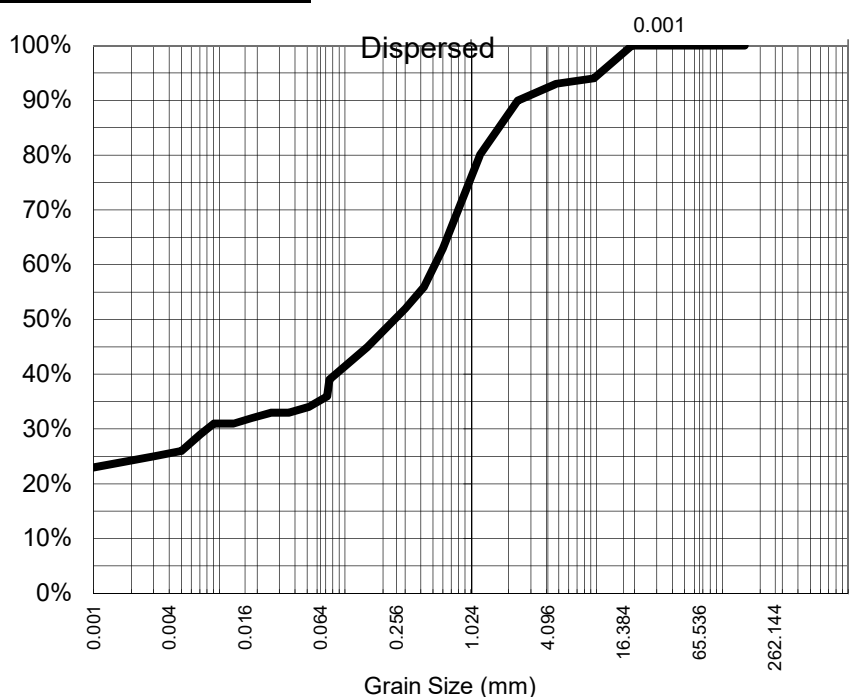
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-012 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** OP2_36 (0.5-1.0)
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	94%
4.75	93%
2.36	90%
1.18	80%
0.600	63%
0.425	56%
0.300	52%
0.150	45%
0.075	39%
Particle Size (microns)	
51	34%
36	33%
26	33%
18	32%
13	31%
9	31%
7	29%
5	26%
1	23%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.257
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.63

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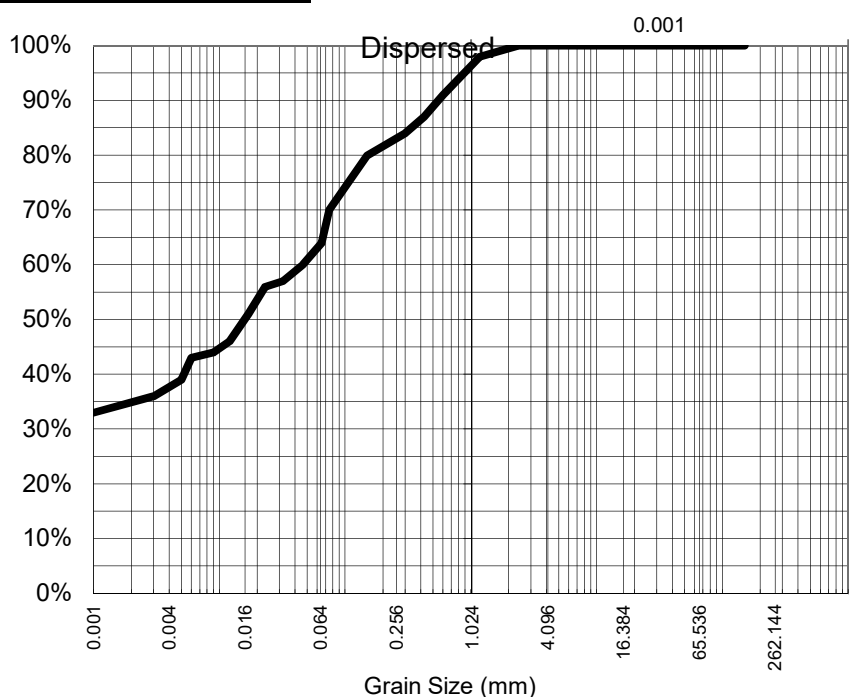
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ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-013 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** OP2_36 (1.0-1.5)
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	98%
0.600	91%
0.425	87%
0.300	84%
0.150	80%
0.075	70%
Particle Size (microns)	
46	60%
32	57%
23	56%
17	51%
12	46%
9	44%
6	43%
5	39%
1	33%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.016
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.66


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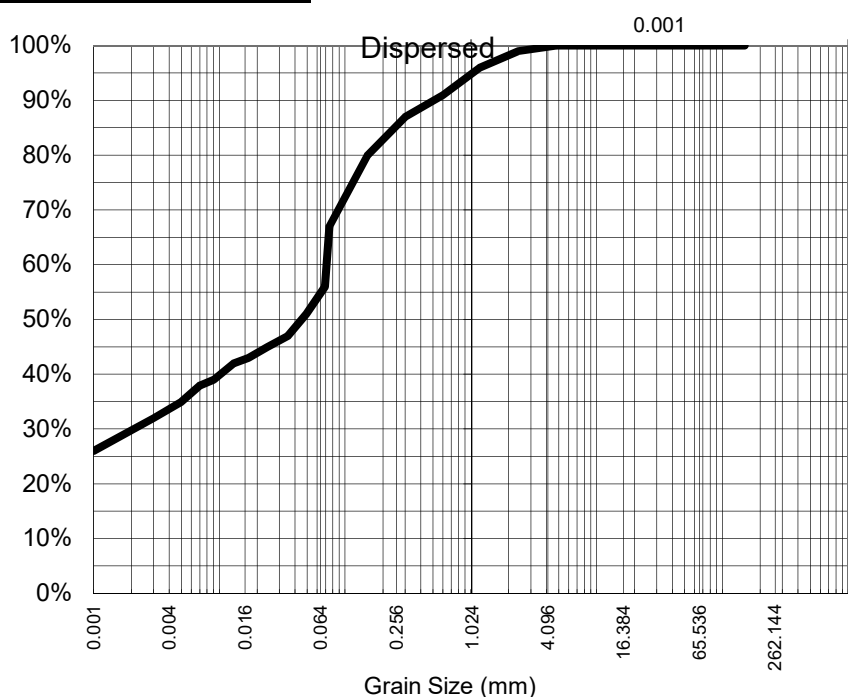
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CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-014 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** OP2_33 (0-0.5)
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	96%
0.600	91%
0.425	89%
0.300	87%
0.150	80%
0.075	67%
Particle Size (microns)	
49	51%
35	47%
24	45%
17	43%
13	42%
9	39%
7	38%
5	35%
1	26%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.046
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.64

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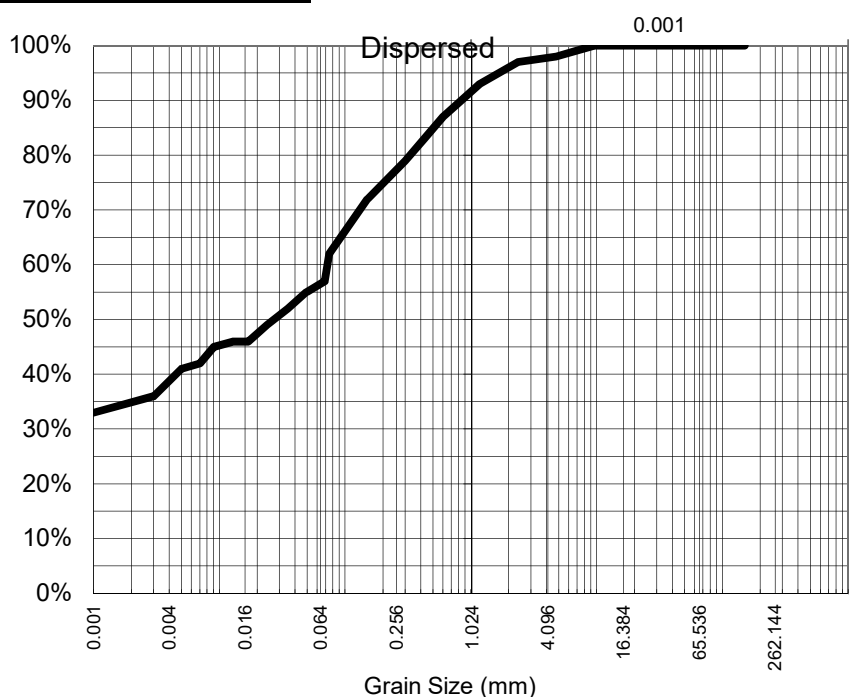
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Newcastle, NSW



CLIENT: Bill Boylson **DATE REPORTED:** 5-Dec-2018
COMPANY: ADVISIAN PTY LTD **DATE RECEIVED:** 22-Nov-2018
ADDRESS: LEVEL 3 **REPORT NO:** EB1828853-015 / PSD
60 ALBERT STREET
BRISBANE
PROJECT: 301001.02018 - Port Of Mackay **SAMPLE ID:** OP2_18 (0-0.5)
Sediment Sampling

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	98%
2.36	97%
1.18	93%
0.600	87%
0.425	83%
0.300	79%
0.150	72%
0.075	62%
Particle Size (microns)	
49	55%
35	52%
24	49%
17	46%
13	46%
9	45%
7	42%
5	41%
1	33%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.028
----------------------------	-------

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

Sample Comments:

Analysed: 30-Nov-18

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.63

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QUALITY CONTROL REPORT

Work Order	: EB1828853	Page	: 1 of 3
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Contact	: Caroline Hill
Address	: LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 22-Nov-2018
Order number	:	Date Analysis Commenced	: 05-Dec-2018
C-O-C number	: ----	Issue Date	: 06-Dec-2018
Sampler	: NICHOLAS BAINTON		
Site	:		
Quote number	: BN/185/18		
No. of samples received	: 15		
No. of samples analysed	: 15		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB1828853	Page	: 1 of 6
Client	: ADVISIAN PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR BILL BOYLSON	Telephone	: +61 7 3552 8662
Project	: 301001.02018 - Port of Mackay Sediment Sampling	Date Samples Received	: 22-Nov-2018
Site	:	Issue Date	: 06-Dec-2018
Sampler	: NICHOLAS BANTON	No. of samples received	: 15
Order number	:	No. of samples analysed	: 15

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing								
Snap Lock Bag (EA150H) SB_40, SB_58	SB_50,	24-Sep-2018	----	----	----	05-Dec-2018	23-Mar-2019	✓
Snap Lock Bag (EA150H) TB_05 (T1), TB_26,	TB_12, H-3	25-Sep-2018	----	----	----	05-Dec-2018	24-Mar-2019	✓
Snap Lock Bag (EA150H) B1_07,	B5_08	26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Snap Lock Bag (EA150H) OP2_36 (0-0.5), OP2_36 (1.0-1.5),	OP2_36 (0.5-1.0), OP2_33 (0-0.5)	28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA150H) OP2_18 (0-0.5)		26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA150H) OP2_32 (0-0.5)		28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) SB_40, SB_58	SB_50,	24-Sep-2018	----	----	----	05-Dec-2018	23-Mar-2019	✓
Snap Lock Bag (EA150H) TB_05 (T1), TB_26,	TB_12, H-3	25-Sep-2018	----	----	----	05-Dec-2018	24-Mar-2019	✓
Snap Lock Bag (EA150H) B1_07,	B5_08	26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Snap Lock Bag (EA150H) OP2_36 (0-0.5), OP2_36 (1.0-1.5),	OP2_36 (0.5-1.0), OP2_33 (0-0.5)	28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA150H) OP2_18 (0-0.5)		26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA150H) OP2_32 (0-0.5)		28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓



Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA151: Settleability 10%								
Snap Lock Bag (EA151-10) SB_40, SB_58	SB_50,	24-Sep-2018	----	----	----	05-Dec-2018	23-Mar-2019	✓
Snap Lock Bag (EA151-10) TB_05 (T1), TB_26,	TB_12, H-3	25-Sep-2018	----	----	----	05-Dec-2018	24-Mar-2019	✓
Snap Lock Bag (EA151-10) B1_07,	B5_08	26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Snap Lock Bag (EA151-10) OP2_36 (0-0.5), OP2_36 (1.0-1.5)	OP2_36 (0.5-1.0),	28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA151-10) OP2_18 (0-0.5)		26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA151-10) OP2_32 (0-0.5)		28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓
EA151: Settleability 20%								
Snap Lock Bag (EA151-20) SB_40, SB_58	SB_50,	24-Sep-2018	----	----	----	05-Dec-2018	23-Mar-2019	✓
Snap Lock Bag (EA151-20) TB_05 (T1), TB_26,	TB_12, H-3	25-Sep-2018	----	----	----	05-Dec-2018	24-Mar-2019	✓
Snap Lock Bag (EA151-20) B1_07,	B5_08	26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Snap Lock Bag (EA151-20) OP2_36 (0-0.5), OP2_36 (1.0-1.5)	OP2_36 (0.5-1.0),	28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA151-20) OP2_18 (0-0.5)		26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✓
Soil Glass Jar - Unpreserved (EA151-20) OP2_32 (0-0.5)		28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✓

Page : 4 of 6
 Work Order : EB1828853
 Client : ADVISIAN PTY LTD
 Project : 301001.02018 - Port of Mackay Sediment Sampling



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA152: Soil Particle Density									
Snap Lock Bag (EA152) SB_40, SB_58		SB_50,	24-Sep-2018	----	----	----	05-Dec-2018	23-Mar-2019	✔
Snap Lock Bag (EA152) TB_05 (T1), TB_26,		TB_12, H-3	25-Sep-2018	----	----	----	05-Dec-2018	24-Mar-2019	✔
Snap Lock Bag (EA152) B1_07,		B5_08	26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✔
Snap Lock Bag (EA152) OP2_36 (0-0.5), OP2_36 (1.0-1.5),		OP2_36 (0.5-1.0), OP2_33 (0-0.5)	28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✔
Soil Glass Jar - Unpreserved (EA152) OP2_18 (0-0.5)			26-Sep-2018	----	----	----	05-Dec-2018	25-Mar-2019	✔
Soil Glass Jar - Unpreserved (EA152) OP2_32 (0-0.5)			28-Sep-2018	----	----	----	05-Dec-2018	27-Mar-2019	✔



Quality Control Parameter Frequency Compliance

- No Quality Control data available for this section.



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Settleability 10%	* EA151-10	SOIL	In house: Determination of the settling rate of sediment or sludge in 10% solids slurries in seawater
Settleability 20%	* EA151-20	SOIL	In house: Determination of the settling rate of sediment or sludge in 20% solids slurries in seawater
Soil Particle Density	* EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EB1828853

<p>Client : ADVISIAN PTY LTD</p> <p>Contact : MR BILL BOYLSON</p> <p>Address : LEVEL 3 60 ALBERT STREET BRISBANE QLD, AUSTRALIA 4000</p> <p>E-mail : bill.boylson@advisian.com</p> <p>Telephone : ----</p> <p>Facsimile : ----</p> <p>Project : 301001.02018 - Port of Mackay Sediment Sampling</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : NICHOLAS BANTON</p>	<p>Laboratory : Environmental Division Brisbane</p> <p>Contact : Caroline Hill</p> <p>Address : 2 Byth Street Stafford QLD Australia 4053</p> <p>E-mail : Caroline.Hill@Alsglobal.com</p> <p>Telephone : +61 7 3552 8662</p> <p>Facsimile : +61-7-3243 7218</p> <p>Page : 1 of 3</p> <p>Quote number : EB2018ADVISI0003 (BN/185/18)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 22-Nov-2018 13:06	Issue Date : 26-Nov-2018
Client Requested Due Date : 06-Dec-2018	Scheduled Reporting Date : 06-Dec-2018

Delivery Details

Mode of Delivery : Samples On Hand	Security Seal : Not Available
No. of coolers/boxes : ----	Temperature : <6.0°C
Receipt Detail : REBATCH	No. of samples received / analysed : 15 / 15

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- **This work order has been created to rebatch samples from EB1823470 & EB1823888.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA150H Particle Size Analysis by Hydrometer. AS1289	SOIL - EA151-10 Settability 10%	SOIL - EA151-20 Settability 20%	SOIL - EA152 Soil Particle Density for Hydrometer Analysis
EB1828853-001	24-Sep-2018 00:00	SB_40	✓	✓	✓	✓
EB1828853-002	24-Sep-2018 00:00	SB_50	✓	✓	✓	✓
EB1828853-003	24-Sep-2018 00:00	SB_58	✓	✓	✓	✓
EB1828853-004	26-Sep-2018 00:00	B1_07	✓	✓	✓	✓
EB1828853-005	26-Sep-2018 00:00	B5_08	✓	✓	✓	✓
EB1828853-006	25-Sep-2018 00:00	TB_05 (T1)	✓	✓	✓	✓
EB1828853-007	25-Sep-2018 00:00	TB_12	✓	✓	✓	✓
EB1828853-008	25-Sep-2018 00:00	TB_26	✓	✓	✓	✓
EB1828853-009	25-Sep-2018 00:00	H-3	✓	✓	✓	✓
EB1828853-010	28-Sep-2018 00:00	OP2_32 (0-0.5)	✓	✓	✓	✓
EB1828853-011	28-Sep-2018 00:00	OP2_36 (0-0.5)	✓	✓	✓	✓
EB1828853-012	28-Sep-2018 00:00	OP2_36 (0.5-1.0)	✓	✓	✓	✓
EB1828853-013	28-Sep-2018 00:00	OP2_36 (1.0-1.5)	✓	✓	✓	✓
EB1828853-014	28-Sep-2018 00:00	OP2_33 (0-0.5)	✓	✓	✓	✓
EB1828853-015	26-Sep-2018 00:00	OP2_18 (0-0.5)	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.



Requested Deliverables

ALEX KOCHNIEFF

- *AU Certificate of Analysis - NATA (COA)	Email	alex.kochnieff@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	alex.kochnieff@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	alex.kochnieff@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	alex.kochnieff@advisian.com
- Attachment - Report (SUBCO)	Email	alex.kochnieff@advisian.com
- Chain of Custody (CoC) (COC)	Email	alex.kochnieff@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	alex.kochnieff@advisian.com
- EDI Format - XTab (XTAB)	Email	alex.kochnieff@advisian.com

BILL BOYLSON

- *AU Certificate of Analysis - NATA (COA)	Email	bill.boylson@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bill.boylson@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bill.boylson@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bill.boylson@advisian.com
- A4 - AU Tax Invoice (INV)	Email	bill.boylson@advisian.com
- Attachment - Report (SUBCO)	Email	bill.boylson@advisian.com
- Chain of Custody (CoC) (COC)	Email	bill.boylson@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	bill.boylson@advisian.com
- EDI Format - XTab (XTAB)	Email	bill.boylson@advisian.com

NICHOLAS BANTON

- *AU Certificate of Analysis - NATA (COA)	Email	nicholas.bainton@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	nicholas.bainton@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	nicholas.bainton@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	nicholas.bainton@advisian.com
- Attachment - Report (SUBCO)	Email	nicholas.bainton@advisian.com
- Chain of Custody (CoC) (COC)	Email	nicholas.bainton@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	nicholas.bainton@advisian.com
- EDI Format - XTab (XTAB)	Email	nicholas.bainton@advisian.com

STEPHEN NEALE

- *AU Certificate of Analysis - NATA (COA)	Email	stephen.neale@advisian.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	stephen.neale@advisian.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	stephen.neale@advisian.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	stephen.neale@advisian.com
- Attachment - Report (SUBCO)	Email	stephen.neale@advisian.com
- Chain of Custody (CoC) (COC)	Email	stephen.neale@advisian.com
- EDI Format - ENMRG (ENMRG)	Email	stephen.neale@advisian.com
- EDI Format - XTab (XTAB)	Email	stephen.neale@advisian.com

From: Kochnieff, Alex (Brisbane) [mailto:ALEX.KOCHNIEFF@advisian.com]
Sent: Thursday, 22 November 2018 1:06 PM
To: Caroline Hill <caroline.hill@ALSGlobal.com>
Subject: EB1823470, EB1823888

Good afternoon Caroline,

As discussed, we require additional PSD and settling rate analysis on the following samples:

Workorder	ALS sample #	Volume Remaining			Advisian Sample ID
		250mL Soil Jar	ASS Bag	Porewater Bag	Units LOR
1 EB1823470	5	1	1	-	SB_40
2 EB1823470	7	2	2	-	SB_50
3 EB1823470	9	2.5	1	-	SB_58
4 EB1823470	16	1	2	-	B1_07
5 EB1823470	19	1.5	1	-	B5_08
6 EB1823470	24	1.75	2	-	TB_05 (T1)
7 EB1823470	27	1.75	2	1	TB_12
8 EB1823470	29	2.75	3	1	TB_26
9 EB1823470	35	0.5	-	-	REF_03
10 EB1823470	39	3.5	2	-	H-3
11 EB1823888	9	2-3	Maybe 1	Unknown	OP2_32 (0-0.5)
12 EB1823888	13	2-3	Maybe 2	Unknown	OP2_36 (0-0.5)
13 EB1823888	14	2-3	Maybe 2	Unknown	OP2_36 (0.5-1.0)
14 EB1823888	15	2-3	Maybe 2	Unknown	OP2_36 (1.0-1.5)
15 EB1823888	16	2	1	Unknown	OP2_33 (0-0.5)
	19	3	Maybe 1	Unknown	OP2_18 (0-0.5)

Please let me know if this is possible.

Kind regards,

Alex Kochnieff
Senior Environmental Engineer

Level 31, 12 Creek St | Brisbane City, QLD 4000
P +61 7 3319 3940 | M +61 468 660 301
E alex.kochnieff@advisian.com

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Advisian

Environmental Division
Brisbane
Work Order Reference
EB1828853



Telephone : + 61-7-3243 7222

CERTIFICATE OF ANALYSIS

Work Order : **EB1825261**
Client : **TRILAB PTY LTD**
Contact : **THE ADMIN RESULTS**
Address : **346A BILSEN RD**
GEEBUNG QLD, AUSTRALIA 4031
Telephone : **+61 07 3265 5656**
Project : **301001-02095**
Order number : **BNE 1910012**
C-O-C number : **----**
Sampler : **----**
Site : **----**
Quote number : **EN/333**
No. of samples received : **8**
No. of samples analysed : **8**

Page : 1 of 4
Laboratory : Environmental Division Brisbane
Contact : Customer Services EB
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61-7-3243 7222
Date Samples Received : 18-Oct-2018 14:35
Date Analysis Commenced : 25-Oct-2018
Issue Date : 26-Oct-2018 08:29



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18100443 / OP2_18 / 0.50m	18100444 / OP2_24 / 0.50m	18100445 / TB-05 / 0.50m	18100446 / SB_45 / 0.50m	18100447 / B1_07 / 0.50m
Client sampling date / time				18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00
Compound	CAS Number	LOR	Unit	EB1825261-001	EB1825261-002	EB1825261-003	EB1825261-004	EB1825261-005
				Result	Result	Result	Result	Result
EP004: Organic Matter								
Organic Matter	----	0.5	%	1.0	1.8	5.9	1.2	4.6
Total Organic Carbon	----	0.5	%	0.6	1.0	3.4	0.7	2.6



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Client sample ID

				18100448/ B4_01 / 0.50m	18100449 / B5_10 / 0.50m	18100450 / B3_14 / 0.50m	----	----
Client sampling date / time				18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00	----	----
Compound	CAS Number	LOR	Unit	EB1825261-006	EB1825261-007	EB1825261-008	-----	-----
				Result	Result	Result	----	----
EP004: Organic Matter								
Organic Matter	----	0.5	%	3.9	3.3	4.2	----	----
Total Organic Carbon	----	0.5	%	2.2	1.9	2.4	----	----

CERTIFICATE OF ANALYSIS

Work Order	: EB1825261	Page	: 1 of 4
Amendment	: 1		
Client	: TRILAB PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: THE ADMIN RESULTS	Contact	: Customer Services EB
Address	: 346A BILSEN RD	Address	: 2 Byth Street Stafford QLD Australia 4053
	GEEBUNG QLD, AUSTRALIA 4031		
Telephone	: +61 07 3265 5656	Telephone	: +61-7-3243 7222
Project	: 301001-02095	Date Samples Received	: 18-Oct-2018 14:35
Order number	: BNE 1910012	Date Analysis Commenced	: 25-Oct-2018
C-O-C number	: ----	Issue Date	: 20-Nov-2018 15:33
Sampler	: ----		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 8		
No. of samples analysed	: 8		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Amendment (20/11/2018): This report has been amended and re-released to allow the reporting of additional analytical data, specifically ANC.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18100443 / OP2_18 / 0.50m	18100444 / OP2_24 / 0.50m	18100445 / TB-05 / 0.50m	18100446 / SB_45 / 0.50m	18100447 / B1_07 / 0.50m
Client sampling date / time				18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00
Compound	CAS Number	LOR	Unit	EB1825261-001	EB1825261-002	EB1825261-003	EB1825261-004	EB1825261-005
				Result	Result	Result	Result	Result
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	57.2	86.2	69.5	96.8	96.2
ANC as CaCO3	----	0.1	% CaCO3	5.8	8.8	7.1	9.9	9.8
Fizz Rating	----	0	Fizz Unit	2	2	2	2	2



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18100448/ B4_01 / 0.50m	18100449 / B5_10 / 0.50m	18100450 / B3_14 / 0.50m	----	----
Client sampling date / time				18-Oct-2018 00:00	18-Oct-2018 00:00	18-Oct-2018 00:00	----	----
Compound	CAS Number	LOR	Unit	EB1825261-006	EB1825261-007	EB1825261-008	-----	-----
				Result	Result	Result	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	98.6	99.9	102	----	----
ANC as CaCO3	----	0.1	% CaCO3	10.0	10.2	10.4	----	----
Fizz Rating	----	0	Fizz Unit	2	2	2	----	----

CERTIFICATE OF ANALYSIS

Work Order : **EB1826671**
Client : **TRILAB PTY LTD**
Contact : **MR CHRIS CHANNON**
Address : **346A BILSEN RD**
GEEBUNG QLD, AUSTRALIA 4031
Telephone : **+61 07 3265 5656**
Project : **301001-02095**
Order number : **BNE 1911004**
C-O-C number : **----**
Sampler : **----**
Site : **----**
Quote number : **EN/333**
No. of samples received : **2**
No. of samples analysed : **2**

Page : 1 of 2
Laboratory : Environmental Division Brisbane
Contact : Customer Services EB
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61-7-3243 7222
Date Samples Received : 02-Nov-2018 11:20
Date Analysis Commenced : 07-Nov-2018
Issue Date : 08-Nov-2018 15:08



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.

Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				18110001 / SB_16 / 0.50m	18110002 / SB40 / 0.50m	----	----	----
Client sampling date / time				02-Nov-2018 00:00	02-Nov-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1826671-001	EB1826671-002	-----	-----	-----
				Result	Result	----	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	73.4	79.8	----	----	----
ANC as CaCO3	----	0.1	% CaCO3	7.5	8.1	----	----	----
Fizz Rating	----	0	Fizz Unit	2	2	----	----	----

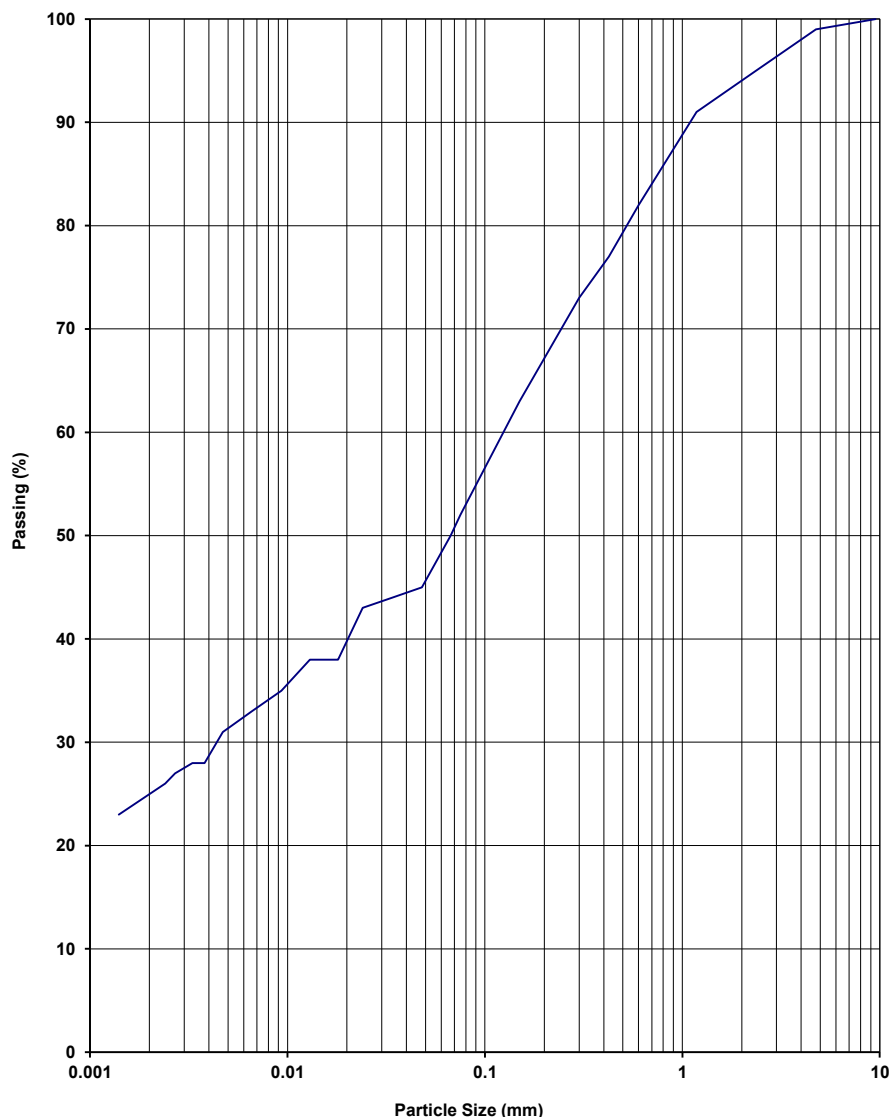
Appendix D Trilab laboratory documentation

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100443-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	OP2_18	Report Date	30/10/2018
Depth (m)	0.50		

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	100
4.75	99
2.36	95
1.18	91
0.600	82
0.425	77
0.300	73
0.150	63
0.075	52
0.067	50
0.048	45
0.034	44
0.024	43
0.018	38
0.013	38
0.0093	35
0.0066	33
0.0047	31
0.0038	28
0.0033	28
0.0027	27
0.0024	26
0.0014	23



NOTES/REMARKS:

-
Moisture Content 63.9% -2.36mm Soil Particle Density(t/m^3) 2.61
Sample/s supplied by the client

Page 1 of 1 REP03904

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to Australian/National Standards.

Tested at Trilab Brisbane Laboratory.

Authorised Signatory


C. Channon



Laboratory No. 9926

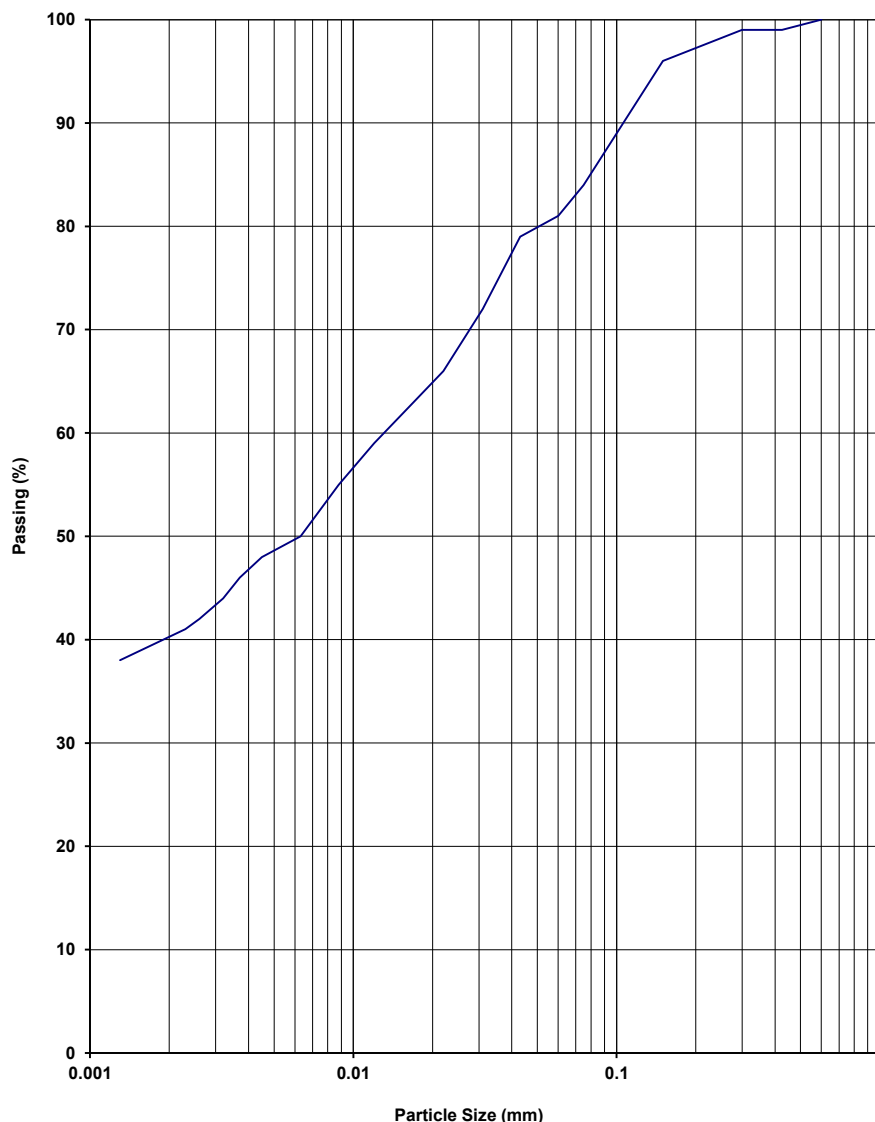
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Trilab Pty Ltd ABN 25 065 630 506

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100444-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	OP2_24	Report Date	30/10/2018
		Depth (m)	0.50

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	
1.18	
0.600	100
0.425	99
0.300	99
0.150	96
0.075	84
0.06	81
0.043	79
0.031	72
0.022	66
0.017	63
0.012	59
0.0088	55
0.0063	50
0.0045	48
0.0037	46
0.0032	44
0.0026	42
0.0023	41
0.0013	38



NOTES/REMARKS:

-
Moisture Content 131% -2.36mm Soil Particle Density(t/m³) 2.56
Sample/s supplied by the client

Page 1 of 1 REP03904

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Authorised Signatory


C. Channon



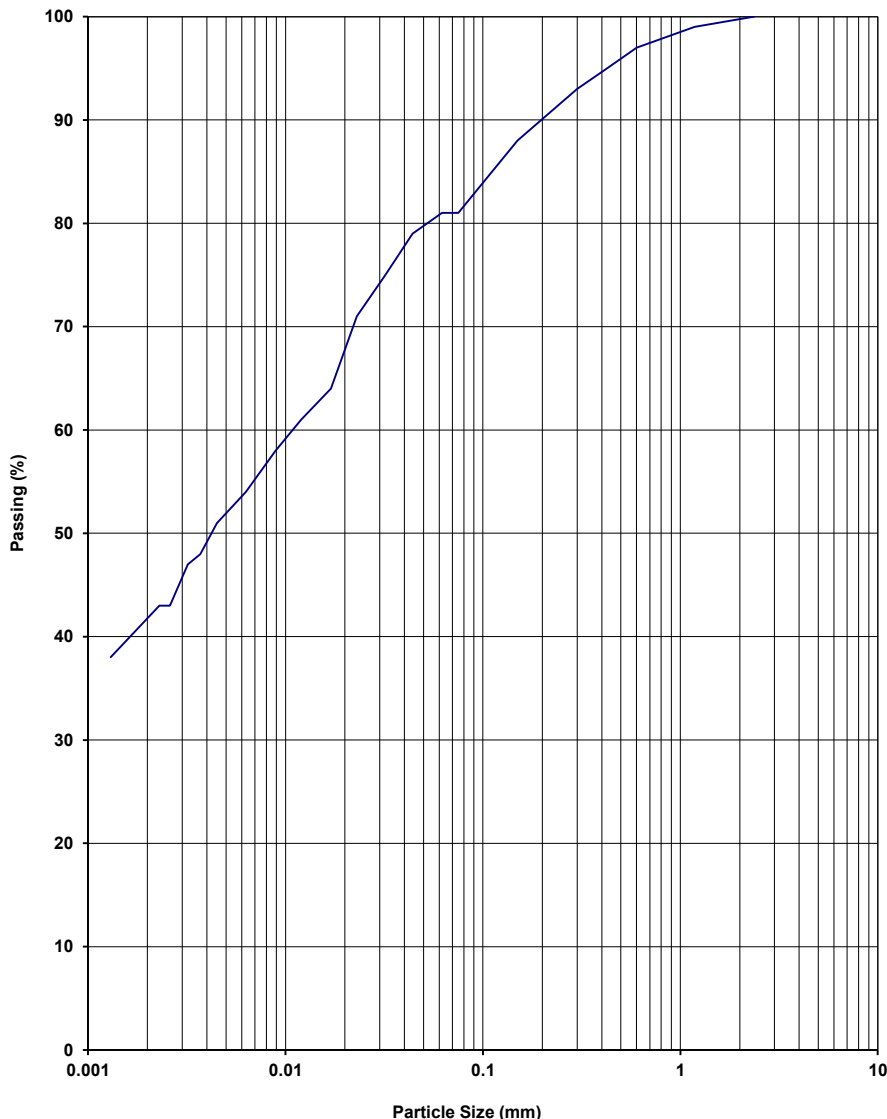
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PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100445-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	TB_05	Report Date	30/10/2018
Depth (m)	0.50		
Sieve Size (mm)	Passing %		
150.0			
75.0			
63.0			
53.0			
37.5			
26.5			
19.0			
13.2			
9.5			
6.7			
4.75			
2.36	100		
1.18	99		
0.600	97		
0.425	95		
0.300	93		
0.150	88		
0.075	81		
0.062	81		
0.044	79		
0.032	75		
0.023	71		
0.017	64		
0.012	61		
0.0089	58		
0.0063	54		
0.0045	51		
0.0037	48		
0.0032	47		
0.0026	43		
0.0023	43		
0.0013	38		



NOTES/REMARKS:

-
Moisture Content 125.5% -2.36mm Soil Particle Density(t/m³) 2.55
Sample/s supplied by the client

Page 1 of 1 REP03904

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory


C. Channon



Laboratory No. 9926

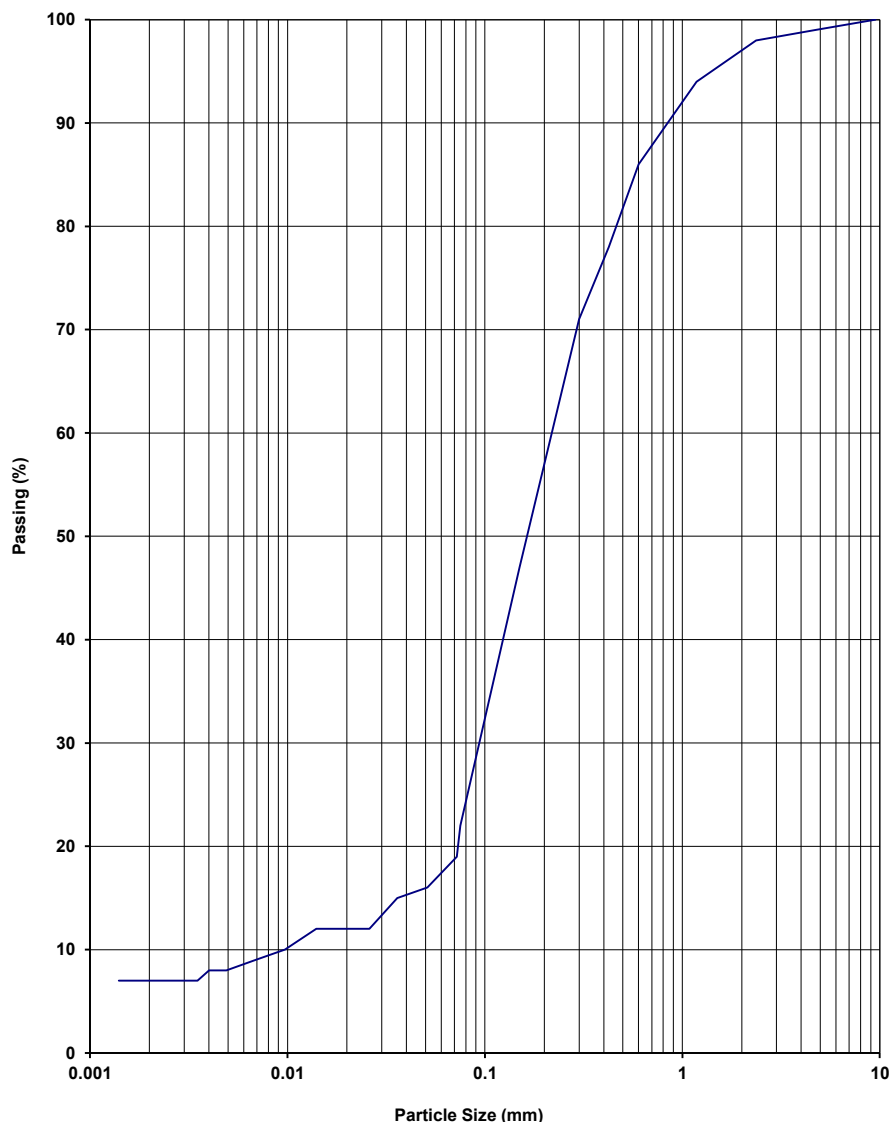
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Trilab Pty Ltd ABN 25 065 630 506

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100446-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	SB 45	Report Date	30/10/2018
Depth (m)	0.50		

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	100
4.75	99
2.36	98
1.18	94
0.600	86
0.425	78
0.300	71
0.150	47
0.075	22
0.072	19
0.051	16
0.036	15
0.026	12
0.019	12
0.014	12
0.0097	10
0.0069	9
0.0049	8
0.004	8
0.0035	7
0.0028	7
0.0024	7
0.0014	7



NOTES/REMARKS:

-
Moisture Content 28% -2.36mm Soil Particle Density(t/m³) 2.61
Sample/s supplied by the client

Page 1 of 1 REP03904

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory


C. Channon



Laboratory No. 9926

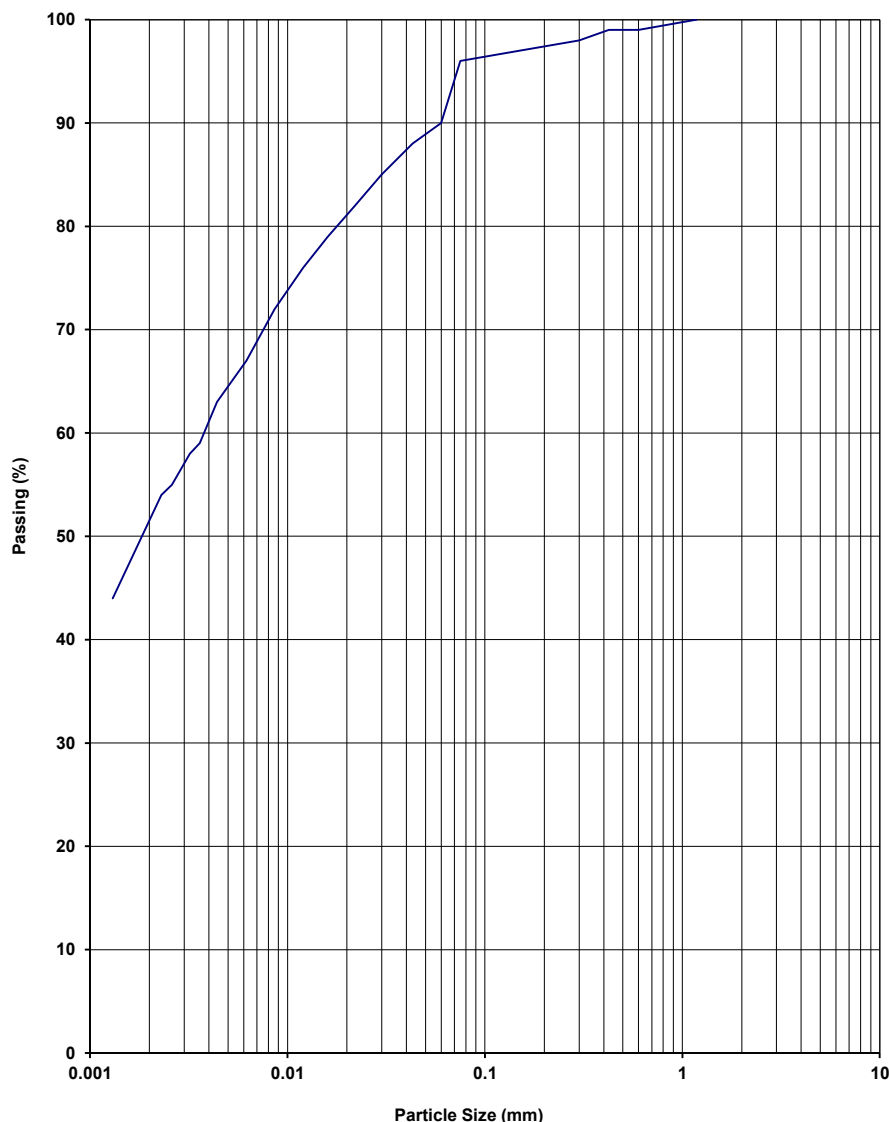
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Trilab Pty Ltd ABN 25 065 630 506

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100447-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	B1_07	Report Date	30/10/2018
Depth (m)	0.50		

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	
1.18	100
0.600	99
0.425	99
0.300	98
0.150	97
0.075	96
0.06	90
0.043	88
0.03	85
0.022	82
0.016	79
0.012	76
0.0086	72
0.0062	67
0.0044	63
0.0036	59
0.0032	58
0.0026	55
0.0023	54
0.0013	44



NOTES/REMARKS:

-
Moisture Content 176% -2.36mm Soil Particle Density(t/m³) 2.49
Sample/s supplied by the client

Page 1 of 1 REP03904

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory


C. Channon



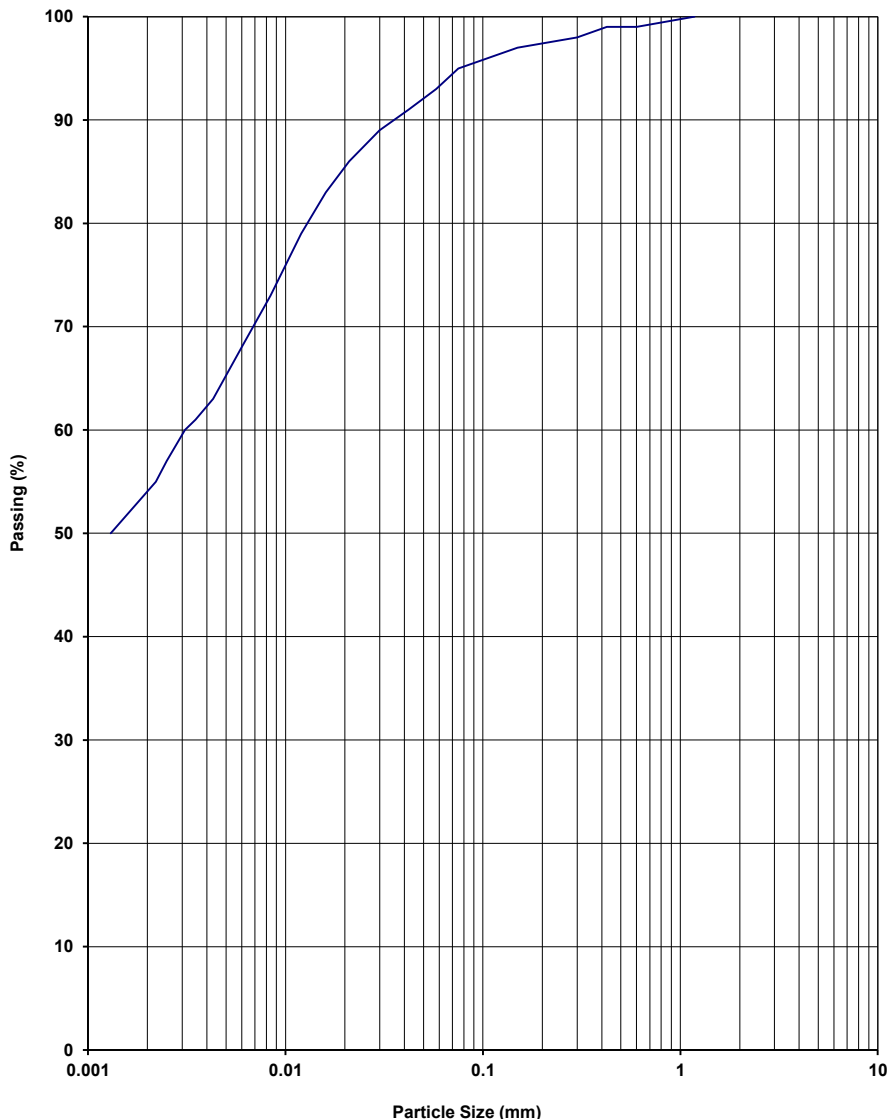
Laboratory No. 9926

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Trilab Pty Ltd ABN 25 065 630 506

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100448-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	B4_01	Report Date	30/10/2018
Depth (m)	0.50		
Sieve Size (mm)	Passing %		
150.0			
75.0			
63.0			
53.0			
37.5			
26.5			
19.0			
13.2			
9.5			
6.7			
4.75			
2.36			
1.18	100		
0.600	99		
0.425	99		
0.300	98		
0.150	97		
0.075	95		
0.058	93		
0.042	91		
0.03	89		
0.021	86		
0.016	83		
0.012	79		
0.0084	73		
0.006	68		
0.0043	63		
0.0035	61		
0.0031	60		
0.0025	57		
0.0022	55		
0.0013	50		



NOTES/REMARKS:

-
Moisture Content 186.6% -2.36mm Soil Particle Density(t/m³) 2.59
Sample/s supplied by the client

Page 1 of 1 REP03904

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory


C. Channon



Laboratory No. 9926

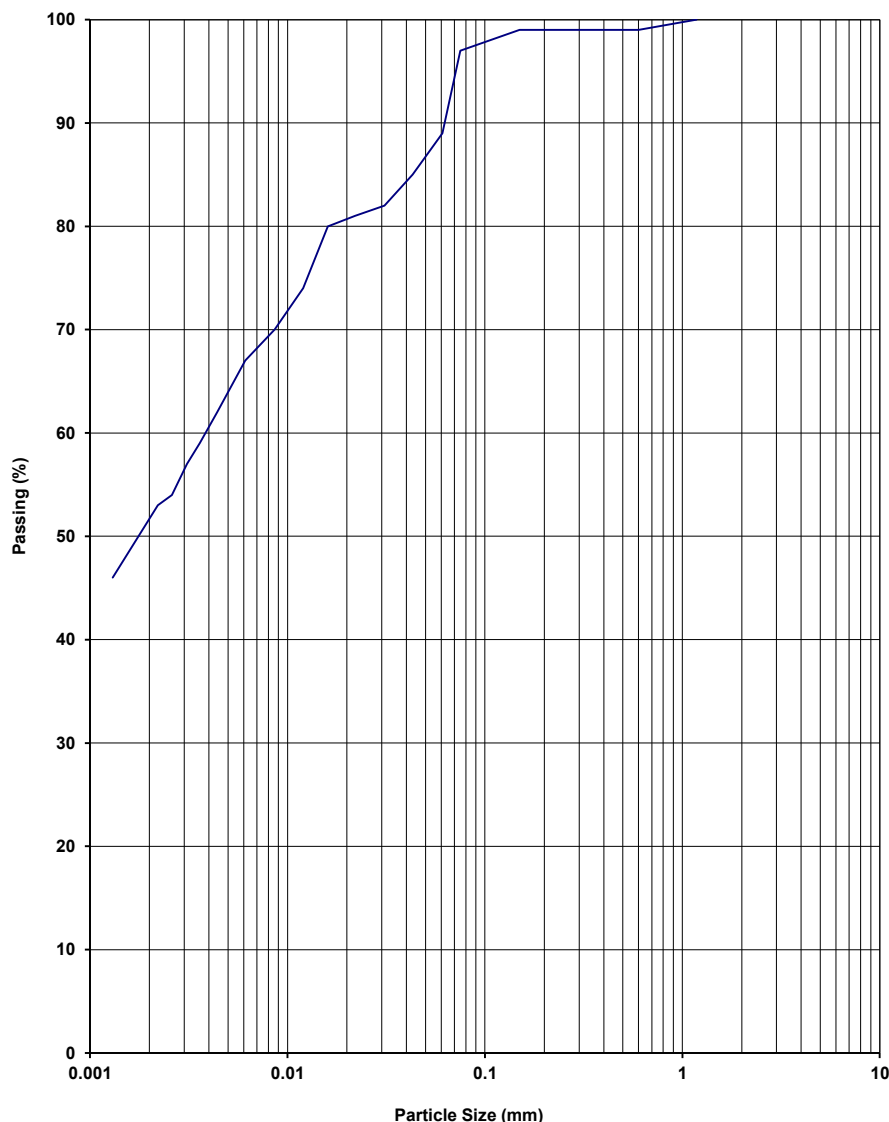
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Trilab Pty Ltd ABN 25 065 630 506

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100449-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	B5_10	Report Date	30/10/2018
Depth (m)	0.50		

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	
1.18	100
0.600	99
0.425	99
0.300	99
0.150	99
0.075	97
0.061	89
0.043	85
0.031	82
0.022	81
0.016	80
0.012	74
0.0086	70
0.0061	67
0.0044	62
0.0036	59
0.0031	57
0.0026	54
0.0022	53
0.0013	46



NOTES/REMARKS:

-
Moisture Content 164% -2.36mm Soil Particle Density(t/m³) 2.58
Sample/s supplied by the client

Page 1 of 1 REP03904

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory


C. Channon



Laboratory No. 9926

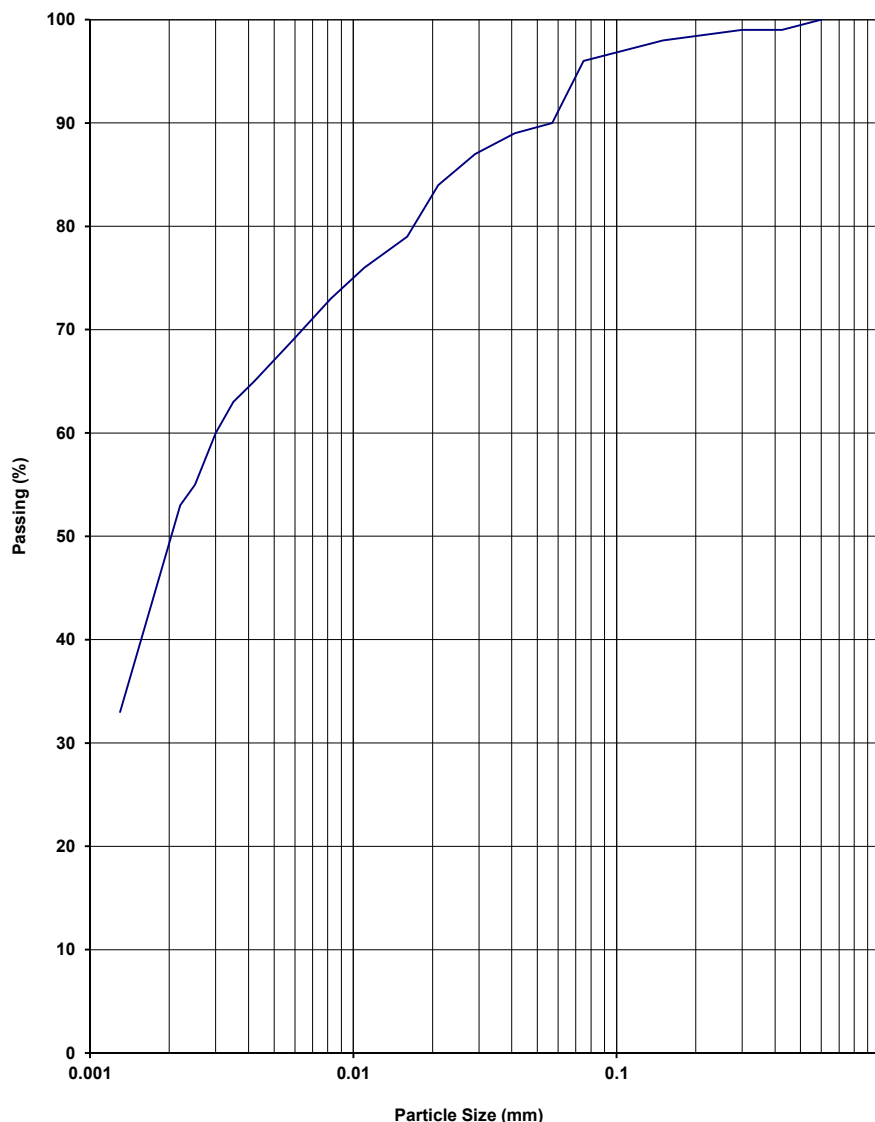
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Trilab Pty Ltd ABN 25 065 630 506

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3, 3.5.1 & 2.1.1

Client	Advisian Pty Ltd	Report No.	18100450-G
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Workorder No.	0005017
Project	301001-02095 - Port of Mackay	Test Date	16/10/18-30/10/18
Client ID	B3_14	Report Date	30/10/2018
		Depth (m)	0.50

Sieve Size (mm)	Passing %
150.0	
75.0	
63.0	
53.0	
37.5	
26.5	
19.0	
13.2	
9.5	
6.7	
4.75	
2.36	
1.18	
0.600	100
0.425	99
0.300	99
0.150	98
0.075	96
0.057	90
0.041	89
0.029	87
0.021	84
0.016	79
0.011	76
0.0082	73
0.0059	69
0.0042	65
0.0035	63
0.003	60
0.0025	55
0.0022	53
0.0013	33



NOTES/REMARKS:

-
Moisture Content 191.2% -2.36mm Soil Particle Density(t/m³) 2.56
Sample/s supplied by the client

Page 1 of 1 REP03904

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory


C. Channon



Laboratory No. 9926

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Reference should be made to Trilab's "Standard Terms and Conditions of Business" for further details.
Trilab Pty Ltd ABN 25 065 630 506

ATTERBERG LIMITS TEST REPORT

Test Method: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Client	Advisian Pty Ltd	Report No.	18100443-AL
		Workorder No.	0005017
Address	Level 31, Blue Tower, 12 Creek Street BRISBANE QLD 4000	Report Date	01/11/2018
Project	301001-02095 - Port of Mackay		

Sample No.	18100443	18100444	18100445	18100446	18100447	18100448
Test Date	27/10/2018	27/10/2018	27/10/2018	27/10/2018	27/10/2018	27/10/2018
Client ID	OP2_18	OP2_24	TB_05	SB_45	B1_07	B4_01
Depth (m)	0.50	0.50	0.50	0.50	0.50	0.50
Liquid Limit (%)	45	83	83	Not Obtainable	128	119
Plastic Limit (%)	17	29	32	Not Obtainable	37	35
Plasticity Index (%)	28	54	51	Non Plastic	91	84
Linear Shrinkage (%)	11.0 +	18.5 *	15.5 +	Not Obtainable	26.5 +	22.0 +
Moisture Content (%)	63.9	131.0	125.5	28.0	176.0	186.6

Sample No.	18100449	18100450				
Test Date	27/10/2018	27/10/2018				
Client ID	B5_10	B3_14				
Depth (m)	0.50	0.50				
Liquid Limit (%)	125	119				
Plastic Limit (%)	38	37				
Plasticity Index (%)	87	82				
Linear Shrinkage (%)	23.5 +	23.0 +				
Moisture Content (%)	164.0	191.2				

NOTES/REMARKS: The samples were tested in a natural state, wet sieved and in a 125-250mm mould.

Sample/s supplied by the client * Cracking occurred + Curling occurred Page 1 of 1 REP00102

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C. Channon



Laboratory No. 9926

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

ATTERBERG LIMITS TEST REPORT

Test Method: AS 1289 2.1.1, 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1

Client	Worley Parsons Pty Ltd	Report No.	18110001-AL
		Workorder No.	0005080
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Report Date	08/11/2018
Project	301001-02095		

Sample No.	18110001	18110002				
Test Date	2/11/2018	2/11/2018				
Client ID	SB_16	SB40				
Depth (m)	0.50	0.50				
Liquid Limit (%)	140	118				
Plastic Limit (%)	34	31				
Plasticity Index (%)	106	87				
Linear Shrinkage (%)	26.5 +	24.0 +				
Moisture Content (%)	198.9	167.1				

Sample No.						
Test Date						
Client ID						
Depth (m)						
Liquid Limit (%)						
Plastic Limit (%)						
Plasticity Index (%)						
Linear Shrinkage (%)						
Moisture Content (%)						

NOTES/REMARKS: The samples were tested in a natural state, wet sieved and in a 125-250mm mould.

Sample/s supplied by the client * Cracking occurred + Curling occurred Page 1 of 1 REP00102

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

SOIL PARTICLE DENSITY TEST REPORT

Test Method: AS 1289 3.5.1

Client	Worley Parsons Pty Ltd	Report No.	18110001-SG
		Workorder No.	0005080
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Report Date	08/11/2018

Project 301001-02095

Sample No.	18110001	18110002					
Test Date	6/11/2018	6/11/2018					
Client ID	SB_16	SB40	-	-	-	-	-
Depth (m)	0.50	0.50	-	-	-	-	-
Soil Particle Density (t/m³) (-2.36mm)	2.57	2.55					
Soil Particle Density (t/m³) (+2.36mm)	-	-					
Total Soil Particle Density (t/m³)	2.57	2.55					

Sample No.							
Test Date							
Client ID	-	-	-	-	-	-	-
Depth (m)	-	-	-	-	-	-	-
Soil Particle Density (t/m³) (-2.36mm)							
Soil Particle Density (t/m³) (+2.36mm)							
Total Soil Particle Density (t/m³)							

NOTES/REMARKS:

Sample/s supplied by the client

Page 1 of 1 REP04603

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

MINIMUM AND MAXIMUM DRY DENSITY OF A COHESIONLESS MATERIAL TEST REPORT

Test Method AS 1289.5.5.1 / Q142E

Client	Worley Parsons Pty Ltd	Report No.	18110383-MM
		Workorder No.	0005139
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Test Date	15/11/2018
		Report Date	22/11/2018
Project	301001-02095		
Description	-		
Sample No.	18110383		
Client ID	SB_45		
Depth (m)	-		
<u>TEST RESULTS</u>			
Nominal Size of Mould Used (cm³)	1002		
Field Moisture Content (%)	28.7		
Minimum Dry Density (t/m³)	1.14		
Maximum Dry Density (t/m³)	1.62		
Maximum Dry Density Moisture Content (%)	24.1		
Notes/Remarks:			
Sample/s supplied by client			

Page: 1 of 1 REP013601

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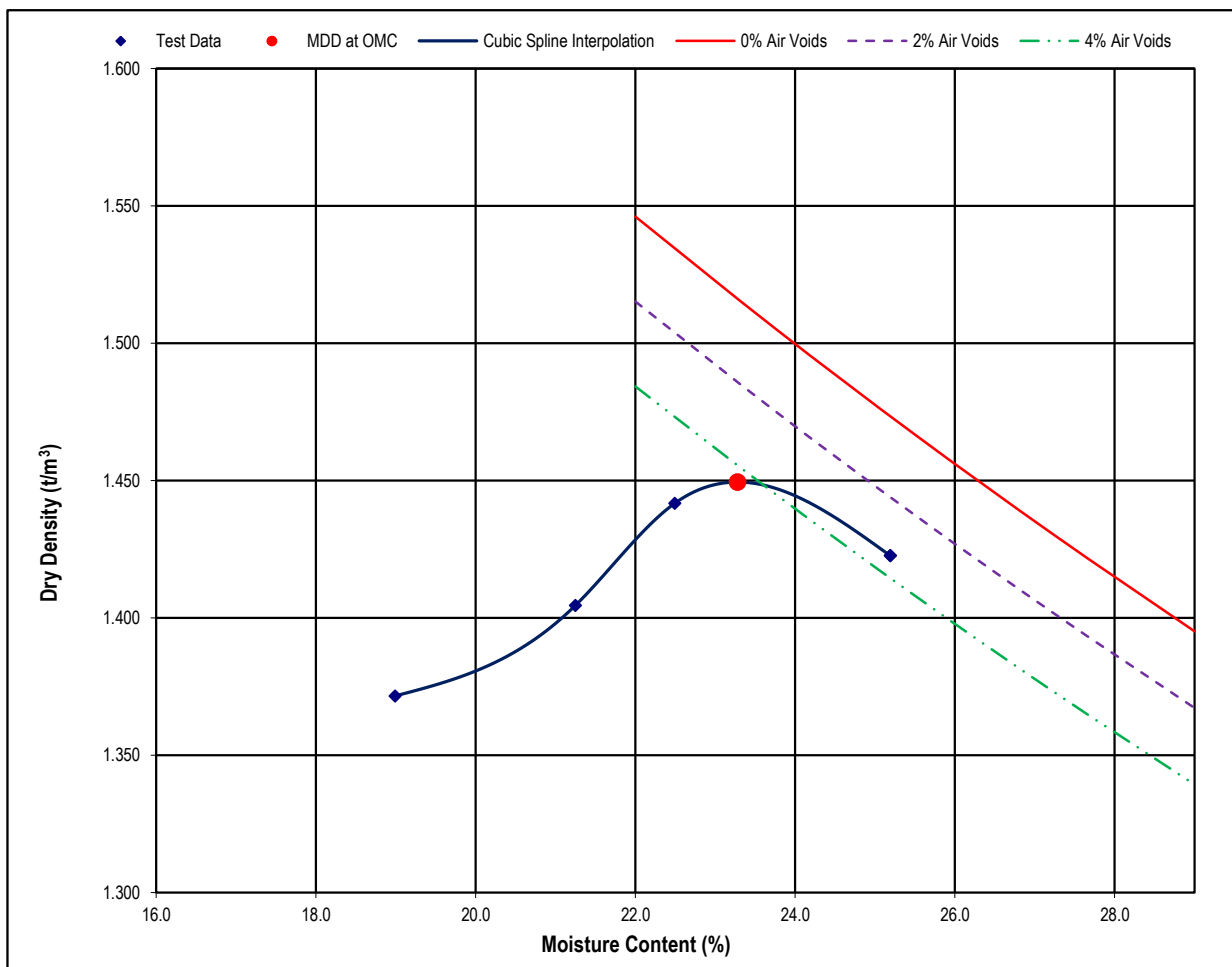
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MOISTURE/DENSITY RELATIONSHIP TEST REPORT

Test Method: AS 1289 5.1.1 & AS 1289.2.1.1

Client	Worley Parsons Pty Ltd	Report No.	18110381-MDD
		Workorder No.	0005139
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Test Date	15/11/2018
		Report Date	16/11/2018
Project	301001-02095		
Client ID	B1_07/B3_14/B4_01/B5_10 - Combined	Depth (m)	-



Maximum Dry Density (t/m³)	1.45	Optimum Moisture Content (%)	23.3
Moisture Content (%)	138.7	Percentage of Oversize/Sieve Size (mm)	0/19

NOTES/REMARKS:

Sample/s supplied by the client

% Voids based on assumed SG of 2.34

Page 1 of 1

REP01304

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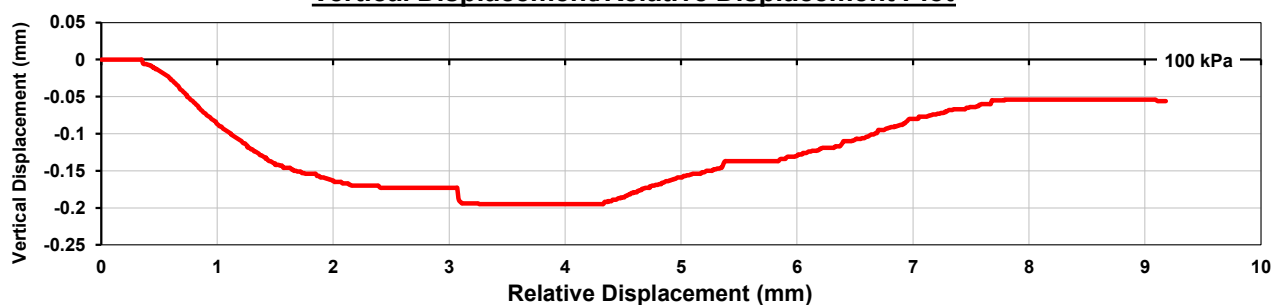
ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

DIRECT SHEAR TEST REPORT

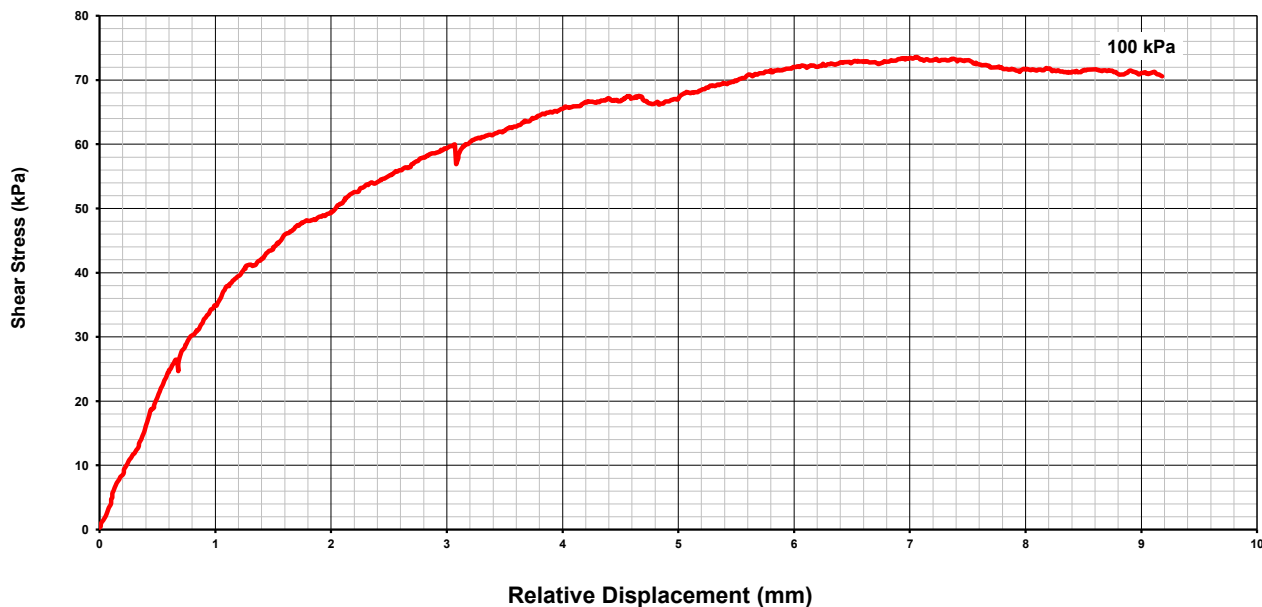
Test Method: AS 1289.6.2.2 / KH2 based on K.H. Head Vol. 2

Client	Worley Parsons Pty Ltd	Report No.	18110383- DS
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No	0005139
Project	301001-02095	Test Date	21/11/2018
Client ID	SB_45	Report Date	26/11/2018
Description	SAND - grey	Depth (m) -	
Sample Type	Single individual soil specimen - Remoulded at 70% of MDD and at OMC as per client request.		

Vertical Displacement/Relative Displacement Plot



Shear Stress/Displacement Plot



Notes/Remarks:

Note: Area correction based on square sample equation.

Graph not to scale

Sample/s supplied by the client

Page 1 of 4 REP07301

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

DIRECT SHEAR TEST REPORT

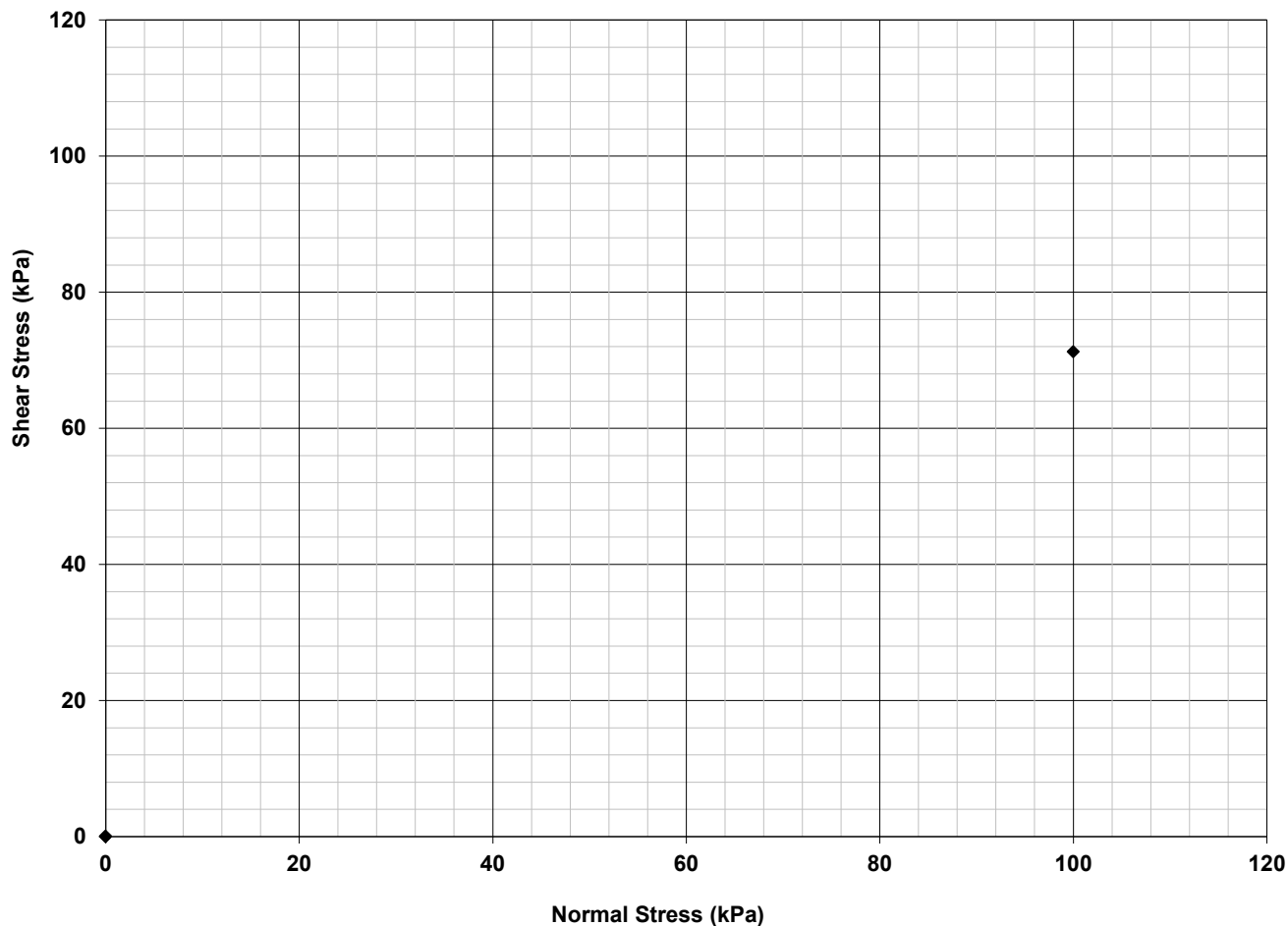
Test Method: AS 1289.6.2.2 / KH2 based on K.H. Head Vol. 2

Client Worley Parsons Pty Ltd

Report No. 18110383- DS

Failure Criteria
Residual @ 9 , , , mm Displacement

Residual - Normal Stress vs Shear Stress



Shear Angle (°)	#DIV/0!	Cohesion (kPa)	#DIV/0!	R ²	#DIV/0!
Specimen Condition	Inundated	Normal Stress (kPa)		Corrected Shear Stress (kPa)	
Specimen Dimensions (mm)	100*100	Stage 1	100.0	71.2	
Rate of Strain (mm/min)	0.008				
Initial Moisture Content (%)	24.1				
Initial Wet Density(t/m ³)	1.79				

Notes/Remarks:

Note: Area correction based on square sample equation.

Graph not to scale

Sample/s supplied by the client

Page 2 of 4 REP07301

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING



DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2 / KH2 based on K.H. Head Vol. 2

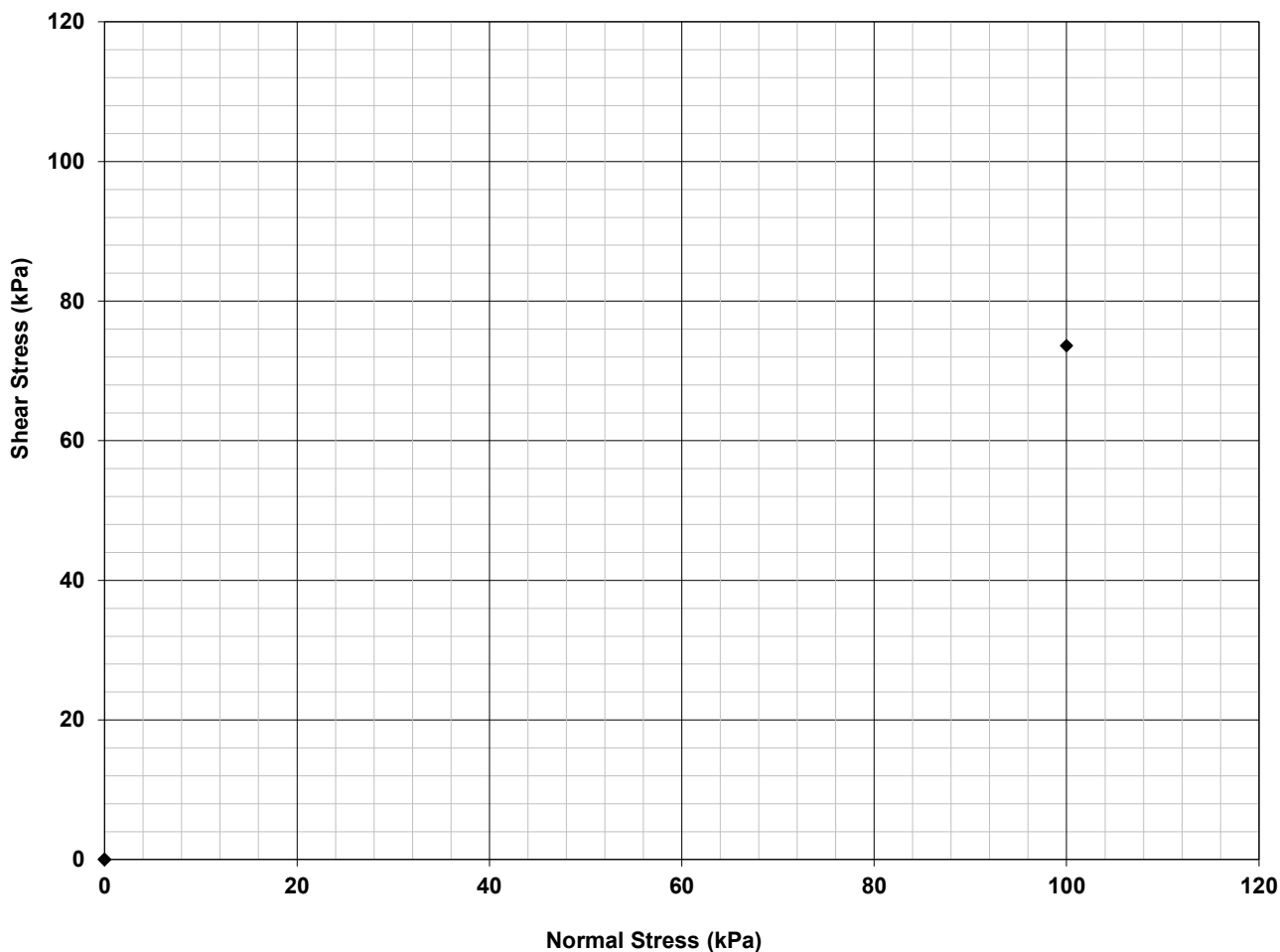
Client Worley Parsons Pty Ltd

Report No. 18110383- DS

Failure Criteria

Peak

Peak - Normal Stress vs Shear Stress



Shear Angle (°) #DIV/0!		Cohesion (kPa) #DIV/0!	R ² #DIV/0!
Specimen Condition	Inundated	Normal Stress (kPa)	Corrected Shear Stress (kPa)
Specimen Dimensions (mm)	100*100	Stage 1 100.0	73.6
Rate of Strain (mm/min)	0.008		
Initial Moisture Content (%)	24.1		
Initial Wet Density(t/m ³)	1.79		

Notes/Remarks:

Note: Area correction based on square sample equation.

Graph not to scale

Sample/s supplied by the client

Page 3 of 4 REP07301

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2 / KH2 based on K.H. Head Vol. 2

Client Worley Parsons Pty Ltd

Report No. 18110383- DS

CLIENT:	Worley Parsons Pty Ltd	
PROJECT:	301001-02095	AFTER TEST
LAB SAMPLE No.	18110383	DATE: 26/11/18
BOREHOLE:	SB_45	DEPTH: 5.80



Notes/Remarks:

Photo not to scale

Sample/s supplied by the client

Page 4 of 4 REP07301

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ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd	Report No.: 18110381 - CU
Address: Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No.: 0005139
Project: 301001-02095	Test Date: 23/11/2018
Client Id.: B1_07/B3_14/B4_01/B5_10 - Combined	Report Date: 3/12/2018
Description: SILTY CLAY- grey	
Depth (m): -	

SAMPLE & TEST DETAILS

Initial Height: 99.4 mm	Initial Moisture Content: 22.7 %	Rate of Strain: 0.006 %/min
Initial Diameter: 47.7 mm	Final Moisture Content: 35.6 %	B Response: 99 %
L/D Ratio: 2.1 : 1	Wet Density: 1.70 t/m ³	
	Dry Density: 1.38 t/m ³	

Sample Type: Single Individual Specimen remoulded as per client request

TEST RESULTS

FAILURE DETAILS

Effective Pressure	Confining Pressure	Back Pressure	Initial Pore	Failure Pore	Principal Effective Stresses			Deviator Stress	Strain
					σ'_1	σ'_3	σ'_1 / σ'_3		
52 kPa	549 kPa	497 kPa	497 kPa	521 kPa	79 kPa	28 kPa	2.817	51 kPa	1.27 %
101 kPa	599 kPa	498 kPa	498 kPa	547 kPa	137 kPa	52 kPa	2.639	85 kPa	3.57 %
199 kPa	698 kPa	499 kPa	499 kPa	592 kPa	272 kPa	106 kPa	2.562	166 kPa	6.53 %

FAILURE ENVELOPES

Interpretation between stages :	1 to 2	2 to 3	1 to 3
Cohesion C' (kPa) :	3.5	2.5	2.9
Angle of Shear Resistance Φ' (Degrees) :	24.7	25.3	25.1
Failure Criteria:	Peak Principal Stress Ratio		

Remarks:
Sample/s supplied by the client

Page 1 of 7

REP03001

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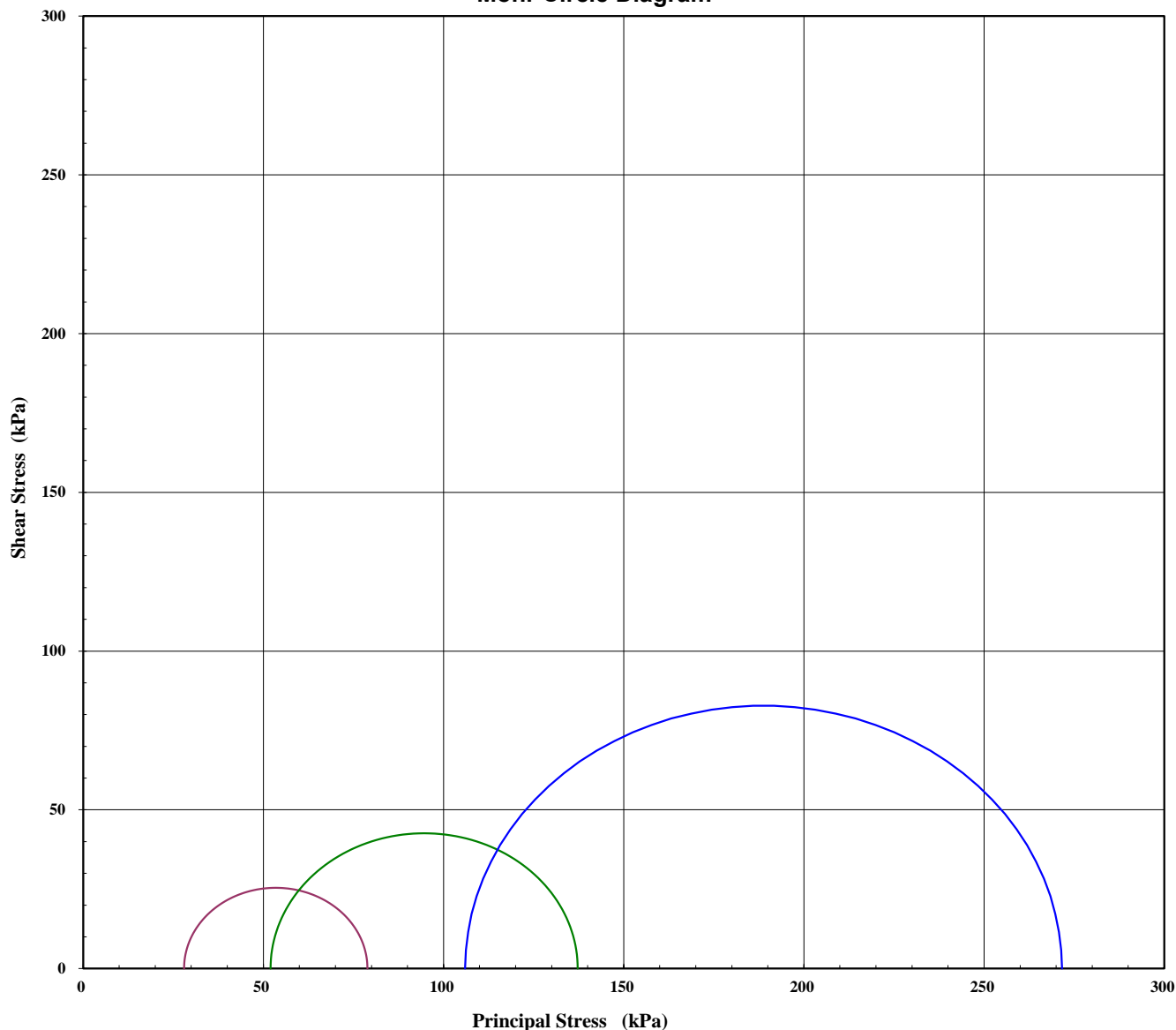
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110381 - CU

Mohr Circle Diagram



Interpretation between stages :	1 to 2	2 to 3	1 to 3
Cohesion C' (kPa) :	3.5	2.5	2.9
Angle of Shear Resistance Φ' (Degrees) :	24.7	25.3	25.1
Failure Criteria:	Peak Principal Stress Ratio		

Remarks:

Sample/s supplied by the client

Note: Graph not to scale

Page 2 of 7

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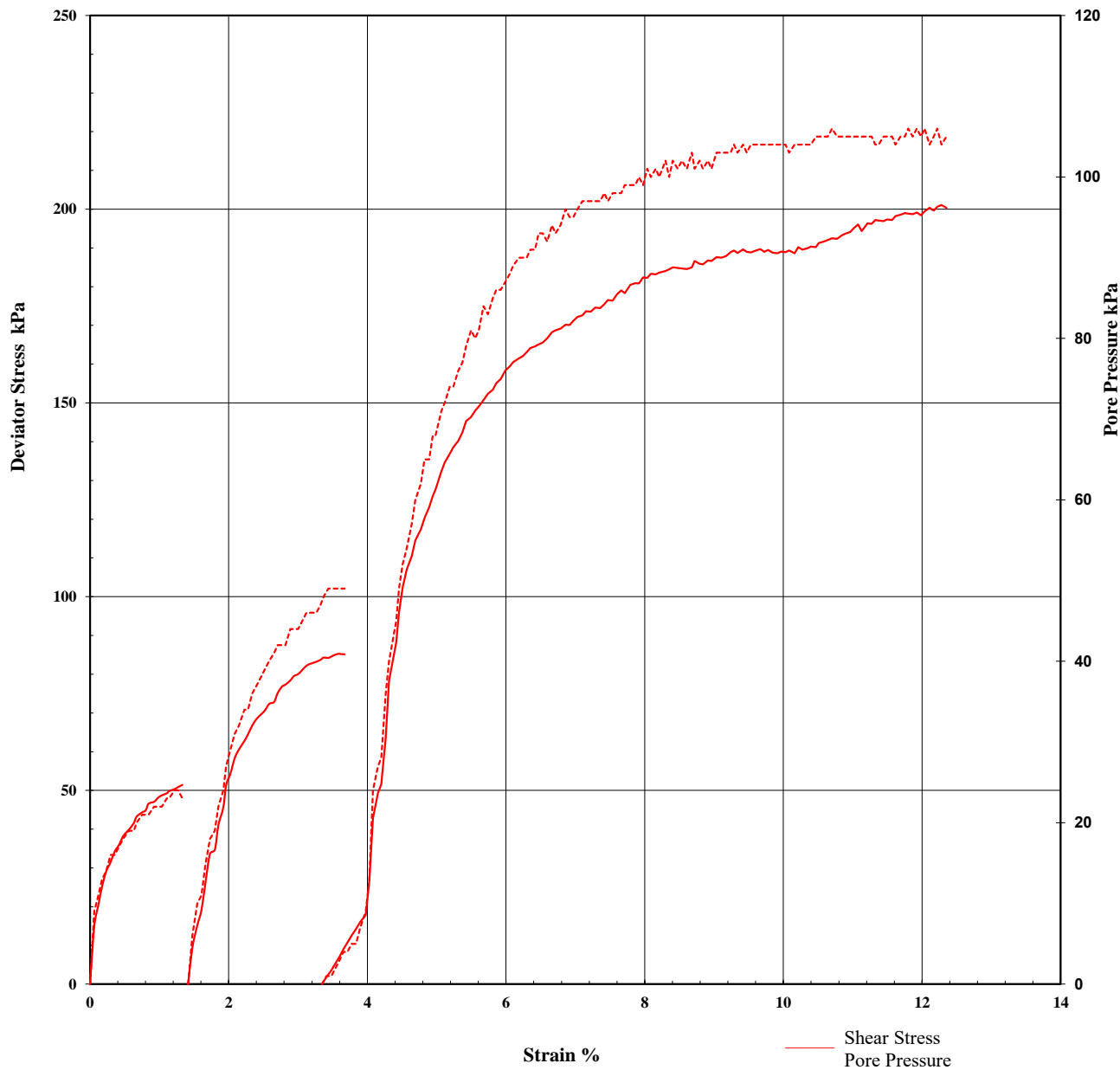
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110381 - CU

Stress/Strain & Pore Pressure/Strain Diagram



Remarks:

Sample/s supplied by the client

Note: Graph not to scale

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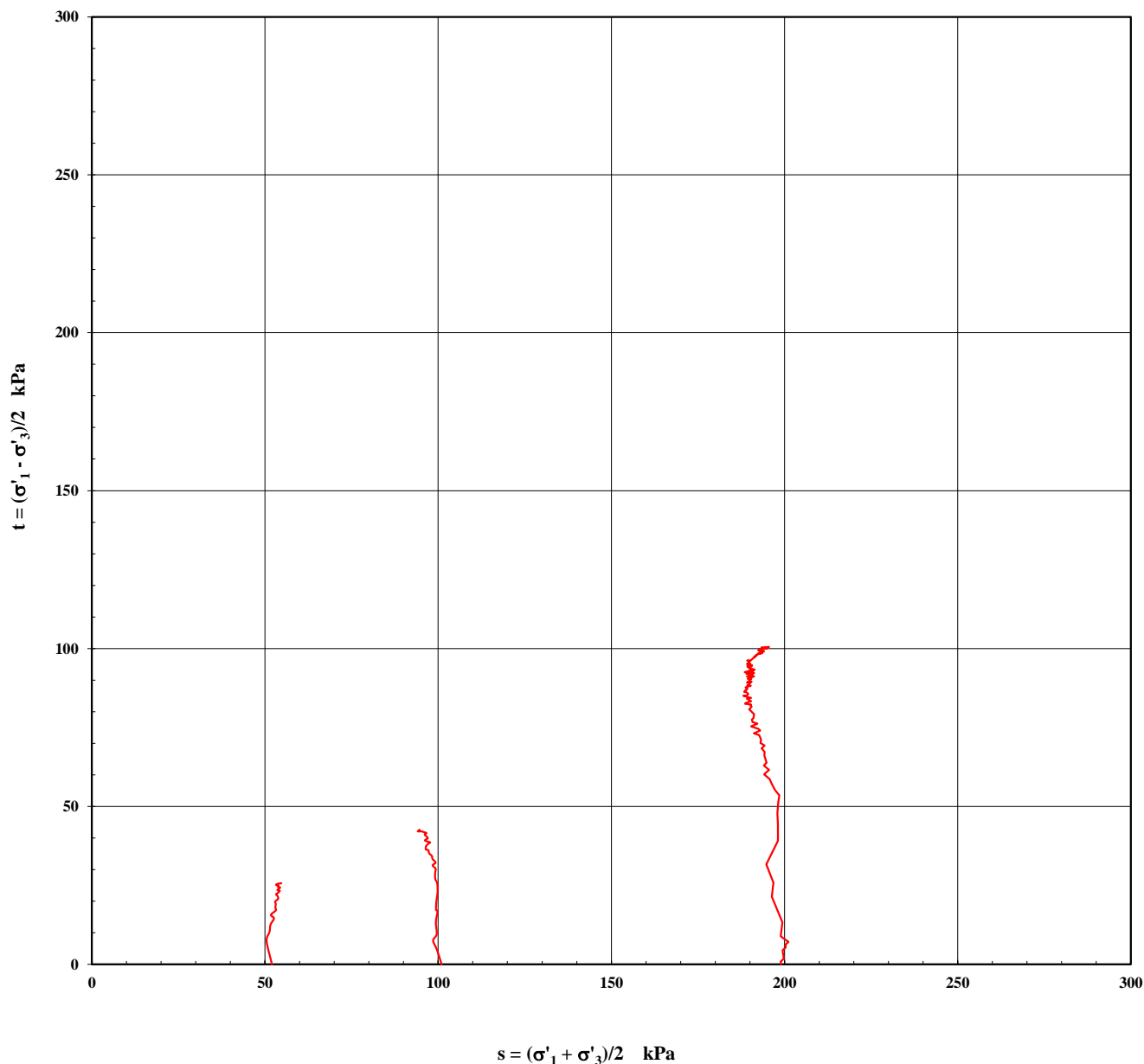
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110381 - CU

MIT Method - Effective Stress Path



Remarks:

Sample/s supplied by the client

Note: Graph not to scale

Page 4 of 7

REP03001

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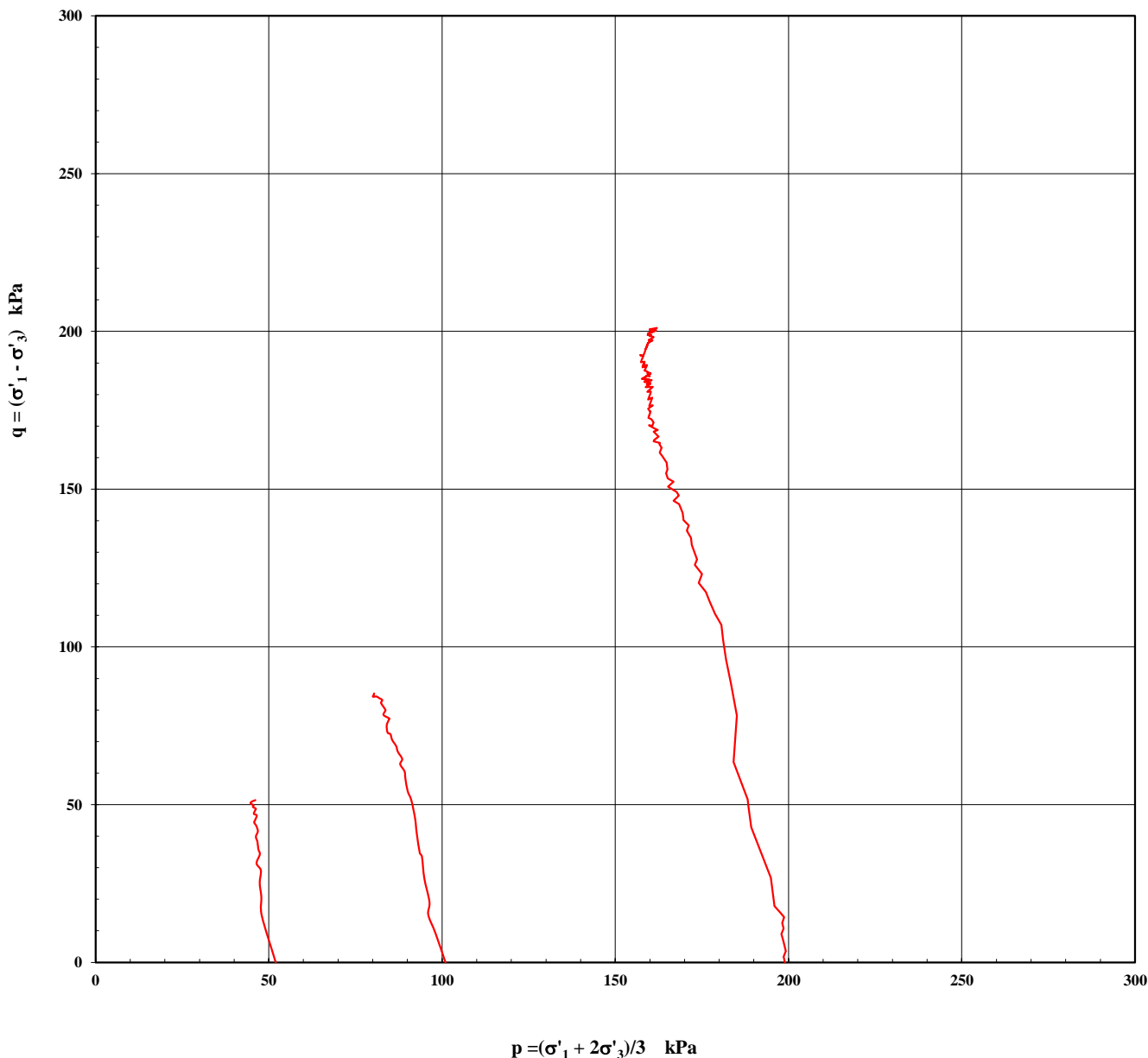
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110381 - CU

Cambridge Method - Effective Stress Path



Remarks:

Sample/s supplied by the client

Note: Graph not to scale

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Laboratory Number
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TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110381 - CU

CLIENT:	Worley Parsons Pty Ltd	
PROJECT:	301001-02095	BEFORE TEST
LAB SAMPLE No.	18110381	DATE: 22/11/18
BOREHOLE:	B1_07/B3_14/B4_01/B5_10 - Combined	DEPTH: 3.00-5.90 Combined



CLIENT:	Worley Parsons Pty Ltd	
PROJECT:	301001-02095	AFTER TEST
LAB SAMPLE No.	18110381	DATE: 30/11/18
BOREHOLE:	B1_07/B3_14/B4_01/B5_10 - Combined	DEPTH: 3.00-5.90 Combined



Remarks:
Sample/s supplied by the client

Note: Photo not to scale

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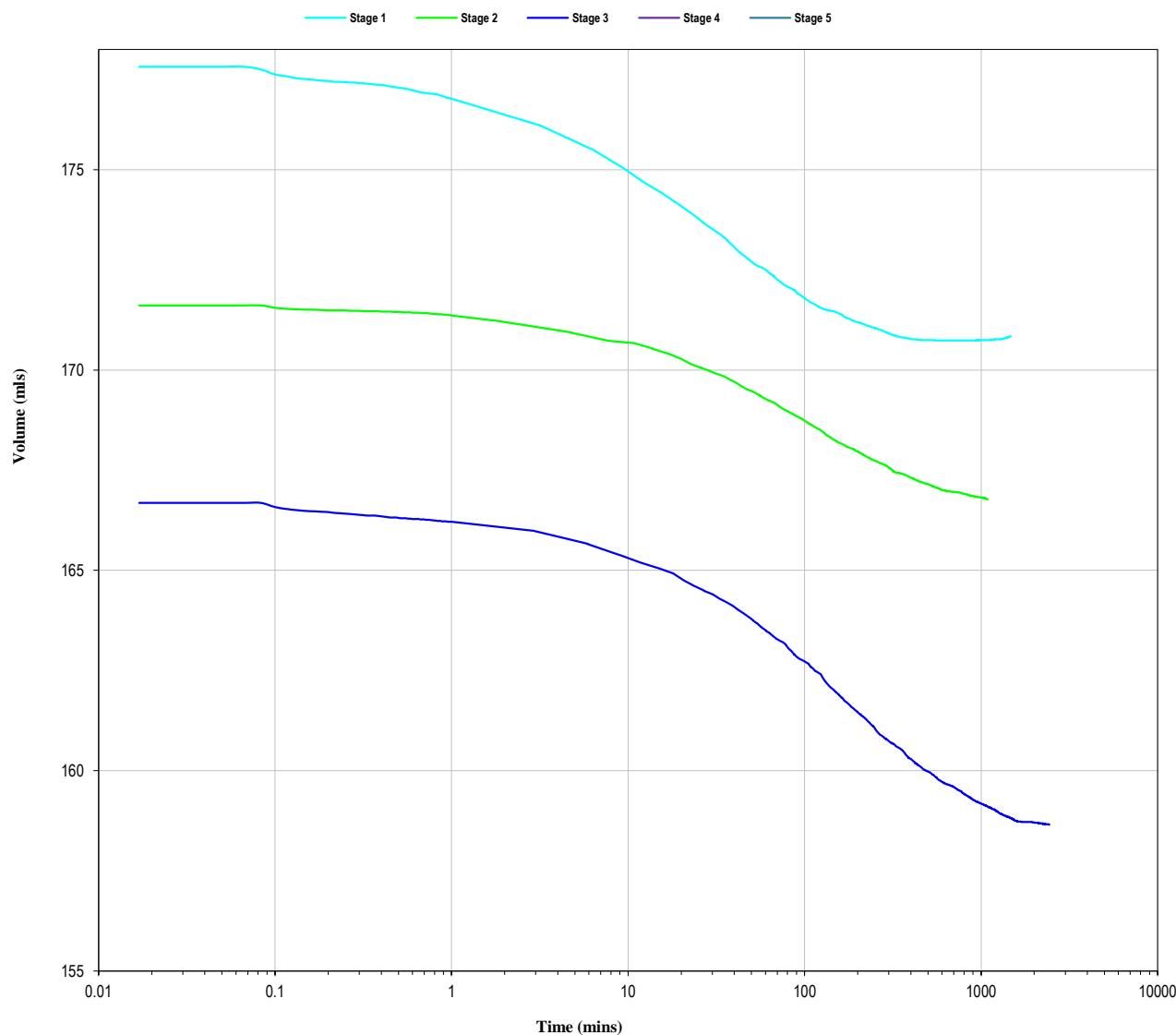
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110381 - CU

Volume v's Time (Log Scale)



	Stage 1	Stage 2	Stage 3
Cv (m ² /year) :	0.39	0.20	0.10
Mv (m ² /MN) :	0.673	0.581	0.526
k (m/s) :	8.23E-11	3.62E-11	1.57E-11

Remarks:

Sample/s supplied by the client

Note: Graph not to scale

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REP03001

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Laboratory Number
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TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client:	Worley Parsons Pty Ltd	Report No.:	18110382 - CU
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No.	0005139
Project:	301001-02095	Test Date:	19/11/2018
Client Id.:	OP2_18	Report Date:	3/12/2018
Description:	CLAYEY SILTY SAND- grey		
Depth (m):	-		

SAMPLE & TEST DETAILS

Initial Height: 99.2 mm	Initial Moisture Content: 24.9 %	Rate of Strain: 0.006 %/min
Initial Diameter: 47.8 mm	Final Moisture Content: 18.8 %	B Response: 97 %
L/D Ratio: 2.1 : 1	Wet Density: 1.87 t/m ³	
	Dry Density: 1.50 t/m ³	

Sample Type: Single Individual Specimen remoulded as per client request

TEST RESULTS

FAILURE DETAILS

Effective Pressure	Confining Pressure	Back Pressure	Initial Pore	Failure Pore	Principal Effective Stresses			Deviator Stress	Strain
					σ'_1	σ'_3	σ'_1 / σ'_3		
49 kPa	551 kPa	502 kPa	502 kPa	534 kPa	78 kPa	18 kPa	4.404	60 kPa	1.91 %
101 kPa	602 kPa	501 kPa	501 kPa	566 kPa	149 kPa	36 kPa	4.187	114 kPa	3.78 %
200 kPa	702 kPa	502 kPa	502 kPa	630 kPa	272 kPa	72 kPa	3.793	201 kPa	6.09 %

FAILURE ENVELOPES

Interpretation between stages :	1 to 2	2 to 3	1 to 3
Cohesion C' (kPa) :	1.9	7.6	4.7
Angle of Shear Resistance Φ' (Degrees) :	36.7	33.1	34.2
Failure Criteria:	Peak Principal Stress Ratio		

Remarks:

Sample/s supplied by the client

Page 1 of 7

REP03001

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Laboratory Number
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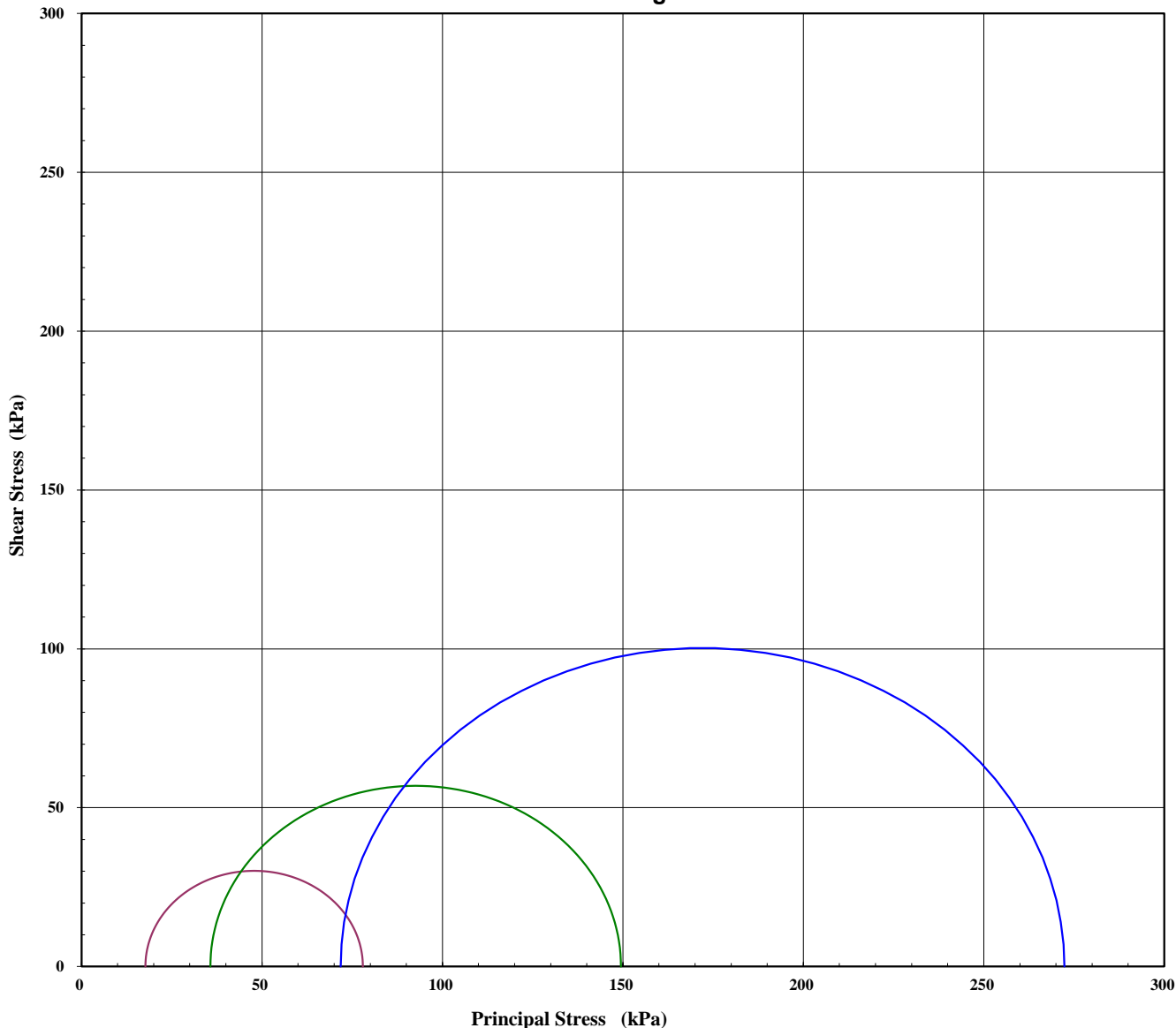
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110382 - CU

Mohr Circle Diagram



Interpretation between stages :	1 to 2	2 to 3	1 to 3
Cohesion C' (kPa) :	1.9	7.6	4.7
Angle of Shear Resistance Φ' (Degrees) :	36.7	33.1	34.2
Failure Criteria:	Peak Principal Stress Ratio		

Remarks:

Sample/s supplied by the client

Note: Graph not to scale

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REP03001

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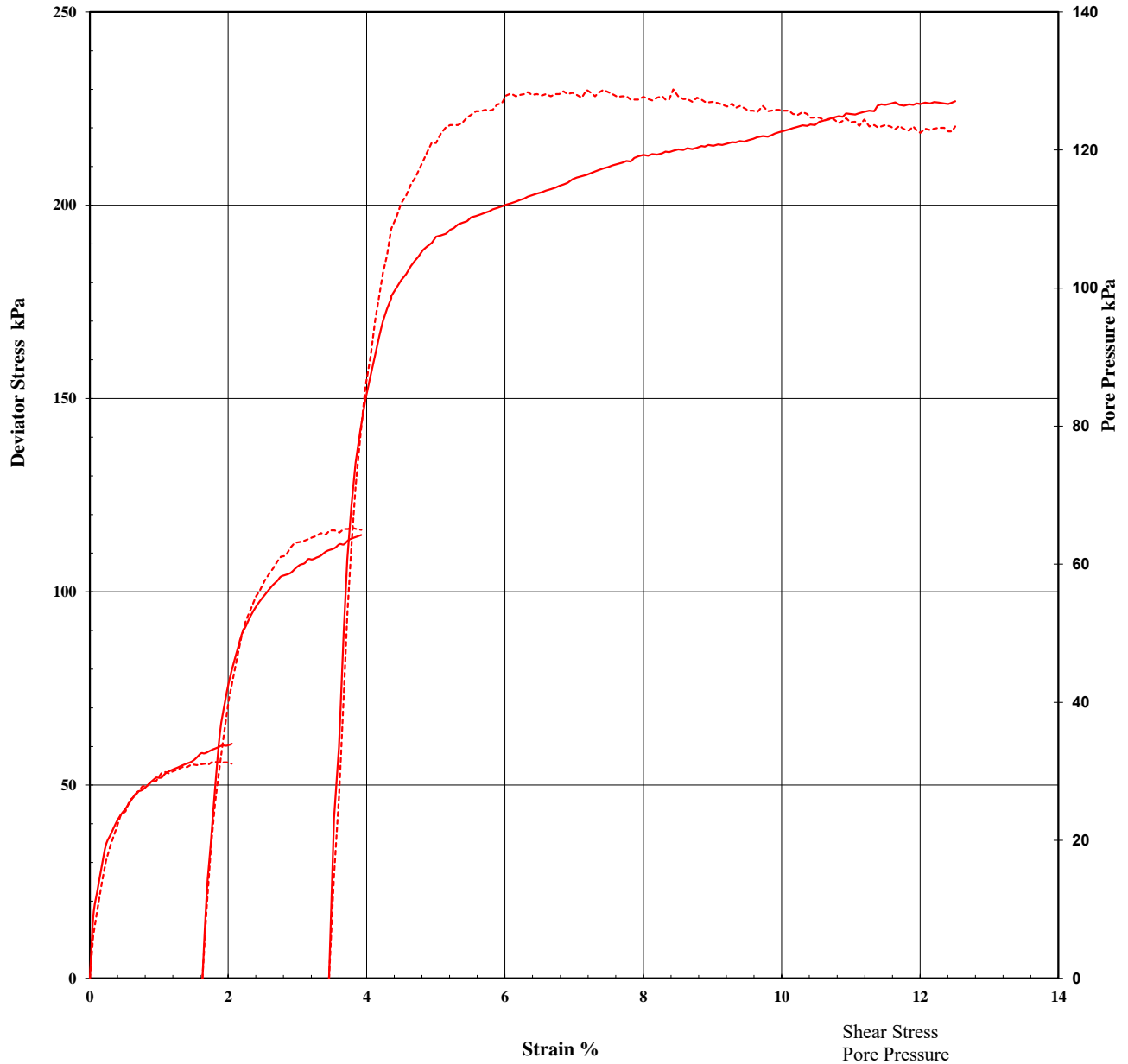
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110382 - CU

Stress/Strain & Pore Pressure/Strain Diagram



Remarks:

Sample/s supplied by the client

Note: Graph not to scale

Page 3 of 7

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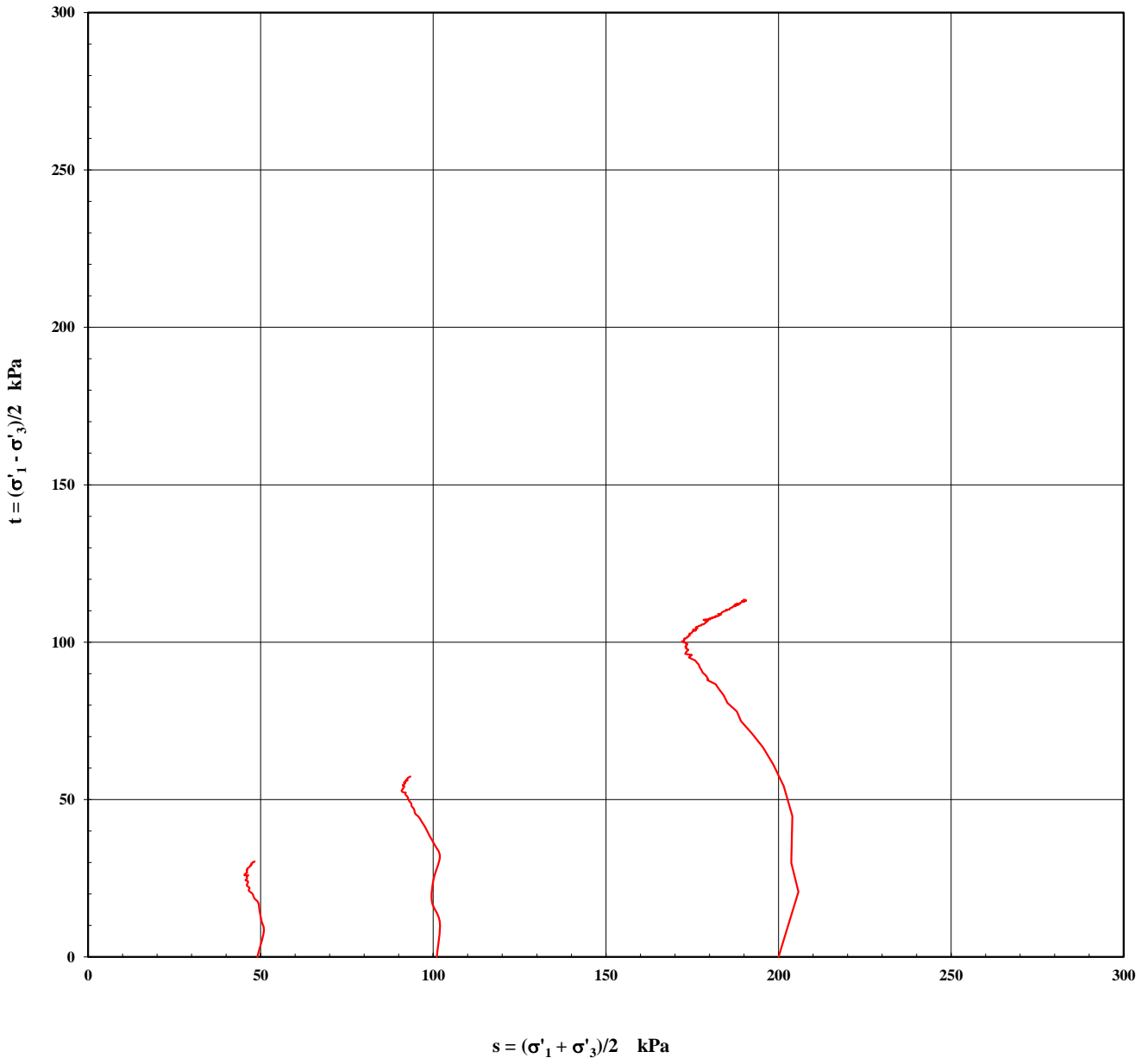
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110382 - CU

MIT Method - Effective Stress Path



Remarks:

Sample/s supplied by the client

Note: Graph not to scale

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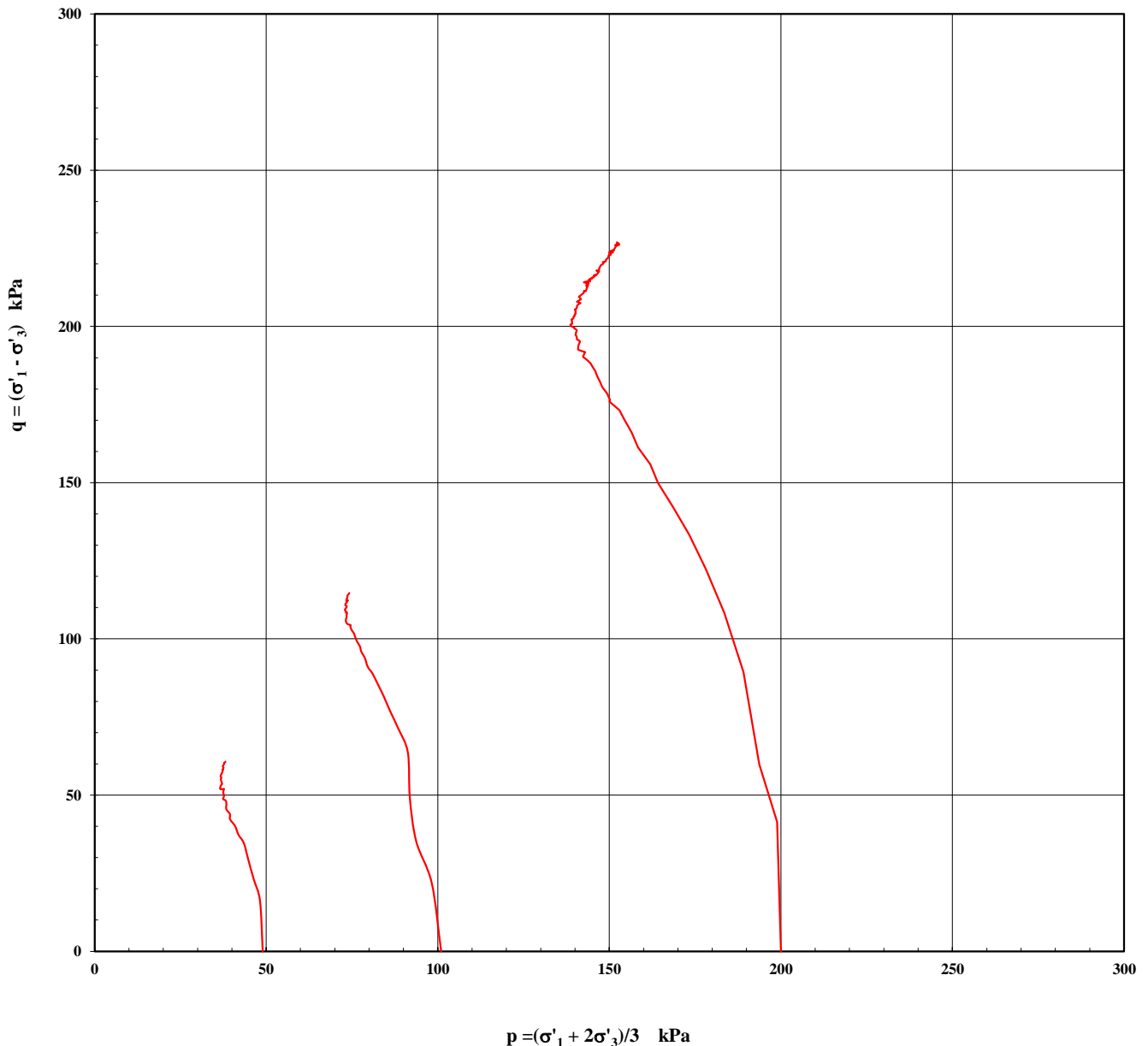
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110382 - CU

Cambridge Method - Effective Stress Path



Remarks:

Sample/s supplied by the client

Note: Graph not to scale

Page 5 of 7

REP03001

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory



C. Channon



Laboratory Number
9926

TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110382 - CU

CLIENT:	Worley Parsons Pty Ltd	
PROJECT:	301001-02095	AFTER TEST
LAB SAMPLE No.	18110382	DATE: 23/11/18
BOREHOLE:	OP2_18	DEPTH: 4.40



Remarks:

Sample/s supplied by the client

Note: Photo not to scale

Page 6 of 7

REP03001

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Authorised Signatory



C. Channon



Laboratory Number
9926

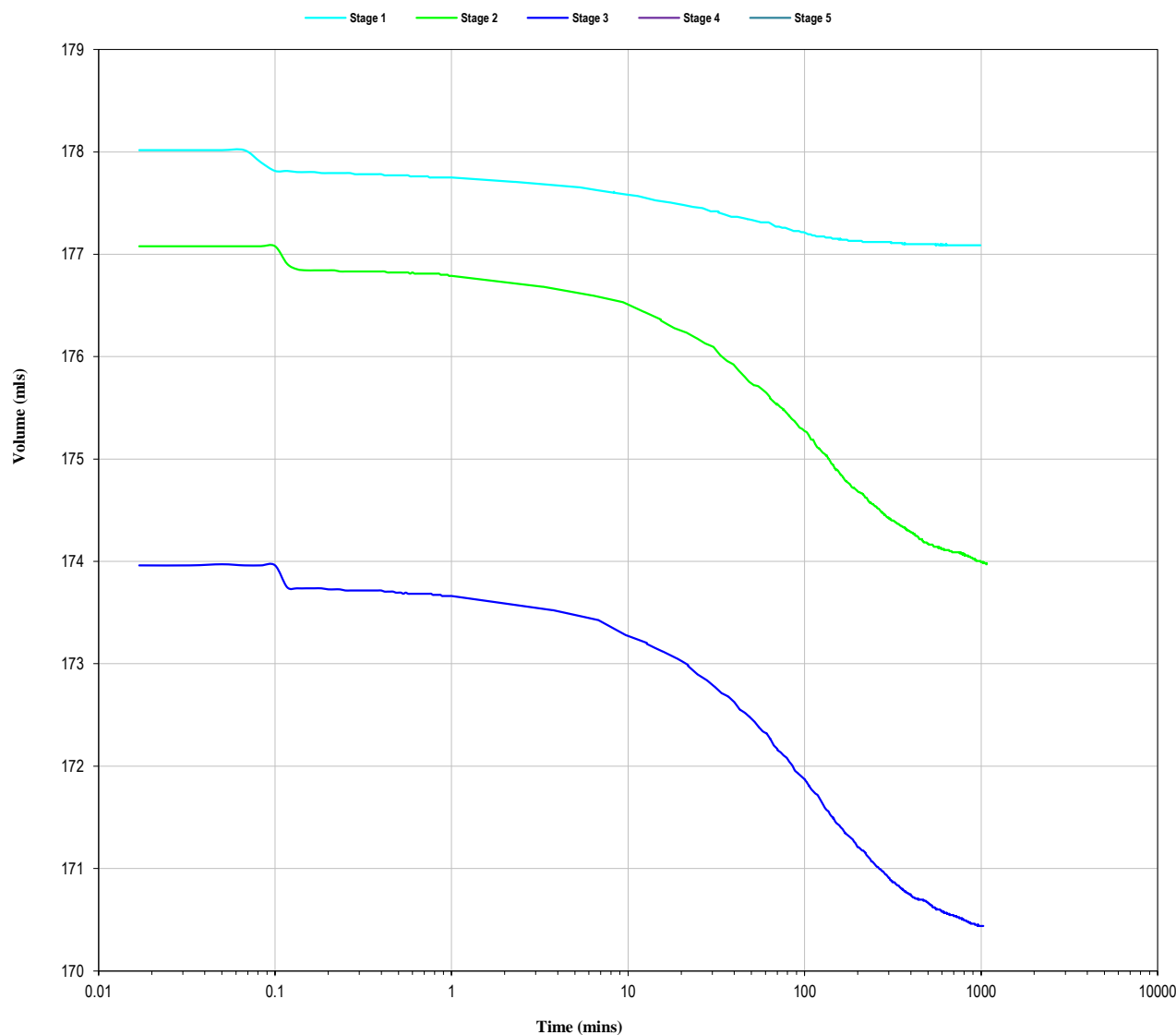
TRIAXIAL TEST REPORT

Test Method: AS1289.6.4.2

Client: Worley Parsons Pty Ltd

Report No.: 18110382 - CU

Volume v's Time (Log Scale)



	Stage 1	Stage 2	Stage 3
Cv (m ² /year) :	0.32	0.25	0.23
Mv (m ² /MN) :	0.101	0.207	0.204
k (m/s) :	1.00E-11	1.58E-11	1.48E-11

Remarks:

Sample/s supplied by the client

Note: Graph not to scale

Page 7 of 7

REP03001

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Authorised Signatory



C. Channon



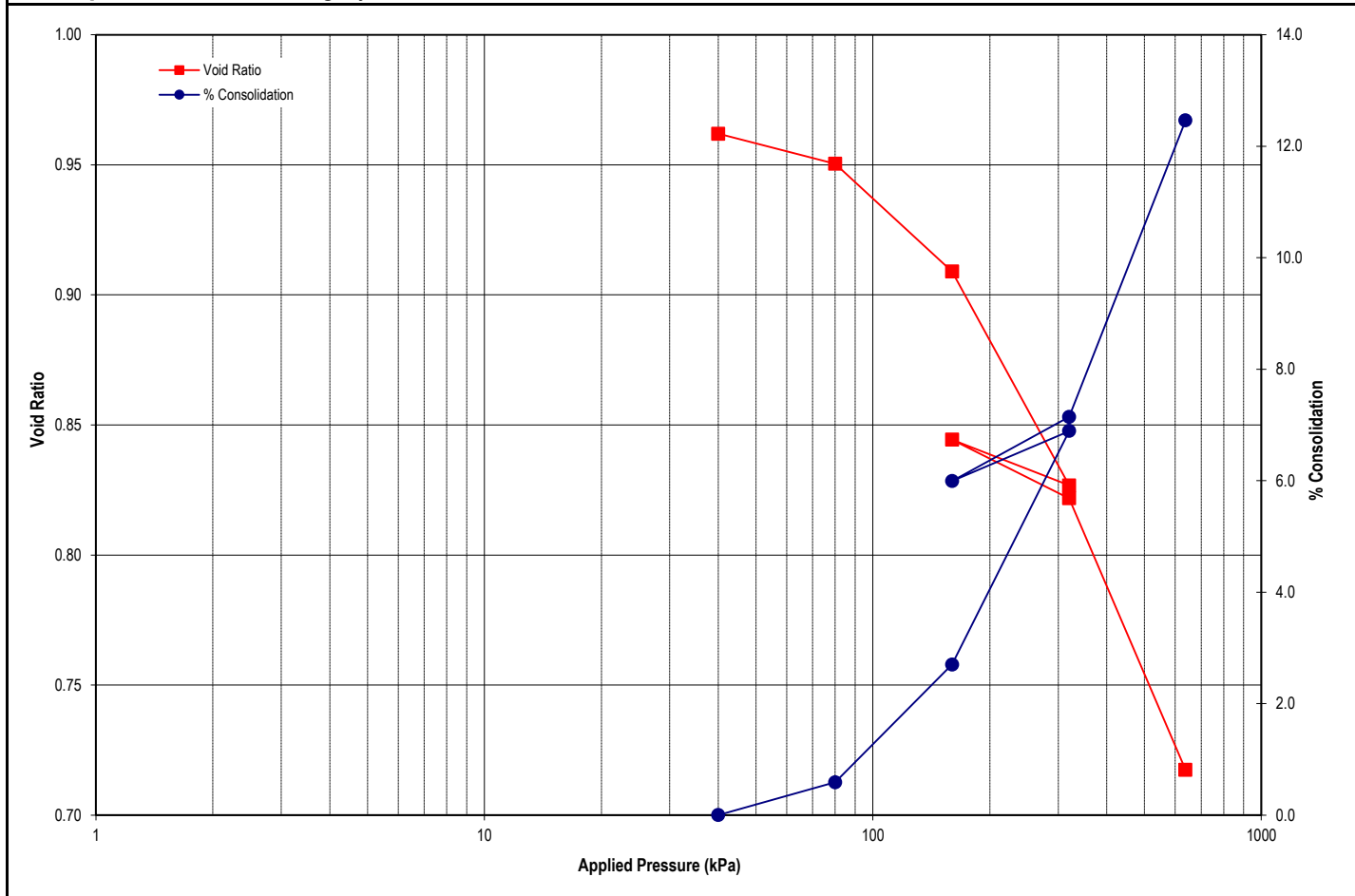
Laboratory Number
9926

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client: Worley Parsons Pty Ltd	Report No.: 18110381-OED
Address: Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No. 5139
Project: 301001-02095	Test Date: 22/11/2018
Client Id.: B1_07/B3_14/B4_01/B5_10 - Combined	Report Date: 4/12/2018
Depth (m): -	

Description: SILTY CLAY-grey



Wet Density (t/m ³): 1.70	Initial Moisture (%): 30.0	Test Condition: Inundated on load
Particle Density (t/m ³): 2.55	Initial Voids Ratio: 0.950	Initial Degree of Saturation (%): 80.6
Sample supplied by the client	Remarks: Single Individual Specimen remoulded as per client request	Page 1 of 2

REP03102

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory



C. Channon



Laboratory Number
9926

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Worley Parsons Pty Ltd	Report No.:	18110381-OED
Address:	Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No.	5139
Project:	301001-02095	Test Date:	22/11/2018
Client Id.:	B1_07/B3_14/B4_01/B5_10 - Combined	Report Date:	4/12/2018
Description:	SILTY CLAY-grey		
Depth (m):	-		

TEST RESULTS

Stage	Load (kPa)	Cc	k (m/s)	Cv (m ² /yr)		Mv (kPa ⁻¹ x10 ⁻³)	C _a x 10 ⁻³	% Consolidation
				t ₅₀	t ₉₀			
1	40-80	0.038	4.3E-09	17.32	93.46	0.147	0.83	0.6
2	80-160	0.138	3.8E-09	3.20	45.86	0.266	2.25	2.7
3	160-320	0.273	6.5E-09	23.53	77.89	0.269	4.03	6.9
4	320-160	0.059	6.6E-10	0.30	35.47	0.060	0.43	6.0
5	160-320	0.075	8.3E-10	0.03	34.78	0.077	2.30	7.1
6	320-638	0.348	1.2E-09	1.88	20.62	0.180	5.07	12.5

Remarks: Single Individual Specimen remoulded as per client request

Page 2 of 2

REP03102

Accredited for compliance with ISO/IEC 17025 - Testing.
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in this document are traceable to Australian/National Standards.

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Authorised Signatory



C. Channon

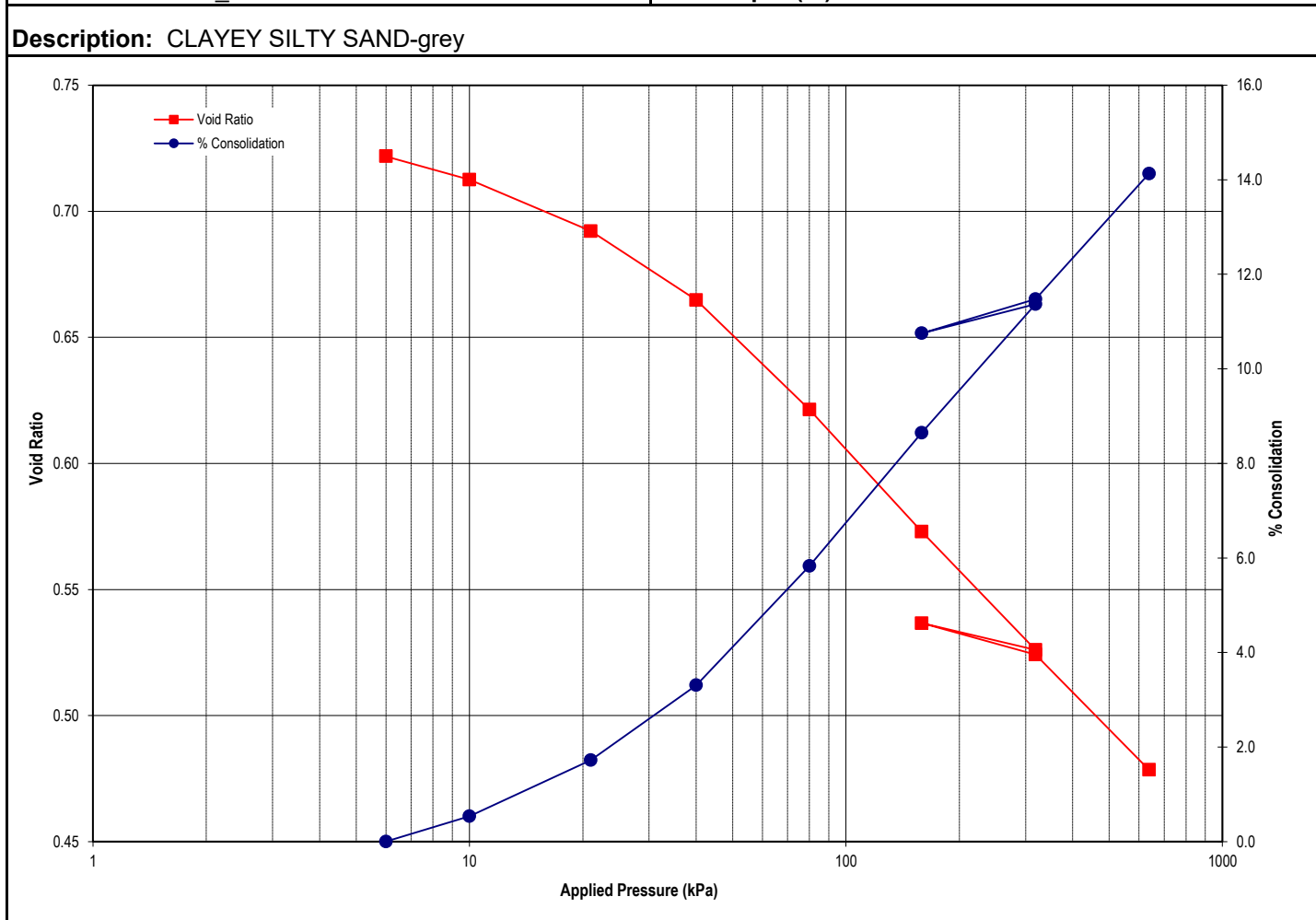


Laboratory Number
9926

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client: Worley Parsons Pty Ltd	Report No.: 18110382-OED
Address: Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No. 5139
Project: 301001-02095	Test Date: 14/11/2018
Client Id.: OP2_18	Report Date: 30/11/2018
Description: CLAYEY SILTY SAND-grey	Depth (m): -



Wet Density (t/m ³): 1.88	Initial Moisture (%): 25.3	Test Condition: Inundated on load
Particle Density (t/m ³): 2.58	Initial Voids Ratio: 0.724	Initial Degree of Saturation (%): 90.4
Sample supplied by the client	Remarks: Single Individual Specimen remoulded as per client request	Page 1 of 2

REP03102

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory



C. Channon



Laboratory Number
9926

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Worley Parsons Pty Ltd	Report No.:	18110382-OED
		Workorder No.	5139
Address:	Level 7, 250 St George's Terrace PERTH WA 6000	Test Date:	14/11/2018
		Report Date:	30/11/2018
Project:	301001-02095		
Client Id.:	OP2_18	Depth (m):	-

Description: CLAYEY SILTY SAND-grey

TEST RESULTS

Stage	Load (kPa)	Cc	k (m/s)	Cv (m ² /yr)		Mv (kPa ⁻¹ x10 ⁻³)	C _a x 10 ⁻³	% Consolidation
				t ₅₀	t ₉₀			
1	6-10	0.042	8.6E-10	0.33	2.06	1.350	0.84	0.5
2	10-21	0.063	5.0E-10	0.98	1.50	1.081	1.50	1.7
3	21-40	0.098	1.1E-09	0.76	4.32	0.850	2.16	3.3
4	40-80	0.144	1.5E-09	1.34	7.44	0.652	2.39	5.8
5	80-159	0.163	5.4E-10	1.64	4.58	0.378	2.41	8.6
6	159-319	0.155	1.2E-09	1.93	20.11	0.186	2.03	11.4
7	319-159	0.035	2.8E-10	158.82	20.98	0.043	0.09	10.8
8	159-319	0.041	3.6E-10	0.10	22.82	0.050	0.54	11.5
9	319-639	0.152	4.7E-10	2.00	16.31	0.094	2.72	14.1

Remarks: Single Individual Specimen remoulded as per client request

Page 2 of 2

REP03102

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Tested at Trilab Brisbane Laboratory.

Authorised Signatory



C. Channon



Laboratory Number
9926

PERMEABILITY BY FALLING HEAD TEST REPORT

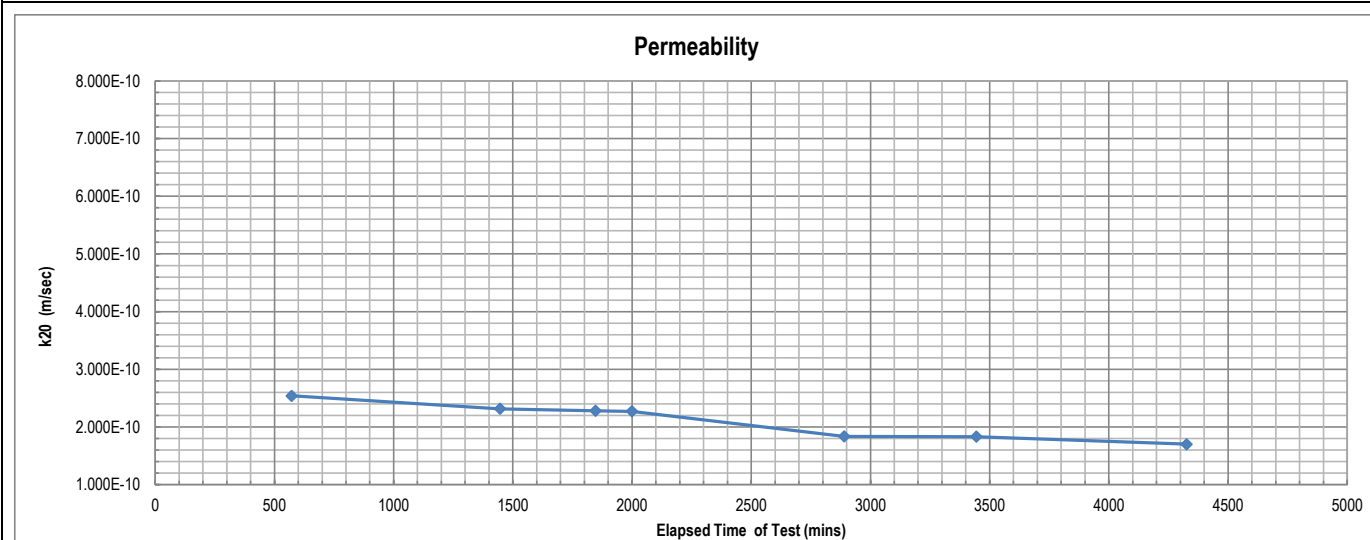
Test Method AS 1289 6.7.2, 5.1.1, KH2 (Based on K H Head (1988) Manual of Laboratory Testing, 10.7)

Client	Worley Parsons Pty Ltd	Report No.	18110381-FHPT
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No.	0005139
Project	301001-02095	Test Date	30/11/2018
Client ID	B1_07/B3_14/B4_01/B5_10 - Combined	Report Date	6/12/2018
Description	SILTY CLAY- grey	Depth (m)	-
		Sample Type	Remoulded Soil Specimen

RESULTS OF TESTING

Compaction Method	AS1289.5.1.1 - Standard Compaction		
Maximum Dry Density (t/m ³)	1.45	Hydraulic Gradient	17.4
Optimum Moisture Content (%)	23.3	Surcharge (kPa)	25.0
Placement Moisture Content (%)	23.1	Head Pressure Applied (kPa)	4.32
Moisture Ratio (%)	99.1	Water Type	De-ionized
Placement Wet Density (t/m ³)	1.79	Percentage Material Retained/Sieve Size (mm)	0 % / 2.36 mm
Density Ratio (%)	100.2		

PERMEABILITY $k_{(20)} = 1.7 \times 10^{-10}$ (m/sec)



Remarks: The above specimen was remoulded to a target of 100% of Standard Dry Density and at 100% of Optimum Moisture Content.

Sample/s supplied by client

Page: 1 of 1

REP06301

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Authorised Signatory



C. Channon



Laboratory No. 9926

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Trilab Pty Ltd

ABN 25 065 630 506

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

PERMEABILITY BY FALLING HEAD TEST REPORT

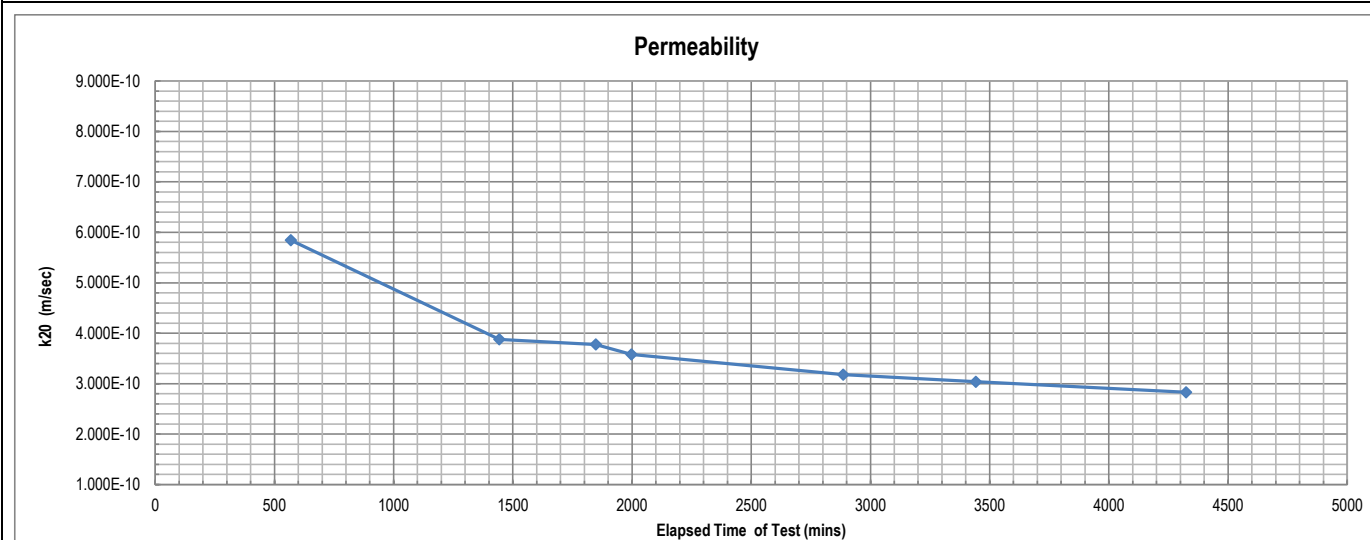
Test Method AS 1289 6.7.2, 5.1.1, KH2 (Based on K H Head (1988) Manual of Laboratory Testing, 10.7)

Client	Worley Parsons Pty Ltd	Report No.	18110382-FHPT
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No.	0005139
Project	301001-02095	Test Date	1/12/2018
Client ID	OP2_18	Report Date	6/12/2018
Description	CLAYEY SILTY SAND- dark grey	Depth (m)	-
		Sample Type	Remoulded Soil Specimen

RESULTS OF TESTING

Compaction Method	AS1289.5.1.1 - Standard Compaction		
Maximum Dry Density (t/m ³)	1.50	Hydraulic Gradient	18.5
Optimum Moisture Content (%)	25.0	Surcharge (kPa)	25.0
Placement Moisture Content (%)	25.5	Head Pressure Applied (kPa)	4.32
Moisture Ratio (%)	102.0	Water Type	De-Ionized
Placement Wet Density (t/m ³)	1.88	Percentage Material Retained/Sieve Size (mm)	0 % / 2.36 mm
Density Ratio (%)	99.6		

PERMEABILITY $k_{(20)} = 2.8 \times 10^{-10}$ (m/sec)



Remarks: The above specimen was remoulded as per clients specific instructions.

Sample/s supplied by client

Page: 1 of 1

REP06301

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Authorised Signatory



C. Channon



Laboratory No. 9926

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ABN 25 065 630 506

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

PERMEABILITY BY CONSTANT HEAD TEST REPORT

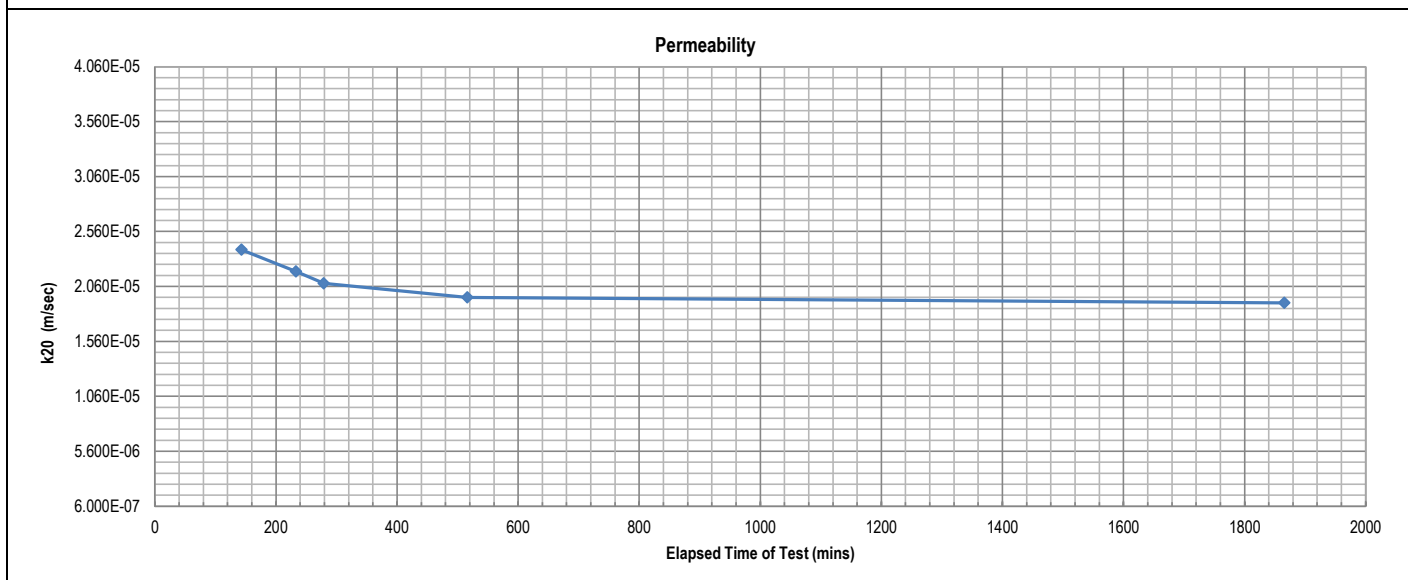
Test Method AS 1289 6.7.1, 5.5.1, KH2 (Based on K H Head (1988) Manual of Laboratory Testing, 10.7)

Client	Worley Parsons Pty Ltd	Report No.	18110383-CHP
Address	Level 7, 250 St George's Terrace PERTH WA 6000	Workorder No.	0005139
Project	301001-02095	Test Date	3/12/2018
Client ID	SB_45	Report Date	6/12/2018
Description	SAND- grey	Depth (m)	-
		Sample Type	Remoulded Soil Specimen

RESULTS OF TESTING

Compaction Method	AS1289.5.5.1- Max Min Method		
Maximum Dry Density (t/m ³)	1.62	Hydraulic Gradient	1.4
Optimum Moisture Content (%)	24.1	Surcharge (kPa)	0.0
Placement Moisture Content (%)	24.0	Head Pressure Applied (kPa)	2.65
Moisture Ratio (%)	99.4	Water Type	De-Ionized
Placement Wet Density (t/m ³)	1.79	Percentage Material Retained/Sieve Size (mm)	0 % / 4.75 mm
Density Ratio (%)	88.9	Sample Height and Diameter (mm)	195 / 114.31 mm

PERMEABILITY $k_{(20)} = 1.9 \times 10^{-05}$ (m/sec)



Remarks: The above specimen was remoulded to a target of 70% Relative Density and at Optimum Moisture Content.

Sample/s supplied by client

Page: 1 of 1

REP06401

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Authorised Signatory



C. Channon



Laboratory No. 9926

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Trilab Pty Ltd ABN 25 065 630 506
ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

Appendix E **Wagners laboratory documentation**



WAGNERS QUEENSLAND PTY LTD
ABN 79 122 176 745

► CONSTRUCTION MATERIAL
► ENERGY SERVICES
► CEMENT, FLYASH & LIME
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► REINFORCING STEEL
► COMPOSITE FIBRE TECHNOLOGIES

Base Laboratory: Pinkenba Cement Lab
Address: 47 Pamela St, Pinkenba QLD 4050
Postal Address: PO Box 1394, Eagle Farm QC QLD 4009
Phone: (+61) 7 3621 1111
Fax: (+61) 7 3621 1100
Email: Sales@wagners.com.au
Laboratory: Lab@wagners.com.au
Website: www.wagners.com.au

XRD TEST CERTIFICATE

FINAL

Prior Related Certificates: None

Client:	Advisian	Certificate Issued:	6 December 2018
Client Reference:	Beneficial ruse assessment by North Queensland Bulk Ports for Mackay Port	Sample Date:	16 November 2018
Sample Identification:	1811-0212-X99	Date Received:	27 November 2018
Product Information:	SB-45		
Description:	Mackay Port - Wet Sediment		
Sampling Location:	Mackay Port		
Testing Condition:	Dry to SSD, grind & ignited material		
Testing Location:	Pinkenba Laboratory		
Analytical Technique:	Bruker AXS D2 X-ray diffractor CuK α 1 operated at 30kV, 10mA		
Method of Analysis:	Scan region: 10 to 80 2Theta Step size: 0.02 Time/step 0.5s		

TEST RESULTS

Minerals	Quantitative Analysis (wt%)
Quartz	52.43%
Albite	33.16%
Berlinite	4.99%
Aragonite	4.27%
Paratellurite	1.44%
Halite	1.93%
Calicte	1.15%
Strontioborite	0.63%

Note: Any quantitaive value determined to be less than 0.5% can be considered negleable and are not included on this report.
Oligoclase could not be added with Topas software as additional mineral.

Remarks: The above results apply only to the sample as described above.
Sample and sampling detail supplied by client.
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NATA Accreditation is not held for analysis using the X-ray diffraction application

Signatory: Tanya Norris

**CHEMICAL TEST CERTIFICATE****FINAL****Prior Related Certificates:** None

Wagners Pinkenba Cement Laboratory
Address: 47 Pamela St, Pinkenba QLD 4009
Phone: (+61) 7 3621 1111
Fax: (+61) 7 3621 1100

Office Email: Pinkenba@wagner.com.au
Laboratory Email: Lab.Admin@wagner.com.au
Website: www.wagner.com.au

Certificate Number: C18-749
Product: X99
Sample Identification: WQP181116-0212
Description: Mackay Port - Wet Sediment
Testing Condition: Dry to SSD, grind & ignited material
Sampling Location: Mackay Port

Client Reference: SB-45
Certificate Issued: Thursday, 6 December 2018
Sample Date: Friday, 16 November 2018
Date Received: Tuesday, 27 November 2018

TEST RESULTS

Test	Loss on Ignition %	Na ₂ O eq. %	Cl %
Result	6.2	4.2	0.447
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None

Test	SiO ₂ %	Al ₂ O ₃ %	Fe ₂ O ₃ %	CaO %	MgO %	SO ₃ %	K ₂ O %
Result	69.7	11.2	3.0	5.5	1.1	0.1	1.93
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	Max 4.5%	None	None

Test	TiO ₂ %	P ₂ O ₅ %	Na ₂ O %	CrO ₃ %	ZnO %	Mn ₂ O ₃ %	SrO %
Result	0.45	0.07	2.92	0.03	0.00	0.12	0.04
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	None	None	None

The above results apply only to the sample as described above.

Sample and sampling detail supplied by client.

Equivalent Sodium (NaEq) is a total value.

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Accreditation No.17004

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Signatory: Tanya Norris



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Base Laboratory: Pinkenba Cement Lab
Address: 47 Pamela St, Pinkenba QLD 4050
Postal Address: PO Box 1394, Eagle Farm QC QLD 4009
Phone: (+61) 7 3621 1111
Fax: (+61) 7 3621 1100
Email: Sales@wagners.com.au
Laboratory: Lab@wagners.com.au
Website: www.wagners.com.au

XRD TEST CERTIFICATE

FINAL

Prior Related Certificates: None

Client:	Advisian	Certificate Issued:	6 December 2018
Client Reference:	Beneficial ruse assessment by North Queensland Bulk Ports for Mackay Port	Sample Date:	16 November 2018
Sample Identification:	1811-0213-X99	Date Received:	27 November 2018
Product Information:	SB-02A		
Description:	Mackay Port - Wet Sediment		
Sampling Location:	Mackay Port		
Testing Condition:	Dry to SSD, grind & ignited material		
Testing Location:	Pinkenba Laboratory		
Analytical Technique:	Bruker AXS D2 X-ray diffractor CuK α 1 operated at 30kV, 10mA		
Method of Analysis:	Scan region: 10 to 80 2Theta Step size: 0.02 Time/step 0.5s		

TEST RESULTS

Minerals	Quantitative Analysis (wt%)
Quartz	65.03%
Albite	21.92%
Berlinite	3.50%
Aragonite	2.06%
Paratellurite	1.20%
Halite	2.75%
Calicte	3.54%

Note: Any quantitaive value determined to be less than 0.5% can be considered negleable and are not included on this report.
Oligoclase could not be added with Topas software as additional mineral.

Remarks: The above results apply only to the sample as described above.
Sample and sampling detail supplied by client.
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NATA Accreditation is not held for analysis using the X-ray diffraction application

Signatory: Tanya Norris

**CHEMICAL TEST CERTIFICATE****FINAL****Prior Related Certificates:** None

Wagners Pinkenba Cement Laboratory
Address: 47 Pamela St, Pinkenba QLD 4009
Phone: (+61) 7 3621 1111
Fax: (+61) 7 3621 1100

Office Email: Pinkenba@wagner.com.au
Laboratory Email: Lab.Admin@wagner.com.au
Website: www.wagner.com.au

Certificate Number: C18-750
Product: X99
Sample Identification: WQP181116-0212
Description: Mackay Port - Wet Sediment
Testing Condition: Dry to SSD, grind & ignited material
Sampling Location: Mackay Port

Client Reference: SB-02A
Certificate Issued: Thursday, 6 December 2018
Sample Date: Friday, 16 November 2018
Date Received: Tuesday, 27 November 2018

TEST RESULTS

Test	Loss on Ignition %	Na ₂ O eq. %	Cl %
Result	7.6	3.6	1.286
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None

Test	SiO ₂ %	Al ₂ O ₃ %	Fe ₂ O ₃ %	CaO %	MgO %	SO ₃ %	K ₂ O %
Result	69.3	10.8	3.5	4.6	1.1	0.4	1.72
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	Max 4.5%	None	None

Test	TiO ₂ %	P ₂ O ₅ %	Na ₂ O %	CrO ₃ %	ZnO %	Mn ₂ O ₃ %	SrO %
Result	0.51	0.07	2.42	0.03	0.01	0.11	0.02
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	None	None	None

The above results apply only to the sample as described above.

Sample and sampling detail supplied by client.

Equivalent Sodium (NaEq) is a total value.

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Accreditation No.17004

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Signatory: Tanya Norris



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ABN 79 122 176 745

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Phone: (+61) 7 3621 1111
Fax: (+61) 7 3621 1100
Email: Sales@wagners.com.au
Laboratory: Lab@wagners.com.au
Website: www.wagners.com.au

XRD TEST CERTIFICATE

FINAL

Prior Related Certificates: None

Client:	Advisian	Certificate Issued:	6 December 2018
Client Reference:	Beneficial ruse assessment by North Queensland Bulk Ports for Mackay Port	Sample Date:	16 November 2018
Sample Identification:	1811-0214-X99 (A)	Date Received:	27 November 2018
Product Information:	TB05		
Description:	Mackay Port - Wet Sediment		
Sampling Location:	Mackay Port		
Testing Condition:	Dry to SSD, grind & ignited material		
Testing Location:	Pinkenba Laboratory		
Analytical Technique:	Bruker AXS D2 X-ray diffractor CuK α 1 operated at 30kV, 10mA		
Method of Analysis:	Scan region: 10 to 80 2Theta Step size: 0.02 Time/step 0.5s		

TEST RESULTS

Minerals	Quantitative Analysis (wt%)
Quartz	46.80%
Albite	29.24%
Berlinite	5.16%
Aragonite	3.04%
Paratellurite	0.73%
Halite	3.73%
Calicte	3.51%
Strontioborite	0.49%
Retgersite	7.30%

Note: Any quantitative value determined to be less than 0.5% can be considered negligible and are not included on this report. Oligoclase could not be added with Topas software as additional mineral.

Remarks: The above results apply only to the sample as described above.
Sample and sampling detail supplied by client.
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NATA Accreditation is not held for analysis using the X-ray diffraction application

Signatory: Tanya Norris

**CHEMICAL TEST CERTIFICATE****FINAL****Prior Related Certificates:** None

Wagners Pinkenba Cement Laboratory
Address: 47 Pamela St, Pinkenba QLD 4009
Phone: (+61) 7 3621 1111
Fax: (+61) 7 3621 1100

Office Email: Pinkenba@wagner.com.au
Laboratory Email: Lab.Admin@wagner.com.au
Website: www.wagner.com.au

Certificate Number: C18-750
Product: X99
Sample Identification: WQP181116-0214 (A)
Description: Mackay Port - Wet Sediment
Testing Condition: Dry to SSD, grind & ignited material
Sampling Location: Mackay Port

Client Reference: TB05
Certificate Issued: Thursday, 6 December 2018
Sample Date: Friday, 16 November 2018
Date Received: Tuesday, 27 November 2018

TEST RESULTS

Test	Loss on Ignition %	Na ₂ O eq. %	Cl %
Result	11.5	3.9	1.461
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None

Test	SiO ₂ %	Al ₂ O ₃ %	Fe ₂ O ₃ %	CaO %	MgO %	SO ₃ %	K ₂ O %
Result	56.6	14.9	5.7	5.5	1.8	0.6	1.70
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	Max 4.5%	None	None

Test	TiO ₂ %	P ₂ O ₅ %	Na ₂ O %	CrO ₃ %	ZnO %	Mn ₂ O ₃ %	SrO %
Result	0.82	0.11	2.82	0.01	0.01	0.13	0.03
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	None	None	None

The above results apply only to the sample as described above.

Sample and sampling detail supplied by client.

Equivalent Sodium (NaEq) is a total value.

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Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No.17004

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Signatory: Tanya Norris



WAGNERS QUEENSLAND PTY LTD
ABN 79 122 170 745

► CONSTRUCTION MATERIAL
► ENERGY SERVICES
► CEMENT, FLYASH & LIME
► PRECAST CONCRETE
► REINFORCING STEEL
► COMPOSITE FIBRE TECHNOLOGIES

Base Laboratory: Pinkenba Cement Lab
Address: 47 Pamela St, Pinkenba QLD 4050
Postal Address: PO Box 1394, Eagle Farm QC QLD 4009
Phone: (+61) 7 3621 1111
Fax: (+61) 7 3621 1100
Email: Sales@wagners.com.au
Laboratory: Lab@wagners.com.au
Website: www.wagners.com.au

XRD TEST CERTIFICATE

FINAL

Prior Related Certificates: None

Client:	Advisian	Certificate Issued:	6 December 2018
Client Reference:	Beneficial ruse assessment by North Queensland Bulk Ports for Mackay Port	Sample Date:	16 November 2018
Sample Identification:	1811-0214-X99 (B)	Date Received:	27 November 2018
Product Information:	TB05		
Description:	Mackay Port - Wet Sediment		
Sampling Location:	Mackay Port		
Testing Condition:	Dry to SSD, grind & ignited material		
Testing Location:	Pinkenba Laboratory		
Analytical Technique:	Bruker AXS D2 X-ray diffractor CuK α 1 operated at 30kV, 10mA		
Method of Analysis:	Scan region: 10 to 80 2Theta Step size: 0.02 Time/step 0.5s		

TEST RESULTS

Minerals	Quantitative Analysis (wt%)
Quartz	31.04%
Albite	5.07%
Berlinite	1.91%
Aragonite	17.55%
Paratellurite	3.21%
Halite	4.77%
Calicte	22.07%
Strontioborite	5.57%
Retgersite	8.06%
Graphite	0.75%

Note: Any quantitaive value determined to be less than 0.5% can be considered negleable and are not included on this report.
Oligoclase could not be added with Topas software as additional mineral.

Remarks: The above results apply only to the sample as described above.
Sample and sampling detail supplied by client.
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Signatory: Tanya Norris

**CHEMICAL TEST CERTIFICATE****FINAL****Prior Related Certificates:** None

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Office Email: Pinkenba@wagner.com.au
Laboratory Email: Lab.Admin@wagner.com.au
Website: www.wagner.com.au

Certificate Number: C18-750
Product: X99
Sample Identification: WQP181116-0214 (B)
Description: Mackay Port - Wet Sediment
Testing Condition: Dry to SSD, grind & ignited material
Sampling Location: Mackay Port

Client Reference: TB05
Certificate Issued: Thursday, 6 December 2018
Sample Date: Friday, 16 November 2018
Date Received: Tuesday, 27 November 2018

TEST RESULTS

Test	Loss on Ignition %	Na ₂ O eq. %	Cl %
Result	11.5	4.8	2.807
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None

Test	SiO ₂ %	Al ₂ O ₃ %	Fe ₂ O ₃ %	CaO %	MgO %	SO ₃ %	K ₂ O %
Result	52.2	14.9	5.7	5.8	2.0	0.9	1.68
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	Max 4.5%	None	None

Test	TiO ₂ %	P ₂ O ₅ %	Na ₂ O %	CrO ₃ %	ZnO %	Mn ₂ O ₃ %	SrO %
Result	0.82	0.13	3.67	0.01	0.01	0.14	0.04
Standard:	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2	AS/NZS 2350.2
AS 3972 Limit	None	None	None	None	None	None	None

The above results apply only to the sample as described above.

Sample and sampling detail supplied by client.

Equivalent Sodium (NaEq) is a total value.

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